

CONTENT

General Information	2
Program Overview	3
Program Detail (Day 1)	4
Program Detail (Day 2)	5
Poster Session	6
Abstracts	8
Author List	59
Food, Beverages and other Amenities in NTU	63
Getting around in Singapore	64

GENERAL INFORMATION

1. Venue Information

The ABC'18 will be hosted at the Nanyang Technological University (NTU) campus in Singapore. The conference will take place at the NTU School of Humanities. The oral presentations will be held at the **Seminar Room 9 (HSS-B1-11)**, and poster session will be held **in the building foyer on level 1**.

Working rooms are available for participants' use during the conference at **HSS-TR+5 and HSS Seminar room 3 on level B1**.

2. Transportation

Please check for updated timing (if any) upon check-in at NEC or at Conference venue

	From NEC	From SoH	Others
3rd Oct 2018 Conference Reception	5:45pm	8:00pm	
4 Oct 2018	8:30am	5:50pm (to NEC)	Conference Dinner SOH-NEC: 6:30pm NEC – Shangri-la: 6:40pm Shangri-la – NEC: 9.30pm
5 Oct 2018	8:30am		

3. Contact information

The members of our organisation committee are here to help you with any inquiries and to ensure that your attendance at the ABC'18 conference is enjoyable. For any inquiries during the conference, please approach one of our volunteers located at the registration desk.

Asia-Pacific BabyLab Constellation Executive Committee	President Denis Burnham Secretary Marina Kalashnikova Treasurer Patrick Wong
ABC'18 Conference Organisation Committee	Ng Bee Chin Marina Kalashnikova Leher Singh Luca Onnis Ann-Marie Chua Mei Fen
ABC'18 Conference Volunteers	Dilu Wewalaarachchi Shruthi Ramachandran Ooi Seok Hui Yvonne Lam

www.asianbabylabconstellation.weebly.com

PROGRAM OVERVIEW

3 rd October	4 th October	5 th October
	8:30am - 9:00am Registration	9:00am - 10:30am Keynote 3: Marc Bornstein
	9:00am - 9:20am Welcome & Official opening	
	9:20am - 10:30am Keynote 1: Denis Burnham	
	10:30am - 10:50am Coffee break	10:30am - 11:00am Coffee break
	10:00am - 12:30pm Oral presentation session I	11:00am - 12:40pm Poster session
	12:30pm - 1:30pm Lunch	12:40pm - 1:40pm Lunch
	1:30pm - 3:00pm Keynote 2: Annick De Houwer	1:40pm - 3:30pm Oral presentation session IV
	3:00pm - 4:00pm Oral presentation session II	3:30pm - 4:00pm Coffee break
	4:00pm - 4:20pm Coffee break	4:00pm - 5:40pm Oral presentation session V
	4:20pm - 5:40pm Oral presentation session III	
5:00pm - 6:00pm Registration		
6:00pm - 9:00pm Opening reception	7:30pm-10:00pm Conference dinner	

PROGRAM DETAIL

4th October 2018

9:00-9:20	Welcome and official opening, <i>Joseph Liow, Dean of NTU's College of Humanities, Arts and Social Sciences</i>
9:20-10:30	Keynote Speaker I: The ABC of lexical tone, <i>Denis Burnham</i>
Oral Presentation Session I	
10:50-12:30	Consonant/vowel bias in lexical processing by Cantonese-learning toddlers: Preliminary data from a word-learning task, <i>Daniel Tszhin Lee, Hui Chen, Regine Yeeking Lai, Thierry Nazzi, Hintat Cheung</i> Phonological biases in Mandarin Chinese learners: Evidence from novel word learning, <i>Thilanga Dilum Wewalaarachchi, Leher Singh</i> Sensitivity to lexical tones in word recognition: Evidence for an age-related decline in tone language speakers, <i>Leher Singh, Thilanga Dilum Wewalaarachchi, Jia Wen Lee</i> Acoustic analysis of lexical tones in Thai infant-directed speech, <i>Chutamane Onsuwan, Juthatip Duangmal, Nawasri Chonmahatrakul, Reiko Mazuka, Naoto Yamane, Hyun Kyung Hwang</i> Neural correlates of non-native lexical tone and vowel discrimination in 9-month-old German infants and adults: An ERP study, <i>Antonia Götz, Anna Krasotkina, Gudrun Schwarzer, Barbara Höhle</i>
13:30-15:00	Keynote Speaker II: Why it is crucial to distinguish between bilingual first and early second language acquisition in the early stages of language development, <i>Annick De Houwer</i>
Oral Presentation Session II	
15:00-16:00	Language experience predicts sensitivity to the degree of phonological mismatch, <i>Katalin Tamasi</i> The developmental trajectory of linguistic and musical pitch perception among non-tone language learning monolingual, bilingual and tone-language learning bilingual infants: Evidence from EEG, <i>Liquan Liu, Varghese Peter, Gabrielle Weidemann</i> Effects of language mixing on language processing among young bilinguals, <i>Charlene Fu, Leher Singh</i>
Oral Presentation Session III	
16:20-17:40	The efficacy of animated e-books in fostering Singaporean kindergartener's Mandarin lexical learning, <i>He Sun, Jieying Loh, Shi Lin Au Yong</i> The role of prosodic and syntactic focus in Mandarin: Evidence from three- and five-year-olds, <i>Hui Ching Chen, Barbara Höhle, Stephen Crain</i> Infant social experiences in different socioeconomic settings: A cross-cultural study, <i>Valentina Sclafani, Leonardo De Pascalis, Nicole Schiutmaker, Laura Bozicevic, Mark Tomlinson, Lynne Murray</i>

PROGRAM DETAIL

5 th October 2018	
9:00-10:30	Keynote Speaker III: Stability in core child language skill from infancy to adolescence, Marc H. Bornstein
11:00-12:40	Poster Session
Oral Presentation Session IV	
13:40-15:30	<p>Eye gaze behaviour on basic emotions in Malaysian infants, Min Hooi Yong, Elena Geangu</p> <p>The four-way stop voicing contrast in Nepali infant-directed speech: Another case of hypo-articulation, Titia Benders, Sujal Pokharel, Katherine Demuth</p> <p>Vowel hyper-/hypoarticulation in infant-directed speech, Lisa Gustavsson, Ellen Marklund</p> <p>Prosodic input to word learning: Cross-linguistic evidence from Dutch and Mandarin Chinese infant-directed speech, Mengru Han, Nivja de Jong, René Kager</p> <p>The quality and quantity of maternal phonetic input play a role in their infants' development of speech perception ability, Minji Nam, Youngon Choi, Reiko Mazuka</p>
Oral Presentation Session V	
16:00-17:40	<p>Does exaggerated affect in infant-directed speech support infant word learning, Christa Lam-Cassettari, Sophie Gates</p> <p>The role of vowel hyperarticulation in IDS in facilitating infants' lexical processing, Irena Lovcevic, Marina Kalashnikova, Denis Burnham</p> <p>An examination of maternal depression and anxiety and infants' early language environment, Ruth Brookman, Marina Kalashnikova, Janet Conti, Kerry-Ann Grant, Nan Xu Rattanasone, Katherine Demuth, Denis Burnham</p> <p>Neonatal imitation: Does it exist, Virginia Slaughter</p> <p>Same- and other-race face scanning in British-White and Malaysian-Chinese infants, Diana Tham, Pei Jun Woo, Gavin Bremner</p>

POSTER SESSION

- 1. Word learning strategy influences word learning performance in multilingual children**
Eleanor Luckcock, Rachel Pye, Carmel Houston-Price
- 2. Perception of English consonant contrasts among multilingual Malaysian-Chinese children under quiet and adverse conditions**
Christine Leong Xiang Ru, Katherine Ren Jia Wen
- 3. Brain responses to Mandarin lexical tone changes measured in early infancy predict later language development at 24 months**
Ying-Ying Cheng, Chia-Ying Lee
- 4. Native Cantonese-learning infants' discrimination of lexical tones that are similar in pitch onset**
Rachel Ka Ying Tsui, Xiuli Tong, Reiko Mazuka
- 5. Visual referential cue enhancing phonetic categories in a familiarization paradigm: Native tone sensitivity in English-Mandarin bilingual infants**
Shruthilaya Ramachandran, Leher Singh
- 6. The effect of age and language experience on infant pitched word learning**
Liquan Liu, Saif Kade, Denis Burnham
- 7. Cross-talker lexical tone discrimination in infancy**
Ye Feng, Marina Kalashnikova, René Kager, Patrick C. M. Wong
- 8. Infants' sensitivity to lexical tone and stress in the first year of life**
Marina Kalashnikova, Chutamanee Onsuwan, Denis Burnham
- 9. Vowel hyperarticulation in toddler-directed speech**
Marina Kalashnikova, Seamus Donnelly, Evan Kidd², Denis Burnham
- 10. Acoustic qualities of intonation and tone in Cantonese infant-directed speech**
Luchang Wang, Marina Kalashnikova, René Kager, Patrick C. M. Wong
- 11. Quantity and quality of infant-directed speech in laboratory versus home settings**
Christa Lam-Cassettari, Sophie Gates
- 12. Assessing the use of mobile technology and machine learning to monitor and increase the quantity of parent-child interactions at home**
Sandra Sobanska, Lamont Tang, Eva E. Chen
- 13. Positive affect in Swedish and Australian mothers' speech to their 3- to 12-month-old infants**
Iris-Corinna Schwarz, Christa Lam-Cassettari, Ulrika Marklund, Ellen Marklund
- 14. Conversational turn taking from six months predicts vocabulary size in Australian nineteen-month-old infants from diverse SES backgrounds**
Anne Dwyer, Caroline Jones, Chris Davis, Christine Kitamura, Teresa Ching
- 15. The Functional Listening Skills Index (FLI-P) as a guide to paediatric rehabilitation**
Aleisha Davis, Elisabeth Harrison, Robert Cowan
- 16. Caregiver factors associated with their nonlinguistic input quality to toddlers**
Jieun Jeong, Youngon Choi, Jisoo Kim, Yunji Kim
- 17. Crossing the bar: Does learning multiple languages affect children's perception of nonlinguistic figure-ground events?**
Yvonne Lam, Roberta Golinkoff, Tilbe Goksun, Leher Singh
- 18. Contrasting two behavioural methods to index infant perception ability**
Caroline Junge, Emma Everaert, Lyan Porto, Titia Benders, Brigitta Keij, Paula Fikkert
- 19. Neural entrainment to auditory-visual speech in infants and children**
Jessica Tan, Denis Burnham
- 20. School-aged sequential bilingual children exhibit no "bilingual verbal deficit"**
Zhen Zeng

- 21. The influence of phonological neighbourhood density on spoken-word comprehension in Russian children: Evidence from eye-tracking** *Vardan Arutiunian, Anastasiya Lopukhina*
- 22. Comprehension of Chinese classifiers in preschool normal hearing and Cochlear Implanted children** *Jon-Fan Hu, Yu-Han Luo, Yu-Chen Hung*
- 23. Using eye-movement data as a developmental measure in Thai and Chinese readers** *Ronan Reilly, Benjawan Kasisopa, Inthraporn Aranyanak, Denis Burnham, Xi Fan*
- 24. Seeds of Literacy: An exploration of possible precursors to reading difficulty in infant speech perception** *Marina Kalashnikova, Ronan Reilly, Denis Burnham*
- 25. Measuring early language developmental trend in Malaysia using the Malaysian Communicative Developmental Inventories** *Jun Ho Chai, Julien Mayor, Hui Min Low, Tze Peng Wong*
- 26. Grandparents as key agents in deciding what children hear in Singaporean homes** *Wenhan Xie, Ng Bee Chin, Francesco Cavallaro*

ABSTRACTS

KEYNOTE SPEAKER I

The ABC of lexical tone

Denis Burnham

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Lexical tone is used in over 70% of the world's languages and tone languages are spoken by more than 50% of the world's population. There is a concentration of tone language speakers in Asia, the home of the ABC (Asia-Pacific Babylab Constellation) and in Singapore, home of this inaugural ABC conference. Three areas (A, B, C) of tone processing research are considered here, and in each, an instance of my (1) published, and (2) new, yet to be published, research is presented.

These 3 x 2 (A/B/C research areas x old/new) topics fall under these head and sub-headings:

A for Acquisition

1. The first-ever experiment on infants' perceptual attunement to lexical tone – plus various subsequent reports.
2. A *new* study of toddlers' and children's development of lexical tone production.

B is for Bimodal

1. A group of visual augmentation studies: better tone perception by adults in auditory-visual (AV) than in auditory-only (AO) modes.
2. A *new* study on infants' perceptual attunement to lexical tone in AV vs. AO modes.

C is for Context

1. Studies of adults' pitch perception in the context of speech or music by (i) tone vs. non-tone language speakers and (ii) musicians vs. non-musicians.
2. A *new* study of pitch perception in adult musicians vs. non-musicians who are either tone language speakers or have merely been exposed to a tone language.

Incursions deeper into the alphabet are also underway:

D is for Difficulty

The *Tone Atlas Study* compares lexical tone contrast perceptual difficulty across three languages and five ABC labs and is assisting in disambiguating the results of tone processing studies.

E is for Everything else in tone processing research incorporating –

F for Future directions.

KEYNOTE SPEAKER II

Why it is crucial to distinguish between bilingual first and early second language acquisition in the early stages of language development?

Annick De Houwer
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Understanding early language and speech development is an integral part of understanding infant development. Children may grow up with two or more languages from birth (or indeed, prior to birth), a Bilingual First Language Acquisition (BFLA) setting. Alternatively, they may start off hearing just a single language before also regularly hearing a second, an Early Second Language Acquisition (ESLA) Setting, or they may hear just a single language throughout early childhood, a Monolingual First Language Acquisition Setting. The latter is probably quite rare in much of Asia today. The former two, BFLA and ESLA, are likely quite common. Often, however, infant development researchers do not make a distinction between them, and speak of "bilingual children" without any further differentiation. This talk explains why it is crucial to distinguish between BFLA and ESLA. It is only when we fully take into account the difference between these two dual language learning environments that we can come to real insights about processes of early dual language and speech development and other issues relating to early bilingualism such as the purported bilingual advantage hypothesis.

KEYNOTE SPEAKER III

Stability in core child language skill from infancy to adolescence

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Command of language is a fundamental life skill, cornerstone of cognitive and socioemotional development, and necessary ingredient for successful functioning in society. Of course, child language on average grows remarkably in development. By contrast, stability is concerned with maintenance of an individual's position in a group through time. Relative to the "developmental function," underresearched, but enduring, questions about child language concern stability of individual abilities and performance over time and moderation of stability by various biological and social factors. This talk focuses on stability. I draw on several large scale, prospective, longitudinal studies to explore stability of individual differences in multiage, multidomain, multimeasure, multireporter measures of child language from infancy through adolescence. In doing so, I introduce a solution to the developmental challenge of assessing age-appropriate measures of stability through the calculation of latent variables. Latent variable analysis taps into a core language skill. Then, I document the robustness of stability of individual differences in core language skill across language, gender, birth status, ethnicity, and socioeconomic class as well as diverse medical risks, such as preterm birth, dyslexia, autism spectrum disorder, and hearing impairment. Core language skill proves to be a highly conserved and robust individual-differences characteristic. Stability of core language skill holds even accounting for child nonverbal intelligence and sociability and maternal age and education. These considerations of stability of core language skill lead to concrete recommendations concerning early intervention to improve lagging language in young children and consequences of stability of core language skill for child mental health.

