

LCICD 2019 AT A GLANCE

Wednesday, Aug 21 st	Thursday, Aug 22 nd
8.30 – 9.00 Registration and Refreshment 9.00 – 9.15 Opening Remarks 9.15 – 10.15 Keynote 1: Victoria Southgate 10.15 – 11.15 Talk Session 1: Social Cognition 11.15 – 11.45 Coffee Break 11.45 – 13.15 Talk Session 2: Infant-Caregiver Interaction 13.15 – 14.15 Lunch 14.15 – 16.15 Poster Session 1 15.45 – 16.15 Coffee Break 16.15 – 17.15 Talk Session 3: Linguistic Input and Environment 19.30 onwards Conference Dinner at The Lancaster House Hotel (advance booking required)	8.30 – 9.00 Registration and Refreshment 9.00 – 10.00 Keynote 2: Catherine Tamis-LeMonda 10.00 – 11.00 Talk Session 4: Speech Perception 11.00 – 11.30 Coffee Break 11.30 – 13.00 Talk Session 5: Curiosity and Information Seeking 13.00 – 14.00 Lunch 14.00 – 15.30 Talk Session 6: Language Development I 15.30 – 16.00 Coffee Break 16.00 – 17.00 Talk Session 7: Pupillometry 17.00 – 19.00 Poster Session 2 18.00 – 19.00 Drinks Reception
	Friday, Aug 23 rd
	8.30 – 9.00 Registration and Refreshment 9.00 – 10.00 Keynote 3: Kim Plunkett 10.00 – 11.00 Talk Session 8: Language Development II 11.00 – 11.30 Coffee Break 11.30 – 12.30 Talk Session 9: Cognitive Development 12.30 – 12.45 Awards and Closing Remarks 12.45 – 13.45 Lunch

ORGANISATION

We are thankful to the following staff and students who have dedicated their time and effort to help organise this conference.

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SPONSORSHIP

We are grateful to the Lancaster University Department of Psychology, The Leverhulme Trust, and Positive Science.

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IMPORTANT INFORMATION

Location

- The conference will take place at the Lancaster Environment Centre (LEC on campus map: <https://www.lancaster.ac.uk/maps/campus.pdf>). Enter by the Spine entrance, opposite Furness College (FUR on the campus map).
- Keynotes and talks will take place in L001.
- Poster presentations will take place in the Atrium of the Lancaster Environmental Centre (LEC on the campus map).

Travel information

- For detailed travel information, please visit <http://www.lancaster.ac.uk/travel>
- **Local taxi services** can be reached on the following numbers: +44 (0)1524 32090; +44 (0)1524 35666; and +44 (0)1524 848848.
- **Visitor car parking** is available on campus 24/7 and is free after 6pm. If you are visiting the campus during the day then parking charges apply and can be purchased from any of the 11 pay and display machines across campus at a cost of £2 for two hours. Chip and pin card payment facilities are available at several machines. Alternatively, all-day visitor scratch cards are available from the Cashiers' Desk in University House (building no. 33 on the campus map) priced at £5 each. The cheapest option (£3 per day) will be to park at Alexandra Park as this is on the edge of campus.
- **In the City:** The bus station is situated on Damside Street in the City Centre and most services also stop at Common Garden Street. Service 1/1A provides a direct connection to the University every 10 minutes, Services 100, 4, 4X, 40, 41 and 42 also serve the University, giving a total of 14 buses per hour from Monday to Saturday until 7pm. Additionally, Services 4 and 4X run every 30 minutes between the Railway Station and the University (Monday to Saturday daytimes). Single tickets cost £2.20, and return tickets cost £3.10.
- **On Campus:** Services 100 and 42, along with certain 4, 40 and 41, serve the southern perimeter road and South West Campus. There are also bus stops directly outside the Sports Centre on the main drive.

Registration

- The registration desk is located in the Foyer of the Lancaster Environmental Centre (LEC on the campus map) at the Spine entrance (opposite Furness College, FUR on the campus map).
- The desk will be staffed between 8.30 and 9.30 on Wednesday, Thursday, and Friday, as well as during coffee breaks.

Coffee breaks, lunch, and reception

- Coffee breaks (Wednesday, Thursday, Friday) will take place in the Foyer of the Lancaster Environmental Centre; the lunches (Wednesday, Thursday, Friday) and evening reception (Thursday) will take place in the Atrium of the Lancaster Environmental Centre.

Social events

- Conference dinner: Wednesday, August 21st, 2019
 - This year's conference dinner will be hosted at **The Lancaster House Hotel** from 19.30. The restaurant is located on campus (LCC on the campus map).
 - The conference dinner is not included in the registration fee. Advance booking is required.
- Drinks reception: Thursday, August 22nd, 2019
 - The reception will take place in the Atrium of the Lancaster Environmental Centre between 17.00 to 19.00.
 - Canapés and drinks will be served.
 - The cost of the reception is included in the registration fee.

Internet access

- To access the Visitor Wi-Fi network, simply select the "LU-Visitor" network, then follow the registration screens, or log in to eduroam.
- Visitor Wi-Fi access will last for 24 hours. For longer access, you will need to register again.
- For support on the day, please see one of our volunteers with a Babylab sticker.

FOOD & DRINK ON CAMPUS AND IN TOWN

Below is a list of favourites, based on an informal survey of Lancaster Psychology staff and students. Reservations in the town centre are recommended, especially for larger groups.

Options on Campus

- **Pizzetta Republic** - Good restaurant for those who like pizza, late opening times. Good for coffee, too.
- **Sultan of Lancaster** - Indian restaurant and takeaway, serves a variety of curries, chicken and wraps. Late opening times.
- **The Deli** - Popular deli salad bar with fresh, homemade tartlets, a selection of meats and cheeses as well as hot roast sandwiches and filled focaccias. Closes at 16.30.
- **The Lounge** - Restaurant on campus. Good food and good place for a sit-down coffee. Shuts at 15.00.
- **Go Burrito** - urban Mexican-style restaurant serving burritos, burrito bowls, tacos, loaded fries, to name a few. Shuts at 18.00.
- **The Mill (Fylde College)** - A great choice of fresh toasties and sandwiches, or for something more filling, try the burgers and burritos. Open until 20.00.
- **Subway** - Offers a wide variety of fresh sub sandwiches. Shuts at 22.00.
- **Wibbly Wobbly Burger** - Good burger place, simply follow directions to Grizedale College. Only open for lunch.
- **Costa Coffee** - Counter-service coffee chain offering hot drinks, iced coolers, sweet snacks and sandwiches. Shuts at 18.00.
- **Greggs** - Affordable savoury products and sweet. Open until 17.00.
- **JuiCafe** - Award winning smoothies, awesome milkshakes, single origin coffee and vegan soups cooked daily in store. Closes at 17.00.
- **Ketcap** - Restaurant offering kebabs, burgers, fried chicken and more. Open till late.
- **The Herdwick** - A traditional pub serving ales, cider, single malt whiskies and mead. Open from 20.00 till late.

Options in Lancaster town centre

- **Aroma Chef** - Authentic Szechuan cuisine. (18-20 Market Street, 01524-847300)
- **Full House Noodle Bar** - Chinese, Malaysian. Very casual. Just walk through the shop and go upstairs. Shuts at 21.00. (21 Common Garden Street, 01524-842888)
- **Kashish** - Good Indian restaurant. Bring your own alcohol (which can be purchased at nearby Sainsbury's supermarket). Open until 23.00. (32 Parliament Street, 01524-388222)
- **Nami Sushi** - Lovely sushi in a cosy and friendly environment. (31-35, China Street, 01524-33388)
- **Priory Hall** - Serves excellent coffee from local, award-winning roastery (Atkinson's). Nice cakes, too. Shuts at 17.00. (10 China Street)
- **Pizza Margherita** - Authentic pizzas, plus pasta dishes, in an informal setting, with classic marble tables. (2 Moor Lane, 01524-36333)
- **Quite Simply French** - French cuisine with a chic style and an intimate vibe. (27a St George's Quay, 01524-843199)
- **Siam Balcony** - Authentic Thai cuisine in a relaxing atmosphere. (6A Chapel Street, 01524-383889)
- **Sun Pizza** - A good pizza restaurant. (26 Sun Street, 01524-846252)
- **Sun Pub** - Good pub food, also nice for drinks. (63-65 Church Street, 01524-66006)
- **The Borough** - Nice pub in town centre, has its own brewery. Serves food till 21.00, drinks till 23.30. (3 Dalton Square, 01524-64170)
- **The Herbarium Bar** - Lancaster's newest vegan establishment. You will find a hangout cafe, yoga studio, bar, and facilities for events. (5-7 Great John Street, 07903-356458)
- **The Music Room** - Serves excellent coffee from local, award-winning roastery (Atkinson's). Nice cakes, too. Shuts at 17.00. (Sun Square)
- **The Tap House** - Artisan brews and niche wines, good for drinks. Open till midnight. (Gage Street, 01524-842232)
- **The Water Witch** - A towpath pub in a converted stable block. Perfect for some afternoon/evening pub grub by the canal. (The Tow Path, Aldcliffe Road, 01524-63828)
- **Whale Tail** - Vegetarian dishes from local, organic and fairtrade produce in a quirky café. Open till 16.30. (78a Penny Street)

DAYS OUT IN AND AROUND LANCASTER

Things to do in Lancaster

- **Williamson Park** - Lancaster's favourite Park offers beautiful panoramic views of Lancaster and its surrounding area. The Ashton memorial, butterfly house (formerly a tropical palm house), small animal zoo (home to resident meerkats and marmosets), and birds attractions make for an entertaining visit.
- **Lancaster Castle** – Take a tour of Lancaster's Grade I listed historic building dating back to Roman times.
- **The River Lune** – Take a stroll along the River Lune. The pathway between Lancaster and Caton offers some interesting features on and around the river.
- **Morecambe beach and promenade** – Take the train or bus to our nearest seaside town. This long stretch of beach is ideal for sandcastles providing the English summer weather is kind to us.
- **Lancaster Market** – If you are after some locally produced food (potted shrimps from Morecambe Bay, Lancashire cheese, Lancashire sauce, and smoked fish), there are many stalls at the outdoor Charter market on Wednesday and Saturday.



Lancaster canal (left) and The Ashton Memorial (right)

If you have your own transport:

- **Old Holly Farm** – Located on the A6, 5.5 miles from the University, this farm offers the opportunity to meet their baby lambs, chicks and calves alongside other farmyard animals as well as an indoor play area, café and farm shop.
- **The Pudding House, Wallings Farm** – Located close to the A6, 5.5 miles from the University, the pudding house boasts homemade, fresh food including the best ice-cream sundaes to be found. Choose from a wide range of flavours and visit the farm animals. N.B. Don't panic if you don't have transport - we have our very own Wallings farm ice-cream shop on campus.

A little further afield:

- **Liverpool and Manchester city centres** can be reached within 1 – 1.5 hours by rail from Lancaster. Here you can visit a fantastic selection of museums, theatres, shops and parks.
- **The Lake District** can easily be reached within 40 – 45 mins by rail from Lancaster. Here you can explore the area walking, cycling, or splashing about in one of Britain's breath-taking spaces.



View from Catbells, The Lake District

SCHEDULE

Wednesday, August 21st, 2019

8.30 to 9.00 Registration and Refreshment

9.00 to 9.15 Opening Remarks

9.15 to 10.15 **Keynote: Victoria Southgate** (*Chair: Michelle To*)
A New View on Early Perspective Taking

SESSION 1: SOCIAL COGNITION

(*Chair: Sylvain Sirois*)

10.15 to 10.45 Do infants learn to follow gaze through reinforcement learning?
Testing a robot prediction

Priya Silverstein, Gert Westermann, Eugenio Parise and Katherine Twomey

10.45 to 11.15 Stopping at nothing: two-year-olds differentiate between
interrupted and abandoned goals

Alexander Green, Barbora Siposova, Sotaro Kita and John Michael

11.15 to 11.45 Coffee Break

SESSION 2: INFANT-CAREGIVER INTERACTION

(*Chair: Szilvia Linnert*)

11.45 to 12.15 Visual exploration during parent-infant interaction in India and UK

Prerna Aneja, Samuel Forbes and John Spencer

12.15 to 12.45 What's in a look? Can mutual awareness of attending to an event
jointly be conveyed in a look between infant and mother?

Kirsty Graham and Katie Slocombe

12.45 to 13.15 The role of gesture in parent teaching and infant word learning

*Rachael W Cheung, Calum Hartley, Kirsty Dunn, Rebecca L Frost
and Padraic Monaghan*

13.15 to 14.15 Lunch

14.15 to 16.15 **Poster Session 1**

15.45 to 16.15 Coffee Break

SESSION 3: LINGUISTIC INPUT AND ENVIRONMENT

(Chair: Nirmala Rao)

16.15 to 16.45 Measuring linguistic input in low resource settings: a LENA approach to the Awadhi dialect

Laia Fibla, Larissa Samuelson and John Spencer

16.45 to 17.15 The BRIGHT study: Using LENA to assess the linguistic environment of rural Gambia

*Maria M. Crespo-Llado, Lena Acolatse, Sam McCann, Omar Njie,
Mariama Saidykhan and Sarah Lloyd-Fox*

19.30 onwards Conference Dinner at The Lancaster House Hotel (advance booking required)

Thursday, August 22nd, 2019

8.30 to 9.00 Registration and Refreshment

9.00 to 10.00 **Keynote: Catherine Tamis-LeMonda** (*Chair: Gert Westermann*)
Learning in Context: The Active Infant in a Responsive World

SESSION 4: SPEECH PERCEPTION

(*Chair: Catherine Davies*)

10.00 to 10.30 Infants discriminate utterances with and without internal prosodic boundaries: An eye-tracking study with delexicalized speech

Marina Vigario, Joseph Butler, Catia Severino, Ertugrul Uysal and Sónia Frota

10.30 to 11.00 Infant response to and association of infant- and adult-directed speech

Melanie Steffi Schreiner, Vivien Outters and Nivedita Mani

11.00 to 11.30 Coffee Break

SESSION 5: CURIOSITY AND INFORMATION SEEKING

(*Chair: Katherine Twomey*)

11.30 to 12.00 Curiosity-based learning: a unique EEG signature of intermediate perceptual complexity

Szilvia Linnert and Gert Westermann

12.00 to 12.30 “I don’t know but I know who to ask”: 12-month-olds actively seek information from knowledgeable adults

Marina Bazhydai, Gert Westermann and Eugenio Parise

12.30 to 13.00 30-month-olds learn words better from tablets in a passive context

Lena Ackermann, Chang Huan Lo, Nivedita Mani and Julien Mayor

13.00 to 14.00 Lunch

SESSION 6: LANGUAGE DEVELOPMENT I

(Chair: Marina Vigario)

14.00 to 14.30 Word and action learning in early childhood

Sarah Eiteljörge, Maurits Adam, Birgit Elsner and Nivedita Mani

14.30 to 15.00 Attractor Dynamics of Vocal Production in Late Infancy

Jeremy Borjon, Drew Abney, Chen Yu and Linda Smith

15.00 to 15.30 Emerging word segmentation abilities in Down Syndrome

Sónia Frota, Catia Severino, Joseph Butler and Marina Vigario

15.30 to 16.00 Coffee Break

SESSION 7: PUPILLOMETRY

(Chair: Mihaela Duta)

16.00 to 16.30 Measuring infant visual behaviour through pupil size: An introduction to PupillometryR

Samuel Forbes

16.30 to 17.00 Ten years of investigating infant cognition through pupillometry: what next, and how?

Sylvain Sirois

17.00 to 19.00 **Poster Session 2**

18.00 to 19.00 Drinks Reception

Friday, August 23rd, 2019

8.30 to 9.00 Registration and Refreshment

9.00 to 10.00 **Keynote: Kim Plunkett** (*Chair: Kirsty Dunn*)
How Infants Build a Semantic System

SESSION 8: LANGUAGE DEVELOPMENT II (*Chair: Sónia Frota*)

10.00 to 10.30 Word recognition without word comprehension in 6-9-month-old infants

Natalia Kartushina and Julien Mayor

10.30 to 11.00 Dynamic features disrupt, but labels facilitate category formation in infants

Jelena Sucevic, Nadja Althaus and Kim Plunkett

11.00 to 11.30 Coffee Break

SESSION 9: COGNITIVE DEVELOPMENT (*Chair: Olivier Pascalis*)

11.30 to 12.00 Predictive Coding and Emotional Face Processing in Infancy

Mariana R. Pereira, Fernando Barbosa, Michelle de Haan and Fernando Ferreira-Santos

12.00 to 12.30 The role of sleep in the development of visual working memory

Samuel Forbes, Lourdes Delgado Reyes, Jeevun Grewal, Joe Cassidy and John Spencer

12.30 to 12.45 Awards and Closing Remarks

12.45 to 13.45 Lunch

POSTER PRESENTATIONS

Session 1: Wednesday, August 21st, 2019, 14.15 to 16.15

1. Japanese mothers' and fathers' language input in toy play with their children at 30, 36, and 42 months of age
Hiroko Kasuya, Kayoko Uemura and Chinatsu Yoshizawa
2. The functional significance of cross-sensory correspondences in infant-directed speech
Anna M Barnett, Peter Walker and Gavin Bremner
3. The impact of phonology (cognateness) on the bilingual lexicon: Parallel cross-language phonological priming
Serene Siow, Gonzalo García-Castro, Nuria Sebastian Galles and Kim Plunkett
4. Word learning from iPads in Autism Spectrum Condition and early typical development: the role of iconicity and engagement.
Bethany Wainwright, Melissa Allen and Kate Cain
5. A Possible Turning Point of Spoken Word Recognition in 3-year-old Mandarin-speaking Toddlers: An Eye Tracking Study
Yuchen Jin and Qinmei Xu
6. Relations Between Parents' Expressed Emotions and Child Development Gathered from Five-Minute Speech Samples
Marina Blum, Wei Li and Andrew Ribner
7. Speaking to Children Learning English as an Additional Language: An Observational Study of Preschool Teacher Talk
Kin Chung Jacky Chan, Padraic Monaghan and Marije Michel
8. Infants' Understanding of Emotions: Eye Movements and Behavioural Responses to Interactive Gaze-Contingent Faces
Jolie Keemink, Jonathan Prunty, Nicky Wood and David Kelly
9. Lending a Helping Hand to Preterm Infants – A Longitudinal Study on Infant Development
Manuela Stets, Sarah Redsell, Samantha Johnson, Angela D'Amore and Ruth Ford

21. Processes of gestural development in young chimpanzees
Kim Bard, Sophie Dunbar, Vanessa Maguire-Herring, Yvette Veira, Kathy Hayes and Kelly McDonald
22. Language-guided encoding of episodic memories in the developing mind
Jelena Sucevic and Kim Plunkett
23. What information do toddlers use to select a causal intervention?
Emma Tecwyn and Daphna Buchsbaum
24. How do infants' early holdout, give, point and reach gestures influence caregiver feedback during social interaction?
Laura Boundy, Thea Cameron-Faulkner and Anna Theakston
25. The effect of a barrier on children's performance on an object choice task
Hannah Clark, Zoe Flack and David Leavens
26. Exploring colour perception in infants across the visual field
Michelle To, Chiara Capparini and Vincent Reid
27. Relating parental MLU to infant's vocabulary size via speed of processing
Julia Egger, Caroline Rowland and Christina Bergmann
28. The Impact of Prematurity on Social Understanding (IPSU)
Catherine Lavery, Andrew Surtees and Caroline Richards
29. Infants' brain processing of the global human motion configuration in biological motion – a fNIRS study with 7 months-old
Isabel C. Lisboa, Sandra Queirós, Adriana Sampaio, Jorge A. Santos and Alfredo F. Pereira
30. The Curious Case of Infant Learning
Anna Kravchenko, Lorijn Zaadnoordijk, Bernardo Nipoti and Rhodri Cusack
31. Semantics-specificity of child directed speech across activities in socio-economically diverse households
Celia Renata Rosemberg, Florencia Alam, Laura Ramirez, Garber Leandro and Carla Giordano

32. Variation sets in child directed speech to Argentinian toddlers. Effects of SES and type of activity assessed in a naturalistic study
Florencia Alam, Leandro Garber, Celia Renata Rosemberg, Alejandra Stein and Maia Julieta Migdalek
33. A mediation analysis of the relationship between maternal education and children's vocabulary at 36 months
Sinead McNally, Cathal McCrory, Jean Quigley and Aisling Murray
34. Is Fetal Hand Posture an Indicator of Maternal Stress
Shilfi Gafur, Suzanne Foggatt and Nadja Reissland
35. How does infants' motor expertise impact their action prediction accuracy?
Joanna Rutkowska, Marta Bakker, Janny Stapel and Sabine Hunnius

Session 2: Thursday, August 22nd, 2019, 17.00 to 19.00

1. Behavioral and neurophysiological precursors of mirror self-recognition
Fiona Pugin, Kira C. Maurer, Norbert Zmyj and Moritz M. Daum
2. Can infants use social and non-social cues to trigger a reward?
Jonathan Prunty, Jolie Keemink and David Kelly
3. Kindergarteners' Active Use of Category Knowledge
Eszter Dóra Szabó and Anett Ragó
4. Multimodal integration in infancy: a computational model of language-mediated attention
Mihaela Duta and Kim Plunkett
5. How Does the State of Curiosity Induced by Uncertain Information Affect Exploration and Learning in Infants?
Xiaoyun Chen, Katherine Twomey and Gert Westermann
6. Can children learn new words from touchscreen apps? Employing fast mapping paradigm in a tablet study.
Joanna Kolak, Padraic Monaghan and Gemma Taylor
7. A corpus analysis of the word segmentation cues in German child-directed speech
Katja Stärk, Evan Kidd and Rebecca L. A. Frost
8. Self-awareness and Prosocial Behavior
Yaroslava Goncharova
9. Older but not younger infants adapt their looking behaviour after seeing a threatening vs. non-threatening stimulus
Samantha Ehli, Babett Voigt, Albert Newen and Silvia Schneider
10. If Looks Could Talk - The Role of Social Context Features for Social Referencing in Infants
Samantha Ehli, Babett Voigt, Albert Newen and Silvia Schneider