Consonant/vowel bias in lexical processing by Cantonese-learning toddlers: Preliminary data from a word-learning task

Daniel Tszhin Lee¹, Hui Chen², Regine Yeeking Lai¹, Thierry Nazzi², Hintat Cheung¹

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Consonants and vowels have been reported to be perceived differently and carry different functions in language processing. Nespor, Peña, and Mehler (2003) proposed that vowels are more important for prosodic and syntactic processes while consonants are more important for lexical-related processes. This C-bias in lexical processing has been supported by studies with adults and infants in languages such as English, French, Spanish, although cross-linguistic variations exist (Nazzi, 2005; Nazzi, Poltrock, & Von Holzen, 2016). As these studies mainly examined non-tonal languages, it is uncertain whether the C-bias exists in tonal languages such as Cantonese, which has a balanced number of consonants and vowels, and more importantly, has tones, which are acoustically more linked to vowels (Khouw & Ciocca, 2007). It is interesting to know whether more processing weight is put on vowels or consonants in tonal languages like Cantonese, and such investigations will provide information for theoretical discussions about the origins of this phonological bias and related hypotheses such as the acoustic/phonetic hypothesis stressing the consonant-vowel acoustic differences (Flocchia, Nazzi, Delle Luche, Poltrock, & Goslin, 2014) and the lexical hypothesis stressing the structure of the lexicon (Keidel, Jenison, Kluender, & Seidenberg, 2007).

To further specify phonological biases in lexical processing in tonal languages, this study investigates the C-bias in word learning in 14-, 20- and 30-month-old Cantonese-learning toddlers (target sample size: 24 per age group per condition). Eye-tracking experiments were conducted, one on consonants (14mo: n=9; 20mo, n=24; 30mo, n=17) and one on vowels (14mo: n=7; 20mo, n=24; 30mo, n=5). Eye movements were recorded and proportion of looks was measured while the toddlers were watching animated cartoons to learn novel words. In each experiment, after 2 practice trials, toddlers proceeded to 8 experimental trials, each presenting a pair of novel objects and a pair of monosyllabic pseudo-words contrasted by one phonological feature (e.g., /tœ6/ vs. /kœ6/, /khim3/ vs. /khɛm3/).

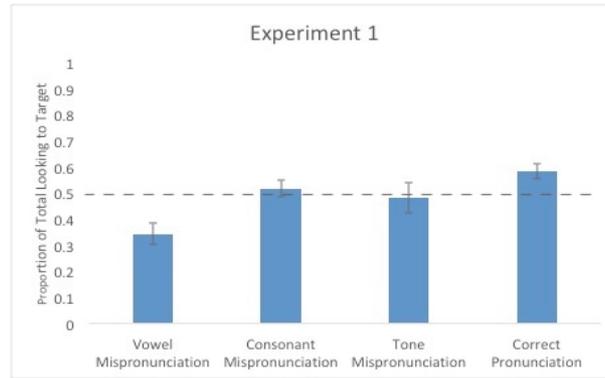
The study aims to tell and discuss (1) whether Cantonese-learning toddlers can process consonant and vowel contrasts when learning new words, (2) whether the C-bias exists in Cantonese, a tonal language, while preliminary evidence has shown that it might not exist in Mandarin (Wewalaarachchi, Wong, & Singh, 2017), and (3) how fast toddlers can use fine phonological information in lexical processing. Preliminary results (data collection is still on the way) show that word learning, as attested by an increase in overall looking times to targets between the pre- and post-naming phases, is better in the 30-month-olds than the 14-month-olds, while no significant difference is found between 20-month-olds and the younger and older groups. Importantly, no difference between the consonant and vowel conditions emerges at this point of data collection for Cantonese-learning toddlers at all 3 ages. Data collection will be continued, and the results will be discussed in terms of the acoustic/phonetic and lexical hypotheses, and previous findings on non-tonal languages.

Phonological biases in Mandarin Chinese learners: Evidence from novel word learning

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A central question in the study of phonological development is the extent to which different sources of phonological variation constrain language processing. Traditionally, it was thought that consonants receive greater priority in lexical processing (e.g. Nespor et al. 2003). However, it is not clear whether a consonant bias, derived mostly from evidence from European languages, applies to Asian languages such as Mandarin. Such languages use tones in addition to vowels and consonants to distinguish word meanings. Given that tone language learners represent the linguistic majority (Yip, 2002), empirical validation from studies with tone language learners are necessary to test the robustness of consonant biases across languages. The goal of the present studies was to investigate phonological biases in Chinese learning children. In Experiment 1, 3-year-old Mandarin monolinguals (N = 18) were taught novel object-word pairings and were tested on their recognition of correct pronunciations and mispronunciations of these words when they underwent a vowel, consonant or a tone substitution. Children's visual responses to the target object (toy labelled during the familiarisation phase) and the distractor object (toy unlabelled during the familiarisation phase) during the test phase were tracked. Results revealed that although children were sensitive to all types of mispronunciations, they did not exhibit equal sensitivity to vowel, consonant and tone variation: children were most sensitive to vowel substitutions, mapping vowel mispronunciations onto the unlabelled toy (Figure 1). Sensitivity was similar for consonants and tones.

Experiment 2 was designed to push the bounds of this bias by determining whether children would prioritize vowel, consonant or tone when these sources of variation were pitted against one another. Unlike in Experiment 1 where children were taught one label for an item and tested on their memory of that label, in Experiment 2, children were taught two labels during familiarization. In addition, children were presented with conflict trials where the mispronounced label differed from the target object by one source of phonological variation and differed from the competitor object by another source of phonological variation. For instance, children were taught 'Men3' and 'Lin3', and tested with 'Len3'. In this example, children have to choose to preserve either consonant information by fixating on the object named 'Men3' or to preserve vowel information by fixating on the object named 'Lin3' allowing us to investigate which cue children chose to dispense with. In Experiment 2, 3-year-old Mandarin monolingual children (N = 18) were presented with correct pronunciations and conflict trials (vowel vs. consonant, vowel vs. tone and consonant vs. tone). Visual responses to the target object and the competitor object were tracked. Although children did recognize correctly pronounced words, results revealed that children did not selectively prioritize one source of phonological variation over any other in conflict trials. Findings suggest that Mandarin learning children demonstrate a task-selective bias towards vowel information over consonant and tone information. More specifically, children only prioritized vowel information when phonological cues were not in conflict with one another. Results suggest that phonological biases are both language- and context-dependent in young children.



Sensitivity to lexical tones in word recognition: Evidence for an age-related decline in tone language speakers

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In order to develop native language proficiency, language learners must learn the words that make up their language, but they must also learn a set of facts about these words. Chief amongst these facts is knowledge of how changes in the sound of a word impact upon the meaning of a word. Prevailing theories of language acquisition would predict that language learners demonstrate an increase in their understanding of these facts as they mature. Indeed, studies investigating sensitivity to particular sound changes, ranging from mispronunciation paradigms to explicit judgment tasks, support this prediction: as children mature, language learners appear increasingly sensitive to native sound changes. These findings have largely drawn from Indo-European languages. Recent research with Asian languages suggests that properties of some Asian languages, such as lexical tone, are an exception to this general trend. In contrast to previous research with languages such as English, studies investigating word recognition and word learning in Mandarin Chinese reveal a developmental paradox: Chinese learners, while exhibiting increasing sensitivity to vowels and consonants as they mature, demonstrate a age-related reduction in sensitivity to lexical tones (Singh et al. 2015; Ma et al. 2017).

In the present study, we investigated whether native learners of Chinese demonstrate a reduction in tone sensitivity, but also in tone specificity, as they mature. Tone sensitivity refers to the extent to which listeners detect tone substitutions. Tone specificity refers to the extent to which listeners' sensitivity to tone variation is limited to native tone substitutions. In a study involving 42 native Mandarin Chinese learning children, we investigated children's abilities to recognize correctly produced and mispronounced Mandarin words. Mispronunciations consisted of native tone mispronunciations (Mandarin tone substitutions) and non-native tone mispronunciations (Cantonese tone substitutions). Children were tested as toddlers (2 years of age) and preschoolers (4 years of age) using an eye-tracking paradigm. Presented with familiar word-object pairings, participants' gaze fixation was tracked to visual referents upon hearing correctly produced and mispronounced forms. Results revealed three primary developments. First, both toddlers and preschoolers preferentially fixated visual referents when their labels were correctly produced, however, preschoolers demonstrated a greater magnitude of response (i.e., higher proportion of fixation to visual referents) than toddlers. Second, both toddlers and preschoolers were equivalently insensitive to Cantonese tone substitutions, correctly interpreting these substitutions as non-lexical. Finally, with respect to native (Mandarin) tone substitutions, only toddlers correctly rejected visual targets as appropriate referents for mispronounced words. Preschoolers appeared to 'hear through' Mandarin tone substitutions, fixating visual targets even when their labels involved a substitution to a different Mandarin tone. Findings confirm previous reports of a decline in tone sensitivity with age in spoken word recognition tasks. However, the current study suggests that this decline is specific to the native tone inventory and does not apply to tone shifts at large.

Acoustic analysis of lexical tones in Thai infant-directed speech

Chutamanee Onsuwan¹, Juthatip Duangmal², Nawasri Chonmahatrakul², Reiko Mazuka³, Naoto Yamane³, Hyun Kyung Hwang³

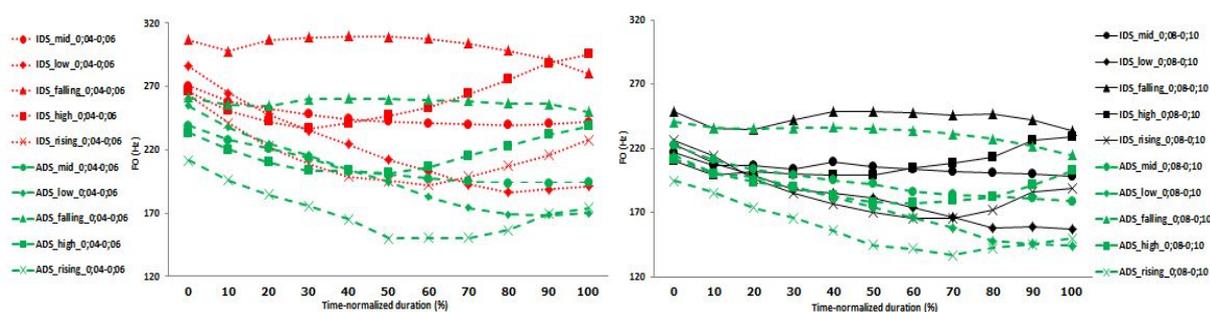
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This work investigated acoustic modifications of Thai lexical tones (mid, low, falling, high, and rising) of infant-directed speech (IDS). Fourteen Thai mothers (BA graduates), ranging in age from 22—38 years old ($M = 31$ years) were separately recorded (wearing a head-mounted microphone) while interacting, using a set of toys labeled with target words, with their own infant and then later with an experimenter (adult-directed speech, ADS). Infants were of two age groups: 0;04—0;06 (6 girls, 3 boys) (IDS-young) and 0;08—0;10 (2 girls, 3 boys) (IDS-old). All mother-infant dyads were part of a perceptual study. The mothers were instructed to naturally produce a series of carrier sentences [ni:f ___kha-l lu:k-f/ tak-h] ('here is___, baby/ experimenter's name'); each contains, in a non-final stressed position, a target monosyllabic word [pa:] with five contrastive tones. Mean F0, pitch range, time-normalized F0 contours, and duration of vocalic portions were extracted from 700 speech tokens (5 words \times 5 repetitions \times 2 speaking styles \times 14 mothers). Differences of mean F0 (Hz), pitch range (Hz), and vocalic duration (ms) for IDS of mothers to the younger group and for ADS of the same mothers were compared. Likewise, the same was carried out for IDS of mothers to the older group and for their ADS. The differences of mean F0 (IDS-young: 251.6 vs ADS: 214.7; $p < 0.01$), pitch range (IDS-young: 75.5 vs ADS: 60.2; $p < 0.01$), and vocalic duration (IDS-young: 262.7 vs ADS: 204; $p < 0.01$) were significant for the IDS-young vs ADS, but not for the IDS-old vs ADS. As for F0 contours, shown in Fig. 1, comparing with ADS, overall shapes of each tone for the IDS groups were relatively maintained. However, some relative shapes between tones in the IDS groups vs ADS. The results provide general support for previous findings on IDS of Thai (Kitamura et al., 2002; Thanavisuth & Luksaneeyanawin, 1998) which reported overall increase in mean F0 and pitch range in IDS compared to ADS. As there has been no data directly examining pitch modifications at the syllable level in Thai IDS, this study was the first to report a possible effect of infants' age on the tone adjustments.



Neural correlates of non-native lexical tone and vowel discrimination in 9-month-old German infants and adults: An ERP study

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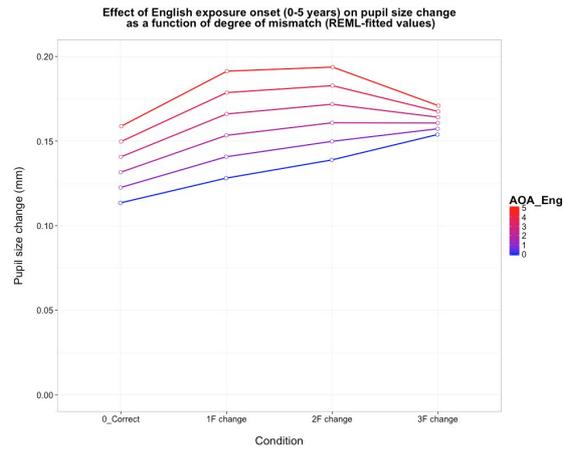
Previous behavioral experiments have shown that perceptual sensitivity for lexical tones declines in infants learning non-tone languages (Mattock & Burnham, 2006; Mattock et al., 2008; Yeung et al., 2013; but see Chen & Kager, 2016; Shi et al. 2017). Besides the decrease of the initial sensitivity some studies have shown a u-shaped development, indicated by a regain of discrimination abilities at 18 months (Liu & Kager, 2014, Götz et al. 2018). The purpose of this study is to examine the neurophysiological correlates of this perceptual reorganization process. This does not only complement behavioral experiments but also contributes to the discussion whether neural discrimination of speech can be maintained in the absence of behavioral discrimination as suggested by Rivera-Gaxiola et al. (2005). To this end, we conducted two ERP-experiments with 9-month-old German-learning infants (n = 15, data collection is ongoing) and German adults (n = 29) using a double oddball paradigm. Our hypothesis was that the strength of a neural mismatch response (MMR) to a non-native lexical tone contrast from Cantonese would decrease while the MMR evoked by a native-like vowel contrast was assumed to get stronger in amplitude and/or faster in latency (Conboy & Kuhl, 2011). We used the Cantonese syllables /se/ and /si/ produced by a native speaker with either high-rising or mid-level tones. This resulted in four different syllables /se25/, /se33/, /si25/, and /si33/. Infants were tested on their discrimination between the frequent standard of the mid-level /se33/ tone and the high-rising /se25/ tone deviant, a contrast for which several behavioral studies have shown no discrimination abilities at 9 months (Yeung et al. 2013, Götz et al. 2018). For a native-like deviant we used the vowel contrast /si33/ with the same tonal properties as the standard, but differing in vowel quality. German monolingual adults were tested in all possible combinations of the standard (e.g. /si33/) paired with a tone deviant, where the vowel remained the same, but the syllable changed in lexical tone, (e.g. /si25/) and paired with a vowel deviant, where the tone remained the same but the vowel quality changed (e.g. /se33/).

So far, our results show that in adults the vowel deviant elicited a robust MMR whereas no MMR was observed for the tone contrast. Contrastingly in infants, the tone contrast elicited a positive MMR whereas no overall effect of the vowel contrast was observed. A possible explanation for these findings could be inter-individual variation in the 9-month-olds. Some infants might already show an MMR – marked by a negativity – and some of the tested infants show an immature positive response to the native like vowel contrast – a maturational switch in the polarity of the MMR that has been observed in previous studies (c.f., Morr et al., 2002, Trainor et al., 2003). More data is needed in order to evaluate this explanation. In contrast, the MMR for tones that was observed for the infants but not for the adults may indicate that infants still show some residual neural sensitivity for this non-native contrast.

Language experience predicts sensitivity to the degree of phonological mismatch

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Past research shows that monolingual adults exhibit gradient sensitivity to the degree of phonological mismatch, which is suggestive of the presence of feature-like information in lexical representations. Such gradient sensitivity emerges early as monolingual 19-to-30 month-old infants demonstrate: When presented with correct labels and labels with differing degrees of featural manipulation, not just adults, but also infants react differentially to correct vs. small vs. large featural manipulations, indicating that even early lexical representations encode information isomorphic to features. It can be hypothesized that ample experience with their language enabled monolingual adults and infants to encode feature-like information in words. Contra monolinguals, bilingual individuals' language experience vary considerably, which may lead not just to differences between mono- and bilingual developmental trajectories, but also to within-group differences as well. To address how language experience affects performance, 39 English-Mandarin-speaking bilingual adults have been tested with the minimally demanding single-picture pupillometry paradigm. In each trial, participants were presented with a pictured referent followed by its English auditory label. The number of featural changes made to the label onset were systematically manipulated (0–3 features; e.g., baby~daby~faby~shaby). Pupillary responses were recorded and in accordance with previous results obtained with monolingual adults and children, the magnitude of pupil dilation was expected to be proportional to the degree of mismatch, reflecting differing levels of cognitive effort to integrate the heard label with the stored lexical representation. As expected, bilingual adults' pupillary response exhibited gradient sensitivity. Crucially, we investigated how gradient sensitivity may be modulated by language experience – onset of English exposure, proportion of English usage, and English proficiency. If the amount of language experience plays a role in word recognition, early English exposure, frequent English use, and high degree of proficiency may predict sensitivity to the degree of phonological mismatch. Our findings are in line with the predictions regarding the former two indicators, but not the last. First, in those participants who have been exposed to English from birth, pupillary response is linearly related to the degree of mismatch, but as the onset of English exposure increases, only the contrast between correct and incorrect forms is maintained (see Figure 1¹). Second, those who use English at least 60% of the time exhibit a linear trend in response to the degree of mismatch, but with lower rates of English use, the contrast between the correct and one-feature change condition no longer remains significant. Third, proficiency did not seem to systematically modulate the effect of phonological mismatch on pupil dilation, which may be due to lack of variation in the sample (even those who reported lesser proficiency rated themselves at least as 7 out of 10). Over the summer, preschool-aged English-Mandarin-speaking bilingual children will be tested using the same paradigm. Children with early exposure to English, frequent English usage, and high degree of English proficiency are predicted to be as sensitive to phonological mismatch as their monolingual peers, which would be consistent with the idea that, with enough experience, feature-like information emerges early even in the bilingual mental lexicon.



The developmental trajectory of linguistic and musical pitch perception among non-tone language learning monolingual, bilingual and tone-language learning bilingual infants: Evidence from EEG

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Behavioural studies have observed differences in linguistic pitch perception across tone- and non-tone-language learning infants. The former keep their sensitivity to linguistic pitch during the perceptual attunement in the first year after birth, whereas the latter lose such sensitivity, although they remain sensitive to non-linguistic pitch information (Mattock & Burnham, 2006). Tone-language learning infants' musical pitch perception remains unclear. As tone-language children and adults show more fine-grained musical pitch processing than their non-tone-language peers (Creel, Weng, Fu, Heyman & Lee, 2018), this study explores whether the same effect may occur in infancy. Additionally, the influence of bilingualism on infant linguistic and musical pitch processing is also examined on a neural level. The research questions are: How do infants' linguistic experiences alter their pitch perception along the developmental trajectory? To what extent do language and music share (or not share) processing components?

One-hundred and twenty infants aged 5-6 and 11-12 months participated in the study. Infants were further grouped into three language conditions: monolingual Australian English, bilingual Australian English with a non-tone language, and bilingual Australian English with a tone language. The non-dominant language was at least 20% of total language exposure among the bilinguals. Participants underwent passive oddball paradigms comprising one linguistic pitch contrast (contracted Mandarin tone, Liu & Kager, 2014) and one musical pitch contrast (violin tone, Liu & Kager, 2017) assessed via electroencephalography.

Distinct neural processing patterns were observed across infants from different language backgrounds. Specifically, monolingual Australian infants exhibited decreased mismatch responses (MMR) to linguistic but not musical pitch. Bilingual Australian-non-tone-language learning infants had similar patterns except that their musical pitch perception became more mature with time, showing mismatch negativity (MMN) responses. Preliminary results with bilingual Australian-tone-language learning infants revealed the most interesting patterns, with limited music but robust linguistic pitch sensitivity at 5-6 months, and MMRs for both language and music processing at 11-12 months. Infant pitch process may be subject to language-specific (exposure to a tone language) and language-general (bilingualism) factors. Similar to the findings among bilingual adults (Krizman, Marian, Shook, Skoe, & Kraus, 2012), bilingual exposure may impact cross-domain auditory processing in infancy.

Effects of language mixing on language processing among young bilinguals

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From a young age, children growing up in bilingual households receive mixed input from their caregivers (e.g. Goodz, 1989), although individual families vary in how much mixed speech is used. Yet, the effects of language mixing on early bilingual language development remains poorly understood, as current approaches to investigating bilingual language development typically compares language abilities between bilinguals and monolinguals (e.g. Curtin, Byers-Heinlein, & Werker, 2011), or tests bilinguals' language skills in each of their languages separately (e.g. Singh, Poh, & Fu, 2016). There is a lack of consensus whether parental language mixing negatively impacts vocabulary development (Bail, Morini, & Newman, 2015; Byers-Heinlein, 2013). Mixed speech has also been associated with processing costs in familiar word recognition among bilingual children and adults (Byers-Heinlein, Morin-Lessard, & Lew-Williams, 2017). These studies provide valuable examinations of the impact of mixing on overall vocabulary development and familiar word recognition, but leave open the question whether bilinguals can learn new words from mixed input.

The goal of the current studies were to investigate how young bilinguals contend with mixed input in the domains of word learning and familiar word recognition at two age groups. Experiment 1 investigated 18-month-olds' associative word-learning abilities. Each child learnt Mandarin target words introduced with Mandarin phrases (i.e. single language context), or with English phrases (i.e. mixed context) across two versions of the same task. They were subsequently tested with Switch trials containing either a tone switch or a vowel switch. Results revealed that infants detected both types of switches only in the single language context, but not the mixed context. These results were unchanged when children were trained on monosyllables or disyllables, suggesting that effects of language mixing were not easily overcome by the increased phonotactic information afforded by an additional syllable.

Experiment 2 examined word learning and word recognition abilities among 3.5-4 year olds across the two language contexts. The main research question was whether these abilities related with each other, and with other background factors including language exposure and executive function abilities. Results revealed that children only learnt novel words from the single language context, but not the mixed context. Language context had less influence on familiar word recognition – children rejected both tone and vowel mispronounced labels regardless of language contexts, suggesting that they were sensitive to both these sources of variation in the identities of familiar words. Sensitivity to vowel and tone mispronunciations were related within tasks, but not across tasks, and most of the current results could not be accounted for by language and executive function measures.

Together, the current findings point to a dissociation between the effects of language mixing on word learning and word recognition among young bilinguals, and suggest that while learning new words from mixed input may prove challenging, the recognition of familiar words remains relatively unaffected by mixing. They also invite future research into understanding how learning from mixed input may be alleviated, and what other factors might underpin children's abilities to efficiently process mixed input.

The efficacy of animated e-books in fostering Singaporean kindergartener's Mandarin lexical learning

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Technology has been fundamentally changing our lifestyle and the increasing popularity of children's electronic storybook is an epitome for such transformation. According to Singapore National Library Board, the number of electronic books borrowed has reached eleven million in 2015, increasing approximately four times since 2009. Compared to traditional print books, features of animated e-storybooks (e.g., motion pictures, and background music) are assumed to provide richer sensory information to children to better understand and retain the story and ultimately enhance language acquisition (Bus, Takacs, Kegel, 2015). It is especially promising for child second language learners/bilingual learners because those children with less language knowledge might need extra information sources to digest the story plots and grasp the new words and grammar.

The current study explored the efficacy of animated e-storybooks on kindergartener's Mandarin vocabulary learning in Singapore. Children's vocabulary learning was compared after using animated e-storybooks and corresponding static versions. 76 K1 children (4-5 years old) who are learning English and Mandarin were investigated. They have been tested for their Mandarin language skills (receptive vocabulary, receptive grammar, and verbal fluency) and cognitive ability (i.e., phonological short-term memory and nonverbal intelligence). Based on their Mandarin competence, they were assigned to any of the three conditions: animated e-book reading group, static e-book reading group and the control group (math gaming). A control condition was set up as otherwise we cannot be sure that the lexical performance at post-test is the result of book exposure instead of teaching during the experiment period. Three prize-winning picture books, namely Little Kangaroo (Genechten, 2007), Na-apers (Veldkamp, 2006), and Cycling With Grandpa (Boonen, 2004) were displayed on a computer for four times over a week for each participant in the two reading groups in a quiet room. Afterwards, all the participants were tested with the 18 target words from the books in the formats of production, reception, contextualization, and meaning recognition. The first two tasks used the original book pictures for the tests while the last two tasks created new contexts. Mixed-effects models were used to analyze the data. Results revealed that 1) the two reading groups outperformed the control group in reception, production, context integration, meaning recognition; and 2) animated reading group outperformed the static group in terms of production and context integration. The findings support the hypotheses made by multimedia learning theory (Mayer, 2013) and imply that animated features (motion and sound) may facilitate children's language output and knowledge transfer, resulting in a better vocabulary learning than traditional reading approach.

The role of prosodic and syntactic focus in Mandarin: Evidence from three- and five-year-olds

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¹IDEALAB

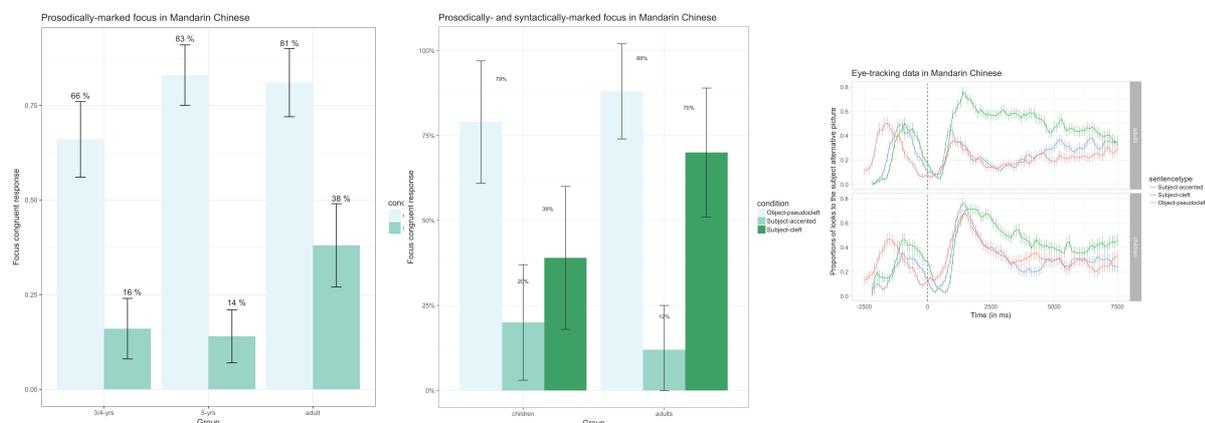
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The questions how information structure (IS) affects the structure of verbal utterances and how listeners interpret the cues related to IS have been explored for decades but still it remains unclear how Mandarin-speaking children implement IS to understand focus. Focus indicates the presence of alternatives in the current discourse and it can be marked by syntactic or prosodic cues (Rooth, 1992). In Mandarin- as a tone and Topic prominent language -the relevance of prosody to mark IS is questionable. Previous research indicates that Mandarin speakers (adults and children) apply acoustic parameters i.e. fundamental frequency and duration to mark IS in sentence production (Yang and Chen, 2014). Most interestingly, Chen found that Mandarin-speaking children relied more heavily on stress than adults to identify focus in a picture verification task and she proposed that children switch from a reliance on prosodic cues to a stronger consideration of syntactic cues based on word order during language development (Chen, 1998).

In the current study, sentence-picture verification tasks with the visual world paradigm were applied to investigate how Mandarin speakers understand prosodically-marked and syntactically-marked focus. The pictures were designed so that participants could correct either the Subject NP or the Object NP, depending on the assignment of focus (Szendrői et al., 2017). Participants were expected to use a pitch accent in the prosody condition and follow syntactic cues in the syntax condition. In the first experiment, prosodically-marked conditions, i.e. Subject-accented and Object-accented sentences, were examined with 41 three-year-olds, 44 five-year-olds and a control group of 40 adult Mandarin speakers (Chen et al., 2018). In the second experiment, Subject-accented, Subject-cleft and Object-pseudocleft sentences were tested with 52 five-year-olds and a control group of 56 adults. Linear mixed-effects models were used to analyse the data. Both studies, the response data as well as the eye-tracking data, showed that Mandarin-speaking adults and children were not sensitive to prosodic information but relied on syntactic information to identify the focus (See figure¹). The findings of the present study are in striking contrast to those of Chen (1998), suggesting that children learning Mandarin Chinese have an adult-like stronger weighting of syntactic over prosodic cues as markers of focus from early on.



Infant social experiences in different socioeconomic settings: a cross-cultural study

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Child development is culturally shaped through daily interactions with caregivers in their immediate environment. However, caregiving is particularly difficult in the contexts of poverty and adversity (Otto et al., 2017). In fact, social and economic differences, both between and within countries, can contribute to inequalities in children's development (Grantham-McGregor et al., 2007). Recent research found that infants growing up in poverty have lower levels of maternal caregiving behaviours, but similar levels of face-to-face contact compared to middle-class infants (Otto et al., 2017). However, there is scarce evidence regarding the actual quantity of social stimulation infants receive. Here we compared mother-infant social engagement in 3 different populations. The study included 16 mother-infant dyads from Reading (UK) (R), and 16 from Stellenbosch (South Africa) (S), both urban middle-class settings, and 19 dyads from Khayelitsha (K), an impoverished peri-urban settlement outside Cape Town (South Africa). Fifteen minutes of spot observations were video-recorded in dyads' homes on multiple occasions, at 2-3 months postpartum. The video-recordings were coded to quantify the time mothers spent: close to the infant; in a physical position enabling face-to-face exchanges; in active social engagement with the infant during face-to-face contacts.

Mothers in K spent less time close to their infants, compared to R and S (p 's < .033; 51.0%, 71.4% and 65.9%, respectively). R and S did not differ.

When close to their infant, all mothers spent similar proportions of time in a face-to-face position (K: 83.3%; R: 86.2%; S: 85.1%). During times when the face-to-face position occurred, K mothers spent less time than R and S socially engaging their infant (p 's < .004; 30.4%, 53.0% and 67.8%, respectively). R and S did not differ.