11. Will young children give up victory for their friends? Pre-schoolers' fairness preferences with different recipients in a contest task
Peidong Mei
12. The role change of tonal information in Mandarin spoken word recognition in Chinese infants
Qinmei Xu and Ye Tao
13. Behavioral and Physiological Displays When Infants are Faced with a Social Threat
Angela Bernardo, Nancy Aaron Jones, Krystal Mize and Melannie Platt
14. Exploring whether mothers create structured learning environments for their children regarding object complexity and choice agreement.
Marina Loucaides, Katherine Twomey and Gert Westermann
15. Cognitive and motor development trajectories in preterm children
Petra Hoffmannová
16. Measuring sensitivity to visual targets across the peripheral visual field in early infancy
Chiara Capparini, Michelle To and Vincent Reid
17. Do socio-economic disparities imply differences in toddlers' comprehension of lexical categories?
Celia Renata Rosemberg, Florencia Alam, Alejandra Stein and María Ileana Ibañez
18. Development of Attentional Orienting towards the Whole Object from 5- to 9- month-old
Yuqing Ge and Qinmei Xu
19. Effects of traditional cradling in Tajikistan
Lana Karasik, Sara Fernandes, Ori Ossmy, Catherine Tamis-LeMonda and Karen Adolph
20. Mother-infant Structured Social Interaction at 12 months: effect of the play task in the Maternal Touch Patterns
Juliana Serra, Helga Miguel, Adriana Sampaio, Ana Alexandra Moura and Alfredo F. Pereira

21. Investigating infants' looking behaviours towards motion trajectories: The role of manner and direction
Nina Harrison, Gavin Bremner and Peter Walker
22. The earlier, the smarter? Socio-cognitive advantages of learning a new language in Early Years of school
Valeria Agostini and Andrea Krott
23. Early life conditions and the emergence of Joint Attention – A cross cultural study
Eve Holden, Joanna Buryr-Weitzel, Claudia Wilke, Edmund Donnellan, Sophie Marshall, Rhiannon Pearce, Maggie Hoffman, Kirsty Graham, Nicole Lahiff and Katie Slocombe
24. The method to predict infant behaviour: A study of Artificial Neural Networks
Mitsuhiko Ishikawa and Shoji Itakura
25. The effects of preterm birth and SES on early phonological development
Nayeli Gonzalez-Gomez
26. Negativity Bias in the Effect of Perceived Emotions on Toddlers' Word Learning
Lizhi Ma, Katherine Twomey and Gert Westermann
27. ERP correlates of action segmentation in infants
Matt Hilton, Romy Råling, Isabell Wartenburger and Birgit Elsner
28. Sleep and Lexical Integration in 2-Year-Old Toddlers
Janette Chow and Kim Plunkett
29. Gender differences in the early mathematics skills in six countries in the Asia Pacific
Shuqi Yang and Nirmala Rao
30. Relations among linguistic and non-linguistic factors and children's acquisition of number concepts
Nirmala Rao, Shuqi Yang, Ben Richards and Stephanie Chan

31. Are young children developmentally on-track in Learning, Psychosocial well-being and Health? Observations from China, Myanmar, Bangladesh and India
Nirmala Rao, Shuqi Yang, Ben Richards and Stephanie Chan
32. Teaching attention to function as a word learning strategy
Cecilia Zuniga Montanez and Andrea Krott
33. Is intention understanding the social mechanism underpinning the relationship between joint attention and gestural ability in typical development and Autism Spectrum Disorder?
Bethany Pearson
34. The impact of restricted interests on language acquisition in ASD
Charlotte Rothwell

KEYNOTE ABSTRACTS

Wednesday, August 21st, 2019

Victoria Southgate (University of Copenhagen)

A New View on Early Perspective Taking

The capacity for perspective taking has been the topic of research in child development since the late sixties, with initial work suggesting that these abilities are only achieved by school age. However, in the last decade, a large body of work has amassed which has revealed the ability of infants as young as 3 months of age, not only to take the others' visual perspective, but to infer others' goals, desires and beliefs on the basis of those perspectives. Perspective-taking, however, is not a trivial ability and work with adults and older children suggests that it entails Executive Functions (EFs) to select among competing perspectives. How then is it possible for infants, with their limited EFs, to achieve what looks like sophisticated perspective-taking abilities? In this talk, I will present a new account of infant perspective taking which views infancy as a period of altercentricity, facilitated by an absence of self-representation, which gives way to increasing egocentricity with development. I will argue that this account not only explains infants' perspective-taking abilities, but also provides a plausible mechanism for developmental change.

Thursday, August 22nd, 2019

Catherine Tamis-LeMonda (New York University)

Learning in Context: The Active Infant in a Responsive World

Everyday interactions contain abundant cues to word meaning. However, researchers often strip away the layers of contextual richness that naturally accompanies infant-directed speech. We tend to observe infants in controlled settings, with a small number of objects, for brief periods of time, as infants play with an adult. But, the experimental rigor of structured tasks obscures the real-time, real-world characteristics of everyday learning. What do infant-mother interactions look like in the home environment—the setting where language learning actually occurs? How do infants learn words as they navigate a sensory-rich, dynamic environment?

Across several studies, we document the contributions of child, caregiver, and context to infants' language experiences. Based on extensive video recordings of infants and their mothers during home routines, we describe the exuberant "active infant", who transitions among hundreds of objects per hour, thereby generating enormous opportunities to hear words for the targets of their activities. We then describe the social and contextual cues that accompany mothers' speech to infants. Analysis of 3,000+ naming events shows that mothers nearly always label objects that are in view of the infant while dyads visually and/or manually engage with the object. Analysis of over 13,000 nouns and verbs in mother speech showed that infants hear words that are tightly bound to specific locations and activities, such as hearing food words while eating in the kitchen and clothing words while on a changing table. Nested social and contextual cues render the unstructured home setting as quite responsive and conducive to learning.

Friday, August 23rd, 2019

Kim Plunkett (University of Oxford)

How Infants Build a Semantic System

The ability to identify appropriate referents, given a label, develops rapidly during the second year of life, so that by the time an infant reaches her second birthday she may understand many hundreds, if not thousands of words. Although we know a great deal about the types of words that infants comprehend, surprisingly, we know very little about their appreciation of the meaning relationships between words themselves. These meaning relations lie at the heart of the human semantic system: Part of knowing what the word 'dog' means involves knowing, if only implicitly, how it relates to the meaning of 'cat' or 'bone'. A proper understanding of human semantic development involves identification of how and when infants begin to link words together in a network of meanings, thereby going beyond word-world associations to achieve a system of meanings that underpins human communication.

In this talk, I will describe a series of experimental and computational studies designed to investigate how toddlers extract meaning from speech and when they begin to integrate word meanings into a network of relationships. The results of these studies suggest that toddlers exploit both taxonomic and thematic information in the construction of a semantic network and that this network has already begun to coalesce by 18 months of age. I also hope to have time to present evidence that inhibitory semantic mechanisms play an important role in lexical-semantic processing at least as early as 24 months of age, and to explore the implications of these findings for a computational account of early lexical development.

TALK ABSTRACTS

Wednesday, August 21st, 2019

SESSION 1: SOCIAL COGNITION

Do infants learn to follow gaze through reinforcement learning? Testing a robot prediction

Priya Silverstein¹, Gert Westermann¹, Eugenio Parise¹ and Katherine Twomey²

¹ Lancaster University, ² The University of Manchester

How joint attention initially emerges has been a topic of great debate, with one of these joint attention abilities being gaze following. The most widely-accepted developmental theories suggest that infants are able to gaze-follow only by understanding communicative intent. Another group of theories suggests that infants may learn to gaze follow based on social reinforcement. Nagai et al. [Advanced Robotics, 20, 10 (2006)] successfully taught a robot to gaze-follow purely through low-level associative learning and social reinforcement, and found that the robot learnt to follow gaze in the horizontal plane before it learnt to follow gaze in the vertical plane, because of the higher variability in the horizontal input. In this study, we tested whether 12-month-old infants were also better at gaze following in the horizontal than the vertical plane. This prediction does not follow from the predominant developmental theories: on these accounts, infants should follow gaze irrespective of gaze direction. We found that infants had higher accuracy when following gaze in the horizontal than the vertical plane ($p = .01$). These results confirm a core prediction of the robot model, suggesting that children may also learn to gaze-follow without the need to invoke complex, high-level intention reading. This study was pre-registered, and all data, code, and materials are openly available on the Open Science Framework (<https://osf.io/fqp8z/>).

Stopping at nothing: two-year-olds differentiate between interrupted and abandoned goals

Alexander Green, Barbora Siposova, Sotaro Kita and John Michael

University of Warwick

The ability to attribute goals to others emerges early in the first year of life (Csibra, 2008; Liu & Spelke, 2017; Luo & Baillargeon, 2005; Sommerville, Woodward, & Needham, 2005; Southgate & Vernetti, 2014). Because most research on goal attribution in early childhood implements experimental scenarios in which the target agent's goals remain constant, little is known about whether young children update their representations of others' goals over time, despite the importance of this ability for accurately representing others' goals. In particular, we do not know whether children are sensitive to the distinction between goal-directed actions that were halted because the goal was abandoned, or because the goal was interrupted.

To test this, we developed and pre-registered an instrumental helping paradigm in which we manipulate the experimenter's reason for not completing a goal-directed action. In test trials the experimenter begins to place a toy into a box (initial location). In the abandoned goal condition, the experimenter then states that he would rather place the toy in another box (alternative location). In the interrupted goal condition, the experimenter encounters an obstacle which prevents him from reaching the initial location. We measure where children help place the toy (initial vs alternative location).

Twenty-four children between the ages of 24 and 30 months were tested using a within-subjects design, consisting of 4 abandoned goal-condition trials and 4 interrupted goal-condition trials. Using GLMMs, we found that the odds of helping the experimenter place the toy in the initial location were over 4 times larger in the interrupted goal-condition as compared to the abandoned goal-condition ($OR = 4.63$, estimate $\pm SE = 1.53 \pm 0.51$, $p = .003$). These results suggest that children do indeed differentiate between interrupted and abandoned goals, and that this can guide their helping behaviour in dynamic social contexts.

SESSION 2: INFANT-CAREGIVER INTERACTION

Visual exploration during parent-infant interaction in India and UK

Prerna Aneja, Samuel Forbes and John Spencer

University of East Anglia

Previous work shows that shared attention between infant and caregiver underscores infant cognitive outcomes, such as social communication and word learning.

Here, we examine how attention is distributed during dyadic interactions between caregiver-infants in India and UK using head-mounted eye-trackers. Ten-minute toy-play sessions with 60 caregiver-infant dyads (six-month-olds) were recorded. Preliminary analyses include caregivers mean fixation duration, fixation switch rate, and dispersion of fixation on normalised X and Y positions (N=30).

Caregivers from High SES Indian and UK samples showed more latterly dispersed eye movements, often to follow their crawling infants. Qualitatively, groups differed in their lateral dispersion. UK caregivers picked a toy and brought it centrally to show and, then hand it to the infant. High SES India caregivers tended to manipulate one object centrally while handing another toy to the infant.

Contrarily, Low SES groups held all the toys together, centrally, placed in front of the infant's face presumably to keep the child entertained. They also showed longer fixations and made fewer switches with little variability in the group, suggesting a slow and stereotypical rate of visual information processing.

Overall, caregiver's performance in the naturalistic task correlated with infant's cognitive performance in the laboratory. A negative correlation was observed between caregiver's fixation duration and infant's engagement in a visual working memory task ($r = -.43$; $p = .038$), suggesting that caregivers with slower visual information processing speed have infants who are less engaged with the cognitive task. Caregivers with higher switch rate had infants with low change preference scores ($r = -.44$; $p = .030$); associated with poor cognitive performance. Research shows that caregivers who follow and hold their infants' gaze at a location have infants who tend to learn more.

We discuss how these data fit with prior ethnographic research indicating that caregiver-infant interactions embody cultural goals related to child development.

What's in a look? Can mutual awareness of attending to an event jointly be conveyed in a look between infant and mother?

Kirsty Graham and Katie Slocombe

University of York

Joint attention, or sharing attention with another individual about an external object or event, is a critical behaviour that emerges in pre-linguistic infants and predicts later language production. Given its importance, it is perhaps surprising that there is no consensus on how to measure joint attention in prelinguistic infants. A rigorous definition proposed by Carpenter and colleagues requires the infant and partner to gaze alternate between an object and each other (which shows coordination of attention), and exchange communicative signals (which shows that they know they are sharing attention jointly). However, Hobson and Hobson (2007) have proposed that the quality of gaze between individuals is sufficient to know if sharing of attention has occurred. They propose that observers can reliably distinguish “orienting”, “checking”, and “sharing” looks, but the empirical basis for this claim is limited as their study focussed on 11-year-old children and only included two raters. We wanted to see if looks between infants and mothers could be reliably categorised by raters according to Hobson and Hobson’s (2007) definitions. Thirty-one raters identified looks in (i) 30 videos comprising 10 infants producing one of each type of looks to the mother, as categorised by the mother, who watched the video immediately after it occurred; and (ii) 33 videos from 8 infants where we had no mother ratings. The raters agreed on some of the looks (determined by Fleiss Kappa), and so we coded the videos to identify cues that participants may be using to identify the type of looks (e.g. duration of look, presence of communication etc.). This approach will allow us to generate a rigorous objective operational definition of joint attention events.

The role of gesture in parent teaching and infant word learning

Rachael W Cheung¹, Calum Hartley¹, Kirsty Dunn¹, Rebecca L Frost² and Padraic Monaghan^{1,3}

¹ *Lancaster University*, ² *Max-Planck-Institute for Psycholinguistics*, ³ *University of Amsterdam*

How infants identify correct word-referent pairs within the complex environment of word learning remains uncertain. Monaghan (2017) found the combination of multiple cues, including gestures, guided information about an intended referent in a canalisation model of word learning. Parent gesture predicts child gesture, and early child gesture predicts vocabulary size (Rowe, Özçaliskan, Goldin-Meadow, 2008). Gesture may thus form a valuable cue in determining intended referents.

We examined environmental manipulations on parental gesture cues during word learning. We hypothesized that parents would initiate more deictic cues when targets appeared amongst more compared to fewer foils, and that infants of parents of those who offer more gestural cues would show better word learning on test trials. We asked parents to teach infants aged 18–24-months-old (N=47) three novel words across three conditions where we manipulated the number of potential referents between one, two, and six. Dyads were video recorded and analysed for gestural cues. We then tested infant knowledge of these novel words (N=27; two trials per word).

Results indicated that parents provided more gestural cues with increased referents (Fig.1) – in particular, they showed an increase in deictic cues from one to two referents ($p = .030$), and from one to six ($p = .006$), but not from two to six ($p = .553$). However, parents offered more gesture with speech cues in the two-referent condition. Gesture cues did not directly relate to infant accuracy during testing, although accuracy was predicted by a fixed effect of condition, with infants performing best with two-referents. Our data indicate that the immediate environment influences parent gestural cues during word learning. Parents appear to alter gesture use due to the presence, but not the degree, of referential uncertainty. Furthermore, a degree of variability in the number of potential referents may be beneficial to infant word learning.

SESSION 3: LINGUISTIC INPUT AND ENVIRONMENT

Measuring linguistic input in low resource settings: a LENA approach to the Awadhi dialect

Laia Fibla, Larissa Samuelson and John Spencer
University of East Anglia

Previous research suggests that wide variation in language outcome measures can be found across children. One major source of variance in young children's language development was their caregivers' socio-economic status (SES); with children whose parents are professionals having larger vocabularies than children born to parents who received government assistance. One-way maternal education may influence early language development is through maternal language input to the child.

Our study focuses on a non-western sample (India, Uttar Pradesh) from two different age and SES groups (6mo, High SES n = 66, Low SES n = 62, mean age = 331; 9mo High SES n = 64, Low SES n = 68, mean age = 421). We carried on daylong naturalistic recordings of caregiver and child interactions from Indian families using the LENA recorder (Language ENvironmental Analysis) that can be placed on a vest that the child is wearing during the day. The LENA is able to capture the linguistic environment to which the child is exposed at home for an extended period of time. It also includes an analysis software that is able to calculate the amount of words that each speaker has produced and can find patterns such as turn taking in the speech.

LENA has never been used in Awadhi (the dialect spoken by our families) before. We assess the validity of this measure in the new linguistic setting and we find adult word count ranges in line with previous literature using audio recordings across different SES and language groups. Our results show differences in parent-child turns and child vocalisations for child gender and SES status. In particular, boys produce more turns and vocalisations than girls. Interestingly, low SES children produce more vocalisations than high SES. We will discuss the implications of our results for the language input literature.

The BRIGHT study: Using LENA to assess the linguistic environment of rural Gambia

Maria M. Crespo-Llado¹, Lena Acolatse², Sam McCann³, Omar Njie², Mariama Saidykhan² and Sarah Lloyd-Fox¹

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² *Medical Research Council, The Gambia at the London School of Hygiene and Tropical disease,* ³*Department of Women and Children's Health, Kings College London*

The Brain Imaging for Global Health (BRIGHT) project has been established to deliver longitudinal measures of brain and cognitive development from 0-24 months in the UK and Gambia. Here, we explore infants' home linguistic environments across three time points (12, 18 and 24 months) in Keneba (Gambia), and Cambridge (UK). Audio-recordings of infants' verbal interactions with family members were obtained over the course of two consecutive days using the LENA system. LENA generates automated counts of language activity in the natural environment of the child, including adult words, conversational turn taking and infant vocalizations. The Communicative Development Inventory (CDI) was also used to assess infants' language production and comprehension skills as informed by their parents. To date, a total of 97 12-month-olds (15 British; 82 Gambian), 121 18-month-olds (43 British; 78 Gambian) and 59 24-month-olds (23 British; 46 Gambian) have been assessed.

Preliminary results with the younger age groups (12 and 18 months) have revealed that British infants engage more frequently in conversational turns with adults than Gambian infants at both age points and that only in the UK there is a significant increase in the amount of turn taking to which infants are exposed from 12 to 18 months. Despite these differences, infants from The Gambia and the UK do not differ in the production of vocalizations at both age points.

We are currently investigating whether this pattern of results changes at the age of 24 months, when infants are even more vocal, and whether LENA measures at 12 months are able to predict larger vocabularies (as measured by the CDI) at 24 months. Results from these preliminary analyses will be presented. By relating these social-environmental markers to cognitive and behavioural outcomes, we aim to assess their utility in predicting developmental trajectories within The Gambia and guide new interventions.

Thursday, August 22nd, 2019

SESSION 4: INFANT-DIRECTED SPEECH

Infants discriminate utterances with and without internal prosodic boundaries: An eye-tracking study with delexicalized speech

Marina Vigario¹, Joseph Butler¹, Catia Severino¹, Ertugrul Uysal² and Sónia Frota¹

¹ *University of Lisboa*, ² *University of Neuchatel*

Prosodic boundaries play a crucial role in signaling speech chunking, and may facilitate language learning. Previous studies have shown that infants are sensitive to prosodic boundaries and use them to segment speech ([1, 2, 3, 4]). Prosodic boundary cues, however, vary across languages ([5]), and infants need to attune to the language-particular cues ([6, 7, 8]). This study explores the perception of prosodic boundaries without the pause cue in Portuguese 9-month-old infants (n=15). Using a familiarization procedure with visual fixation implemented with eye-tracking (SMI RED500), infants were presented with delexicalized utterances with and without an internal prosodic boundary (IP) while watching a video with a randomly moving pattern. Delexicalization was obtained, using Mbrola software, by converting all vowels into [e] and all consonants into [n], except for coda consonants that were converted into [ʃ] (example utterances in Fig. 1; stimuli acoustic properties in Table 1). For looking time analysis, two areas of interest were defined, the whole screen (AOI1) and the visual moving pattern (AOI2), as well as a time window of interest for the familiarity effect. For both AOIs, a main effect of familiarity was found, with longer looking times to the familiar prosodic pattern, and no effect of familiarization condition (with, without IP) or interaction (Figure 2; Table 2). Effects were stronger in AOI2, with a medium effect size compared to a small one in AOI1. Evidence for discrimination between utterances with and without IP was thus found, demonstrating that the pause is not necessary by 9 months in line with the language-specific adult pattern ([9]). Importantly, the use of delexicalized stimuli ascertains that infants' successful discrimination could only rely on the processing of prosodic structure. Potential implications of our findings for crosslinguistic variation in the development of prosodic boundary perception, and for prosodic bootstrapping theory are discussed.

Infant response to and association of infant- and adult-directed speech

Melanie Steffi Schreiner¹, Vivien Outters¹ and Nivedita Mani²

¹ *University of Göttingen*, ² *Georg-August-Universität Göttingen*

Across cultures, infants are addressed in infant-directed speech (hereafter, IDS), for which adults modify their speech commonly used with other adults, known as adult-directed speech (hereafter, ADS; Ferguson, 1964). While numerous studies report preferences for IDS over ADS, it remains unclear whether infants attend to IDS because they associate this register as speech specifically directed at them.

Using an eye-tracking task, 6-month-olds ($n=41$) were presented with two female speakers using IDS or ADS towards a curtain. The addressee was subsequently revealed to be matching the speech register (e.g., IDS and infant) or mismatching (e.g., ADS and infant). We measured infants' pupil diameter in response to the reveal of the addressee with the assumption that larger pupil diameters represent an index of infants' violation of expectation (Figure 1). We also measured infants' pupil diameter during IDS and ADS exposure to assess infants' preferences in terms of internal arousal. In line with previous findings, we expected larger pupils in response to IDS compared to ADS.

Infants' pupil diameter was significantly larger for the mismatching compared to the matching condition during the expectation phase, $t(40)=2.58$, $p=0.014$ (Figure 2). In addition, baseline-corrected pupil diameter was significantly larger for IDS compared to ADS, $t(32)=3.31$, $p=0.002$ (Figure 3). Ongoing data collection with 13-month-olds will further shed some light onto the development of infant response to and infant associations of IDS and ADS.

The results suggest that infants as young as 6-months already associate ADS with adults and IDS with young children. In addition, IDS seems to create greater infant arousal compared to ADS, even if it is just overheard. Thus, the current findings underline the attentional salience of IDS and, in addition, provide first evidence that infants may attend to IDS because they already associate this register with speech input exclusively addressed towards them.

SESSION 5: CURIOSITY AND INFORMATION SEEKING

Curiosity-based learning: a unique EEG signature of intermediate perceptual complexity

Szilvia Linnert and Gert Westermann
Lancaster University

According to curiosity-based models, learning occurs at intermediate levels of complexity, relative to existing mental representations. Low-level complexity does not stimulate significant learning, as similar information is already mentally represented, whereas overly complex information is difficult to integrate into existing representations. However, little is known about the brain mechanisms underlying preference for intermediate levels of complexity. The aim of this study was to address this question by investigating EEG correlates of perceptual complexity. We quantified complexity by the perceptual difference between category exemplars. The stimulus set consisted of nineteen colour images of novel animals, where attributes such as posture (stooping to standing) and size of wing were varied incrementally. Images were presented successively, differing by either one, three or seven positions along the continuum; corresponding to small, intermediate or large levels of difference, respectively. The final sample included fifteen 9-month-old infants. Stimuli were presented on the screen consecutively, while EEG was recorded at 128 electrodes. Event-related potentials (ERPs) were calculated and compared for the three conditions (small, intermediate or large difference). Visual ERPs differed between small vs. intermediate and small vs. large differences as early as 60-130 ms after stimulus onset, indicating less effort to process an image if it was preceded by a similar one. Central, attention- and memory-related ERPs between 500-600 ms were larger for large differences compared to small and intermediate differences, indicating larger attentional allocation when an image is very different from the previous one. More importantly, central ERPs between 350-450 ms were larger for intermediate differences compared to small or large differences. This indicates distinct attentional and/or encoding mechanisms when two images, presented consecutively differed at an intermediate level. In conclusion, the brain responds differently to levels of complexity and we found an EEG signature that reflects the role of intermediate complexity in perceptual learning.

“I don’t know but I know who to ask”: 12-month-olds actively seek information from knowledgeable adults

Marina Bazhydai, Gert Westermann and Eugenio Parise

Lancaster University

Active social communication is an effective way for infants to learn about the world. Do preverbal infants pose epistemic requests to their social partners when motivated to obtain information they cannot discover independently? Recent experimental work has shown that infants are sensitive to the distribution of knowledge among social partners (Poulin-Dubois & Brosseau-Liard, 2016) and expect to learn from previously reliable informants (Begus & Southgate, 2012; Goupil, Romand-Monnier & Kouider, 2016; Tummeltshammer, Wu, Sobel & Kirkham, 2014). Infants’ pointing has been proposed to serve an information-seeking function (Southgate, Van Maanen, & Csibra, 2007), however, little is known about pre-verbal and pre-pointing infants’ ability to make epistemic requests.

The present study investigated whether 12-month-olds selectively seek information from knowledgeable adults in situations of referential uncertainty. We measured social referencing as a behavioural correlate of the active information-seeking process. In a live experiment, infants were introduced to two unfamiliar adults, an Informant (reliably labeling objects) and a Non-Informant (equally socially engaging, but ignorant about object labels). At test, infants were asked to locate a novel referent among two novel objects – that is, to make an impossible choice. Infants selectively referred to the Informant rather than the Non-Informant but showed no such preference at the familiarization and training phases, when no uncertainty was present. These results suggest that preverbal infants use social referencing to actively and selectively seek information from social partners, prior to their active use of pointing as part of the interrogative communicative toolkit.

30-month-olds learn words better from tablets in a passive context

Lena Ackermann¹, Chang Huan Lo², Nivedita Mani¹ and Julien Mayor³

¹ *University of Göttingen*, ² *The University of Nottingham - Malaysia Campus*,

³ *University of Oslo*

Over just a few years, the popularity of tablets has skyrocketed; tablet ownership in British households with children have increased ten-fold, from 7% in 2010 to 86% in 2017. In parallel, there has been an explosive growth in apps: to date, the Apple Store features nearly 200'000 “educational” apps, many of them targeted at children, toddlers being the most popular age group. These apps are mostly released without having their effectiveness tested, and it is questionable whether children do learn from touchscreen devices.

Indeed, it has been suggested that young children learn less from passive video viewing than from equivalent live experiences – a “video deficit effect”. Yet, it is still unclear whether this deficit is primarily driven by the lack of social interactions during learning, or due to the fact that children are passive in such situations.

To dissociate both effects, we designed a tablet study in which “active” participants chose which images were being named, while age-matched “passive” participants were automatically given selections made by their, active, peers. Learning was assessed by 2-AFC and 4-AFC test blocks. Seventeen pairs of 30-month-old German-speaking participants took part in the study. Both groups learnt words above chance. Surprisingly, children in the passive condition outperformed those in the active condition in the 2-AFC ($p = 0.037$). In the 4-AFC, the interaction between condition and test order ($p = 0.021$) indicated that active participants' performance decreased in later trials, while passive participants improved as the test phase went on.

These results suggest that 30-month-olds do not systematically benefit from active learning in touchscreen-based word learning tasks. Our study adds to the growing body of evidence that educational apps should be treated with caution: While children might benefit from interactive apps under certain conditions, locomotor and cognitive constraints should always be taken into account.

SESSION 6: LANGUAGE DEVELOPMENT I

Word and action learning in early childhood

Sarah Eiteljörge¹, Maurits Adam², Birgit Elsner² and Nivedita Mani¹

¹ *Georg-August-Universität Göttingen*, ² *University of Potsdam*

Communication with children is often multimodal in nature, involving, e.g., language and actions. This multimodal input supports language learning when it highlights the word-object mapping. However, actions (as part of the multimodal input) can also guide the child's attention away from the language input, and thus, exacerbate learning. Here, we examined the influence of semantic consistency of actions on word learning as well as children's word and action learning.

In the first study, children (18, 30, 36-48 months) and adults were presented with two novel objects and their novel labels. These objects were either moved always in the same way (Consistent group) or in variable ways across trials (Inconsistent group). During the test phase, participants' target looking was recorded while they saw both objects and heard one of the labels. 30-month-old and 3- to 4-year-old children learned words for objects in the Consistent condition only, contrary to adults who learned words for objects in both conditions.

In a second study, we investigated the development of word-object and action-object learning. Children (12, 24, 36 months) and adults were presented with two novel objects and their novel labels and novel actions. During the test phase, participants saw both objects and either heard one of the labels or saw one of the actions, and participants' target looking was measured. 12-month-olds learned action-object mappings, 24-month-olds learned word-object mappings, and 36-month-olds and adults learned both.

These results suggest that the presentation of multimodal input affected word learning in early childhood, which is absent in adulthood. Further, children's learning of words and actions for objects across early childhood might influence these findings. These results highlight how children choose different kinds of input at different points in development and how the interaction of the child and the environment can shape the child's learning experience.

Attractor Dynamics of Vocal Production in Late Infancy

Jeremy Borjon, Drew Abney, Chen Yu and Linda Smith

Indiana University Bloomington

Human development emerges from nested processes operating at multiple timescales [1]. Vocal development is the dynamic coordination between the vocal apparatus, musculature, nervous system, and social interactions [2-3]. While all vocalizations probabilistically emerge from these dynamics, much research tends to focus on individual components such as social contingency [4] or linguistic content [5]. The interplay between the vocal apparatus and the head in which it is situated is often overlooked, especially in naturalistic settings. The present study examines the dynamic interaction between vocal production and head stability during dyadic play from 9-24 months of age. A total of 3,163 vocalizations emitted by 44 unique infants across a total of 128 sessions were studied. Across development, the frequency and number of infant vocalizations increase (Figure 1A-B). From 9-15 months of age, vocalization duration increases and from 18-24 months of age, duration decreases (Figure 1C). To capture patterns of head movement, a motion capture sensor was affixed to the infant's head (Figure 2A-B). Using a multivariate Gaussian distribution, an attractor region, a range of stability [6], for the head's rotational speed was calculated (Figure 2C-D). The size of the attractor region for head stability decreases from 9-24 months of age (Figure 2E). From 9-15 months of age, children are likely to be in a stable state during naturalistic vocal production (Figure 3A-C, shaded region), suggesting that early vocal behavior occurs with their head movement in a constrained and stable state. From 18-24 months of age, the infant is unlikely to be in the attractor during vocal production (Figure 3D-F, shaded region), revealing a diminishing influence of the attractor on vocal production, supporting the capacity to flexibly produce vocalizations. Together, these results advance the understanding of typical naturalistic vocal development and its sensorimotor dynamics.

Emerging word segmentation abilities in Down Syndrome

Sónia Frota, Catia Severino, Joseph Butler and Marina Vigario

University of Lisbon

The ability to extract word-forms from continuous speech plays a crucial role in language acquisition, particularly for word learning ([1]), and may predict later language outcomes ([2]). This ability has been shown to develop differently across languages ([3]). Although language production is seriously delayed in children with intellectual disabilities ([4, 5]), studies on word segmentation in this population are rare ([6, 7]). The present study investigated emerging segmentation abilities in European Portuguese (EP) infants with Down Syndrome (DS, $n=17$; age range 7-21 months), testing the ability to segment monosyllabic target word-forms located at prosodic edges and medial positions. EP-learning TD infants aged 4-10 months were found to segment at edge position only ([8]). Using a modified version of the visual familiarization paradigm, DS infants were familiarized with passages with target word-forms in edge and medial positions, and then tested with four sequences of isolated word-forms, two of which consisted of familiar targets, and two were new, unfamiliar word-forms (as in [8]). Infants younger than 18 months were found to behave differently from older infants ($F(1, 15) = 10.612$, $p = .005$, $\eta^2 = .414$; Fig.1). This difference was driven by the edge condition, with older infants looking significantly longer at familiar targets presented at edges than younger infants ($U = 62.00$, $p = .011$; all other comparisons not significant, Table 1). Moreover, segmentation abilities were found to be correlated with two language assessment scores: the CSBS DP Checklist ([9]) speech composite percentile, and the EP-CDI short forms ([10]) expressive vocabulary score. More looks to edge than to medial or unfamiliar correlated with higher percentiles/scores (Fig.2). Taken together, these findings demonstrate that only older DS infants approached the pattern found for TD infants, and that segmentation abilities and speech abilities are closely linked in DS.

SESSION 7: PUPILLOMETRY

Measuring infant visual behaviour through pupil size: An introduction to Pupillometry

Samuel Forbes

University of East Anglia

Eye-tracking has become a key paradigm to unlock infant looking behaviour during tasks. As well as gaze location, eye-tracking has the potential to collect information on changes in pupil size throughout the task. Pupil data, however, can be notoriously difficult to manage, requiring filtering and pre-processing prior to analysis. Furthermore, due to availability of functions, many researchers are forced to use multiple software bundles or even languages to analyse data. PupillometryR is a package designed to work with the R statistical software package, which specialises in pre-processing, visualising, and analysing complex pupil data. PupillometryR allows researchers analysing pupil size data to follow a single pipeline to clean and filter pupil data, perform window-based or timecourse-based analyses, and to visualise results ready for presentation. Here I present a demonstration of real eye-tracking data analysed through the PupillometryR pipeline and highlight how the package allows R users to analyse pupil data within a familiar setting. In particular, I focus on the multiple options available for analysing and visualising pupil data, and discuss how those analytical outcomes can be interpreted by researchers, with particular reference to the kinds of experiments used by infant researchers.

Ten years of investigating infant cognition through pupillometry: what next, and how?

Sylvain Sirois

Université du Québec à Trois-Rivières

The use of pupil diameter as a complement (or alternative) to looking-time measures in infancy research has seen a steady growth in the last decade, following notable publications by Jackson and Sirois (2009) and Gredebäck and Melinder (2010). Ensuing work from a growing number of laboratories has highlighted the potentially unique ability of this measure to reveal aspects of infant cognition and development that elude traditional approaches (Hepach & Westermann, 2016).

In this talk, I highlight key methodological issues that can guide experimental design to increase participant retention and data quality and minimise data loss and residual errors. Special attention is dedicated to dynamic stimuli, time-locked events across trials, factorial designs, and baseline pupil measurement. These issues all contribute to statistical power, which is an exacerbated problem in infancy research (a difficult population of participants that requires expensive and time-consuming logistics to extract useable data).

I will also provide an overview of popular analysis strategies that have been applied to pupillometry data by infancy researchers. These will be contrasted in a bake-off format as they are applied to distinct published datasets. Relative strengths and weaknesses of these strategies can guide experimental design, again with the aim of increasing statistical power.

Finally, this talk will present new visualisation tools (and free Matlab scripts to use them) to better understand task-evoked pupil diameter changes. Of particular interest are hotspots (which combine features of fixations and heatmaps) and hotspot swarms, which are particularly helpful with dynamic stimuli. These tools can help researchers analyse and communicate study findings.

Some ten years on from the start of this “second wave” of pupillometry research, it is important for the field to have more than an additional dependant measure. Ideally, infancy researchers can harness this data to substantially advance our understanding of infant cognition.

Friday, August 23rd, 2019

SESSION 8: LANGUAGE DEVELOPMENT II

Word recognition without word comprehension in 6-9-month-old infants

Natalia Kartushina and Julien Mayor

University of Oslo

The past five years have witnessed an explosion of claims that 6-month-old infants understand the meaning of several words. To reach this conclusion, researchers presented infants with pairs of pictures from distinct semantic domains and observed gaze patterns consistent with the interpretation that infants know these words. Yet, longer looks to a given item might not reflect comprehension of the word per se; infants may rely on extra-linguistic cues while disambiguating between two items.

Recent research demonstrated infants' reliance on extra-linguistic cues when learning new words. Words heard consistently within well-defined temporal, spatial or linguistic contexts are acquired earlier than words heard in broader contexts whereas a noun's concreteness and frequency are strong predictors of the emergence of its comprehension.

The current study assessed the robustness of a 'comprehension' interpretation by examining whether infants use extra-linguistic cues to disambiguate between items. Seventy 6-9-month-old Norwegian infants were tested on their comprehension of sixteen familiar words using an intermodal preferential looking paradigm. Contrarily to previous studies in English-learning infants, our results revealed no word comprehension in 6-7-month-old Norwegian infants, suggesting cross-linguistic differences in the onset of word comprehension. However, 8-9-month-old Norwegian infants showed robust target preference, suggesting that they understood the familiar words used in the study. Yet, word-pair effect sizes were highly correlated with the frequency imbalance between the two words in a pair, such that frequency-matched pairs were not disambiguated by infants.

Our results suggest that infants exploit frequency differences between items to disambiguate them. Moreover, they suggest that the very onset of word comprehension is not based on the infants' knowledge of words per se. Rather, infants use a converging set of cues to identify referents, among which frequency is a robust (pre-semantic) cue that infants exploit to guide object disambiguation and, in turn, learn new words.

Dynamic features disrupt, but labels facilitate category formation in infants

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The ability to encode correlations between static and dynamic features is crucial for infants' developing knowledge about a wide range of categories (Rakison, 2004). There is, however, conflicting evidence about the impact of labels and motion on infants' ability to learn categories. Labels were shown to have positive effects on categorisation (e.g. Althaus & Plunkett, 2016), but also to hinder it (Deng & Sloutsky, 2015). Similarly, motion was found to help learning (Deng & Sloutsky, 2015), whereas other studies found that infants were unable to learn dynamic categories (Rakison, 2004). To reconcile these diverging results, the present study investigated the impact of motion (Experiment 1) and labels (Experiment 2) on novel category learning in 10-month-old infants.

Both experiments used a gaze-contingent familiarisation novelty-preference task. During familiarisation infants were presented with a set of training items, and items would only start moving or be labelled once fixated. Following familiarisation, infants' category formation was measured as a preference for one of the two items presented in test. To explore category representation at different levels of familiarity, three familiarisation blocks were interleaved with test blocks in order.

The results of Experiment 1 (N=25) revealed that motion disrupted learning; no evidence of categorisation was observed, even after three blocks of familiarisation (mean novelty preference scores: Block 1: .52; Block 2: .47; Block 3: .51, all n.s.). In contrast, Experiment 2 (N=26) revealed that category-specific labels facilitate category learning and infants show evidence of learning already after one block of familiarisation (mean novelty preference scores: Block 1: .55, $p < .05$; Block 2: .56; Block 3, .57).

Taken together, these results show that highly salient stimulus properties, such as motion and labels, can strongly affect the process of category formation, even when these additional features are entirely redundant for extracting information about the category structure.

SESSION 9: COGNITIVE DEVELOPMENT

Predictive Coding and Emotional Face Processing in Infancy

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Predictive processing provides a new approach to brain function that has been used to explain a wide range of processes, from perception to socioemotional processing. The main assumption of this framework is that the brain is an active system that works in a top-down fashion, constantly making predictions about its future states and inputs based on previous experiences with the world. The explanatory power of this framework for adult brain function is widely recognized, but it has yet to be systematically applied to understand the developing brain, in which the existent knowledge of the world is in constant evolution. Applying this framework to the development of facial and emotion processing allows to uncover a progress from the existence of predictive algorithms and a very primitive prior present in neonatal stages, to the development of a highly environment-based prediction in the first year, and an emotion-related processing in which prediction errors are driven by valence in pre-school ages and by arousal in adolescence and adulthood. The implications of this framework will be discussed, as well as some electrophysiological results with a sample of infants, who performed tasks that are appropriate to study predictive processing and to tackle how predictions are generated, violated, and accommodated in early stages of development.

The role of sleep in the development of visual working memory

Samuel Forbes, Lourdes Delgado Reyes, Jeevun Grewal, Joe Cassidy and John Spencer
University of East Anglia

The association between sleep and cognitive capacity is well-documented. In infants and children sleep is thought to facilitate neural plasticity through synaptic downscaling, facilitating memory and learning. Past research has found that later sleep is associated with poorer cognition in early years, and that the loss of just one hour of sleep can affect cognition throughout the day. In older children and adults, loss of sleep has been shown to affect cognitive capacity, while later sleep has been associated with poorer cognition and working memory. We focus on the role that sleep plays in the development of visual working memory, by examining the role that sleep patterns play in the development of visual working memory (VWM) in 6-month-old infants, and to compare that with their cognitive development. In the present study, infant VWM was measured with a preferential looking task, while optical neuroimaging data were collected using fNIRS. Infant sleep data were collected over at least 5 days using an actigraphy device. The behavioural and optical results demonstrated different patterns of attentiveness for later and more irregular sleepers than for those who slept regularly and early. In particular, there was a relationship between the difficulty level of the task, and the behaviour in the VWM task, which was moderated by sleep variability. Additionally, sleep efficiency was strongly related to performance in the VWM behavioural task. The findings of this study suggest a key role for sleep in the development of VWM and offers further insight into the wider relationship between sleep and executive functioning. These findings were discussed in the context of brain development.

POSTER ABSTRACTS

Session 1: Wednesday, August 21st, 2019

1. Japanese mothers' and fathers' language input in toy play with their children at 30, 36, and 42 months of age

Hiroko Kasuya¹, Kayoko Uemura¹ and Chinatsu Yoshizawa²

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The first three years of children's lives are characterized by rapid advances in all areas of development, including the acquisition of language, mostly through social contexts with caregivers. Row, Coke, and Pan (2004) found that mothers and fathers did not differ on the amount of talk and the diversity of vocabulary, but fathers did use more wh-questions that conversationally challenged their children. In the current study, we aimed to describe how a father and a mother in each family talked with his or her child and how parental engagements and children's conversational skills were changed across ages and families.

Three mothers and fathers were videotaped at home in dyadic interaction with their children at 30, 36, and 42 months of age during toy play. All verbal and non-verbal behavior for 15 mins was transcribed. Parental behavior was coded as EP (Engaging in the play), PR (Positive Regard), TE (Teaching), ST (Structuring), and DE (Detachment). The quality of dyadic interactions was globally rated by a 3-point scale with 1(low) to 3 (high), after coding who initiated interactions. We coded these categories in 15-sec intervals for a total of 60 intervals.

Analyses revealed that both mothers and fathers interacted with their children through pretend play and a within-family difference in the father's session was found for teaching and structuring behavior. At Time 2, all parents engaged in the play very frequently, while frequency of parental teaching behavior decreased. While this tendency of parental behavior remained the same at Time 3, all interactions initiated by children were rated higher than those initiated by the parents. These findings suggest that children need parents who can understand what children need as well as encourage them to learn and enjoy themselves in their play while nurturing the child's self-initiative through timely and stimulating parental communication.