Mothers living in Khayelitsha, a context of high poverty and adversity, showed low level of social engagement with their infants, putting them at risk for developmental and cognitive deficits. Since promoting mother-infant social interactions positively affects child outcomes in impoverished settings (Cooper et al., 2009; Murray et al., 2016), parental education on the importance of consistent social stimulation should be emphasised.

Eye gaze behaviour on basic emotions in Malaysian infants

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Some studies proposed that basic emotions are viewed differently between different cultures while others suggested that all emotions are universal. This difference, also known as other-race-effect (ORE) has been reported in infants as early as 6 months. The viewing strategies are slightly different between East Asians (e.g. Japan, Korea) and Malaysians, suggesting that effects of mono- and multi-cultural societies in Asia has an influence on the viewing strategies on how faces are perceived. Empirical evidence demonstrated poorer accuracy in recognising emotions when expressed by a person from another race. Yet, one study reported that participants did not differ on accuracy when recognising emotions from respective groups, suggesting that contact with various groups in a multicultural context may have increased the recognition accuracy.

Human infants can reliably differentiate and respond between distinct emotional expressions. There is little research evidence demonstrating the ORE effect with emotion recognition in infants. To our knowledge, only one study in infants has reported on ORE with happy/fear stimuli. They reported that East Asian infants looked longer at the eyes while Western infants looked longer at the mouth, which is in contrast with Caucasian/Western infants viewing on own- and other race faces. Infants also spent more time looking at the fearful expression compared to happy expressions. This study aims to examine infants' looking preference in a face when viewing the six basic emotions expressed by an Asian (own-race) or a Caucasian (other-race).

We tested 21 Malaysian infants (14 females, 4 Malays, 13 Chinese, 4 Indians, Mage = 8.11 months, SD = 0.34) using faces obtained from NimStim while tracking their eye movements. We selected two female faces each (Caucasian and Asian) depicting the six basic emotions (anger, disgust, fear, happy, surprised, sad) and neutral facial expressions. Each participant viewed four blocks; each block has one nursery rhyme video at the beginning and contained seven emotional expressions and six filler images (e.g. ball, boat, giraffe). Each face/image was shown once for five seconds, and the order was randomised using Tobii Pro Studio.

We performed Wilcoxon signed rank tests on the gaze duration and frequency of looks. When shown happy faces, infants looked longer at Asian eyes compared to Caucasian's eyes, $Z = 2.54$, $p = .01$, and more frequently too, $Z = 2.57$, $p = .01$. There are no significant differences for Asian or Caucasian eyes and mouths across other emotions, all $ps > .20$.

Our findings are consistent with, in that infants looked longer at the eyes but not at the mouth. Unlike, we didn't find any clear difference for fearful expression. Our finding further adds that familiarity is useful in identifying emotions, a preference for positive expression over others, or that the infants have yet to develop a fully working schema on emotional face perception for negative expressions.

The four-way stop voicing contrast in Nepali infant-directed speech: another case of hypo-articulation

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Background: Hyper-articulation in infant-directed speech (IDS) compared to adult-directed speech (ADS) is often reported (Kuhl et al., 1997). However, it is not cross-linguistically universal, and IDS may even be hypo-articulated in some languages (Martin et al., 2015). It has been proposed that parents hyper-articulate to support perceptual attunement (Liu et al., 2003). This raises questions about the relationship between hyper-articulation and the difficulty of the learning task that children face.

The production of stop voicing is no exception to the mixed results on hyper-articulation: Stop contrasts are hyper-articulated in some studies (Malsheen, 1980), which may be a side effect of speaking rate (McMurray et al., 2013), and hypo-articulated in others (Baran et al., 1977). The acquisition of stop voicing contrast may be more challenging when the phonetic space is crowded and includes contrastive prevoicing, which is not perceptually salient (Eimas et al., 1971). However, stop voicing in IDS has been documented for one system with more than two stops (Narayan & Yoon, 2011; hypo-articulation of the Korean three-way contrast), and one system with contrastive prevoicing (Fish et al., 2013; hyper-articulation in Spanish), but never in a system that has both. The present study therefore investigates the production of oral stops in Nepali IDS. Nepali has a four-way stop voicing system (/g, g^h, k, kh/; Poon & Mateer, 1985), which is the largest attested stop consonant inventory including two stops with contrastive prevoicing (/g, g^h/).

Method: Word-onset /g, g^h, k, kh/ were elicited in target words from sixteen Nepali-speaking mothers in naturalistic interactions with their own infants (mean age: 14.1 months; IDS) and a Nepali-native experimenter (ADS). Lead time, lag time, and the duration of the following vowel were annotated in words produced in isolation and in utterance-initial position. Analyses were conducted using mixed effects regression models.

Results: IDS, compared to ADS, displayed less frequent production of prevoicing, shorter lead time (if present), and shorter lag time (Figure 1¹). The contrast between voiced and voiceless stops is thus hypo-articulated in Nepali IDS.

To assess the potential cause of the lead-time hypo-articulation and lag-time shortening in Nepali IDS, it was investigated whether consonant shortening is a side effect of vowel lengthening. IDS, compared to ADS, generally displayed longer vowels and smaller consonant-to-syllable ratios (Figure 1¹). These effects were particularly noticeable in the words produced in isolation compared to words in utterance-initial position.

Discussion: The hypo-articulation of stop voicing in Nepali IDS casts doubt on the claim that parents hyper-articulate to support perceptual attunement. This is the first illustration that hypo-articulation of consonants in IDS can be due to lengthening of the vowel, particularly in words produced in isolation. Long vowels may enhance vowel acquisition and affect communication, and words produced in isolation may be easier to learn. Yet, these benefits come at the cost of consonant clarity. Future cross-linguistic research should address the prevalence of this register-specific consonant/vowel trading relationship, and the implications for learning crowded consonant systems.

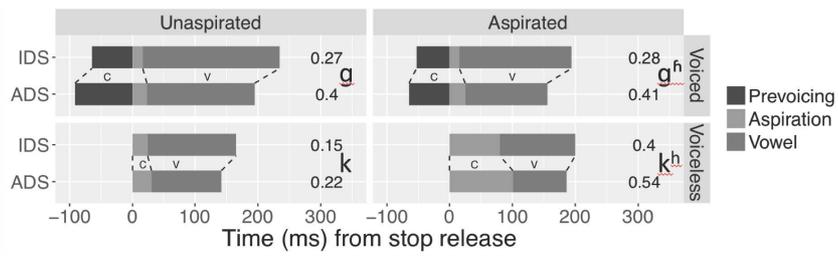


Figure 1. Stacked bar graphs display the duration (ms) of the lead time (dark grey), lag time (light grey) and vowel duration (medium grey) of the target syllables, for IDS (top) and ADS (bottom). /g, g^h/ only include the prevoiced tokens. The numbers provided are the mean consonant-to-syllable ratios per stop per register.

Vowel hyper-/hypoarticulation in infant-directed speech

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Speech sounds in infant-directed speech (IDS) are often hyperarticulated which may have a positive effect on language development (Kalashnikova and Burnham, 2018; Hartman et al., 2017; Liu et al., 2003). However, adult-directed speech (ADS) also varies between hypo- and hyperarticulation, depending on listener and context factors (Lindblom, 1990). The spectral quality of speech sounds is typically described in terms of exemplar representativeness, for example by comparing vowels or vowel space between speakers in absolute frequency values. These measures are difficult to use, since values vary between speakers and between vowels. This can explain some of the disparate findings in this field. A fair description of hypo/hyper-articulation should account for the individual speaker (Wang et al., 2015) and each speech sound.

This study explores an alternative approach to estimate vowel hyper- and hypoarticulation (VHH) to get a normalized measure across speakers and vowels that captures within-conversation dynamics of VHH. In this approach, the formant measures of vowels in conversation are placed on a scale, ranging from a particular speaker's extreme articulation of a particular vowel to the relaxed vowel space, resulting in a measure of overall VHH. Such a scale is defined by the speaker's own vowel-space and extreme realizations of each vowel, which yields an advantage over traditional first and second formant frequency comparisons of absolute values. This measure captures the dynamic aspects of VHH during a conversation across vowel types and speakers.

The participant was a male native speaker of Swedish. In order to obtain each vowel type's hyperarticulation end-point on the VHH scale, clearly articulated lab speech (lists of nonsense words with Swedish vowels in /h_d/ context) was recorded. For the hypoarticulation end-point, the subject was asked to produce a schwa. The conversational speech sample was taken from a recording of the subject in free interaction with his child (IDS) and talking with an experimenter (ADS). The speech was orthographically transcribed (Gerholm, 2017) and then segmented using the online tools Chunk preparation (Poerner & Schiel, 2016) and MAUS General (Norwegian language model; Kisler et al., 2017) available via BAS Web Services. Formants of the recordings were extracted, and a script calculated the Euclidian distance in F1-F2 vowel space between extreme/conversational tokens and schwa. For each conversational token, the overall VHH was calculated as conversational token distance from schwa over extreme token distance from schwa for that particular vowel type.

Preliminary results indicate that the range of VHH is approximately equal in IDS and ADS, but that hyperarticulation occurs more frequently in IDS (Figure 1¹). We propose that the VHH measure has the potential to shed light on the dynamics of hyper/hypo-articulation that could help explain the conflicting results of previous studies on hyperarticulation in IDS.

Future plans include using a perceptually motivated vowel space for the VHH measure, comparing the performance of the automatic speech segmentation for Swedish when using different language-models and evaluating different automatic formant tracking procedures, before applying the protocol to a larger sample of speakers.

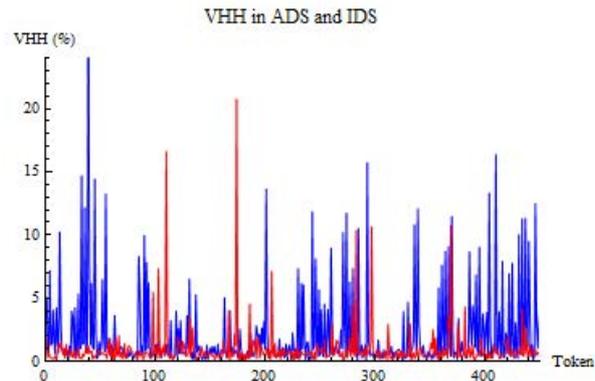


Figure 1: Hyper/hypo-articulation of the first 450 vowels of IDS (blue) and ADS (red).

Prosodic input to word learning: Cross-linguistic evidence from Dutch and Mandarin Chinese infant-directed speech

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Infant-directed speech (IDS) is characterized by a higher pitch, a larger pitch range, and slower articulation rate compared to adult-directed speech (ADS) (Cristia, 2013). IDS facilitates word learning: toddlers learn words better from IDS compared to ADS (Ma, Golinkoff, Houston, & Hirsh-Pasek, 2011). However, language-specific prosody is often neglected in studies on IDS (Wang, Seidl, & Cristia, 2016), and no study to date has investigated how mothers use pitch-related cues and temporal cues to highlight unfamiliar vs. familiar words to a child. To better understand how language-specific prosody affects the prosody of IDS in word-learning contexts, we conducted a cross-linguistic investigation on Mandarin Chinese (a tonal and syllable-timed language) and Dutch (a non-tonal and stress-timed language). Our research questions are: (1) Does IDS addressing 18-month-old children have higher pitch, larger pitch range, and slower articulation rate compared to ADS? (2) Do mothers use pitch-related cues (higher pitch and larger pitch range) and/or temporal cues (slower articulation rate) to highlight words that are unfamiliar to children compared to familiar words in IDS? (3) Does Chinese and Dutch IDS use different prosodic cues in word-learning contexts?

Twenty-one Chinese and thirty-one Dutch mothers of 18-month-old children participated in a semi-spontaneous picture-book telling task (no scripts provided). They read the same book to their child (IDS condition) and to an adult (ADS condition). The book contained seven target words: five unfamiliar to the child and two familiar. We used linear mixed-effects models for each language. The fixed factors were Condition (ADS/IDS) and Familiarity (Familiar/Unfamiliar), and the random factor was Participant. The dependent measures were the mean F0, F0 range, and articulation rate of the target words and the utterances containing target words (N=1462).

First, there was a main effect of Condition on all the pitch-related cues, suggesting that both Dutch and Chinese IDS had exaggerated pitch. However, the effect of Condition on articulation rates was significant for Dutch but not for Chinese, indicating that Dutch IDS was slower than ADS, while Chinese IDS was not (Table 1)¹. Second, there was a significant interaction of Condition and Familiarity on utterance mean F0 for Chinese, indicating that Chinese mothers specifically raised pitch for unfamiliar words in IDS, which may attract children's attention to unfamiliar words and potentially facilitate word learning. However, Dutch mothers raised pitch at both utterance and word level for familiar words instead of unfamiliar words, possibly due to positive affect. Instead of using pitch cues to highlight unfamiliar words, Dutch mothers specifically slowed down when introducing unfamiliar words compared to familiar words in IDS. Overall, Chinese IDS tended to highlight unfamiliar words with pitch-related cues while Dutch IDS preferred temporal cues.

Despite the robust evidence supporting the universality of IDS, our results suggest that prosodic input to word learning differs between the IDS of Mandarin Chinese and Dutch – two typologically distinct languages. Consequently, the role of IDS in word learning and the specific cues that account for the facilitative effects require further examination in a diversity of languages and cultures.

Table 1 Results Summary

	Condition	Condition * Familiarity
Chinese		
Utterance mean F0	$p < 0.001^*$	$p = 0.013^*$
Utterance F0 range	$p = 0.002^*$	n.s.
Utterance articulation rate	n.s.	n.s.
Word mean F0	$p < 0.001^*$	n.s.
Word F0 range	$p = 0.005^*$	n.s.
Word articulation rate	n.s.	n.s.
Dutch		
Utterance mean F0	$p < 0.001^*$	$p < 0.001^*$
Utterance F0 range	$p < 0.001^*$	n.s.
Utterance articulation rate	$p = 0.010^*$	$p = 0.025^*$
Word mean F0	$p < 0.001^*$	$p = 0.023^*$
Word F0 range	$p < 0.001^*$	n.s.
Word articulation rate	$p < 0.001^*$	n.s.

*Note. n.s.: not significant; *: $p < 0.05$*

The quality and quantity of maternal phonetic input play a role in their infants' development of speech perception ability

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It has been reported that maternal speech clarity supports their infants' phonological learning, for instance, by presenting affricates in expanded vowel spaces (Liu et al., 2003) and by providing more acoustically extreme tokens of fricatives (Cristia, 2011). The acoustic cues relevant for Korean stop contrasts have undergone some changes in the past decades (Bang et al., 2015) and as a result, the input to Korean infants may have mixed distributions in their acoustic characteristics, giving rise to some consequences on Korean infants' learning their native phonology. To explore this possibility, the present study investigated whether the acoustic characteristics (e.g., voice onset time, VOT, or fundamental frequency, f0) of stop sounds in maternal input contribute to the infants' discriminate ability.