2. The functional significance of cross-sensory correspondences in infant-directed speech

Anna M Barnett, Peter Walker and Gavin Bremner
Lancaster University

Despite traditional assumptions that prosody contributes only to the structural organisation of spoken language, increasing evidence suggests that it plays a fundamental role in the communication and interpretation of ambiguous word meaning. Specifically, recent research suggests that users of infant-directed speech (IDS) manipulate prosody in ways that reflect known cross-sensory correspondences between visual and auditory sensory channels, such as the relationship between auditory pitch and visual size (i.e. higher-pitched sounds are associated with smaller objects). But do infants attend to these prosodic cues in an attempt to resolve linguistic uncertainty? To address this question, we presented 24, 24-month-olds with novel object pairs varying by a single dimension (e.g. size, pointiness or brightness) and asked them to locate one of the objects using a phrase containing a novel pseudoword (e.g. “Where is the rebo one?”). The speaker applied either a high-pitch tone of voice and a fast rate of speech or a low-pitch tone and slow rate of speech during this enterprise in an attempt to guide word-object pairings. The findings throw light on the functional significance of cross-sensory correspondences in IDS.

3. The impact of phonology (cognateness) on the bilingual lexicon: Parallel cross-language phonological priming

Serene Siow¹, Gonzalo García-Castro², Nuria Sebastian Galles² and Kim Plunkett¹
¹ *University of Oxford*, ² *Pompeu Fabra University*

The non-selective hypothesis for bilingual lexical access states that when presented with a familiar object, bilinguals simultaneously activate the object’s labels in both languages (Costa, Caramazza & Sebastian-Galles, 2000). While there is considerable support in the literature for adults, less is known if this hypothesis holds true for early development. The present study utilises a phonological priming paradigm with eye-tracking to investigate this hypothesis in 27–30-month-old bilingual toddlers, focusing on English-Spanish and Spanish-Catalan bilinguals in the UK and Spain. Monolingual toddlers act as controls, providing a baseline measure of priming independent of dual-language effects.

During trials, the prime image is presented in silence. An auditory target label is subsequently presented, followed by target and distractor images displayed side-by-side. Participants will hear target labels in their dominant language (L1). Each target

label shares its first phoneme with the corresponding prime's L1 label. Primes differ on cognateness, where 'cognates' share phonology across the L1 and non-dominant language (L2) (e.g. button/botón), while 'non-cognates' do not (e.g. butterfly/mariposa). Cognate primes in our study always share their first phoneme. To investigate the effect of primes on target recognition, we measure the proportion of time toddlers spend looking at the target after onset of the target and distractor images.

Previous priming studies with monolingual toddlers found lexical interference in phonologically-related prime-target pairs (Mani & Plunkett, 2011). If bilingual toddlers simultaneously activate both L1 and L2 labels, we expect cognate primes to exert dual-language lexical interference on bilinguals' target recognition, contrasting with single-language interference by non-cognate primes. We thus operationalise support for the non-selective hypothesis as significantly greater lexical interference on cognate trials than on non-cognate trials for bilingual toddlers, above and beyond any difference between conditions for monolinguals. This study will allow us to investigate the early manifestation of non-selective lexical access in bilingual development.

4. Word learning from iPads in Autism Spectrum Condition and early typical development: the role of iconicity and engagement.

Bethany Wainwright¹, Melissa Allen² and Kate Cain¹

¹ *Lancaster University*, ² *University of Bristol*

This study investigated word-picture-referent learning in children with autism spectrum condition (ASC): the aim was to determine if providing a three-dimensional context to images facilitated symbolic understanding and whether visual and/or physical engagement were associated with learning. Children with ASC (N=48) and a sample of typically developing (TD) children matched for receptive language ability (N=48) completed a word learning task on an iPad. They viewed coloured pictures of a novel object in two trials under one of three conditions: static 2D image; automatic rotation of the image and manual rotation of the image. The rotating images (automatic and manual) provided increased iconicity through three-dimensional context. In each condition, the target image was named with a novel word by the experimenter. No difference in robust symbolic understanding was found between conditions or groups. However, both groups in the manual rotation condition had greater on-screen looking time and physical touching of the screen compared to the 2D and automatic conditions. The ASC group physically touched the screen more often than the TD group. This study suggests that increasing iconicity to a 'transparent' (Fuller, 1997) level through two-dimensional colour

photographs may be sufficient to elicit the maximum benefit to symbol learning in children with ASC. Interactive iPad tasks may benefit on-task engagement in both typical and atypical development. Individual differences in engagement will be explored in relation to learning.

5. A Possible Turning Point of Spoken Word Recognition in 3-year-old Mandarin-speaking Toddlers: An Eye Tracking Study

Yuchen Jin and Qinmei Xu

Department of Curriculum and Learning Sciences, College of Education, Zhejiang University

How do toddlers understand spoken words? Do they process the unfolding auditory input in time, or do they comprehend the word as an indivisible semantic label? Mounting evidence points toward the cascade hypothesis (e.g., Morsella and Miozzo, 2002; Costa et al., 2000), which suggests that phonological encoding normally occur before lexical node selection. Previous studies have demonstrated that adults as well as 2-year-olds attend to a phonological match faster than a semantic match (Huettig & McQueen, 2007; Chow, Aimola Davies, & Plunkett, 2017). These findings, however, mainly base on Indo-European languages such as English while the unique phonetic features of Sino-Tibetan languages such as Mandarin could lead to a bifurcation in the cognition of spoken word. In the present study, the Visual World Paradigm (VWP) (Huettig & McQueen, 2007) is used to explore the manner and order of phonological and semantic information extraction in Mandarin-speaking toddlers. Seventeen 2-year-olds and ten 3-year-olds have contributed valid data. A replication of Chow's experiment (Chow, Aimola Davies, & Plunkett, 2017) as it is, this study has some novel discoveries in a wider age group. While 2-year-olds show a phonological activation prior to a semantic activation, which confirms Chow's finding, 3-year-olds, however, are less likely to notice phonological matches and still show a phonological activation later.

Evidence from ERPs has suggested that the recognition of Mandarin monosyllabic words might rely more on global similarity of the whole syllable structure or syllable-based holistic processing rather than phonemic segment-based processing, which is shown in English word recognition (Zhao, J. et al., 2011). Based on our results, inference can be made that Mandarin-speaking toddlers tend to adopt a phonemic segment-based way to recognize spoken words at their age of two, while for 3-year-olds, the role of phonemes may gradually be replaced by syllables. This transformation probably derives from the increase of Mandarin input and makes listeners better prepared for rhymes and tones which are unfolded later in words but carry important information.

6. Relations Between Parents' Expressed Emotions and Child Development Gathered from Five-Minute Speech Samples

Marina Blum¹, Wei Li² and Andrew Ribner¹

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There is substantial variability in the ways parents talk about their children when they are not around: Some parents express criticism and aspects they wish were different, others talk about traits they love about their children, and still others express a degree of emotional involvement that verges on unhealthy. Interestingly, individual differences in the way parents describe their children is related to aspects of parenting and the home environment in school-aged children (Khafi et al., 2019). In this study, we apply the expressed emotions coding paradigm (Magaña et al., 1986) to parents' five-minute speech samples when their children are 4, 14, and 24 months old. We ask the following research questions: (1) Can the expressed emotions coding paradigm commonly used in the study of mental health be used reliably and validly in the study of infant and toddler development, and (2) Do parents' expressed emotions relate to aspects of parenting and child development for young children. To address these questions, we leverage a sample of first-time parents recruited from prenatal hospital visits and classes in the US, the Netherlands, England, and China. Both mothers and fathers were prompted to give thoughts, attitudes, and feelings about their child. Samples are coded for a number of different characteristics, including expressed emotions. Expressed emotions include critical comments (e.g., "She is whiny"), emotional over-involvement (e.g., "I was so worried I couldn't sleep"), and quality of relationship (e.g., "We get along great"). The availability of these speech samples allows for unique insights into the thoughts, attitudes and feelings of new parents and their relationship to children's development. Preliminary results indicate unique relations between the ways in which parents talk about their children and children's executive function in the US. At time of presentation, relations between parents' expressed emotions and child self-regulation will be examined cross-culturally.

7. Speaking to Children Learning English as an Additional Language: An Observational Study of Preschool Teacher Talk

Kin Chung Jacky Chan¹, Padraic Monaghan^{1,2} and Marije Michel^{1,3}

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In a 21st-century super-diverse world, children are likely to speak first languages that are not the majority language of society. For some children, preschool is one of the few environments where they experience the majority language. A pressing issue

encountered by preschool teachers is how to communicate with these children and help them acquire the majority language. The present study investigated how preschool teachers communicate with preschoolers learning English as an additional language (EAL), and how this affects language learning. We audio- and video-recorded a preschool classroom for 1 hour per week for 4.5 months and observed whether and how preschool teachers tailor their speech to children of different linguistic backgrounds (monolingual English vs. EAL) and language proficiency levels, as assessed by the Clinical Evaluation of Language Fundamentals – Preschool 2 (CELF-P2) towards the beginning (T1) and the end (T2) of the 4.5 months. Analyses on the transcripts showed that the teachers tended to use a less diverse vocabulary ($p = .040$) and shorter utterances ($p = .001$) with EAL than monolingual English children. When we looked at changes in the teachers' speech longitudinally, we found that the lexical diversity and utterance length increased as the children grew, and the teachers first increased both lexical diversity and utterance length, then only increased utterance length. This suggests that the teachers adapted the way they speak to the children as the children's language developed by introducing more varied vocabularies and using longer sentences. These results seem to be in line with Rowe (2012) that suggested that language ability-appropriate scaffolding is beneficial for early language development.

8. Infants' Understanding of Emotions: Eye Movements and Behavioural Responses to Interactive Gaze-Contingent Faces

Jolie Keemink¹, Jonathan Prunty¹, Nicky Wood² and David Kelly¹

¹ *University of Kent*, ² *Kent and Canterbury Hospital*

Background

Previous research on emotion processing in infancy has predominantly focussed on emotion categorization. Several studies (e.g. Hunnius et al., 2011) suggest that 4- to 7-month-olds preferentially look at positive emotions compared to negative emotions; this is inferred as evidence for emotion recognition.

Method

We assessed emotion recognition within a social interaction using an interactive gaze-contingent eye-tracking paradigm. Participants aged 6- ($n = 22$), 9- ($n = 43$) and 12-month-olds ($n = 35$; data collection ongoing) viewed eighteen 5-second trials showing a neutral-looking actor who would display one of six universal emotions (sadness, anger, disgust, surprise, fear, happiness) after the infant engaged in eye-contact (see Figure). Infants' behavioural responses were video-recorded to explore their reactions (i.e. understanding) to emotions and were coded frame-by-frame in terms of valence (positive/negative) and mimicry.

Results

Eye Movements

Analyses of overall dwell time indicated that looking duration did not differ per emotion ($p = .878$). However, we uncovered a significant AOI by Emotion interaction, $F(10,930) = 7.526$, $p < .001$. Inspection of dwell time per AOI showed that infants deploy emotion-specific eye movements.

Behavioural Responses

Infants frequently produced behavioural responses/reactions (63% of trials), but unlike their eye movements, infants did not produce emotion-specific behavioural responses. Positive responses (i.e., smiling) were produced as frequently, for example, to sad faces and fearful faces as they were to happy faces.

Conclusions

Infants' high responsiveness suggests that our gaze-contingent paradigm successfully engaged the infants and simulated a realistic social interaction. While eye movements provide evidence of discrimination of facial expressions (i.e. visual categorisation), the behavioural responses suggest that infants' understanding of facial expressions is limited. We infer that emotion recognition has a more protracted course of development than is implied by emotion categorization studies. We will also discuss additional applications of our method in populations at risk for atypical development.

9. Lending a Helping Hand to Preterm Infants – A Longitudinal Study on Infant Development

Manuela Stets¹, Sarah Redsell², Samantha Johnson³, Angela D'Amore⁴ and Ruth Ford¹

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Using a variety of assessments in a longitudinal design, we study whether specially implemented play experiences can benefit the development of babies who were born very preterm (earlier than 33 weeks of pregnancy). While survival rates have improved, premature infants are vulnerable to brain injuries that can result in learning difficulties. Consequently, there is an urgent need for effective intervention programmes during early infancy – a period when the brain is developing rapidly.

Studies with full-term babies have shown that certain play experiences delivered around 3 months of age can give them a head start in their ability to reach for, grab, and manipulate objects - activities that are fundamental to learning (e.g., Bornstein, Hahn, & Suwalksky, 2013; Libertus & Needham, 2010). Our 3-year longitudinal project aims to see, for the first time, whether these experiences are similarly effective for premature babies. When a preterm infant reaches 3 months corrected age, we ask parents to engage their baby in daily play-sessions involving soft mittens and specially adapted toys for three weeks. There are two ways of carrying out the play activities with babies assigned randomly to one of the groups. Both groups are assessed for their cognitive, social, and motor skills at four time-points: (a) shortly before the onset of the 3-week intervention period, (b) shortly after (around 4 months corrected), (c) 4 months after (around 8 months corrected), and (d) 11 months after the end of the intervention period (around 15 months corrected).

Assessments include measures of reaching and grabbing behaviours, exploratory play, face preference, intention understanding, working memory, planning and social attention. In this poster, we report preliminary findings from the first year of the project.

10. Investigating the Allocation of Visual Attention to Salient Stimuli in Infants and Young Children with Prader-Willi Syndrome

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Prader-Willi syndrome (PWS) is a genetically determined neurodevelopmental disorder, whose characteristics include early failure to thrive, later food preoccupation, and impairments in social functioning. Difficulties in social functioning develops throughout early childhood and become more evident in adolescence and adulthood. Specific difficulties lie in recognising and processing visual social cues and an inability to effectively interpret social situations, indicating impairments in visual and attentional abilities. As well as impairments in the social domain emerging in infancy, people with PWS also develop an insatiable appetite and young children with PWS demonstrate difficulties in shifting their attention away from food. Any already established impairments in visual attention might therefore also be further affected by food preoccupation.

This cross-sectional study aims to investigate, in infants and young children with PWS, the allocation of visual attention to salient stimuli, as compared to typically-developing controls, and to examine if and at what age attentional capture is

disproportionally biased towards food. Established questionnaires and the assessments of eye gaze in structured settings with different visual images will be used to assess infants and children with PWS (N=28) between 12 and 30 months of age, and age-matched typically-developing infants (N=24) to investigate whether PWS infants and children are disproportionately biased towards food stimuli over neutral or emotional stimuli.

11. The Effect of Social Gaze on Infant Social Behaviour and Language Learning

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³ *University of East London*, ⁴ *Nanyang Technological University, Singapore*

During the first year of life, infants acquire early social skills through interactions with their caregivers. When infants and adults communicate, they exchange social cues that signal their availability and responsiveness as a social partner. Therefore, the presence of social cues in the environment, such as eye gaze, may facilitate positive social behaviour and learning. The current study tested 9-month-old infants (N = 15) on two core aspects of early social and cognitive development: prosocial behaviour and language learning. To explore the role of social gaze, two groups of infants viewed videos of the same female adult experimenter singing nursery rhymes to them with either direct gaze (N = 8), or averted gaze (N = 7). Subsequently, infants' language learning from the experimenter and prosocial behaviour toward her (relative to a baseline) were measured. Language learning was assessed using a classic statistical word learning task involving the extraction of statistical regularities from a syllable stream (Saffran et al, 1996). Prosocial behaviour was assessed using a triad of helping and sharing (food, toys) tasks. Our results showed that the gaze manipulation had a significant impact on infants' language learning – only the group receiving direct gaze showed significant word segmentation (as measured by infants' looking behaviour). Although there was no significant effect of social eye gaze on overt measures of prosocial behaviour, infants' communicative efforts toward the adult increased significantly in the group that received direct eye contact as compared to the averted gaze group. These results suggest that social gaze potentiates early language learning and communication during social interaction with adults. Future research plans in the field of early language acquisition based on these initial results will also be introduced.

12. Word-learning heuristics in bilingual infants: The mutual exclusivity bias

Shannon Gibson¹ and Nayeli Gonzalez-Gomez²

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Research has suggested that bilingual infants do not reliably show the word learning heuristic, mutual exclusivity. The mutual exclusivity bias refers to the tendency to map novel labels onto novel objects. It has been argued that this tendency may occur due to infants using one-to-one mapping between items and labels. However, this approach would not be appropriate for multilingual infants as each item can have at least two labels. The current project aimed to investigate whether bilingual 22-to-26-month-olds hold a different representation of the mutual exclusivity bias in which they must know the label for the familiar item in both languages before attributing a novel label to a novel object. Additionally, performance on mutual exclusivity tasks was compared between known and unknown words for monolingual infants. A personalised stimulus set was produced for each participant based on parental reports of vocabulary and eye-tracking was used to record participant responses. Bilingual infants were found to demonstrate mutual exclusivity if the familiar item was known in their additional language; whilst only demonstrating a trend towards significance if the familiar item was known in English or both languages. Secondary analyses suggested the importance of language dominance and other vocabulary measures in predicting performance. Bilingual infants were found to demonstrate mutual exclusivity if the familiar item was known in their dominant language, but not if this was only known in the nondominant language. The monolingual participants demonstrated a marginal use of mutual exclusivity on trials in which the familiar item was known and failed to use this strategy if the familiar item was unknown to the infant. Taken together, these preliminary results suggest that mutual exclusivity is affected by early language experience. For infants exposed to multiple languages, it seems that the dominant language plays a key role in the use of this strategy.

13. The Impact of Parents' Smartphone Use on Object Learning in 9-month-old Infants: A Dual Head-mounted Eye-tracking Study

Xiaoyun Chen¹, Han Ke², Malcolm Wong¹, Christine Michel³ and Gert Westermann¹

¹ *Lancaster University*, ² *Nanyang Technological University*, ³ *Max Planck Institute for Human Cognitive and Brain Sciences*

New digital technologies such as iPads and smartphones are revolutionizing family life as well as parenting styles. Here we aim to explore the phenomena of parenting styles influenced by smartphones in the digital era. We asked mothers to look at a smartphone to avoid establishing eye contact during an interaction with

their baby. Previous studies highlighted the influence of mutual gaze as part of joint attention situations on the processing of novel objects, which suggested that joint attention facilitates object encoding in 9-month infants (Cleveland, Schug, & Striano, 2007; Cleveland & Striano, 2007). Here we examined the effect of mutual gaze on object learning in 9-month-old infants in a smartphone using situation during the infant-parent interaction.

In this experiment, mothers were asked to show objects to their child in a live interaction in two conditions. In the Joint Attention (JA) condition, mothers described the objects and engaged with their child using ostensive cues (mutual gaze, infant-directed speech and name calling), while in the Smartphone (SM) condition, mothers described the objects while watching videos on a smartphone on the table. Following each interaction phase, infants' looking preferences to the familiar object paired with a novel object were tested. We used dual head-mounted eye trackers to record and code both mother and infant's gaze movement synchronously. Based on a wide range of literature that JA situations set the infant into a receptive state for novel information (natural pedagogy: Csibra & Gergely, 2006; Cleveland, Schug, & Striano, 2007; Cleveland & Striano, 2007), we expect that infants' performance in recognizing familiar objects would be better in JA condition than in SM condition.

Preliminary results (N=16) show that there was a significant looking preference to familiar objects ($M=6499.73\text{ms}$, $SD=4949.35\text{ms}$), than to novel objects ($M=4100.68\text{ms}$, $SD=2460.21\text{ms}$) in JA condition, $t(23)=3.00$, $p=.001$. There was no significant looking preference between familiar ($M=5170.56\text{ms}$, $SD=4269.84\text{ms}$) and novel objects ($M=4408.24\text{ms}$, $SD=2701.74\text{ms}$) in SM condition, $t(23) = 1.06$, $p=.30$.

14. Infant-parent Emotional Synchrony during Social and Non-social Play

Sayaka Fujita¹, Kaili Clackson², Stanimira Georgieva², Sam Wass³, Dave Neale¹, Paul Ramchandani² and Victoria Leong²

¹ *Lancaster University*, ² *University of Cambridge*, ³ *University of East London*

There is growing evidence that early experience of play is related to various developmental outcomes. During face-to-face interactions such as social play, parents and infants mirror each other's affect, and the interchange of positive affect is considered a defining feature of infant-parent play. Despite this, we could find no existing studies comparing the expression of positive affect in different play contexts. Furthermore, the literature has predominantly focused on one-directional influences of parents on their children, and less is known about reciprocal emotional

mirroring and synchronicity during naturalistic play interactions. The present study investigates (1) whether there are differences in positive affect expression between social and non-social play, (2) whether both positive and negative emotions are mirrored during parent-infant play, and (3) the temporal dynamics of emotional mirroring (parent to infant versus infant to parent).

Twenty mother-infant dyads (aged 10.4 months) participated in social (i.e. joint) and non-social (i.e. separated) play with toys, whilst their emotional expressions were monitored on video. Our results showed that both mothers and infants showed significantly more positive affect and more affect synchrony during social play than non-social play. In terms of the temporal dynamics of positive emotional responding, we found that mothers tended to follow, rather than lead, their infants' positive emotional expressions. Further, mothers responded faster to their infants' positive emotions during social play as compared to non-social play. By contrast, there were no significant differences on any of these measures for negative emotions.

These results suggest that different mechanisms may underpin the exchange of positive and negative affect during parent-infant social interactions. Further, different play contexts result in different levels of positive affect, suggesting social context may be a crucial factor in determining play's developmental benefits.

15. Can we Emulate Pre-referential Knowledge in Adults and Infants? An EEG Study

Lewis Ball¹, Colin Bannard¹, Perrine Brusini¹ and Eugenio Parise²

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Around the time of the vocabulary spurt, infants shift from an associationist mechanism of lexical acquisition to a referential mechanism of acquisition (Nazzi & Bertoncini, 2003). This transition appears to be sourced from the formation of referential connections between phonological and semantic representations in memory, beyond mere associations between the phonological and visual form (Friedrich, 2017). Yet does this mean that experienced speakers immediately attain referential knowledge when presented with new words, or does associative knowledge still serve as initial foundation for deeper levels of understanding?

Through a series of studies, we will investigate this issue with the aid of the rich electrophysiological literature in the area of lexical acquisition. We are interested in measuring two different Event-Related Potentials (ERPs)- the N200-500 component and N400 component- which appear to reflect associative and referential word processing respectively (Friedrich & Friederici, 2004; 2011; Kutas & Federmeier, 2010).

Beginning with adults we will present novel words and objects to participants. In a subsequent test phase, we will measure participants' ERPs in response to these words and compare to ERPs produced by familiar words. Although we expect to observe sound referential knowledge for familiar words (i.e. a detectable N400), equivalent levels of understanding for novel words is debatable. With just brief exposure to novel words and their referents, we expect the strength of representations assembled during learning to be sufficient enough to provide associative knowledge (reflected via an N200-500), yet are equally too weak to elicit referential understanding (absent N400).

These results will be compared to results from an infant (12-18 months) sample using a similar paradigm. Such methods will not only allow us to examine age differences in understanding familiar words, but also explore similarities in very early representations for new words, which may not be so different across experienced and novice speakers.

16. The Role of Shape Bias in 'Online' and 'Offline' Categorisation in Autism

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From around 24-months-old, children develop a tendency to categorise objects by shape over other perceptual features during word learning, known as the shape bias. This bias appears to be a powerful tool that allows children to learn new words faster and make generalisations from a single example. Recent evidence suggests some children with Autism Spectrum Disorders (ASD) may not use shape as a preferred cue to category membership, which may affect the efficiency of word learning, however the relationship between this attentional bias and the ability to generalise labels to novel exemplars is not yet well understood.

For much experimental research into shape bias, both the new category exemplar and the test objects are visible at all times, allowing direct ('online') comparisons to be made. Whereas children's real-life category judgements are often made from internal representations ('offline'), without a known example present. To date there has been no research into how these different task types may affect word learning for children with ASD.

This poster presents two research studies: study 1) to investigate whether different task types influence the use of shape bias in word learning in typical and atypical

development; study 2) to investigate underlying explanations for reduced shape bias in some children with ASD during word learning and categorisation.

17. The Effect of Interpersonal Behavioural Synchrony on Children's Learning

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The effect of interpersonal synchrony on children's behaviour is an emerging field rich with research potential. The present study aims to investigate the effect of synchrony on learning in early childhood and uncover its underlying behavioural and physiological mechanisms.

Recent studies have shown that experiencing interpersonal synchrony encourages affiliative and prosocial behavior in children (Cirelli, Einarson, & Trainor, 2014; Fawcett, & Tunçgenç, 2017) and enhances imitation (O'Sullivan, Bijvoet-van den Berg, & Caldwell, 2018). However, the role of behavioural synchrony in children's learning has not yet been investigated experimentally. One possibility is that synchrony, as a coordinated social activity, encourages perceived social bonds between the child and the adult, which leads to heightened attention and better information retention. Equally likely is that physiological, rather than social learning, mechanisms mediate the effect.

Here, we designed a study inducing the experience of synchrony between 2.5-year-old children and the experimenter in the laboratory setting. We asked the caregiver to rock their child side to side to the song's beat together with the experimenter, either synchronously or asynchronously. Following such prime, children engaged in a novel word learning task facilitated by the same experimenter (Horst & Samuelson, 2008). During the synchrony and the learning episodes, we measured children's physiological arousal (heart rate and skin conductance response signals acquired by a wearable wristband device, Empatica E4) as an index of heightened attention and interest. Data acquisition is in progress. We predict that interpersonal behavioural synchrony will differentially affect children's learning, in that following a synchrony episode, children will successfully retain more learned words than following an asynchrony episode. We further expect that children's heightened physiological arousal level following the synchrony episode will accompany higher rates of successful word learning. The proposed study will help shed light on the underlying mechanisms of interpersonal synchrony experience.

18. Imitation and Exploration in 3-Year-Old Children in a Pedagogical Situation

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Pedagogical demonstration of a novel object's functions promotes efficient learning but decreases exploration in preschool children (Bonawitz et al., 2010). We were interested in whether pedagogical interaction style had an effect on imitation and exploration behavior in younger kindergarteners. Three-year-old children ($N = 40$) were presented with a variant of the unusual box task (Bijvoet-van-den-Berg & Hoicka, 2014) in a between-subject design. Children in the pedagogical condition saw demonstrations of different actions on a novel toy, accompanied by "instructive" speech (e.g., "this is how it's done"). Children in the non-pedagogical condition received the same demonstration, but instead with "exploratory" speech (e.g., „this is how it could be done"). Each child received three trials with a new action demonstrated in each trial; actions were modelled twice per trial. After each trial, children were given 90 seconds to explore the box. Children's actions on the box during the exploration phase were coded for imitation, fluency, and originality. Results indicate that children in the pedagogical condition performed more imitative actions than children in the non-pedagogical condition while fluency was at the same level. This study suggests that a non-instructive pedagogical interaction style reduces the tendency to imitate and thereby might encourage exploration in young children.

19. Can language influence other race faces identification?

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Many adult studies suggest that language has an impact on the recognition of individuals. For example, adults remember faces previously paired with their native language more accurately than faces paired with a non-native language. We have previously found that from 9 months of age, own race faces associated with native language are learned and recognized whereas other race faces associated with a non-native language are not. Between 6 and 9 months, while discrimination among familiar own-race faces is maintained, discrimination of faces from within other-race categories decline. The same pattern of change in response has also been reported for language, i.e., native vs. non-native speech. Can language modulate the face narrowing? We hypothesized that native language could facilitate recognition of other-race faces. We tested 9- and 12-month-old Caucasians infants. During a familiarization phase, infants were shown still photography of an Asian face while

audio either in native or non-native language was played. Immediately after the familiarization, the familiar and a novel face were displayed side-by-side for the recognition test. 9-month-olds recognize the familiar face in the non-native condition but not in the native language condition. 12-month-olds failed to recognize the familiar face in both conditions. Native language didn't facilitate recognition of other-race face at 9 months of age but non-native language did, like if 9-month-olds associated other race faces with non-native language. However, this effect is not lasting as it is not present at 12 months.

20. How do 3-year-olds comprehend descriptive vs. contrastive adjectives pre- and post-nominally?

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Adjectives are essential for describing and differentiating concepts. However, they have a protracted developmental course relative to other open word classes. This has been in part attributed to their semantic, syntactic, and pragmatic variability. To understand how 4-year-olds process scalar adjectives across different contexts, we ran an eyetracking study with a 2 (syntactic frame: prenominal; postnominal) x 2 (pragmatic function: descriptive; contrastive) x 2 (age: children, adults) design.

Unlike previous research that has focused on adjectives in prenominal position (the big flower), we also measure children's processing of postnominal adjectives (the flower that's big). Since the interpretation of adjectives depends on the modified noun, the noun-anchor hypothesis (Ninio, 2004; Weisleder & Fernald, 2009) predicts that modified noun phrases are easier to interpret when the noun precedes the adjective. Therefore, we hypothesise that noun phrases will be processed more quickly when adjectives appear postnominally than prenominally. Additionally, we analyse the effect of pragmatic function, where adjectives contrast an object with another of the same class (the big flower alongside a smaller one), or describe a lone entity on its own merits (the little car). Although it is possible to resolve reference during the adjective in both contexts, adults (n=40) show earlier reference resolution in the contrastive than the descriptive condition by using contrastive inference.

In younger children than have been tested previously (Huang & Snedeker, 2013), this study will identify the strategy that children use to interpret adjectives online. Do they 1) listen through the prenominal material and wait for the noun before fixating the target object, regardless of the adjective's informativeness (the easier/safer but slower strategy), or 2) deduce the informativeness of the adjective

online, then use it flexibly in incremental adjective interpretation, requiring adult-like pragmatic abilities and processing capacities. We expect to have analysed data from children by August.

21. Processes of gestural development in young chimpanzees

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Great apes possess a large repertoire of communicative gestures and are useful as a model species for investigating gestural development. The prevailing theory is that actions have motor effects, and through repeated interactions (with a caregiver) these actions are abbreviated and ritualized to become communicative signals (i.e., ontogenetic ritualization: Tomasello et al., 1994). We designed and conducted a responsive care programme for nursery-reared chimpanzees in which caregivers nurtured social and communicative skills, such that species-typical chimpanzee gestures developed. Attainment of milestones in socio-communicative development were recorded daily, longitudinally from birth through 52 weeks of age (n=16). We found a consistent and significant developmental pattern in the contexts of tickle play, grooming, and chase play, consisting of engagement in other-initiated interactions early in life, a later period in which the infant initiated the interactions, and finally, infant requested social partners to join interactions with the use of gestures. In the first year of life, chimpanzees used gestures for displaying submission, and for initiating and/or requesting tickle play, comfort/contact, chase play, grooming, and food sharing. The age at which gestures emerged was significantly different across these contexts. We found that most gestures were not previously effective motor acts. Rather most gestures emerged from actions that were already communicative. Not all gestures were requests, some (e.g., rank-related submissive gestures) indicate non-imperative, perhaps proto-declarative motivations. Some gestures appeared to have a stronger genetic basis, which initially emerged in abbreviated, communicative form. Chimpanzee gestures were either co-constructed or strengthened in response to scaffolded interactions with competent partners. We offer a new view on gestural development, different from ontogenetic ritualization, specifically, our view emphasises that gestures develop from communicative behaviours, through interaction, and communicate socio-emotional desires. The assumption that any single process underlies all chimpanzee gestural development, however, is unwarranted.

22. Language-guided encoding of episodic memories in the developing mind

Jelena Sucevic and Kim Plunkett

University of Oxford

Episodic memory represents the capacity to retain information about events from a particular time and place. The key feature of episodic memory is encoding relational information, such as object location, i.e. identity-location binding (Pathman & Gheti, 2016). It is generally thought that episodic memory abilities emerge relatively late, given the protracted development of the hippocampus (Gómez & Edgin, 2016). There is, however, some contrasting evidence suggesting relational memories can be encoded even during the first year of life (Richmond & Nelson, 2009).

The present study aims to map out the developmental trajectory of episodic memory with a focus on identity-location binding. To achieve this, we developed a novel gaze-contingent eye-tracking paradigm. During training, participants were presented with a set of closed windows and had an opportunity to freely explore them. Windows that were fixated upon would open and reveal an object. In the subsequent test phase, an auditory probe identifying a previously-explored object was played (e.g. “Look at the dog”). The closed windows then appeared again. When the correct location was fixated, the object would be revealed accompanied by positive auditory feedback. To investigate the impact of scene complexity on encoding, set sizes of 2, 3, and 4 items were presented.

Furthermore, to elucidate the role of language in encoding episodic memories, we contrasted infants’ performance when objects were accompanied during training by a label or by a non-linguistic sound.

The results of the pilot study (N=30, 16-28 month-olds, main study in-progress) suggested that encoding abilities improve with age. Additionally, we observed a change in exploration patterns related to age: older participants tended to visit more locations during training as compared to younger ones.

Taken together, this project will enable us to better understand emergence of episodic memories and how language and memory systems start to interact in development.

23. What information do toddlers use to select a causal intervention?

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Understanding causal structure allows us to successfully navigate our world. Pre-schoolers have a sophisticated ability to make causal inferences by observing others' actions, reasoning about the intentions behind them (Sobel & Legare, 2014), and attending to cues like temporal priority (Rankin & McCormack, 2013). Much less is known about what information toddlers use when selecting a causal intervention. In the present study toddlers observed an adult manipulate parts of a puzzle-box (A and B, e.g., spinning a dial, pulling a lever; Fig.1), which led to a sticker being dispensed (effect E). Toddlers then interacted with the puzzle-box and their actions were recorded. In Experiment 1, 18- to 30-month-olds (N=42) observed A-B-E (only B was causally necessary), and the causal plausibility of A and the social cues the demonstrator provided were manipulated. Toddlers primarily intervened on B, though they were more likely to include A if it was spatially contiguous with the outcome (Fig.1a). Their actions were not influenced by the social cues provided by the demonstrator. In Experiment 2, 12- to 35-month-olds (N=83) observed A-E-B (only A was causally necessary). Toddlers primarily intervened on A, even when it was on a separate box (Fig.1b). This suggests that toddlers grasp the temporal priority principle—the notion that causes must precede their effects in time, and also rules out a recency effect explanation for the results of Experiment 1. In Experiment 3 (ongoing) 12- to 35-month-olds saw evidence that a sequence of two actions (AB) was necessary, whereas a single action (B) was not sufficient, to cause effect E. This experiment will shed light on whether toddlers struggle to grasp multi-action causes (i.e., hierarchically goal-directed action). Overall, this study contributes to our limited knowledge of toddlers' causal reasoning, particularly regarding how different sources of information are used when selecting a causal intervention.

24. How do infants' early holdout, give, point and reach gestures influence caregiver feedback during social interaction?

Laura Boudy, Thea Cameron-Faulkner and Anna Theakston

The University of Manchester

Infants' early declarative gesture use has been linked to their later language outcomes, and the shared interactions these facilitate with a caregiver are often viewed as an important mediator between gesture and language acquisition (Tomasello, Carpenter, Call, Behne & Moll, 2005). The current study examined how specific types of gestures produced by pre-linguistic infants predict the duration of

a triadic interaction between an infant, caregiver and object, and both the number and type of caregiver utterances produced during these interactions. Video recordings of forty infants aged 11 months interacting with their caregiver during naturalistic play were examined. Interaction duration, number and type of caregiver utterances (e.g. object label, action description, question) towards infants' communicative points, reaches, holdouts and gives were coded. The type of gesture was found to be a significant predictor of both interaction duration and number of utterances, with holdouts and gives producing longer interactions and a greater number of caregiver utterances than points or reaches. Type of gesture was also a significant predictor of utterance type, with points and reaches eliciting significantly more object labels, gives producing more interjections, and holdouts eliciting more action descriptions. These findings suggest that all four gestures may play different roles in infants' early interactions, which could help explain some of the later developmental patterns of gesture use and language in infants (Olson & Masur, 2015).

25. The effect of a barrier on children's performance on an object choice task

Hannah Clark¹, Zoe Flack² and David Leavens¹

¹ *University of Sussex*, ² *University of Brighton*

The Object Choice Task (OCT) challenges participants to use an experimenter's nonverbal cues to find hidden rewards. Comparisons across species are systematically confounded with procedural differences; for example, human participants are almost never tested with barriers between themselves and the experimenter, but great apes are almost always tested behind cage mesh. So-called "species differences" might be due to these ecological factors, rather than evolutionary history. We tested 18-month-olds and 36-month-olds on the OCT, with and without a barrier. The barrier did not have a suppressing effect on performance, but did elicit more communicative behaviour, overall. Moreover, 18-month-olds displayed more communicative behaviour in comparison with 36-month-olds, who more frequently reached through the barrier in acts of direct prehension. These findings demonstrate (a) effects of barriers on humans' propensity to communicate and (b) strikingly different response profiles to the OCT in humans at 18 and 36 months of age.

26. Exploring colour perception in infants across the visual field

Michelle To, Chiara Capparini and Vincent Reid
Lancaster University

The mature visual field extends to over 90 degrees eccentricity from the line of sight (e.g. To, Regan, Wood & Mollon, 2011). In adults, two kinds of photoreceptors underlie the different regions of the visual field: central vision is driven by trichromatic cones that offer high acuity and colour vision, while peripheral vision is processed by achromatic rods that offer high sensitivity but poor colour vision (e.g. To, Gilchrist, Troscianko & Tolhurst, 2011). In early postnatal retina, the morphology and distribution of cones and rods is constantly changing, and at 8 months, the retina is still maturing (Hendrickson, Bumsted-O'Brien, Natoli, Ramamurthy, Possin, and Provis, 2008). This has direct implications on how colour is processed in infancy and early childhood. Davida Teller's seminal research has offered important insights into infant colour vision, but her research has been limited to the foveal and parafoveal regions (e.g. Packer, Hartmann & Teller, 1984; Kelly, Borchert & Teller, 1997; Teller, 1998). This experiment is the first to examine infant colour vision at higher eccentricities. Here we compare how infants and adults respond to coloured stimuli across their visual fields. More specifically, we present 6-month old infants (and adult controls) with isoluminant Gabor patches at various locations in their mid-peripheral visual field (30 to 60 degrees in eccentricity) and record how often they orient towards the stimuli at each location. These results are the first to map out infant colour vision in the periphery.

27. Relating parental MLU to infant's vocabulary size via speed of processing

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Parental speech input has been shown to play a vital role in infant's language acquisition as well as cognitive development. For example, Hurtado, Marchman and Fernald (2008) found correlations between different measures of maternal input at 18 month with the infant's vocabulary size as well as with infant processing capability at 24 months. While they also presented a link between maternal mean length of utterance (MLU) and speed of processing (SoP), in their study MLU did not seem to correlate with CDI scores, which measure vocabulary size. In contrast, Hoff and Naigles (2002) revealed a strong link between maternal MLU and the number of word types children produced, which they used as an estimate of vocabulary. This suggests that parental MLU impacts on child vocabulary development, just like many other aspects of the input.

We propose that a) parental MLU will influence child vocabulary size and b) the influence of parental MLU on vocabulary size is mediated through the infant's individual SoP. We hypothesize that fast processors are able to benefit from higher parental MLU, because they can process longer sentences, whereas slow processors might even be hindered by hearing long sentences in their input. In order to test these predictions, we conducted a study with 60 18-month-old infants learning Dutch. We assessed their lexical speed of processing (SoP) in a looking-while-listening paradigm and their concurrent vocabulary size with the Dutch CDI. We are currently collecting follow-up CDIs as they turn 24 months. The parental speech input the infants received was sampled during a lab-based play session. We will use mediation analysis to unravel the relationship between SoP, MLU and vocabulary size. Our data from a new population will shed further light on early language acquisition and the role of input and infant capabilities in this process.

28. The Impact of Prematurity on Social Understanding (IPSU)

Catherine Laverty, Andrew Surtees and Caroline Richards
University of Birmingham

Background: Preterm birth (<37 weeks) adversely affects development in behavioural, cognitive and mental health domains. Heightened rates of autism are identified in preterm populations, indicating prematurity may confer risk for delayed/divergent social cognition, social understanding and social competency. Historically, research emphasises the link between prematurity and autism through the use of broad diagnostic and screening tools, yet there is a paucity of detailed neurodevelopmental phenotyping. Additionally, research has focused on describing outcomes in children who are born very-preterm, at the expense of late-preterm groups which are more common. Therefore, we aim to provide the first nuanced phenotype data on social development in children born late-preterm, addressing the following research aims:

- 1) To synthesise the literature through a meta-analysis generating pooled prevalence estimates for autism described by gestational age.
- 2) To delineate the social-cognitive profile of children born late-preterm.
- 3) To describe the relationship between infants' early social behaviour and social attention.

Methods: The current study proposes a novel experimental research strategy, progressing beyond the limits of existing epidemiological data. Methods will combine play-based assessments with eye-tracking paradigms to evaluate children's emerging understanding of themselves and their social world. Implicit evaluation of

social attention through the use of eye-tracking tasks will advance understanding of the mechanisms underpinning neurodevelopment in children born late-preterm.

Analysis: Between-group analyses will evaluate differences in early social cognition between children born preterm and children born at term. Differences in scores between the preterm and term samples on play-based tasks will be explored alongside eye-tracking parameters.

Planned outcomes: The proposed study aims to identify mechanisms underpinning deleterious social-cognitive outcomes infants born late preterm and highlight opportunities to repurpose early autism interventions for preterm cohorts. Understanding the early markers of putative neurodevelopmental impairments has the potential to enhance current knowledge and increase quality of life amongst those born preterm.

29. Infants' brain processing of the global human motion configuration in biological motion – a fNIRS study with 7 months-old

Isabel C. Lisboa, Sandra Queirós, Adriana Sampaio, Jorge A. Santos and Alfredo F. Pereira

University of Minho

The term biological motion (BM) refers to the intrinsic motion of humans and animals and is associated with a now-classic technique: illuminated dots are attached to the major joints of a person to isolate and study the information revealed by motion [1]. We are particularly sensitive to BM: observers instantly identify the global configuration of a person walking from a point-light-walker (PLW) [2].

To do this, one has to be able to integrate the information contained in the motion of the individual dots into the global percept of a person.

How the human visual system globally processes BM is still not completely understood [3] – yet neuroimaging studies are consistent in implying the right STS [4]. Plus, STS role starts early: 7months-old show differential activations in this region to an intact PLW vs. a rigid moving PLW frame; but not relative to an inverted PLW [5]. Though not directly analysed, these results suggest a mechanism in which right STS preferentially responds to articulated motion and the global human motion configuration.