Twenty Korean mothers read a list of words that included three-way stop categories across three places of articulation (bilabial, alveolar, & velar) word initially, embedded in a carrier sentence (e.g., "This is pul (fire)"), five times for each item. The recordings were analyzed for the differences in VOT, f0, and H1-H2 among three stop pairs in Infant-Directed Speech (IDS) and Adult-Directed Speech (ADS) register, respectively. Their 7-9-month-old infants also participated in a visual habituation-dishabituation experiment, testing their ability to discriminate the fortis from the lenis stop (/p*u/ versus /pu/). From these, we obtained individual infant's looking time difference (LTD) score between the same and switch trials; with greater LTD score indicative of better discrimination ability. Infants' LTD scores were positively correlated with the infant's age ($r = .577$, $p = .008$), indicating infants' ability to discriminate them were increasing with age. When mothers' IDS tokens were examined, the VOT difference between the fortis and lenis stops ($r = .507$, $p = .023$), and the VOT difference between the aspirated and fortis stops ($r = .461$, $p = .041$) were positively correlated with infants' LTD scores. No correlations were observed with ADS tokens. Furthermore, the VOT difference between the fortis and lenis stops explained additional 17.6% of variance in infants' LTD scores after controlling for infants' age (R^2 change = .176; $F(2, 17) = 8.817$, $p = .002$; $\beta = .425$, $p = .024$), suggesting that the acoustic characteristics of maternal phonetic input uniquely contribute to their infant's discrimination ability of the phonemes related to these acoustic parameters. We also found that the individual differences in mother's time spent on English book-reading (time dedicated to learning of a foreign language, not the native one) was negatively associated with the infants' LTD scores ($r = -.46$, $p = .041$), further suggesting that the amount as well as the quality of the phonetic input contribute to the development of speech perception abilities.

These results provide further support for the direct link between mother's phonetic input and their infants' phonetic perception abilities. Also, the findings here strongly imply that recent observation on Korean infants' delayed development of lenis-aspirated distinction (Choi et al., 2017) is closely linked to the diachronic change that has occurred to these categories in speakers of recent generations.

Does exaggerated affect in infant-directed speech support infant word learning?

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High pitch and expanded pitch range are typically used in infant-directed (IDS) speech to encourage, reward and regulate the arousal level of the infant (e.g., Fernald, 1984; Kitamura & Burnham, 1998). These exaggerations to pitch are closely tied with the expression of positive emotion (Scherer, 1986) and are known to increase the responsiveness, interest and “cuddly” appearance of the infant when they are given the opportunity to listen to IDS (Werker & McLeod, 1989). Over and above attracting infant attention, there is evidence that exaggerated IDS prosody assists infants in many of the challenges of early speech perception, e.g., to segment the speech stream (Thiessen, Hill, & Saffran, 2005), find stressed words in sentences (Fernald & Mazzie, 1991a) and discriminate multi-syllabic words (Karzon, 1985). However, it is not well understood how vocal affect contributes to word learning. This study examines whether increased positive affect predicts infants ability to learn a CVCV nonsense word-object pairing in a laboratory task.

In this task, infants were seated on their mothers lap while facing 3 screens in a darkened, distraction free room. The middle screen presented centering stimulus and the outer two screens presented images of the objects in the familiarisation and test phases. The word learning task lasted approximately 5 minutes for each infant, and consisted of three phases: pre/post test wherein familiar word/object pairings e.g. a “ball” were shown to orient the infants to the task, infant- controlled familiarisation to two novel object/word pairs (Mitud, Tumik) spoken in (positive or neutral affect), and four test trials. The object/word pairing, order and starting side were counterbalanced between participants. Sixteen month old infants are currently being recruited from the MARCS Babylab register to participate in this study. To date (N=16) 16-month-olds (9 female) have completed testing.

The proportion of infant looking time at target image was entered into a 2 (Neutral, Positive affect) x 2 (Familiar x Unfamiliar Word) ANOVA to test the effect of affect and familiarisation. There was no main effect for affect and no main effect for word familiarity. There was no interaction. Thus far, the data do not indicate that positive affect facilitates learning of a nonsense word-object pairing. However, additional infants are still being tested to complete all counterbalancing conditions.

The role of vowel hyperarticulation in IDS in facilitating infants' lexical processing

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Although it is well-established that infant-directed speech (IDS) has a number of distinctive acoustic features compared to adult-directed speech (ADS), few studies have examined whether infants are sensitive and able to use those features in the acquisition of specific language skills. One of those skills is lexical processing, which is measured by speed and accuracy in recognising the visual referent of a familiar word in real time. Efficiency in lexical processing in the second year of infants' life is significantly correlated with early vocabulary growth as well as language and working memory measures later in childhood.

One IDS feature, vowel hyperarticulation, i.e., the expansion of the acoustic space between the corner vowels /i,u,a/, specifically is proposed to serve the linguistic function of facilitating the development of infants' early speech perception skills. Investigating the potential effect of this feature on infants' lexical processing may clarify whether IDS facilitates linguistic skills by drawing infants' attention to speech or by providing them with better perceptual cues and linguistic information in the input. Song et al. (2010) assessed how three acoustic features of IDS, slow speaking rate, vowel hyperarticulation and wide pitch range, impact lexical processing in 19-month-old infants. Speech rate and vowel hyperarticulation facilitated infants' performance by reducing response latencies. This finding suggests that vowel hyperarticulation in IDS may facilitate lexical processing. However, it is still unclear whether vowel hyperarticulation could facilitate lexical processing independently from other acoustic features such as heightened pitch and reduced speech rate.

This study investigated the role of vowel hyperarticulation in facilitating infants' lexical processing. Forty monolingual infants between 18 and 20 months of age participated in a looking while listening paradigm. Infants completed three between-subjects conditions where the presence of vowel hyperarticulation was manipulated using the three corner vowels (/a/, /i/, /u/). To achieve this a female speaker was recorded producing the stimuli sentences in three different ways. In the hyper-IDS condition, stimuli were recorded in natural IDS (duration, pitch, and vowel formants were exaggerated when compared to the speaker's ADS). In the hypo-IDS condition, stimuli had exaggerated duration and pitch compared to ADS and vowel formants did not differ from ADS. Finally, in the hyper-ADS condition, stimuli were recorded in ADS that had vowel formants exaggerated similar to speaker's IDS.

Preliminary analyses compared performance between the hyper-IDS and hypo-IDS conditions. Onset-contingent analysis demonstrated that infants in hyper-IDS condition were faster in switching to the target when they were looking to the distracter at the trial onset than infants in the hypo-IDS condition, which was confirmed by a linear mixed-effects model analysis. Data collection for the hyper-ADS condition is currently in progress.

These findings are in accordance with the Song et al. (2010), and they support the importance of vowel hyperarticulation in facilitating infants' linguistic processing. Data from the hyper ADS condition will further clarify whether vowel hyperarticulation provides specific linguistic information that can facilitate infants' language development independently from the additional acoustic cues present in IDS such as heightened pitch and reduced speech rate.

An examination of maternal depression and anxiety and infants' early language environment

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Environmental influences such as the quantity and quality of mother-infant interactions assist in shaping infants' language development. The quantity of speech input to infants, specifically infant directed speech (IDS), is a predictor of vocabulary development. Mothers who speak more to their infants have infants who also speak more, have larger vocabulary sizes, and more advanced lexical processing skills.

Maternal depression is one environmental factor that can affect mother-infant interactions and infants' development. Mothers with depression communicate less frequently with their infants, and infants are in-turn less vocal and responsive. However, most previous studies have been cross-sectional, descriptive and laboratory based, so the impact of maternal depression and anxiety upon the quantity of IDS in the home environment is unknown.

In this study, 41 mother-infant dyads were followed longitudinally from the infant ages of six to 12 months. Mother-infant dyads were classified into at-risk ($n = 20$) or control groups ($n = 21$) based on maternal postnatal depression and anxiety measures (Epidemiologic Studies Depression Scale – Revised, CESD-R; State-Trait Anxiety Inventory, STAI). Recordings of natural speech by the mother and the infant produced during an average day (12 hours) were obtained and analysed using the Language Environment Analysis system (LENA Foundation, 2009).

Three LENA measures were used for analyses: adult word count, conversational turns, and child vocalisations. Repeated measures analyses of variance were conducted with each LENA measure as the dependent variable and infant age and group as the independent variables. Results showed that infants in the risk group vocalised less ($F(1, 39) = 8.70, p < .01, \eta^2 = .18$) and engaged in fewer conversational turns ($F(1, 39) = 5.8, p < .05, \eta^2 = .13$) than controls. Regardless of group, all mother-infant dyads increased the number of conversational turns with infants' age, ($F(1, 39) = 4.8, P < .05, \eta^2 = .11$). There were no effects of risk group on the adult word counts. An initial correlational analysis was conducted to explore the relationship between maternal depression (CESD-R) and maternal anxiety (STAI) measures and the home recording LENA measures. The number of infant vocalisations, was negatively correlated with maternal anxiety scores at six months of age ($r(41) = -.32, p = .047$). When separate correlations were conducted for each group, adult word counts within the risk group were shown to be negatively related to maternal depression ($r(26) = -.40, p = .046$) and anxiety measures ($r(26) = -.50, p = .010$).

Thus, infants of mothers with elevated depression and/or anxiety vocalise less and engage in fewer conversational turns, despite exposure to similar quantities of speech input at home. Furthermore, at six months, maternal anxiety scores are related to the number of infant vocalisations. While group differences in adult word counts were not significant, there were significant relations between at-risk infants' language input and their mothers' depression and anxiety scores. These findings will be discussed in relation to the effects of maternal emotional health on maternal responsiveness, and their consequences for early language development.

Neonatal imitation: Does it exist?

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Neonatal imitation is a cornerstone in many theoretical accounts of human development, social behaviour and cultural change, yet its existence has been debated for the last 40 years. I will present data from the largest longitudinal study of newborn imitation in which over 100 infants were tested for imitation of nine different gestures at four time points over the first 10 weeks of life. This study revealed no evidence of imitation of any gesture, at any time point (Oostenbroek et al, 2016, *Current Biology*). I will also present new findings from the first and only meta-analysis of available data on the phenomenon. For this, we synthesised effect sizes from 31 independent samples of human infants under 6 weeks of age, reported in 24 papers. The meta-analysis revealed that when studies are combined, there is evidence for neonatal imitation ($d = 0.74$, 95% CI = 0.44 to 1.03). Additional analyses revealed no significant impact of methodological variations on the overall effect; for example, the length of model presentation and response periods, the familiarity of the model and the positioning of the baby made no difference to the strength of the neonatal imitation effect. However publication bias analyses strongly suggest non-reporting or non-publication of null and negative results over the last 40 years. Considering these sources of evidence, the most plausible conclusion is that human infants do not imitate from birth. This demands re-consideration of the developmental timetable and mechanisms of early imitation.

Same- and other-race face scanning in British-White and Malaysian-Chinese infants

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The ability to process faces requires rapid scanning of facial features. Recent studies employing eye-tracking methodologies suggest individuals' scanning pattern is culture dependent (Kelly et al., 2011; Blais et al., 2008). For example, Caucasian children and adults (Western societies) tend to scan the eyes and mouth whereas Asian children and adults (Eastern societies) tend to fixate at the centre of the face. In addition, those that have exposure to both Western and Eastern societies showed a hybrid fixation pattern. Malaysian-Chinese adults living in a multiracial and Western influenced Asian society displayed an intermediate strategy by focusing on the eyes and nose (Tan et al., 2012).

The current study aims to investigate same-race (SR) and other-race (OR) face scanning patterns in 9-month-old infants who have exposure to both Western and Eastern societies and those who have exposure to one society. Twenty-two Malaysian-Chinese (Chinese race) and British-White (Caucasian-White race) infants were tested using faces of three racial groups (Chinese, Malay, and Caucasian-White). Scanning patterns around the three major features (eyes, nose, and mouth) were recorded. Analyses of the proportion of looking at the eyes, nose, and mouth indicated a 3-way interaction between culture, face race, and features ($p < .001$). Malaysian-Chinese infants showed more scanning towards the eyes and nose than the mouth area ($p < .028$) whereas British-White infants showed more scanning around the eyes relative to the nose and mouth area ($p < .005$). Further analyses showed differences in scanning between face race for certain features within the British-White culture only ($p < .001$). Overall, the study suggests that infants' scanning pattern is culture dependent and that those who are exposed to both Western and Eastern societies adopt a broader scanning pattern for SR and OR faces than those who are exposed to only one society.

Word learning strategy influences word learning performance in multilingual children

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Language experience can have an impact on the way that language develops in children, influencing a child's linguistic expectations and the resulting strategies used. The objective of this research was to examine how the choice of word learning strategy relates to later learning in children. Behavioural experiments were used to investigate whether the number of languages a child knows influences their use of mutual exclusivity as a word learning strategy, and their ability to learn new words. Children aged between five and seven years, with varied language experience, took part in two different word learning experiments.

The first experiment was intended to investigate children's strategies during a disambiguation task – during which children were presented with one familiar object and one novel object, and were asked to select an object referred to by a novel label. They were then tested on both the word-novel object pairings and word-familiar object pairings, immediately after the disambiguation task, and one week later. It was expected that the more languages children knew, the more willing they would be to apply lexical overlap, the more often they would select the familiar object as the referent, and the more novel word-familiar object pairings they would successfully learn. Results demonstrated that the number of languages children were proficient in negatively predicted their use of mutual exclusivity during the disambiguation task, which is in line with previous work showing this effect in younger children (Houston-Price, Caloghiris & Raviglione, 2010; Byers-Heinlein & Werker, 2013). Whilst there was no effect of language experience on word learning score in immediate or delayed testing, there was an effect of word learning strategy. The use of mutual exclusivity during the disambiguation task positively predicted word learning score in the familiar object testing trials. This suggests that the use of a word learning strategy results in better general word learning.

The second experiment intended to measure each child's learning of word-object pairings, in a non-ambiguous learning situation. One task involved learning novel object labels, whilst the other task involved learning familiar object labels. In both tasks, it was predicted that the more languages children knew, the higher their scores would be. No effects of language number were found. Children demonstrated significant learning of the familiar object labels, but did not demonstrate significant learning of the novel object labels.

These results suggest that language experience still influences the use of word learning strategy in school age children, and that the use of a word learning strategy influences word learning ability at this age. However, no direct link between language experience and word learning ability was found.

Perception of English consonant contrasts among multilingual Malaysian-Chinese children under quiet and adverse conditions

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In comparison to the native speakers, adult non-native speakers are more susceptible to the adverse effects of background noise during non-native speech perception (e.g. conversation over a phone or in a canteen; see Lecumberri et al., 2010; Mattys et al., 2013 for review). Part of this native advantage can be attributed to the native speakers' immense experience with the target language and their effective use of native strategy in attending to the acoustical cues that facilitate speech comprehension (Bradlow & Bent, 2002; Bradlow & Alexander, 2007). How children from a multilingual society would perform under adverse conditions however, remains unexplored. This study serves to examine the adverse effects and dominant language effects on Malaysian Chinese children's identification of the English consonant contrasts - /t/-/d/, /f/-/v/ and /r/-/l/, located at word initial and final positions. Phonetic identification accuracy under quiet and adverse conditions was compared between dominant Malaysian English and dominant Mandarin speaking Chinese children. Forty-five children (aged between 4 and 6 year old) completed a 15minutes word repetition task to learn the involved English words before their semantic learning and perceptual accuracy of the English phonemic words were tested with a 2-alternative-forced-choice English minimal pair identification task. Lastly, they had to perform the same identification task with multi-talker babble presented as the background noise. Children's identification accuracy was then analyzed with forty-seven young adults' (aged between 18 and 26-year-old) who went through the same experimental procedure. Four-way-mixed-design ANOVA revealed that both adults and children suffered to a similar extent from the adverse effects of the added background babble. In general, dominant English speaking adults performed better than dominant Mandarin speaking adults. The dominant Mandarin speakers were influenced by the Mandarin language system and had greater difficulty identifying the word final consonants compared to the word initial consonants (Flege, 1989). The dominant language effects however, was less apparent among the children. Implication of the findings will be discussed further in the discussion section.