We present the first study using fNIRS to specifically address this question. We tested 7 months old infants ($N=26$, $n=17$, mean age: 7 months and 14 days), comparing cortical responses to a coherent PLW, with a spatially scrambled version of this display, that maintains the local motion but disrupts its global motion configuration. Our fNIRS array, composed by 9 channels, covered only the right STS region.

Concentration of oxy-haemoglobin was different from baseline on channel 1 at [12, 18] time-window ($t(16) = 2.34$, $p = .048$) only in the coherent PLW condition; and it statistically differed from the scrambled PLW ($t(16) = 2.16$, $p = .034$).

These results extend previous findings and show that the global human motion configuration is processed differently in the right STS region since very early.

30. The Curious Case of Infant Learning

Anna Kravchenko, Lorijn Zaadnoordijk, Bernardo Nipoti and Rhodri Cusack
Trinity College Dublin

The environment provides infants with a rich, heterogeneous opportunity for learning. Infants do not process information passively, but actively select the inputs from which they learn. Due to new psychological paradigms, neural measures and the rise of developmental robotics there has been renewed interest in what drives infants to attend to one stimulus over another.

Some researchers have emphasized the value of attending to novelty (Haber et al., 2018; Itti & Baldi, 2005). This is in line with evidence that adults' trait-curiosity is related to novelty-seeking behavior (Baranes, Oudeyer & Gottlieb, 2015) and the proposal that childhood involves shifting from a highly exploratory mode in infancy to an adult strategy of exploiting the skills one has developed (Gopnik et al., 2017). However, this approach does not take into account previous learning and expected gain, and surprise maximization risks pushing infants towards complex, unlearnable things.

Others have treated curiosity as a strategy that maximizes learning in a given context, ranging from information compression (Schmidhuber, 2009) to progress in prediction (Oudeyer & Smith, 2016) or minimizing discrepancies between stimuli and internal representations and adding the notion of learning plasticity (Twomey & Westermann, 2018). Support for these theories comes from evidence that infants preferentially attend to stimuli of a mid-level "Goldilocks" complexity (Kidd, Piantadosi & Aslin, 2012; Vygotsky, 1978). Within the structure of the world and of

infants' learning capacities it seems beneficial to learn about easier events before learning about complex events.

However, while intuitive, it remains unclear what aspect of the learning process is facilitated by an easy-to-complex hierarchy of experience. We consider computational models based on deep learning and hierarchical Bayesian models that have the potential to reveal the mechanisms and constraints on optimal curiosity-driven learning. Finally, we consider how these models can be tested with behavioral measures.

31. Semantics-specificity of child directed speech across activities in socio-economically diverse households

Celia Renata Rosemberg, Florencia Alam, Laura Ramirez, Garber Leandro and Carla Giordano

CONICET (National Scientific Research Council from Argentina)

Several naturalistic studies have recently started to devote attention to the at-home everyday activities in which children are embedded and that likely shape their word development trajectories (Roy, Frank, DeCamp, Miller, & Roy, 2015; Tamis-LeMonda, Custode, Kuchirko, Escobar & Lo, 2018; Glas, Rossi, Hamdi-Sultan & Batailler, 2018). As suggested by Nelson (1996) the social, spatial, temporal and linguistic dimensions of the activities provide multiple cues that constitute a context for children's language experience. Though these dimensions, affecting the ebb and flow of children's everyday life, vary in different socioeconomic (SES) backgrounds (Bradley & Corwin, 2002), studies have not considered SES differences in the extent in which child directed speech (CDS) is semantically structured around the activities of everyday life. Here we assessed semantic specificity of CDS across different type of activities in a socio-economically diverse sample of Argentinian children.

Thirty children (8 to 20 months), half low and half middle SES, were audio-recorded for 4 hours. The 2 middle hours were transcribed and the MOR tool from CLAN was used to identify nouns and verbs. We coded CDS for ongoing activities that implied defined spatial and temporal boundaries: feeding, play, booksharing, grooming, households chores. Following Tamis Le Monda et al. (2018) we calculated the proportion of 21 types of concrete nouns and action verbs, eg. food nouns, eating and cooking verbs, body parts, clothing nouns, washing and dressing verbs, toys, animals, furniture, vehicles. To estimate context-specificity in the semantics of CDS and the impact of SES in the regularity across activities we conducted regression analysis. Findings in this population are in line with those from previous studies: a) the semantics of language is activity specific, however the magnitude varies across

activities (see figure); b) the analysis identified a significant effect of the type of activity but no effects of SES.

32. Variation sets in child directed speech to Argentinian toddlers. Effects of SES and type of activity assessed in a naturalistic study

Florencia Alam, Leandro Garber, Celia Renata Rosemberg, Alejandra Stein and Maia Julieta Migdalek

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A distinct structural feature of Child Directed Speech (CDS) is the use of "variation sets" (Küntay & Slobin, 1996): successive utterances with partial self repetitions. Previous research on mother-child play situations found an impact of socio-economic status (SES) on the quantity and extension of variation sets (Tal & Arnon, 2018). However, every day children are embedded in interactions with multiple people in the context of diverse activities. Hence, we examine the extension and quantity of variation sets in naturalistic at-home multiple participant CDS to Argentinian toddlers. We ask about the effects of SES and the type of the ongoing activity on these characteristics.

Participants were 30 socio-economically diverse Argentinian children (8 to 20 months). Families varied regarding mothers' education (primary, secondary, graduate and postgraduate degrees), considered here as a proxy of SES. Children were audio-recorded for 4 hours at-home, without the researcher's presence. Transcriptions were done in CHAT format. Each utterance was coded according to the activity and clustered into: 1) structured activities -booksharing, regulated play adult-child conversations-, 2) non-structured activities- feeding, grooming, exploratory object and physical play, household chores, conversations between adults, outings and watching TV. Variation sets were automatically extracted from the CDS provided by all the participants. We conducted linear mixed-effect regression analysis to estimate the effects of mother's education and type of activity on the quantity and extension of variation sets, considering the child as random effect and controlling for age.

Results showed an effect of the interaction between mother's education level and type of activity on the quantity of variation sets: in structured activities families in which mothers' have a post-graduate degree, children heard significantly more variation sets than in families where mothers have a secondary and primary education. Neither predictor showed an effect on the extension of the variation sets.

33. A mediation analysis of the relationship between maternal education and children's vocabulary at 36 months

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Expressive vocabulary in early childhood is an established predictor of children's later language development (Marchman & Fernald, 2008) and positively predicts children's literacy and academic skills (Ramey & Ramey, 1999). Social gradients in lexical development have been reported as early as 18 months (Hoff-Ginsberg, 1998) and gradients in children's vocabulary by socio-economic status are well established by the time children enter school (Taylor, Christensen, Lawrence, Mitrou & Zubrick, 2013). This study investigated the processes by which maternal education, as a powerful indicator of socio-economic status, affects early expressive language at 36 months using a large nationally representative cohort study from the Republic of Ireland (n=8062). In addition to the potential role of established predictors of expressive language in explaining maternal education effects, this study considered a broad range of maternal health practices that are structured by maternal education and that are in turn associated with children's cognitive development. No study has yet examined whether maternal education affects young children's vocabulary through factors in early development such as mothers' health behaviours during pregnancy and after birth while also accounting for established predictors of vocabulary development such as book reading. We found that children of mothers with the minimum level of educational attainment scored 6.25 points lower ($p<0.001$) on the British Ability Scales (BAS) Naming Vocabulary test at 36 months [95% CI=46.6, 48.5] compared with children of mothers with a degree-level education [95% CI=52.8, 53.8]. Decomposition analysis revealed that 78% of the difference between polarised educational groups was explained by mediating variables, primarily household income (16.7%), parenting practices (15.7%) and availability of books (24.5%). This study contributes to literature on early child development by highlighting inequities that contribute to a large gap in children's language skills early in life.

34. Is Fetal Hand Posture an Indicator of Maternal Stress

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Durham University

Fetal exposure to stress has been linked to a range of adverse postnatal outcomes, including epigenetic changes, neurobehavioral, and physical deficits. It is argued that direct measures of fetal motor behaviour provide potential markers of child

outcome. Given that areas of the brain that control hand movement have a direct pathway to the spinal cord which is also connected to lateral area five (involved in somatosensory processing), the current study will examine fetal hand posture in relation to maternal stress. In sum, it is hypothesized that disturbances to the CNS by maternal stress will affect prenatal hand postures, which are essential for post-natal somatosensory integration, exploratory, and reach and grasp behaviours. A correlational design was used. 30 archival 2D and 4D ultrasounds of fetus scanned at 32 weeks gestation were coded offline on Observer X12, using a coding scheme devised to distinguish between different hand postures such as a closed or open hand. Stress was also recorded from each fetus mother using the Perceived Stress Scale (PSS). Reliability of the coding was 95% and 89%. PSS scores were grouped based on Cohen et al (1983): 0-13 = Average Stress and 14-20 = Above Average Stress. A significant negative correlation at $p < 0.05$ level between Average Stress levels and a Left-Hand Open Hand Posture was found ($r_s = -0.465$) with a borderline large effect size. A significant positive correlation at $p < 0.05$ level between Above Average Stress levels and Left-Hand Open Hand Posture was found ($r_s = 0.801$) with a large effect size. A positive significant correlation at $p < 0.01$ was also found between Above Average Stress levels and a Left-Hand Semi-Closed Hand Posture ($r_s = 0.856$) with a large effect size. These findings highlight differential effects of stress levels on the CNS and resulting fetal hand postures with significant implications for post-natal life.

35. How does infants' motor expertise impact their action prediction accuracy?

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Predicting others' action is essential for interacting in the social world (Sebanz & Knoblich, 2009). Those predictions are suggested to be built upon the same neural motor plans that are used for action execution (Kilner et al., 2007; Wilson & Knoblich, 2005). When children learn a new motor act, they acquire a motor representation of it that enables them to predict the same action in others (Stapel et al., 2016). With motor experience, the motor representation might become more stable, which may express itself as a reduction in movement variability (Chen et al., 2010). We hypothesise that infants who display more stable movements (low movement variability) are also more stable (less variable) in their predictions of others' actions. Furthermore, we expect that infants who perform more mature and adult-like actions are more accurate in their temporal predictions of adults' actions. To examine these links, we tested 58 6- to 8-month-old infants (34 girls). Firstly, infants were presented with a set of videos of an adult actor carrying out a placement action, while their eye movements were measured. The actor grasped a

toy, transferred it to the other side of the screen and placed it on a higher container off the screen (Figure 1). Part of the screen was always occluded by a black rectangle, so that the actor's movements were hidden from view during a part of the stimuli presentation. Infants' predictive eye movements for the reemergence of the hand grasping the toy from behind the occlusion were measured. Then, the infants' execution skills of the same action were tested and recorded with a motion capture system. They had to transfer a ball from a lower container to a higher one (Figure 2). Data analysis is in progress and the results will be presented at the conference.

Session 2: Thursday, 22nd August 2019

1. Behavioral and neurophysiological precursors of mirror self-recognition

Fiona Pugin¹, Kira C. Maurer¹, Norbert Zmyj² and Moritz M. Daum¹

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Mirror self-recognition (MSR) is typically assessed using the mark test: children detecting a mark on their face via a mirror are considered to recognize themselves. At 18 months, around half of the children pass this test, which is also discussed to reflect a milestone of self-awareness development. However, the dichotomous all-or-none outcome of the mark test offers only limited insight into the development of MSR. The aim of this study is to find specific behavioral patterns which are predictive for passing the mark test. Specifically, 39 children were video-recorded twice (at ages 14 and 18 months) while they were exploring their mirror image and undergoing the mark test. Their behavior was scored using Interact® according to a predetermined scheme, encoding more than ten different types of behavior (frequency and duration). In a first step, we focused on testing behavior (testing and exploring the mirror image) because this is discussed to be a precursor of MSR. Preliminary analyses showed that 14-month-olds displayed more testing behavior than MSR and the opposite pattern with 18 months. No relation between frequency of testing behavior at 14 months and MSR at 18 months was found.

In a next step, we will apply time-series analysis to explore behavioral patterns that may predict MSR at 18 months. Furthermore, we plan to study EEG responses to observed pictures of the own and someone else's face to identify neurophysiological markers of MSR development. Our study design involves longitudinal EEG measurements at 14 and 18 months. Combining this with the detailed behavioral coding scheme, the goal is to detect a neurophysiological precursor of MSR. In summary, the combination of detailed behavioral pattern analysis and EEG may offer insights into not only the mark test, but also into gradual steps of the development of self-recognition in general.

2. Can infants use social and non-social cues to trigger a reward?

Jonathan Prunty, Jolie Keemink and David Kelly

University of Kent

Infants are sensitive to social cues such as eye gaze from birth (Farroni, Massaccesi, Pividori, & Johnson, 2004), and the ability to use these cues is a vital precursor to more sophisticated socio-cognitive abilities. By 7 to 9 months infants can reliably use

an informant's gaze or head direction to predict the location of a reward (Xiao et al., 2017).

Typically developing children display a “social advantage” in stimulus value-learning paradigms. Young children and adults learn stimulus-reward associations with greater speed and efficiency for social compared to non-social stimuli (Vermetti, Smith, & Senju, 2017), while three-year-olds showed an enhanced ability to predict which faces would gaze-contingently animate compared to non-social fractal images (Wang, DiNicola, Heymann, Hampson, & Chawarska, 2018). Interestingly, this social bias for stimulus-reward learning is not present in children with a diagnosis of ASD (Wang et al., 2018), and is yet to be investigated in infancy.

Using a novel gaze-contingent eye-tracking paradigm, we are exploring whether infants (6, 9 and 12 months) can use social (referential gaze) and non-social (colourful balloons) cues to predict which on-screen “button” will trigger an audio-visual reward. These cues were presented individually during a learning phase, but then competed in a subsequent test phase.

Data collection is ongoing but preliminary analyses ($N = 55$) suggest that infants fixate the cued box more than the un-cued box ($F(1,82) = 159.683$, $p < .001$, $\eta^2 = .661$), and the time before infants trigger the reward by looking to the “correct” button decreases across the learning phase ($F(1.7,64.48) = 4.192$, $p = .026$, $\eta^2 = .110$). Infants can therefore use social and non-social cues to predict which box contains the reward, and can learn to “open” it using gaze-contingent buttons.

3. Kindergarteners’ Active Use of Category Knowledge

Eszter Dóra Szabó and Anett Ragó

Eötvös Loránd University

Dual models argue for separate systems behind category learning: an implicit and a verbal learning process. Because of the late maturation of the frontal lobe, the implicit system dominates at kindergartener’s age, so they should acquire information-integration tasks easily. However, in case of complex visual categories they mostly categorize by chance. Our goal was to develop a long-term training information-integration task where implicit acquisition of new categories is possible.

21 children age of 4-5 participated in a four-session training in four consecutive weeks where they got familiar with 8-8 far-from-prototype exemplars (32 in total) of 2 categories according to a complex family resemblance structure. In test phase they had to create an exemplar of each category with features given to them.

We found that children were able to create exemplars that matched the category. Most of them created the category-prototype, but some children created far-from-prototype exemplars.

Knowledge transfer in case of kindergarteners is more difficult to trigger because of the lack of source memory information. However, in this study we showed with prolonged training this effect can be avoided and children can make abstractions to actively create the category-prototype.

4. Multimodal integration in infancy: a computational model of language-mediated attention

Mihaela Duta and Kim Plunkett
University of Oxford

We present neuro-computational implementations of the hub-and-spoke model of multimodal perception applied to the study of contextualised spoken word processing in the learning developing brain. In this particular model architecture sensory inputs feed into a hub that makes the link with semantic representations and motor action units. The role of the hub is to integrate modality-specific sensory information and create amodal conceptual representations that facilitate semantic generalisation and concept inference. Neuroanatomical evidence for the existence of an amodal integrative structure in the adult brain comes from studies of semantic dementia patients, which revealed that progressive deterioration of the bilateral anterior temporal lobes is responsible for selective and graded concept degradation across all sensory modalities. Previous modelling work has evaluated the suitability of such a model to contextualised speech processing in adults, but no work to date attempted to evaluate its predictive power in the context of the developing infant brain at the start of the word learning process.

The models are trained on real-life corpora derived from imageable nouns present in infant vocabulary, as documented by the Oxford Communicative Development Inventory data. Each noun from the corpus is assigned a unique phonological, visual and semantic representation. The phonological forms are encoded with a feature-based representational scheme. The visual representations are given by the activations of the final hidden layer of a deep neural network pre-trained on ImageNet database, in response to images representing real-life illustrations of the nouns. Semantic encodings are obtained from a model that was pre-trained to derive representations from aggregated global word-word co-occurrence statistics

from an adult corpus. The trained models are used to simulate behavioural responses in paradigms in which spoken word processing is visually contextualised.

5. How Does the State of Curiosity Induced by Uncertain Information Affect Exploration and Learning in Infants?

Xiaoyun Chen¹, Katherine Twomey² and Gert Westermann¹

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The information-gap theory (Loewenstein, 1994) suggests that the arousal of curiosity is linked to a knowledge gap between an agent's prior knowledge and the uncertain amount of knowledge that is needed for understanding. Previous studies showed that facing uncertain information induces subjective curiosity (Berlyne, 1966). The closing of the knowledge gap is rewarding, which motivates further explorations for knowledge gain (Gruber, Gelman & Ranganath, 2014; Jepma et al., 2012).

The purpose of this study is to explore whether the induced curiosity by uncertain information would be specific to the resolution of the uncertain information itself. In a first study, a blurred picture of a novel toy will first be shown. Then, the identical clear picture paired with a new, clear picture of a novel toy will be displayed at the same time. Infants' looking time and eye gaze will be recorded by a Tobii remote eye tracker. We expect that infants will prefer to look at the identical clear pictures more often than at the new, clear pictures.

In a second study we will investigate if the states of curiosity modulated by an uncertain information gap affect infants' exploration and learning. There are two conditions in the experiment. For the Curiosity Induction (CI) Condition, blurred pictures followed by identically clear pictures will be used to induce infants' curiosity. For the Non-Curiosity Induction (Non-CI) condition, a same clear picture will be shown twice. Incidental information (an image of a novel object) will be presented during the period of induction/non-induction of curiosity. Recognition of incidental information will be tested immediately afterwards using a looking preference paradigm. We expect that infants will recognise the incidental information displayed in the CI condition more than in the Non-CI condition. We expect to have analysed data from 7-to-8-month infants (n = 32) by the end of July.

6. Can children learn new words from touchscreen apps? Employing fast mapping paradigm in a tablet study.

Joanna Kolak¹, Padraic Monaghan² and Gemma Taylor¹

¹ *University of Salford*, ² *Lancaster University*

According to a study conducted in the UK, children's digital media use is on the rise, with 65% of 3-4-year olds using a tablet regularly (Ofcom, 2017). Therefore, it is crucial to understand to what extent touchscreen apps can support language development.

The current study explores whether touchscreen apps can teach 2-4-year olds new words, using a design based on fast mapping paradigm from the Axelsson and Horst (2014) study, but implemented in a touchscreen app with varying features in line with the range of background elements found in child-directed apps.

Monolingual children aged 2- or 3-years old were asked to play a game on a tablet and help the character tidy up his room by moving the requested object (one of the three objects on the screen) onto a shelf. There were 3 familiar and 3 novel objects, each presented 3 times during learning trials. For the novel learning trials, the novel object was presented alongside two familiar objects, and so learning was via mutual exclusivity. Children interacted either with a complex version of the app, including colourful background, music and 5 distractors, where the required action was dragging, or a simple version of the app (no background colour, no music and no distractors), requiring tapping. After the learning trials and a reengagement trial, children were tested on their ability to map novel words; in all 3 test trials novel targets also served as non-target competitors.

We have currently tested 39 children, with the aim to test 90. Preliminary results show that children performed at chance in both age groups and in both conditions (see Figure 1), with no significant interaction. After collecting the full sample we also plan to conduct eye tracker analysis to determine whether children's attention differs when they interact with different versions of the app.

7. A corpus analysis of the word segmentation cues in German child-directed speech

Katja Stärk¹, Evan Kidd^{1,2} and Rebecca L. A. Frost¹

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Speech segmentation is one of the first major challenges infants face during language acquisition. There are multiple cues in speech that learners can draw on for help (e.g., pauses, stress, phonotactics, information about syllable co-occurrence, see e.g., Cutler, 2012). Much is known about the way these cues work in a variety of the world's languages, yet comparatively little research has examined the precise distribution of such cues in German. We conducted a corpus analysis of German child-directed speech using data from the CHILDES database (MacWhinney, 2000), and investigated the relative availability of stress, word length, word/syllable frequencies, and transitional probabilities (TPs) as potential cues for word segmentation. Seven hours of data (approximately 15,000 words) were coded, which represents around an average day of speech heard by infants. We found that 97% of words were stressed on the initial syllable, in line with previous assumptions, providing a reliable cue to word onset. Additionally, over two-thirds of the words were monosyllabic with only around 2% being compounds. Furthermore, nearly 80% of those monosyllabic words were function words, which have been suggested to aid segmentation (Bortfeld et al., 2005). Our corpus also gave us insights into TPs in German: Due to the huge variety of words children hear per day, TPs within and between words are both relatively low, yet initial analyses suggested that TPs are higher within words than between words ($\beta = -0.222$, $SE = 0.006$, $t = -38.524$, $p < .001$), and higher backwards than forwards ($\beta = -0.025$, $SE = 0.003$, $t = 8.851$, $p < .001$), while controlling for the frequency of the syllable pair in the corpus – adding support to prior suggestions about how TPs may aid segmentation. These results give new insights into the availability of segmentation cues in German child-directed speech.