Brain responses to Mandarin lexical tone changes measured in early infancy predict later language development at 24 months

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Mandarin is a tonal language with four lexical tones: a high-level tone (T1), a high-rising tone (T2), a low-dipping tone (T3), and a high-falling tone (T4). Among these, T3 is acoustically more similar to T2 than to T1 in terms of pitch contours and heights. Cheng et al. (2013) used the multiple-deviant paradigm to trace the mismatch responses (MMRs) to Mandarin lexical tone changes in infants at birth and at 6-month of age. The data revealed that, in newborns, the large T1/T3 change elicited a positive MMR (P-MMR) between 300 and 500 ms. As in 6-month-old infants, the T1/T3 change elicited an adult-like mismatch negativity (MMN) between 150 to 250 ms. No MMR was found for the small T2/T3 change in both age groups. The present follow-up study assessed those infants' vocabulary production and syntactic complexity at 24 months by using Mandarin-Chinese Communication Development Inventory – Taiwan (MCDI-T). The goal was to examine whether the brain responses to lexical tone changes measured in early infancy could predict the future language performance. This study took the mean amplitude of consecutive 50-ms windows in the intervals of P-MMR in newborns and MMN at 6 months, reported in Cheng et al. (2013), as predictors to perform the Pearson's *r* correlation analysis between each observation of MMR and each subscale of MCDI-T. The results show that newborns' MMR to T1/T3 change in 300 to 350 ms positively correlates with the vocabulary production, but newborns' MMR to T1/T3 change in 350 to 500 ms negatively correlates with both vocabulary production and syntactic complexity measured at 24 months. MMR to T2/T3 change in newborns did not correlate with any MCDI-T score at 24 months. As for MMRs measured at 6 months, MMR to T2/T3 change in 150 to 200 ms negatively correlates with both vocabulary production and syntactic complexity at 24 months, whereas MMR to T1/T3 change did not correlate with any MCDI-T score at 24 months. These findings suggest that more negative-going MMRs measured in early infancy predict larger vocabulary growth and better syntactic skills at 24 months. The current study supports that MMR to lexical tone in newborn and at 6 months could be an early index for the future language performance.

Native Cantonese-learning infants' discrimination of lexical tones that are similar in pitch onset

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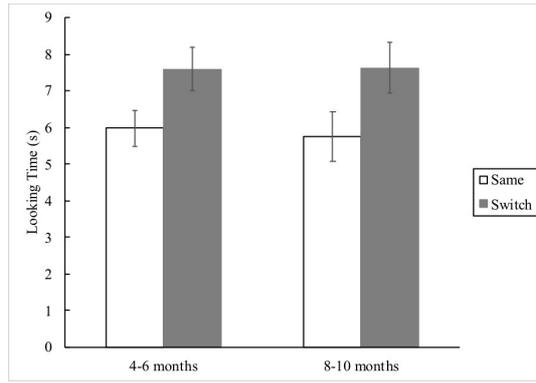
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Research with infants learning non-tonal languages have found that they begin to lose their sensitivity to discriminating lexical tones between 6 and 12 months of age, which may indicate that tone-discrimination develops in the same pattern as segmental discrimination, i.e., perceptual narrowing pattern (e.g., Mattock & Burnham, 2006). Yet, only a few studies have examined native lexical tone perception in infancy, and discrepant results have been reported. On the one hand, Yeung, Chen, and Werker (2013) reported that Cantonese-learning infants were able to discriminate Cantonese tones from as early as four months of age, while Tsao (2008; 2017) found that some of the Mandarin tones remained difficult for Mandarin-learning infants at 10-12 months of age. The discrepancy found could be attributed to the fact that (1) different procedures were employed, and (2) different lexical tone stimuli were tested. While Yeung and colleagues (2013) tested only one pair of Cantonese tones which was considered easy to discriminate, i.e., the high rising T25-mid level T33 contrast, Tsao (2008; 2017) tested a series of Mandarin tone contrasts varying in degree of acoustic similarity. Therefore, based on the results from these studies, it is difficult to draw conclusion with regards to whether different native tonal contrasts are equally well-perceived by native infants.

To address this question, the present study extended Yeung and colleagues' (2013) and examined whether Cantonese-learning infants' can discriminate a tonal contrasts (i.e., high rising T25-low falling T21 contrast) that is predicted to be more difficult (e.g., Lee et al., 2002; Varley & So, 1995). With a visual habituation-dishabituation paradigm, 20 4-to-6-month-old (9 girls; mean age = 5 months 10 days) and 20 8-to-10-month-old (10 girls, mean age = 9 months 18 days) native Cantonese-learning infants from Cantonese-speaking families in Hong Kong were tested. Figure 1¹ shows the average looking times in each age group for the same and switch trials. A repeated-measures analysis of variance was conducted, with Age (4-6 months and 8-10 months) as between-subject factor and Trial (Same vs. Switch) as within-subject factor. It was revealed that both Cantonese 4-6-month old and 8-10-month old infants discriminated the T25-T21 contrast.

Our result indicates that native Cantonese-learning infants were able to discriminate a Cantonese lexical tone contrast that is predicted to be more difficult than the pair previously tested. Despite the similarity in pitch onset, which has been proven difficult to discriminate by native Cantonese children and adults, Cantonese-learning infants were able to discriminate the T25-T21 contrast by 4-6 months of age. The present study extends Yeung and colleagues (2013)'s study, indicating that Cantonese learning infants' ability to discriminate native tone contrasts may not be constrained to the easy lexical tone contrast (i.e., T25-T33 contrast). Whether all the lexical tone contrasts are similarly discriminated by Cantonese-learning infants, or some of them are difficult like Mandarin lexical tones in Tsao (2008, 2017), remains open for further study.



Visual referential cue enhancing phonetic categories in a familiarization paradigm: Native tone sensitivity in English-Mandarin bilingual infants

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In the realm of bilingualism, developmental progression of native tone and phonological sensitivities seem to be flexible and susceptible to various factors' influences. Tonal prosodic cues convey either lexical or non-lexical information about a word's identity, depending on tonal (Mandarin) or non-tonal language (English) respectively. Tone-related findings from monolingual and bilingual infants show English-Mandarin (EM) bilinguals demonstrating tone sensitivity in speech segmentation paradigms that provide a language context, but showing tone insensitivity in habituation-based discrimination paradigms with single syllables in absence of such cues. EM bilinguals' poorer discrimination performance, when compared to their English/Mandarin monolingual counterparts, could be attributed to a lack of context in the selected test paradigm. Use of varying acoustical salience of specific tone contrasts and sensitivity of paradigms provide an array of varied results.

Six to nine months of age approximately marks a period of declining tone sensitivity, suggesting a U-shape trajectory for both tone and non-tone language learning infants (retained sensitivity: between 5-6 month-olds and 17-18 month-olds; a trough: between 8 and 12 months for monolinguals and an earlier sensitivity regain at around 11-months for bilinguals). Studies on acquired distinctiveness and associative learning explain infants' functional learning mechanisms for perceptual reorganization. Arbitrary object-sound links also aid phonetic category development in 6-12 month old infants.

Pooling prevailing evidence, this paper explores native tone attunement in bilingual infants who are in the process of learning two distinct language systems, to see if regaining native tone sensitivity can happen at an earlier age, whereby the tone sensitivity window period is alterable. Do additional cues paired to salient tonal contrasts help streamline tonal discrimination, aligning it more closely with infant's native language? 24 7.5-9-months old EM bilingual infants were tested on a stimulus-alternating paradigm, using Mandarin tonal contrasts 1 (high-level) and 4 (high-falling). During familiarization phase, infants were taught two object-sound pairings, using the object as a referential visual cue to learn that the two tonal contrasts are variants. During test phase, infants are exposed to either tokens of same tonal category (within-category pairs) or of different tonal category (across-category pairs). Non-alternating trials consisted of within-category pairs in high-level tone ([pa(55)]-[pa(55)]) or in high-falling tone ([pa(51)]-[pa(51)]) and alternating trials consisted of across-category pairs of high-level and high-falling tones ([pa(55)-pa(51)]/[pa(51)]-[pa(55)]). Looking-time to non-alternating and alternating trial types were compared. A t-test revealed significantly different looking times to both trial types, favoring the alternating trials, demonstrating that the tonal contrast 1 and 4 were found to be discriminable.

Infants younger than 9 months and within this declining sensitivity period have not been documented to show any aided tone discriminating ability. Current results illustrate 7.5-9month-old EM bilinguals to be able to differentiate two salient pitch contour types in a familiarization paradigm. Presence of a visual referential cue proves useful for even younger bilingual infants to learn tonal contrasts without requiring the knowledge of long-lasting learnt associations. Tone attunement's developmental progression and declining sensitivity seem to be influenced by listening experience and context.

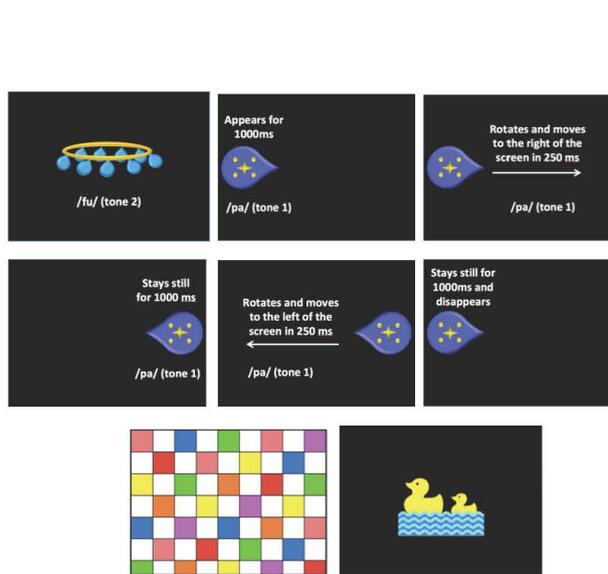


Figure. (a) Warm-up trial's swiveling toy paired with a nonsense word 'fu'. 6 novel tokens presented in 10 s. (b) Sample familiarization trial - referential object (objA) paired with a tone (tone 1). Four unique tokens from either Tone 1 or Tone 4 contrast were presented multiple times with one object in each familiarization trial. Familiarization trials have consistent object-tone pairings. (c) Visuals for tone discrimination test trials - a visual coloured checkerboard. (d) Animated colourful attention-getter (in-between trials if infant does not look at the screen).

The effect of age and language experience on infant pitched word learning

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Few previous studies have investigated word-object associative learning in infancy involving lexical pitch. This study extends participant age to the first year before birth, auditory stimuli to musical pitch, and testing infants from a diverse language background. The research questions are: 1) What are infants' tonal associative word learning patterns before the first year after birth? 2) Do monolingual and bilingual infants differ in such patterns? 3) Can infants learn words contrasted in musical pitch?

One-hundred and thirty-four non-tone-language learning monolingual and bilingual infants aged 5-6 and 11-12 months were tested on their word learning ability where novel objects were associated with a linguistic pitch (manipulated Mandarin) contrast in Experiment 1 and a musical (violin, Liu & Kager) pitch contrast in Experiment 2. The overall results suggest that bilingual infants exhibited improved associative word learning ability with linguistic pitch across ages compared to their monolingual peers, but decreased learning with musical pitch.

Linking with previous findings, bilingual infants' increased linguistic tonal word learning ability by the end of the first year may be related to their tonal perceptual rebound trajectory. This further suggests that bilingual enhanced acoustic sensitivity may be utilized for linguistic purposes at this stage, reflecting perceptual flexibility and possibly neural plasticity. Additionally, the poorer performance of bilingual infants when learning novel objects contrasted in musical pitch may indicate their general orientation towards the domain of language facing a relatively more challenging learning environment. In other words, despite having no prior linguistic experience with pitch related to lexical tone, bilingual infants still prefer lexical over non-linguistic pitch information. The overall findings, centring on the impact of bilingualism and enrich existing discussions in word learning advantages at early stages of development.

Cross-talker lexical tone discrimination in infancy

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Discriminating and categorizing phonologically contrastive sounds serves as a prerequisite for early language development (Kuhl, 1983). In natural language environment, the same word may display varying acoustic properties coming from different speakers due to physiological differences, cultural background, and social status among other factors (Bent & Holt, 2017).

Early works on infant sound discrimination in the face of talker variability date back to Kuhl (1979, 1983) where it was found that 6-month-olds successfully transferred categorization of both dissimilar (/a/ and /i/) and less dissimilar vowels (/a/ and /ɔ/) across different voices. However, without step-by-step training, infants could generalize categorization of the less dissimilar vowels only in conditions with identical pitch contour but not with different pitch contours (Kuhl, 1983). Similarly, Jusczyk et al. (1992) found that infants as young as 2-month-old were able to detect the consonant change from /bʌg/ to /dʌg/ produced by multiple speakers. However, when the authors modified the high-amplitude-sucking procedure such that a 2-min delay was inserted between the habituation and test phases, only in the single talker condition did infants detect the phonetic change. These findings coincide with adult studies (e.g., Wong and Diel, 2003), indicating that talker variability may tax infants' speech encoding.

Yet little is known about cross-talker lexical tone discrimination in infancy. Chen & Kager (2016) looked at tone discrimination across multiple tokens by non-tone-learning infants and found that 6- and 12-month-olds successfully discriminated Mandarin T2 and T3 in the presence of within-talker variability. However, Mandarin T2 and T3 differ not only in pitch height but also in pitch contour, which makes it unclear whether infants succeeded in the task because they normalized the tokens into two sound categories or because they simply failed to recognize the small intrinsic differences among tokens within the same category.

The present study sets out to investigate the effect of inter-talker variability on lexical tone discrimination by infants aged 6-month, 12-month, and 18-month using the visual fixation paradigm. The 6- and 12-month-olds are chosen following the findings of Chen & Kager (2016), and an additional older group (the 18-month-olds) are included to test whether age modulates the effect of talker variability. Cantonese level tones (T1 and T3) are chosen as stimuli as they only differ in pitch height, which varies across speakers. In this case, intrinsic cues are no longer sufficient for normalization. Hence the possible confounding factor of insensitivity to within-category fine acoustic differences need not to be considered. Infants will be habituated to one of the two tones and then tested with the other. In the single-talker condition, stimuli are produced by one female speaker, while in the multiple-talker condition stimuli are produced by 6 female speakers with different pitch ranges. If infants do discriminate the two tones in the presence of talker variability, it will indicate successful normalization across talkers. But it is also predicted that the discrimination in the multiple-talker condition may not be as robust as that in the single-talker condition since previous findings suggested that inter-talker variability taxes speech encoding.

Infants' sensitivity to lexical tone and stress in the first year of life

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Newborns are sensitive to the rhythmic and prosodic patterns of their native language. This early sensitivity allows infants to successfully differentiate samples of familiar and unfamiliar languages that belong to different rhythmical classes (e.g., English and Japanese). During their first year, infants' speech perception is further attuned to their native language. First, infants become sensitive to the supra-segmental cues of their language. For instance, four-month-olds are able to differentiate languages based on their stress patterns (Friederici et al., 2007). Later, around nine months of age, infants develop the ability to recognise the phonotactic patterns and the phonetic categories of their language (Jusczyk et al., 1994). This distinction between infants' reliance on segmental and supra-segmental cues in the language input is less clear for infants acquiring a lexical tone language. These languages mark phonemic distinctions at the supra-segmental level allowing for the possibility that infants may develop an earlier sensitivity to the phonetic information of their native language than infants acquiring a language that does not use lexical tones.

This study assessed the ability to differentiate their native and a non-native language in 6-10-month-old infants (N=64) acquiring English (in Sydney, Australia) and Thai (in Bangkok, Thailand). English and Thai are both stress-timed languages, but unlike English, in Thai, the weak-strong stress pattern is predominant and lexical tone is phonemic. Infants from each language group were randomly assigned to the two-syllables or the one-syllable condition. In the two-syllables condition, English and Thai words differed both in their stress patterns (strong-weak vs. weak-strong) and in the presence of lexical tone. In the one-syllable condition, however, words differed based on the presence or absence of lexical tone, but no information about their stress patterns was available. All stimuli consisted of low-frequency words unfamiliar to young infants. During a familiarisation phase, infants were presented with English words when they oriented to one side of the experimental set up, and with Thai words when they oriented to the other side. During the test phase, infants' looking time to each side was recorded across six trials as a measure of their preference to the word lists in each language.

Results showed that English infants preferred English over Thai words only when presented with bi-syllabic and not mono-syllabic words. On the contrary, Thai infants showed a significant preference to Thai in both the one-syllable and two-syllable conditions. Therefore, consistent with previous studies, infants acquiring English only successfully identified their native language by relying on stress cues, but they showed no discrimination when only phonetic information was available in the task. Thai infants also showed sensitivity to the stress patterns of their language, but their early sensitivity to lexical tone allowed them to discriminate native words even in the absence of additional prosodic cues.

Vowel hyperarticulation in toddler-directed speech

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Infant-directed speech (IDS) refers to the speech register that parents use when interacting with young children. Compared to adult-directed speech (ADS), IDS has several distinctive acoustic and linguistic components including exaggerated pitch and pitch range, positive affect, and hyperarticulated vowels. The affective and prosodic patterns of IDS attract infants' attention to early communicative interactions, and allow parents to express emotions and comfort their infants. Additionally, some IDS components are proposed to facilitate infants' language acquisition.

Vowel hyperarticulation in IDS is specifically proposed to serve a linguistic function. It refers to adults' tendency to expand the acoustic space between the three corner vowels (/i,u,a/) in IDS compared to ADS. It is indexed by the size of the triangle area that results from plotting the first and second formant (F1, F2) values of these vowels in two-dimensional space. These exaggerated speech sounds in IDS are proposed to assist phonological development, as these sounds are easier for infants to perceive, learn, and later reproduce in their own vocal tract. Supporting this view, Liu et al. (2005) demonstrated that the degree of vowel hyperarticulation in mothers' speech was significantly correlated with their infants' performance in a speech perception task.

Recent findings also show that the degree of vowel hyperarticulation in maternal IDS predicted infants' vocabulary size at 15 and 19 months, suggesting that this IDS component fosters the development of not only phonological, but also early lexical skills (Kalashnikova & Burnham, 2018). Importantly, the degree of vowel hyperarticulation was recorded longitudinally from 7 to 19 months, and it did not change across ages, but only vowel hyperarticulation from 9 to 19 months, and not at 7 months, predicted infants' vocabulary scores. Thus, infants may utilise vowel hyperarticulation differently across development according to their changing linguistic needs.

This study focused on vowel hyperarticulation in speech to 21-month-old toddlers and its effects on vocabulary skills. At this age, children have consolidated their phonological skills and have acquired a considerable vocabulary size (post-vocabulary spurt), so a decrease in vowel hyperarticulation can be expected. In this longitudinal study, IDS was recorded in mother-infant interactions (N=49) when the infants were 9- and 21-months-old. Mothers' ADS was also recorded. The vowels /i,u,a/ were extracted from maternal speech and used to calculate vowel triangle areas for IDS and ADS. A vowel hyperarticulation score for each mother was computed by dividing the size of the vowel triangle area of her IDS by ADS (hyper scores > 1 denote hyperarticulation). Infants' vocabulary size at the two ages was assessed using the MacArthur-Bates CDI.

Results showed that mothers hyperarticulated vowels to a greater extent in IDS at 21 than at 9 months, $F(1,46)=7.394$, $p=.009$. Vowel hyper-scores in IDS at 9 months correlated with 9-month vocabulary scores, $r(46)=.335$, $p=.023$, but vowel hyper-scores at 21 months did not correlate with 21-month vocabulary scores. These findings suggest a change in the role of vowel hyperarticulation over age in relation to lexical development, despite an increase in the degree to which it is manifested in toddlers' speech input.

Acoustic qualities of intonation and tone in Cantonese infant-directed speech

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Introduction: In tone languages, the same acoustic cue, pitch is shared by both intonation and lexical tones, which makes the realization of them inevitably interact with each other, and such interaction may also affect modifications of intonation and tone in IDS (infant-directed speech) produced in tone languages.

Higher mean pitch has been consistently found in IDS in both non-tone and tone languages (Fernald et al., 1989; Grieser & Kuhl, 1988). However, larger pitch range in IDS has only been widely found in non-tone languages (Fernald et al., 1989), while in tone languages, it has been found to be either exaggerated (Greiser & Kuhl, 1988), unchanged (Kitamura et al., 2002), or reduced (Xu & Burnham, 2010). As for lexical tones, while some studies report hyperarticulation in IDS (Xu, Burnham & Reilly, 2013), others show opposite results (Papousek & Hwang, 1991). These inconsistent findings may be due exactly to the potential interaction between intonation and tone. One hypothesis is that modifications in one aspect may constrain modifications in the other aspect (Papousek & Hwang, 1991).

This study examined the intonation and tone in Cantonese IDS compared to ADS (adult-directed speech) simultaneously as well as their potential changes across development. More importantly, it, for the first time, tested the potential interaction between modifications of intonation and tone in IDS, to determine whether exaggerations of these two types of tones are interactive or independent.

Methods: IDS was recorded by providing caregivers with 6 sets of toys/pictures to interact with their infants. Each set elicited one target word carrying one of the 6 Cantonese tones. ADS was recorded by asking caregivers questions about the same target words.

Extensive measures were taken for intonation, including mean pitch, pitch range, pitch variability, and degree of fluctuation; and for tone, including tone triangle area, tone ellipse area/length of tone ellipses' axes, degree of tone overlap (Barry & Blamey, 2004), and tone contour dispersion (Zhao & Jurafsky, 2009).

Results: Preliminary data from 8 caregiver-infant dyads (aged from 9.7 to 18.6 months) were obtained. Wilcoxon signed rank test showed significantly higher mean pitch ($p < 0.05$), larger pitch variability across utterances ($p = 0.05$) and higher degree of fluctuation ($p < 0.05$) in IDS than ADS. No other measures including pitch range showed significant differences. A significant positive correlation was found between infants' age and tone triangle area (IDS/ADS) ($r = 0.76$, $p < 0.05$) and degree of overlap (IDS/ADS) ($r = 0.82$, $p < 0.05$). For older infants, caregivers tended to show more expanded tone space with less overlap in IDS compared to ADS. No significant correlations were found between age and other measures.

Most importantly, pairwise correlations were tested between each measure of intonation and tone (IDS/ADS) (Table 1)¹. Significant positive correlations were found: caregivers speaking with larger intonational pitch range showed more dispersed tone space, and caregivers speaking with more varied intonation across utterances also showed more dispersed tone contour but with more varied tone tokens. This indicates a general trend of mutual enhancement of intonation and tone modifications in IDS.

r	Mean pitch	Pitch range (Hz)	Pitch range (semitones)	Variability(SD) across utterances	Variability(SD) within utterance	Degree of fluctuation
Tone contour dispersion	0.77*	0.71*	0.40	0.81*	0.61	0.56
Tone triangle area	-0.28	-0.05	0.20	-0.26	0.03	0.17
Tone ellipse area	0.71*	0.40	-0.04	0.60	0.23	0.17
Tone ellipses' axes	0.78*	0.52	0.11	0.73*	0.40	0.38
Index I (degree of overlap)	-0.31	-0.07	0.21	-0.31	0.03	0.19
Index II (degree of overlap)	-0.25	0.01	0.30	-0.33	0.15	0.04

Table 1. The correlation matrix between measures of intonation and tone. All data used in the correlation test are calculated by dividing the IDS measure by the corresponding ADS measure. The correlation coefficients (r) with statistical significance ($p < 0.05$) are marked with *. The data discussed in the abstract are shown in bold.

Quantity and quality of Infant-directed speech in laboratory versus home settings

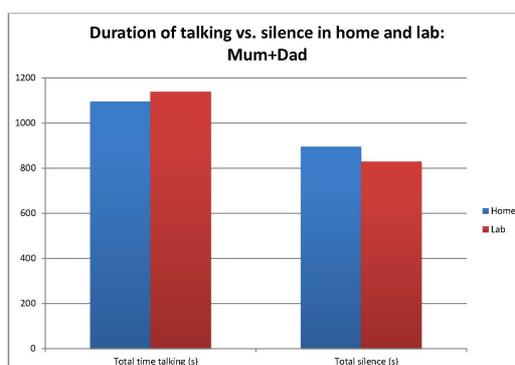
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Caregivers spontaneously adapt their speech when talking to young infants to capture their attention (Fernald, 1984) and provide an opportunity for infants to engage in social interaction. This sing song style of speech is known as infant-directed speech (IDS) and readily distinguished from speech to other adults because it has a higher mean fundamental frequency (F0) and higher and wider F0 excursions (e.g., Burnham, Kitamura, & Vollmer-Conna, 2002; Fernald, 1989). There is growing evidence that infants who are exposed to more IDS in their first years of life have better language outcomes as toddlers and are more successful academically than peers who receive less language input (e.g., Hirsh-Pasek et al., 2015; Hurtado, Marchman & Fernald, 2008; Weisleder & Fernald, 2013). However, this evidence is based on studies of American mother-infant pairs (see Hart & Risley, 1995 for similar findings including American fathers). Moreover, the environment in which speech was recorded varies between day long home recordings (e.g., Weisleder & Fernald, 2013) to semi-structured laboratory sessions with a book and/or toys (e.g., Hirsh-Pasek et al., 2015). This study examines whether the quantity of IDS and quality of F0 produced by mothers and fathers differs when they are recorded in a play session at home compared to a laboratory play room.

Mothers' and fathers' (N=6) wore an Olympus LS-14 portable audio recorder and lapel microphone during separate unstructured play sessions with their 6-month-old at the MARCS Institute Babylab. Parents were provided with three soft toys (a sheep, shoe and shark) and asked to "play with (child's name) as you normally would at home, using the toys provided". Parents then took the recording devices home and recorded a second play session with their infants using the same toys in the week following the lab visit. Data from 6-minutes of interaction for each parent was segmented in PRAAT speech analysis software (Boersma & Weenick, 2015) to determine who was talking (mum, dad, infant), calculate the duration of IDS utterances and extract measures of F0 (mean, minimum, maximum).

Paired t-tests compared the duration of IDS utterances and measures of F0 spoken by mothers and fathers in the lab compared to home. The results showed no difference in the duration of IDS utterances spoken by mothers or fathers in the laboratory compared to home play sessions. Like Analysis of F0 revealed no difference in mothers or fathers mean F0 or maximum F0 at home or in the lab. However, fathers maximum F0 was significantly higher in the lab compared to home recordings. These preliminary findings demonstrate that mothers and fathers IDS is similar in laboratory and home settings in unstructured free play settings.



Assessing the use of mobile technology and machine learning to monitor and increase the quantity of parent-child interactions at home

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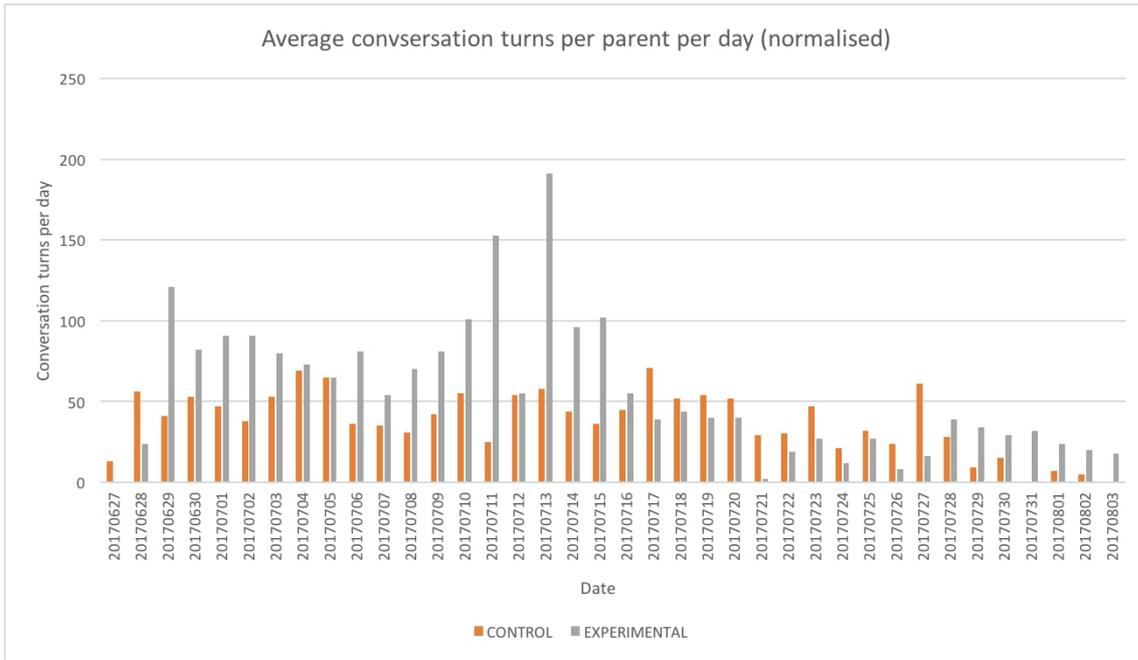
The number of words that a child hears by age 5 has been a key measure of parent-child interactions, correlating with positive outcomes for language development, reading skills, and academic readiness. More recently, additional focus has been drawn to the parent-child interactions themselves and their impact on children's cognitive abilities. As a result, conversation turns have become an important language and cognitive indicator, and have been most recently linked with increased neural responses in the language region of a child's brain and predicted academic scores. Recording and measuring parent-child conversations in a time- and manpower-efficient manner is thus crucial to understanding how these interactions impact children's early growth.

We have developed a Natural Language Processing algorithm that can analyze audio files for words number and conversation turns. The recordings are made through a mobile application, which parents and other caregivers can easily use at home when interacting with their children. We tested the effectiveness of our mobile application and algorithm in the present study, assessing whether mobile technology can serve as a more accessible, home-based, and scalable solution to monitor and stimulate the quantity of child-directed input.

Families (24 parents, age range: 23-41 years; 25 infants, age range 16-20.5 months) living in Hong Kong participated in the study. After completing a family background questionnaire and assessing the children for their language abilities, participants were divided into control and experimental groups for the 8-week intervention period. Parents in both groups downloaded the mobile application on their phones and were asked to capture at least 30 minutes of their interactions with the child every day. Additionally, the application for experimental group had a behavioral intervention with daily word goals, quantitative feedback, and access to materials about early childhood development.

After the intervention was completed, we assessed the adult participants' parenting practices and the infant participants' language abilities again with the same measures. Significant improvements in the Mullen scale scores were found in both groups for Receptive language ($p = .002$) and the Expressive language ($p < .001$). Children in experimental group also scored higher on Receptive language ($p = .02$) compared to those in control group. The conversation turns for a subset of participants ($n = 16$; 7 participants in the experimental group, 9 in the control group) were examined. Results showed that parents in the experimental group recorded for longer periods of time and engaged in more conversation turns. On average, parents who received the intervention had 18 more conversation turns per day and recorded 9.5-minute longer interactions compared to those in the control group.