8. Self-awareness and Prosocial Behavior

Yaroslava Goncharova

University of Dundee

When self-focused, adults self-evaluate, and alter their behavior to conform to idealized standards. Thus, self-awareness has a prosocial function. However, there is very little developmental work exploring the social functionality of self-awareness. This cross-sectional study investigated the relationship between self-awareness and prosocial behavior in early childhood. A series of online self-reported questionnaires

completed by 98 parents about their child ($M = 26.78$ months, range = 11 – 54 months) tested the hypothesis that there may be a developmental relationship between self-awareness and prosocial behavior. A linear regression model was used to determine the relationship between self-awareness (as measured by the Stipek Questionnaire) and prosocial behavior (as measured by the Early Prosocial Behavior Questionnaire). Prosocial behavior increased with the child's age ($r = .475$, $p < .001$), and with general cognitive and motor development (as measured by the Parents Report Of Children's Abilities scale; $r = .520$, $p < .001$). There was also a strong relationship between prosocial choices and self-awareness ($r = .558$, $p < .001$). When all variables were entered into a model to predict prosociality, we could account for 32% of the variance, with self-awareness emerging as the only independently significant predictor. These results imply that there is a close relationship between self-awareness and prosociality in early childhood. However, longitudinal work is needed to explore the directionality of this relationship. Self-awareness may drive prosociality by instilling a social conscience, but prosocial choices may also help us to learn about the self and how our actions are viewed by others.

9. Older but not younger infants adapt their looking behaviour after seeing a threatening vs. non-threatening stimulus

Samantha Ehli, Babett Voigt, Albert Newen and Silvia Schneider
Ruhr University Bochum

Background: In ambiguous situations infants increase their looking behaviour towards social partners (social referencing). Previous research suggests that looking at the social partner serves (a) to gain information for evaluating the ambiguous situation and (b) to receive emotional comfort. However, it is yet unknown, whether the function of SR depends on the physical and social context. That is the function of receiving emotional comfort is particularly obvious if the situation is threatening, but is less obvious in situations with lower potential threat.

Methods: In an eye-tracking paradigm, $n=34$ 6-month-old infants and $n=34$ 12-month old infants saw a picture of a snake or a picture of a fish (threat vs. non-threat, randomly assigned to between-subjects groups). Afterwards they saw a picture of their mother and of a female stranger simultaneously (familiar vs. unfamiliar, within subjects, matched through appearance). Infants' eye-gaze (duration, first look, frequency), and infants' physiological arousal (ECG, pupillary dilation) were recorded. Our hypotheses were three-folded:

(1) the increase in physiological arousal is higher in response to snakes, compared to the response to fish (pupillary response, ECG). (2) After seeing a snake (high threat), infants look more often towards their mother than the stranger. This is

independent of age and associated with decreasing physiological arousal. (3) After seeing a fish (non-threat), 12-months olds prefer to look at the stranger than the mother (novelty preference), whereas 6-month-olds' looking behaviour is similar to the snake-condition, i.e. they still prefer to look at their mother.

Results and Conclusion: Data collection is still ongoing. Preliminary results of n = 20 children will be presented and discussed.

10. If Looks Could Talk - The Role of Social Context Features for Social Referencing in Infants

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¹ *Ruhr University Bochum*, ² *Clinical Child and Adolescent Psychology, Ruhr University Bochum*

Background: In ambiguous situations infants increase their looking behaviour towards social partners (social referencing, SR).

Social-cognitive accounts (SCA) see SR's function as a two-step information-gathering process: first about the social context, then about the physical context. SCA respects social context proposing that SR decreases with increasing familiarity of the social partner (novelty hypothesis). Since the child has to gather more information about the most unfamiliar person.

Co-regulation accounts (CRA) see SR's function as keeping arousal within optimal range (emotional information gathering). CRA also respects social context proposing an effect of familiarity, but in opposite direction as the child can be soothed more easily by a familiar person.

Striano et al. (2006) argue that SR's function varies depending on how threatening the context is: In a moderately threatening situation, SR's function follows SCA and in a strongly threatening situation, it follows (CRA). The present study tests this claim.

Methods: Using the visual-cliff paradigm, 95 Infants (8-13 months) were randomly assigned in one of three familiarity groups (mother, familiar informant, unfamiliar informant) in two threat conditions (high vs. low cliff). Using a multi-method approach, we combine behavioural data (SR-look duration and frequency, affectivity, exploration behaviour) with physiological data (ECG).

Results: Preliminary results (n=21, low-cliff condition) show that SR and exploration behaviour are higher if the mother is present compared to more unfamiliar persons and that infants' affect is less negative. These results contradict SCA. Instead, in a visual-cliff the function of SR is emotional information gathering (CRA). We will present an analysis of the whole sample.

Conclusion: We suggest that SCA results could not be replicated due to differences in the situational features of experimental methods, in particular perceived ambiguity and threat. The visual cliff could be a strongly threatening situation per se and hence only elucidate a CRA response.

11. Will young children give up victory for their friends? Pre-schoolers' fairness preferences with different recipients in a contest task

Peidong Mei

Lancaster University

Despite the influence of allocation's attributes on ultimatum game, for instance, costly allocation results in less fair behaviour, social factors also play a critical role in young children's inequality aversion. Literature from the WEIRD societies has demonstrated that closeness with the recipients and competition can both affect children's fairness judgement significantly in an opposite way: Children normally behave fairly with a friend rather than with a stranger while they also prefer to keep more resources to themselves in a competition. However, competing against a friend is more realistic in children's day to day life. This raises the question what are the odds that children can still being fair rather than prioritizing victory when these two social factors occur in the same occasion? This study examined one hundred four Chinese children and another hundred British children from two age groups: 3-year-olds and 6-year-olds on their recourse preferences with a friend and an unknown peer in a colouring contest task. Their moral judgements in the distribution were also recorded. Our findings on cost of allocation and competition fell in line with previous research. However, unlike children from the WEIRD societies, we found that Chinese children trended to be less fair with their friends than with an unknown peer cross all the trials. In addition to the above cultural influence, gender effect and developmental effect were also found interacting with all three experimental manipulations: competition, cost and relation. This study shows that children can grasp the moral understanding of fairness, rather than simply showing inequality aversion, at a fairly young age with the stimulation of social cues.

12. The role change of tonal information in Mandarin spoken word recognition in Chinese infants

Qinmei Xu¹ and Ye Tao²

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The majority of the world's languages rely on both segmental (vowels, consonants) and supra-segmental (lexical tones) information to contrast the meanings of individual words. However, the majority of experimental research on early language development focuses on consonant–vowel languages. In the present study, the developmental changes of the role of lexical tones in emergent word knowledge are explored in Chinese infants who were native learners of a tonal language (Mandarin).

Using with intermodal preferential looking paradigm, the experimental session consisted of 20 trials, each of which involved a unique familiar object–novel object pair. Chinese infants were presented with correct pronunciations, tonal variations, and novel pronunciations of known words. The proportion of target object looking (PTL) means the amount of time infants spend looking the familiar object over the object pair. If infants could recognize the target object, the differences in PTL between the post- and the pre-naming phases of the trial should be above 0 significantly (naming effect).

Nineteen 17-month-olds ($M=16.95$ months) and nineteen 20-month-olds ($M=20.05$ months) participated. When their labels were correctly pronounced, visual targets were reliably identified at both age groups. The naming effects were as follows: $M=19.69\%$, $SD=17.02$, $t(18)=5.04$, $p<0.001$; $M=15.95\%$, $SD=20.27$, $t(18)=3.43$, $p=0.003$. In the tonal mispronunciation condition, the naming effect ($M=5.08\%$, $SD=10.22$) was found only in 17-month-olds, $t(18)=2.17$, $p=0.044$. When infants heard novel words, both groups did not show naming effect.

In conclusion, 1) tones interact with phonological information in Chinese infants; 2) 20-month-olds have a higher degree of sensitivity to variation in lexical tones relative to 17-month-olds. In other words, 17-month-olds preferred to treat tonal mispronunciations as known words, while for experienced word learners (i.e., 20-month-olds), tonal mispronunciations are considered as novel words.

13. Behavioral and Physiological Displays When Infants are Faced with a Social Threat

Angela Bernardo, Nancy Aaron Jones, Krystal Mize and Melannie Platt
Florida Atlantic University

Infants are inherently motivated to form and maintain social bonds. Prior to the first year of life infants display a variety of social skills (Hepach & Westermann, 2013). Six-month-old infants will work to regain attention usurped by a social rival who threatens that bond (Hart & Legerstee, 2011). Negative affect and approach behaviors are evident in response to social threat along with left-frontal EEG asymmetry (Platt & Jones, 2018). The aim of the current study is to examine patterns when infants are faced with a social threat, ultimately, examining the social brain.

Behavioral and physiological data were collected from 50 mother-infant dyads of 12-month-old infants. Behavioral data were collected during a condition where mothers ignored their infant and attended to a social (doll) object and in another condition mothers attended to a non-social (book) object (counterbalanced). Second-by-second infant behaviors were coded for gaze, proximity, touch, vocalizations, arousal and affect. EEG activity (across the scalp from frontal to occipital regions) was recorded and asymmetry scores were calculated, utilizing alpha band (6-9 Hz, Bell, 2002), ($\ln(\text{right}) - \ln(\text{left})$).

Paired sample t tests revealed that the proportions of mother-directed gaze, proximity and touch were significantly higher during the social compared to the non-social object, (ts range: -2.94 to -6.08, $ps < .01$). Preliminary correlations demonstrated positive associations between mid-frontal EEG asymmetry and mother-directed gaze and touch (rs range: .50 to .56, $ps < .03$).

Infants demonstrated approach-type behaviors during the social object and left-frontal asymmetry was associated with mother-directed behaviors. Infants appear to have the capability to express complex emotions, primarily if motivated by the desire to regain the loss of an attachment figure's preferential attention to a social competitor. EEG markers linked to approach behaviors offer insight about underlying physiological patterns that occur during social situations (Platt & Jones, 2018) in infancy.

14. Exploring whether mothers create structured learning environments for their children regarding object complexity and choice agreement.

Marina Loucaides¹, Katherine Twomey² and Gert Westermann¹

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Previous research suggested that children's exploration is influenced by the features in their learning environment, such as object types and social partners. Recent empirical and computational work showed that children generate intermediate task complexity in visual learning in unconstrained environments where learning was the result of their curiosity. Since social partners influence children's learning, in the current study we explored whether mothers would also generate intermediate task complexity for their children. We explored whether mothers and children chose the same objects to play and whether children's shyness level and attachment affected agreement scores and complexity sequences.

Two-year-old (N = 24) children wore head-mounted eye-tracking equipment and took part with their mothers. Each dyad was given sets of 3D-printed stimuli, each set on a tray and one tray each time. Each set was a category of five objects with edges that differed in a continuum from corners to rounded edges (e.g., from a cube to a ball). The mothers chose and play with one object each time for 20s. Five-second breaks between each object selection allowed children to show preference to objects. Mothers completed behavior (ECBQ) and attachment questionnaires (AQSQ).

Mothers and children did not choose the same objects, as their agreement scores were relatively low. Agreement scores were higher when children were less securely attached to their mothers. Mothers showed a tendency to generate higher to intermediate complexity object sequences for their children, however this result was random and by chance. Mothers of shyer children were found to generate more complex sequences.

This research helps to enhance our understanding of how mothers structure the learning environment of their children when choosing objects and generating complexity sequences of objects and demonstrates the importance of children's individual characteristics and their effect on their mothers' behaviors during play that influence children's learning input.

15. Cognitive and motor development trajectories in preterm children

Petra Hoffmannová

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Prematurely born infants (born before 37 weeks of completed gestation) have a high risk of cognitive and motor impairment or delays. It is a fact that premature birth can lead to poor visual and auditory perception, working memory, executive functions, motor skills and motor learning. Premature birth can also increase the risk of language impairments. Although we have a lot of data on neurodevelopmental outcomes of premature babies, little is known about motor and cognitive functioning over time, especially during the first three years of their lives. Therefore, the aim of our study is the early identification of cognitive and motor development trajectories in premature children (from birth to 36 months). To examine this issue, we are going to assess 200 preterm born children with the Bayley Scales of Infant Development, Second Edition (BSID II). Data collection will be done in The University Hospital Brno. In order to capture the time development, we will perform a total of 7 measurements – 1 month (T1), 6 months (T2), 12 months (T3), 18 months (T4), 24 months (T5), 30 months (T6) and 36 months (T7). The data will be analysed by applying growth curve modeling. Understanding the direction of cognitive and motor development during early childhood could help us anticipate further developments and adapt necessary interventions.

16. Measuring sensitivity to visual targets across the peripheral visual field in early infancy

Chiara Capparini, Michelle To and Vincent Reid

Lancaster University

Human infants are highly sensitive to social information in their environment from the earliest stages of development. The neuroscience underlying the processing of relevant aspects of information within the physical and social environment has been primarily studied using simplified two-dimensional images that are presented centrally on computer displays. This methodology lacks ecological validity because in reality only a minority of the visual information is confined to two-dimensions and restricted within the central and parafoveal fields (within 10 degrees of visual angle). In fact, the majority of visual information in the environment is presented at peripheral locations, extending to over 90 degrees in eccentricity (e.g. To, Regan, Wood, & Mollon, 2011). The visual system must therefore be able to process information across the visual field. Thus far, very little is known about infants' peripheral vision. Although there is some evidence that infants' ability to perceive stimuli across their visual field is influenced by the characteristics of stimuli (e.g.

Tronick, 1972; de Schonen, McKenzie, Maury, & Bresson, 1978), firm conclusions cannot be drawn due to methodological differences across the studies. Furthermore, the developmental changes occurring across the visual field during infancy have not been considered. The present experiment addresses the following: (a) how far in their periphery can infants see and (b) what low-level visual features (e.g. contrast and spatial frequency) are processed in central and peripheral areas. More specifically, 6-month old infants and adult controls are presented with Gabor patches at different locations up to 60 degrees in eccentricity. Head/eyes orientation and the latency of saccadic eye movements in response to the peripheral targets are recorded. This information is key to developing more complex and naturalistic social stimuli with optimal low-level visual features and to setting the scene for further infant studies across the perceptual and social domains.

17. Do socio-economic disparities imply differences in toddlers' comprehension of lexical categories?

Celia Renata Rosemberg, Florencia Alam, Alejandra Stein and María Ileana Ibañez
CONICET (National Scientific Research Council from Argentina)

The impact of socio-economic status -SES- on children's vocabulary has been amply documented (Pace, Luo, Hirsh-Pasek & Golinkoff, 2016). However, few studies have analyzed vocabulary comprehension: several, using standardized tests (Rowe, 2012) or assessing online processing of familial nouns (Fernald & Weisleder, 2013). Another fruitful strand of research, the Computerized Comprehension Test -CCT- (Friend & Keplinger, 2003) measures children's comprehension of nouns, verbs and adjectives of different level of difficulty implementing a forced-choice task on a touch screen. The aforementioned studies have targeted relatively educated and rich populations -incomplete high school versus college graduates- in the US (Friend et.al., 2012) and Western Europe (Fibla, Scaff, & Cristia, in preparation). Findings regarding these educational ranges for Mexican Spanish-speaking population indicate a weaker impact of SES (De Anda et al., 2016). Friend & Keplinger (2003) found differences in the comprehension of various lexical categories: children comprehend nouns better than verbs and the latter better than adjectives. Given that SES implies variations in children's linguistic environment and consequently in the lexical forms they access (Hoff, 2013), we ask about SES-differences in the comprehension of nouns, verbs and adjectives in an Argentinian Spanish-speaking population in which economic and educational disparities are more pronounced. We designed a task inspired by the CCT, thus containing 41 pairs of words -nouns, verbs, adjectives- with different levels of difficulty. In an effort to create a culturally non-biased test, the lexical items were chosen matching frequency of occurrence across low and middle SES groups in an Argentinian corpus (480 hours). Findings in a sample

of 112 low and middle SES toddlers (2;6-3) showed SES differences in the accuracy of children's comprehension of nouns and adjectives, but not verbs (see Figure); this might be linked to differences in the vocabulary composition of child directed speech between SES groups in this population.

18. Development of Attentional Orienting towards the Whole Object from 5- to 9-month-old

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Object-based attention (OBA) helps people select a whole object and facilitate further processing for its parts which is important for perception, memorizing, learning and other higher cognitive function. And there is a developmental process to OBA. This research used a preferential looking paradigm to investigate 5-to-9-month-old attention orienting towards whole objects. Infants watched a natural object and a scrambled one at the same time and an eye tracker collected their gaze data. 8-to 9-month-old showed a strong attentional orienting towards whole nonface objects while 5-to 7-month-old did have such bias. Whereas attentional orienting towards whole faces did emerge at 5 months old. Preliminary results indicate a developmental shift from attending to local features to whole objects at the first gaze.

19. Effects of traditional cradling in Tajikistan

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In more than a century of work on infant motor development, researchers have focused on identifying ages and stages of motor skills and describing developmental changes in coordination, movement patterns, and muscle activations. Much of this work has been conducted in Western populations, overlooking cultural influences and assuming universals. In fact, researchers have taken childrearing practices for granted, considering variability in childrearing as nuisance rather than important differences in infants' experiences, which offer different opportunities for posture, balance, and locomotion. The effects of everyday experiences are most clear in cross-cultural comparisons. The aim of this poster is to show how cultural research illustrates the formative role of experience in motor development thereby challenging our assumptions that differences in childrearing have no effects on

motor development. We describe our work in Tajikistan, where caregivers use a “gahvora” cradle in which infants are bound head to toe. To examine the extent of restriction and daily gahvora use, we video-recorded mothers cradling their infants and interviewed mothers using time diaries. To examine motor skills in infancy, we video-recorded 8- to 24-month-olds out of the gahvora in structured tasks and during free play. A subset of 12-month-olds were followed longitudinally at 16 and 20 months to examine the transition to walking. We also collected a sample of 4.5-year-olds to ask about long-term effects of restriction in infancy. In the infant sample, we show short-term delays but fail to detect effects longer term, in preschool years. Results from these studies provide new insights into the enormous variability in children’s experiences, learning, and development.

20. Mother-infant Structured Social Interaction at 12 months: effect of the play task in the Maternal Touch Patterns

Juliana Serra¹, Helga Miguel², Adriana Sampaio¹, Ana Alexandra Moura¹ and Alfredo F. Pereira¹

¹ *University of Minho*, ² *Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)*

Several studies have demonstrated the benefits of mother-infant interaction through touch for human development [1, 2, 3, 4]. Nonetheless, the study of maternal touch in infancy and how mother’s touch behavior is modulated according to distinct interactive tasks are still limited. We aimed to explore if there are differences in maternal social touch patterns when they interact with their twelve-months-old infants in object-oriented and non-object-oriented play tasks.

Mothers and their infants aged twelve months old were observed in social structured interaction with three mother-child play tasks (N = 40 dyads): (1) free play with toys, (2) free play without toys (face-to-face), and (3) play with a challenging toy. Touch in mother-child interactions was coded using an adapted version of Stepakoff et al.’s Mother Touch Scale [5]. The onset/offset of every maternal touch was coded and categorized in twenty-one types of touch behaviors, that were further ordinalized in eight categories from effective touch to intrusive touch.

We compared, with individual one-way ANOVAs, proportion, duration, and rate of touch events per minute in the three play conditions. We found main effects of the play task on mother’s touch patterns ($p < .01$): mean proportion of time, $F(2, 117) = 72.887$; mean duration, $F(2, 117) = 14.872$; mean rate of touch events per minute, $F(2, 117) = 55.483$.

Mothers touch more often (Mtask2 = 56% vs, Mtask1 = 12%, and Mtask3 = 21%), more frequently per minute (Mtask2 = 3.21 vs, Mtask1 = 1.61 and Mtask3 = 2.27) and during more time (Mtask2 = 10.9 vs, Mtask1 = 3.8 and Mtask3 = 5.1) in non-object-oriented task comparatively to the object-oriented play tasks.

To conclude, we found that mothers' touch in the face-to-face task was considerably different from object-oriented tasks: time spent touching and the rate of events was higher.

21. Investigating infants' looking behaviours towards motion trajectories: The role of manner and direction

Nina Harrison, Gavin Bremner and Peter Walker
Lancaster University

Previous research has suggested that infants' looking behaviours towards different types of motion are dependent on the specific characteristics of the stimuli presented. Known contributing factors include rate of motion (Mareschal, Harris, & Plunkett, 1997) and trajectory orientation (e.g., vertical vs. horizontal; Grönqvist, Gredebäck, & von Hofsten, 2006). Behaviours such as tracking accuracy are also thought to be constrained by development of oculomotor control. As infants' looking behaviours are sensitive to a variety of perceptual and developmental factors, a prior assessment of suitability should be considered when motion stimuli are to be presented within an experimental design. We report preliminary findings from one such study to establish baseline looking behaviours.

We test 3-4-month-old infants ($n = 24$) and 8-12-month-old infants ($n = 24$). They are presented with animations depicting a ball varying in how it moves across the screen (manner; rounded, angular and linear) and direction (up-down, down-up, left-right and right-left). Using eye-tracking and manual coding of looking behaviours, measures include both tracking accuracy and preferential looking. The findings from this preliminary study are thought to be an interesting contribution to the motion perception literature in itself. They shed light on looking behaviours across development and inform an ongoing discussion as to whether infants have a preference for curvature. For this study, we are nearing completion for data collection and hope to present the findings in this presentation.

22. The earlier, the smarter? Socio-cognitive advantages of learning a new language in Early Years of school

Valeria Agostini and Andrea Krott
University of Birmingham

Early foreign language learning (EFL) is often considered important for a future mastery of the target language. However, other non-linguistic reasons speak in favour of children's multilingual experience from an early age. The presence of two languages in the mind has been shown to be beneficial to non-linguistic cognitive skills. Bilingual children display advantages in executive function measures, demonstrating superior abilities in control over attention and switching between rules (Bialystok & Martin, 2004). Young bilinguals also show a less egocentric approach in solving perspective-taking problems (Greenberg et al., 2013), display more flexible thinking (Leikin, 2013) and show enhanced pragmatic skills, regardless of their competence in the second language (Fan et al., 2015).

We investigated the impact of EFL at school on a range of non-verbal skills. We recruited three groups of children aged 4-5 who experienced only English at home. One group attended bilingual schools, another group had weekly foreign language classes and a third control group did not have any foreign language education. We tested the children in tasks of non-verbal reasoning (Coloured Progressive Matrices; Raven et al., 1998), attentional control (Attention Network Test; Rueda et al., 2004), switching (Dimensional Change Card Sorting; Zelazo, 2006), and conversational perspective-taking (Director Task; Keysar et al., 2000) in the first few months of the school year and 24 weeks later.

Preliminary results show that both groups of language learners outscored the control group in the conversational perspective-taking game and in the measure of non-verbal reasoning at the second (but not first) testing point. Pupils attending bilingual schools showed an additional enhanced progress in their switching abilities. These results suggest that even a limited weekly exposure to a foreign language has an impact on children's socio-cognitive development, but a more substantial immersion in a bilingual environment is needed to boost cognitive flexibility.

23. Early life conditions and the emergence of Joint Attention – A cross cultural study

Eve Holden, Joanna Buryan-Weitzel, Claudia Wilke, Edmund Donnellan, Sophie Marshall, Rhiannon Pearce, Maggie Hoffman, Kirsty Graham, Nicole Lahiff and Katie Slocombe
University of York

Joint Attention is an important social skill that starts to develop in the first year of life. Some aspects of maternal behaviour, such as maternal sensitivity, have been shown to predict Joint Attention. However, previous research has focused on western, industrialised, educated, rich, and democratic populations, and the amount of variation in joint attention that maternal behaviour explained was modest. Interaction styles are, however, likely to be more diverse across cultures than within populations, so in this study we aimed to identify elements of the socio-ecological environment that were important for the development of Joint Attention in British and Ugandan infants. We looked at how early life environment and maternal behaviour at 3 and 6 months were related to Joint Attention skills at 11 months. Forty-eight British mother-infant dyads, and 46 Ugandan mother-infant dyads participated in this longitudinal study. At 3 and 6 months we administered questionnaires to obtain information about the infants' home environment. We also conducted full day follows of the infant and collected regular scan data on mothering style, social environment, and opportunities for object manipulation at 3 and 6 months. At 11 months we measured joint attention skills and events during an experimental presentation of a novel, erratically moving laser light on the ground close to the mother and infant. We will present preliminary data available from members of our cohort who have completed their 3, 6, and 11 month time points.

24. The method to predict infant behaviour: A study of Artificial Neural Networks

Mitsuhiko Ishikawa and Shoji Itakura
Kyoto University

Many studies have examined the mechanism of infant gaze following. However, it has remained unclear which factors decide the emergence of gaze following in infants. Here, we used the data collected in the empirical study and applied machine learning with an artificial neural network to predict infant gaze following. We used 80% of cleaned data collected in the previous study for training, and created predictive models with artificial neural networks. Then the other 20% of data was used to evaluate prediction accuracy of each model. As a result, the model including baseline heart rate levels, heart rate levels during watching actor's action, conditions of communicative cues and fixation times toward actress' face predicted infant gaze following 75%, showing significantly higher accuracy than chance level, and it was

the most predictive model. Also, additional analysis showed that baseline heart rate and looking time toward face can decrease prediction accuracy to 62.5%, which has no difference from chance level. This study tried to predict infant gaze following by physiological and attentional states using machine learning with artificial neural networks. Results highlighted that machine learning can predict infant social behaviour with relatively high accuracy. It can be suggested that machine learning may be helpful to consider mechanisms of infant social behaviour.

25. The effects of preterm birth and SES on early phonological development

Nayeli Gonzalez-Gomez

Oxford Brookes University

Two major developmental trajectories have been identified as markers of infants' specialisation on their native language. First, there is an increase in infants' ability to process native sounds. Second, infants' ability to process non-native sounds decreases over time, a process known as perceptual narrowing. These processes of learning have been assumed to be "universal". However, the vast majority of developmental studies have relied on "convenience samples", which are, for the most part, unrepresentative of the larger population. There is thus no evidence as to how much the time course of learning is affected by maturational and environmental factors.

The present project addresses this issue. To do so, we investigated early phonological development in cases where: a) maturation is following an altered timetable: infants born preterm; and b) the environment is different: infants from lower-socio-economic status families. The linguistic abilities of both populations have been found to lag well behind their advantaged peers during the school years. Preterm children and children from low-SES families show poorer auditory discrimination and memory, reading difficulties, poor vocabulary, a specific delay in verbal processing and reasoning, less complex expressive language and lower receptive understanding than their matched controls.

Three longitudinal studies explored infants' phonetic, prosodic and phonotactic development, respectively, at 7.5, 9, 10.5 and 12 months of age. The results of 76 infants showed no significant differences between the phonetic or the phonotactic development of the preterm and the full-term infants. However, a time-lag between preterm and full-term developmental timing for prosody was found. Socioeconomic status didn't have a significant difference on prosodic or phonetic development. Nevertheless, phonotactic development was affected by SES, infants from lower SES showed a preference for high-frequency sequences later than their

more advantaged peers. Overall these results suggest that different constraints apply to the acquisition of different phonological subcomponents.

26. Negativity Bias in the Effect of Perceived Emotions on Toddlers' Word Learning

Lizhi Ma¹, Katherine Twomey² and Gert Westermann¹

¹ *Lancaster University*, ² *The University of Manchester*

Adults perceive negative information as more salient than positive information during learning (Öhman & Mineka, 2001). This negativity bias is also found in infants from seven months, who pay more attention to negative than to positive facial expressions (Hoehl, 2014). Positive and negative valence also affects language processing; for example, emotionally positive and negative vocalizations facilitate 10-month-old infants' word recognition (Singh, Morgan, & White, 2004). However, whether emotional valence influences toddlers' learning of word-object associations is not known.

Thirty 30-month-old toddlers participated a screen-based word learning task in which they were taught novel words in neutral, positive and negative affect. This two-day study consisted of a referent selection (RS) phase followed by two retention phases (RT1 & RT2). RT1 after a five-minute break and RT2 on the following day to examine longer-term retention. During RS, participants saw three sets of one novel and two known objects and heard them being labeled by an on-screen experimenter. At test, toddlers saw the three familiarized novel objects. Retention of word-object associations was tested by labeling novel objects neutrally in label trials (look! The coodle!). Retention of affect-object associations was tested by cueing with neutral, positive or negative interjections (e.g., Wow, look!) in no-label trials.

Toddlers retained negatively and neutrally familiarized word-object associations (all $ps < .02$), but not the positively familiarized associations. Meanwhile, participants looked at negatively familiarized objects after hearing the negative and neutral interjection. However, they looked at three objects randomly when they heard the positive interjection.

Negative emotions may promote toddlers' learning of novel objects because negative emotion is less experienced by them and may convey more information relative to positive emotion.

27. ERP correlates of action segmentation in infants

Matt Hilton, Romy Råling, Isabell Wartenburger and Birgit Elsner
University of Potsdam

We aimed to examine whether the processes underlying speech segmentation are also involved in the segmentation of action sequences during infancy. Infants make use of prosodic cues (e.g. pre-boundary lengthening, pause) to determine the location of boundaries between words and phrases in speech (e.g. Seidl, 2007; Wellmann et al., 2012), and processing of these cues results in an ERP component characterized as a broadly-distributed positivity known as the Closure Positive Shift (CPS; Steinhauer, Alter & Friederici, 1999; Holzgrefe-Lang, 2018). Recent work has shown a CPS-like positivity in response to boundaries between actions of an action sequence in adults (Hilton et al., submitted), and we extended this work by examining whether infants' processing of an action boundary also evokes a CPS-like positivity. The emergence of a positivity in response to a boundary in an action sequence would suggest that the processes underlying the segmentation of speech and action are domain-general already during infancy. We therefore presented 12-month-old infants ($N = 36$) with videos in which an animated character performs three consecutive actions (e.g. jumping, stretching and spinning). On no-boundary trials, the three actions were performed continuously as one single action sequence. However, on boundary trials the duration of the second action was extended and followed by a short pause during which the character was motionless, two modifications that signal a boundary between individual sub-units of a visual sequence (Friend & Pace, 2016; Frost, Monaghan & Tastumi, 2017). We recorded EEG during the presentation of these videos, and preliminary results suggest that the ERP was more positive at the time of the boundary in the boundary condition than during the equivalent time interval in the no-boundary condition. Final results will be presented, and implications of these findings for our understanding of the development of language and action segmentation will be discussed.

28. Sleep and Lexical Integration in 2-Year-Old Toddlers

Janette Chow and Kim Plunkett
University of Oxford

Children are exposed to new words every day. They may be able to learn a new word very quickly, but when does a new word become an integral part of a child's existing vocabulary (i.e. lexicalisation), causing lexical competition effects during word retrieval? Recent research suggests that sleep supports lexicalisation in school-aged children more so than in adults. Sleep-dependent lexicalisation, however, has not been investigated in toddlerhood, a period of rapid vocabulary expansion.

Moreover, a recent meta-analysis shows that school-age children's vocabulary scores were a significant predictor of lexical competition effects after an overnight sleep. Such finding suggests the Matthew effects in word learning, that those with a richer vocabulary are benefit more from sleep-dependent lexicalisation.

In this poster, I will present findings of a word learning study conducted in 30-month-old toddlers. Lexical competition effect is measured using an eye-tracking paradigm, immediately after word learning and on the next day after sleep. Vocabulary size data, sleep diary data and measurement of general cognitive development are collected. I will address the following research questions: 1) Is sleep required for lexical integration to occur in toddlers? As young children rely on sleep for lexical integration more so than adults, it is predicted that toddlers should show weak to no lexical competition effect immediately after learning, and stronger lexical competition effect after overnight sleep. 2. What role(s) do verbal and non-verbal / general cognitive ability play in sleep-independent and sleep-dependent lexical integration as measured in the experiment? It is predicted that vocabulary size and general cognitive ability are correlated, but that after accounting for cognitive ability, vocabulary size may still account for individual differences in both sleep-independent and sleep-dependent lexical competition effects in the word learning experiment.

29. Gender differences in the early mathematics skills in six countries in the Asia Pacific

Shuqi Yang and Nirmala Rao
The University of Hong Kong

The gender gap in mathematics and science achievement is a matter of societal concern and a number of explanations have been put forward to explain the gap including genetic factors, early cognitive socialization, and contextual and cultural factors. This study examined gender differences in the early maths skills in 3- to 5-year-olds from diverse contexts in the East Asia Pacific using data from the validation sample of the East-Asia Pacific-Early Child Development Scales (EAP-ECDS).

Representative samples of children from six countries (Cambodia: $n=1197$, China: $n=1511$, Mongolia: $n=1228$, Papua New Guinea: $n=1323$, Timor: $n=1070$ and Vanuatu: $n=296$) including 3334 girls (3yrs: $n=1074$, $M=41.71$ months, $SD=3.30$; 4yrs: $n=1121$, $M=53.68$ months, $SD=3.39$; 5yrs: $n=1139$; $M=65.24$ months, $SD=3.31$) and 3291 boys (3yrs: $n=1073$, $M=41.83$ months, $SD=3.38$; 4yrs: $n=1094$, $M=53.69$ months, $SD=3.40$; 5yrs: $n=1124$, $M=65.17$ months, $SD=3.35$) were assessed in

individual sessions (rote counting, counting objects, Give-N objects, simple addition and subtraction). All testing was conducted in children's first languages.

Regression indicated that older children performed significantly better than younger children ($\beta=0.22$, $t(6322)=55.77$, $p<0.001$) and were more likely to get more difficult items correct (Table 1) after controlling for age, SES, preschool attendance, urbanicity and country. Girls and boys performed equally well in rote counting, counting objects, Give-N objects and simple addition except that boys did significantly better than girls in subtraction ($\beta=0.054$, $t(6322)=2.77$, $p=0.006$; see Figure 1). The results indicate that there is no clear evidence of a gender gap in the early numeracy. This provides less support to the statement that gender differences in their later mathematical performance are due to early cognitive differences. While reasons for the gender differences in subtraction need to be explored in further studies and could possibly be due to different experiences of boys and girls in preschools.

30. Relations among linguistic and non-linguistic factors and children's acquisition of number concepts

Nirmala Rao, Shuqi Yang, Ben Richards and Stephanie Chan
The University of Hong Kong

Language plays an important role in children's acquisition of number concepts, especially the understanding that the last number word in the counting list represents cardinality of the set. Children who know the cardinal meaning of number words can match the number word to the exact quantity. Previous research has shown that learning of number concepts is associated with language development, particularly vocabulary development. This study examined relations among understanding of number concepts, linguistic (vocabulary) and non-linguistic (working memory capacity) factors using data from a project on early developmental functioning.

A total of 956 children (317 3-year-olds, 319 4-year-olds, 320 5-year-olds) from China, India, Myanmar and Bangladesh with approximately equal numbers of boys and girls and children from urban and rural areas, participated in the study. Children were assessed in individual sessions in their mother tongues (Chinese, Hindi, Myanmar and Bengali) and completed number (rote counting and "Give-N" tasks), vocabulary (both receptive and expressive vocabulary tests) and visual working memory (point to the N objects that were just presented) tasks.

Both general vocabulary and visual working memory capacity uniquely predicted children's acquisition of the number words after controlling for SES, preschool attendance, country, gender and age ($\beta=0.032$, $t(934) = 2.19$, $p = .029$; $\beta=0.124$, $t(934) = 8.17$, $p < .001$, respectively) (Table 1). The development of cardinal number concepts appears to be scaffolded both linguistic and non-linguistic factors. Its association with the visual working memory may be due to the fact that children's ability to give correct number in the Give-N task is relevant to their ability to retrieve the ordinal position of the number words, and therefore, related with their working memory capacity. The present study precludes conclusions about causal relationships and suggests the need for further studies with longitudinal and mixed methods research designs and that consider the influence of the number system/simplicity of number words in a language on early numeracy.

31. Are young children developmentally on-track in Learning, Psychosocial well-being and Health? Observations from China, Myanmar, Bangladesh and India

Nirmala Rao, Shuqi Yang, Ben Richards and Stephanie Chan

The University of Hong Kong

Progress towards United Nations Sustainable Development Goal Target 4.2 is to be measured by determining the percentage of children who are developmentally on-track in the areas of, learning, psychosocial well-being, and health (Indicator 4.2.1). UNICEF is currently developing a parent-report measure to obtain population level estimates of Indicator 4.2.1. This study complemented UNICEF's efforts and developed a direct assessment tool to evaluate children's development in four countries that together make up 35% of the world's children under 5 years. Children's scores on the direct assessment were compared to parent reports.

Children, ranging in age from 3 to 5 years, from urban and rural areas in Bangladesh ($n=239$, 120 girls), China ($n=240$, 120 girls), India ($n=239$, 117 girls), and Myanmar ($n=238$, 119 girls) were directly assessed by "Developmentally on Track for 4.2.1 (DOT)". The 28 items were each dichotomously scored (Learning: 15 items; $\alpha = 0.82$; Psychosocial well-being: 9 items; $\alpha = 0.74$; and Health: 4 items; $\alpha = 0.66$). Parents responded to parallel items in individual interviews.

The linear regression indicates a developmental trend in direct assessment scores with older children performing better than younger children in learning ($\beta=0.98$, $t(940)=0.98$, $p < 0.001$), psychosocial well-being ($\beta=0.67$, $t(899)=3.67$, $p < 0.001$) and health ($\beta = 0.53$, $t(941)=5.74$, $p < 0.001$). After controlling for age, urbanicity still predicted psychosocial well-being ($\beta =0.98$, $t(899)=3.06$, $p=0.002$). We defined on-track as the total score being not more than 2 SDs below the mean from children at

that month-of-age and found that the majority of the children were on-track (Bangladesh: 96.23%, China: 99.58%, India: 94.96%, Myanmar: 96.03%). Significant associations were found between direct assessment and parent report for the learning, psychosocial and health domains in all four countries ($r=0.59$, $p<0.001$; $r=0.13$ $p<0.001$; $r=0.36$, $p<0.001$, respectively). Implications of the findings are discussed.

32. Teaching attention to function as a word learning strategy

Cecilia Zuniga Montanez and Andrea Krott
University of Birmingham

By the end of the second year of life, infants present a shape bias when learning and extending labels. This bias is a tendency to infer that objects that look the same are called the same (Diesendruck & Bloom, 2003). Teaching a shape bias to 17-month-olds can even facilitate noun learning (Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002). Despite the importance of shape in early naming, the function of an object can also determine its name.

We taught infants to use function as the relevant property for extending labels and assessed if this training had similar positive effects on vocabulary development as the shape bias training conducted by Smith and colleagues (2002).

Twenty-three 17-month-olds were randomly divided into a training group and a control group. During 7 weekly sessions, infants in the training group played with four sets of novel objects presented alongside novel labels and demonstrations of the objects' functions. Infants in the control group played with the same sets but did not hear labels or saw the objects' functions. In two further sessions, infants were assessed to see if repetitive experience with objects organized by function, their labels and the demonstration of their function, highlighted function as the relevant property for generalizing known and novel names. Additionally, word learning was assessed at the beginning and end using the UK-CDI Words and Gestures (Alcock, Meints & Rowland, 2017).

Results showed that infants learned to extend labels based in function similarities, but this training did not boost vocabulary learning. Together with research on the shape bias, these results support the notion that the shape bias has a special status in noun vocabulary development and a focus on function does not have the same effect.

33. Is intention understanding the social mechanism underpinning the relationship between joint attention and gestural ability in typical development and Autism Spectrum Disorder?

Bethany Pearson
Lancaster University

In infancy, gestural ability and engaging in joint attention both predict later language development. Theoretically, both concepts have been revealed to reflect a similar underlying social mechanism, perhaps intention understanding (Salo, Rowe & Reeb-Sutherland, 2018). However, these three concepts are rarely studied in parallel. Furthermore, the relationship between intention understanding, joint attention and gestural ability may also explain the socio-cognitive problems experienced by children with Autism Spectrum Disorder. The existing literature does not elaborate on how any impairments in their ability to infer intention as a younger age may impact early social-communicative behaviours.

To examine this, a pair of studies will independently explore typical and atypical development. Study 1 will examine these three skills in typically developing 12-month-old infants. Study 2 will compare verbal-age matched children with a sample of children with Autism Spectrum Disorder who are minimally verbal (e.g. 5 or fewer words in their expressive vocabulary). Both studies will replicate and extend (by the inclusion of intention reading) the original Salo, Rowe & Reeb-Sutherland's (2018) study. On commencing the study, gestural ability will be gleaned from a 20-minute free-play interaction with a caregiver, whilst aspects of joint attention are measured using the Early Social Communicative Scales (Mundy et al., 2003). The ability to infer intention will be measured using an imitation task which asks the participants reproduce rational and non-rational actions. In each study a measure of language development (Mullen, 1995) will be collected at the time of study and a year later. Each has complementary objectives:

1. To assess whether the ability to infer intention is related to joint attention, gestural ability and later language skills in typical development
2. To see whether the relationship between these three constructs might explain language delay in children with Autism Spectrum Disorder

34. The impact of restricted interests on language acquisition in ASD

Charlotte Rothwell
Lancaster University

During word learning in the environment, when an unfamiliar object is given a novel label, children must use mutual exclusivity to evaluate competitors, select the

correct referent, and encode a representation of the referent in association with the word (Carey & Bartlett, 1978). The success of this process depends on attentional mechanisms (Axelsson, Churchley, & Horst, 2012). However, these mechanisms can be disrupted by disorders such as autism spectrum disorder (ASD). One characteristic of ASD is restricted and repetitive behaviours and interests, meaning children with ASD often fixate on particular topics of interest and do not flexibly engage with their environment, consequently affecting their language acquisition (APA, 2013). This study will be the first to investigate the relationship between atypical attentional mechanisms in ASD, and linguistic deficits. Approximately twenty TD children, and twenty-children with ASD, matched on verbal mental age of around two to four years, will take part in an interactive touch screen task. Participants' looking patterns will be recorded using a multi-camera set-up, as well as reaction times and accuracy on the touch screen. All children, in both the TD and ASD groups, will complete two within-subjects conditions, using a referent selection and retention word-learning paradigm based on Horst and Samuelson (2008). The interest condition will involve children learning novel names for four unfamiliar animals, since animals are a common fascination of young TD children and children with ASD (Martin & Farnum, 2002). The neutral condition will involve novel names for four unfamiliar objects that are not animals. Retention of novel words will be tested after 10 minutes and 24 hours. The predicted results are that retention accuracy for children with ASD will be superior for interest (animal related) words due to heightened attention during referent selection, and perhaps diminished for neutral stimuli due to reduced attention.

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