Results of this study confirm that mobile technology can be effective at monitoring early childhood, home-based interventions and stimulate positive parenting habits. Development of affordable and accessible research tools using mobile technology can help increase the scalability of such interventions, assisting researchers in understanding what happens in families of young children outside of the lab.



The Functional Listening Skills Index (FLI-P) as a Guide to Paediatric Rehabilitation

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Introduction: Increasingly parents and health professionals involved in supporting and guiding the development of a child's real-world listening skills are asking for more information than can be provided by an audiogram or speech perception results. Better information is vital in making decisions about intervention choices, management, and use of hearing technology. This is of particular concern in children under the age of 6 years, for whom speech-based testing is unreliable and limited. Based on formative auditory scales, the Functional Listening Index – Paediatric (FLI-P) was developed to provide a measure of a child's developing functional listening from birth through to 6 years of age. Items assess auditory skills in natural settings that underpin language, literacy, communication development and social competence.

Methods: A retrospective analysis of use of the FLI-P with over 500 children with hearing loss in an early intervention and cochlear implant program. Results will be reported since its adoption by the program as an integral part of tracking early development over 5 years of use. Group analysis was undertaken comparing FLI-P outcomes in infants and young children with different levels and types of hearing loss using a range of devices, with a small sample of typical hearing children. Specific analysis of age of implant was examined, in conjunction with listening outcomes of children with: additional needs; different family contexts; learning more than one language; with Auditory Neuropathy Spectrum Disorder; or with Single-Sided Deafness.

Results: Data showed strong levels of concurrent and convergent validity with expected differences between groups and against outcomes with existing tools. Differences in trajectories provided strong evidence for early evaluation and amplification decisions. Outcomes were indicated on the FLI-P at an earlier age than was possible for standardized speech and language scores. FLI-P scores at 3 years were shown to be predictive of language outcomes at 5 years of age.

Conclusions: Integrating a measure of functional listening as a critical component of early intervention provides the opportunity to bring a child's real world listening skills and every day context into consideration for language acquisition. Along with quantifying cognitive components of auditory skill development in a meaningful and contextual way for families, it provides the opportunity to support parental understanding of the development of their child's functional listening skills to guide choices, awareness of learning opportunities, and engagement in their child's outcomes.

Positive affect in Swedish and Australian mothers' speech to their 3- to 12-month-old infants

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Affect is an important feature of infant-directed speech (IDS). IDS towards infants during the first year of life varies in degree of affect. In Australian English (AuE), positive affect in mothers' IDS increases over age from birth to twelve months, with a dip at nine months (Kitamura & Burnham, 2003).

This study investigates whether affect in Swedish (Swe) mothers' IDS towards their infants develops in a similar pattern compared to the Australian English data. It also introduces a cross-linguistic perspective of affect perception in IDS as Swedish native speakers rate both the Swe and AuE IDS samples.

The adult raters (N=16; 8 female, mean age 36.4 years; SD = 10.1) assessed affect polarity and affect degree in low-pass filtered IDS samples on a scale from -4 to +4 (highly negative to highly positive). The 25 s long samples were cut from interactions between mothers and their infants at three, six, nine and twelve months and low-pass filtered. The Australian material was sampled from the same dataset as used in Kitamura and Burnham (2003); the Swedish material was recorded at Stockholm Babylab (Gerholm et al., 2015).

Separate repeated measures ANOVAs were conducted on the mean affect ratings of AuE and Swe IDS, with infant age as within-subject factor, followed up with polynomial contrasts. For AuE IDS, a significant main effect was found for age ($F(45,3)=10.356$; $p<.001$), with a linear ($F(15,1)=20.542$; $p<.001$) and a cubic trend ($F(15,1)=7.780$; $p=.014$). For Swe IDS, a significant main effect was found for age ($F(45,3)=4.186$; $p=.011$), with a linear ($F(15,1)=10.993$; $p=.005$) and a quadratic trend ($F(15,1)=6.124$; $p=.026$). In both languages, positive affect decreases over age.

While cross-linguistic affect perception of AuE IDS is still similar to the original, Kitamura and Burnham's data show a more pronounced cubic trend and a general increase of affect in IDS over the first year. In this study, affect development in AuE IDS shows a steep increase from three to six months, followed by a decrease from six to nine months and a slight recovery from nine to twelve months. Affect in Swe IDS follows a different developmental trajectory, as it decreases from three to nine months to recover with an increase from nine to twelve months. This is a first indication for language-specific differences in IDS affect over the first year. Future ratings of the same material with AuE native speakers will show if the difference in the AuE results is an effect of rater language.

Conversational turn taking from six months predicts vocabulary size in Australian nineteen-month-old infants from diverse SES backgrounds

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Early differences in children's vocabulary related to socioeconomic status (SES) have been attributed, in part, to quantitative and qualitative differences in linguistic experience (e.g. Bornstein et al., 1998; Fernald et al., 2013; Hirsh-Pasek et al., 2015; Hoff, 2003; Huttenlocher et al., 2010). This paper reports on part of a longitudinal study, in which we examined quantitative aspects of infants' early linguistic experience at home to assess SES differences and their potential association with later spoken vocabulary skills. In earlier stages of the research (blinded for review), we used automatic speech processing technology to examine quantitative differences in the daily language experiences of 50 infants representing two levels of maternal education ($n = 25$; higher \geq bachelor degree, lower \leq bachelor degree) at two ages (6-9 and 12-15 months). There, we found that at both ages, despite wide individual variation, higher maternal education was associated with significantly higher daily counts of adult words and conversational turns, but not with higher child vocalisation counts.

In the current study, when the same infants ($N = 50$) were aged 12-15 months and 19 months, parents reported on children's expressive vocabulary using the Australian English Communicative Development Inventory (OZI; Kalashnikova et al., 2016). We examined infants' OZI scores at both ages in relation to a) maternal education and b) the two earlier speech measures related to maternal education (i.e. adult words and conversational turns). Based on previous research, we predicted that higher maternal education, and higher quantities of adult input (adult words and conversational turns) at 6-9 months and 12-15 months would be associated with infants' larger spoken vocabularies at 12-15 months and 19 months, respectively.

Key findings: At 12-15 months and 19 months, we found no significant 2-group differences in OZI scores (though maternal education differences between narrower educational strata were evident at 12 to 15 months). In linear regressions, earlier adult word count was not a significant predictor of later vocabulary at either age, accounting for no more than 6% of variance ($p > .05$). Conversational turn counts at 6-9 months and 12-15 months were the best predictor of later vocabulary, accounting for 8% [$R^2 = .08$, $F(1, 46) = 4.2$, $p = .046$] and 27% [$R^2 = .27$, $F(1, 45) = 16.65$, $p = .0002$] of variance in OZI scores at 12-15 months and 19 months, respectively. Additionally, conversational turn counts at 6-9 months accounted for 11% of variance in 19 month OZI scores [$R^2 = .11$, $F(1, 46) = 5.75$, $p = .021$].

Our results provide support for a largely indirect relationship between maternal education and expressive vocabulary at 12-15 and 19 months that operates via earlier conversational interaction, from as early as 6 months. Our findings suggest that even from before infants have spoken their first real word, conversational experience, not the sheer quantity of words heard, appear to be key for infant vocabulary development.

Caregiver factors associated with the their nonlinguistic input quality to toddlers

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Cartmill et al. (2013) demonstrated that input quality, that is, how clearly word meaning is conveyed to the learner using the immediate social and visual context, is a unique predictor of the child's vocabulary growth above and beyond socioeconomic status of the family and the quantity of input. This finding implied that there are individual differences among parents in their use of social and visual context when they introduce a word to their child: some are effective while others are not. The present study explored potential factors that may contribute to these individual differences in effectively utilizing relevant cues for their 14-18-month-old toddlers. We hypothesized that differences in parental mind-reading abilities, perspective taking abilities, and sensitivity to one's own and others' emotional state might be key factors that can allow parents to be effective in utilizing social and visual cues to make their referential intention clearly conveyed to their young learners of language.

To test this idea, 33 dyads of 30-minute interactions between 14- to 18-month-old toddlers and their main caregivers (i.e., mothers) were video-recorded in their homes with a set of toys, materials, and picture books provided. From these, we coded maternal mind-mindedness (Meins, Fernyhough, Fradley, & Tuckey, 2001) and computed the frequency of appropriate mind-related comments out of the total utterance. We also extracted 40-second vignettes (15 per dyad) and presented them to 300 college students to assess individual differences in the referential transparency (i.e., input quality), using Human Simulation Paradigm (Gillette, Gleitman, Gleitman, & Lederer, 1999). Additionally, mothers completed Interpersonal Reactivity Index (Davis, 1983), which yields measures of their Perspective-Taking, Fantasy, Empathic Concern, and Personal Distress level. Mothers also participated in an experiment where their empathic accuracy was assessed by examining their real-time sensitivity to another person's emotional state, using a paradigm developed by Zaki, Bolger, & Ochsner (2008).

Among the three measures of caregiver factors, maternal mind-mindedness showed a positive association with the quality of input ($r = .323$, $p = .033$, one-tailed), suggesting that mothers who were more skilled at mentioning their child's emotional and cognitive state of the mind were better able to provide their referential intent using the relevant social and visual context. To our surprise, neither the Perspective-Taking subscale of IRI nor empathy related factors displayed any relations to input quality. However, Personal Distress, a subscale of IRI, indexing sensitivity to the distress of others also showed a positive correlation, explaining about 17% of input quality variance together with maternal mind-mindedness ($R^2 = .224$, adjusted $R^2 = .172$, $F = 4.331$, $p = .022$). These results will be discussed in light of specific cognitive/emotional factors that are linked to individual differences in parental referential transparency.

Crossing the bar: Does learning multiple languages affect children's perception of nonlinguistic figure-ground events?

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Infants enter a world comprised of dynamic events. How is their perception of events constrained by language acquisition? Is there a universal conceptualisation of events or do properties of the native language guide event interpretation? One way to investigate this is to study infants' sensitivity to different nonlinguistic events that may or may not be encoded contrastively in their native language. Göksun et al. (2011) found that by 14 months of age, Japanese and English infants demonstrate universal event interpretation for different kinds of grounds; both sets of monolingual infants discriminated bounded grounds which have edges (e.g., a road) from unbounded grounds with no edges (e.g., field) even though English does not make these distinctions between events. However, later in development, Göksun et al. (2011) found that 19-month-old English monolingual infants no longer saw the difference between these types of ground distinctions. In contrast, Japanese monolingual infants at the same age, whose language encodes such ground categories in verbs, continued to discriminate ground events. Thus, Göksun et al. (2011) proposed a universal to language-specific shift in perceiving events, a transition termed 'semantic narrowing'.

It remains unclear whether bilingual infants also begin with universal to language-specific discrimination of physical events. Here, we adopted the paradigm used by Göksun et al. (2011) with English-Chinese bilingual infants at 14 and 19 months (n=52). Two types of ground category conditions were presented. In the between-grounds condition, participants were tested on their discrimination of the same motion event (i.e., walking) occurring on a bounded and unbounded ground (e.g., road vs. field). In the within-grounds condition, bilingual children were tested on their discrimination of motion events from within bounded grounds (e.g., road vs. railroad) – monolingual children from both prior language groups did not make this discrimination. Would bilinguals detect these perceptual differences?

After exposure to these events, participants were familiarized with one type of event. After familiarization, infants were then re-exposed to both events in test-trials. Using an eye-tracking paradigm, fixation time was the dependent variable. Results revealed an age-dependent sensitivity to ground-contrastive events distinct from that reported with monolingual infants in Göksun et al. (2011). Specifically, at 14 months, infants did not detect ground distinctions - either within or between category distinctions - suggesting that universal discrimination of ground information is not evident in bilingual infants. At 19 months, bilingual infants did not discriminate between-category grounds, but they demonstrated marginally significant ($p=.08$) discrimination of within-category grounds. Results point to a distinct trajectory of semantic narrowing in bilingual infants and suggest that event discrimination observed in monolingual children may not generalize to bilingual populations.

Contrasting two behavioural methods to index infant perception ability

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Background: Many procedures to assess infant language acquisition rely on infants' preference for listening to one type of sound over another, as indexed by longer looking to a visual stimulus. Looking-time preferences can reveal what infants have extracted from their native language environment, or from a short lab-based familiarisation phase preceding the test. The familiarisation-then-test paradigm is particularly important for studying the environmental cues and learning mechanisms infants can employ for language acquisition. Both familiarity preferences (familiarised over novel sounds) and novelty preferences have been observed, and the direction of preference remains difficult to predict (Bergmann & Cristia, 2016). This hampers the interpretation of variation in the extant literature and formulation of predictions. The present study therefore examines whether choice of test procedure modulates infant preference in a familiarisation-then-test paradigm.

Approach: We compare infant looking preferences to peripheral blinking lights in the head-turn preference procedure (HPP) and infant looking preferences to a central screen in a central fixation (CF) procedure. The HPP requires custom-made equipment and infant responses need to be manually coded. The CF, in contrast, can be automatically coded using an eye-tracker. We specifically tested infants' ability to segment disyllabic trochees from running speech, which is traditionally tested using the HPP procedure (Jusczyk & Aslin, 1995), but has also been assessed using the CF procedure (Altvater-Mackensen & Mani, 2013).

Method: Participants were two groups of 32 ten-month old Dutch infants. Infants were familiarised to two words embedded in passages and tested on their preference for the familiarised words over two novel disyllabic trochees. One group was tested in the HPP procedure, the second in the CF procedure.

Results: Within each of the procedures, the effect of Condition (familiar vs novel) on looking times was assessed using linear mixed effects models. Infants in the HPP displayed a familiarity preference (familiarised: $M = 6.32$, $SD = 5.78$; novel: $M = 5.25$, $SD = 5.20$; $F(280.57) = 4.711$, $p = .031$). A familiarity preference was not observed in infants in the CF (familiarised: $M = 5.41$, $SD = 5.78$; novel: $M = 6.09$, $SD = 5.23$; $F(272.06) = 1.12$, $p = .29$). The procedures were compared in the aggregated looking times per condition and difference between conditions. Although methods do not differ in the average looking time during the test phase for either familiarised ($Z = -1.907$, $p = .057$) or novel words ($Z = -0.255$, $p = .799$), the relative difference in looking time between the two speech stimuli is larger in the HPP than in the CP procedure ($t(62) = -2.22$; $p = .030$). No significant differences between procedures were detected in terms of the duration of the familiarisation phase.

Discussion: Only the HPP, but not the CF, robustly revealed infants' word segmentation ability through a familiarity preference. We hypothesise that the contingency between gross motor behaviour and sound presentation in the HPP better enables infants to display preferences. In addition to having implications for the interpretation of disparate findings, these outcomes are important to researchers who consider establishing or extending infant language labs.

Neural entrainment to auditory-visual speech in infants and children

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Speech is a multimodal phenomenon. Over and above auditory information, visual speech information, such as a speaker's lips and head movements, contributes to, and augments, speech perception and comprehension. The augmentation of speech perception by visual speech information is known as the visual speech benefit (VSB). Numerous behavioural studies of VSB have shown that adults and children perceive speech better in an auditory-visual condition than in an auditory-only condition (e.g., Ross et al., 2011; Taitelbaum-Swead & Fostick, 2016). Turning to the neural level of VSB, neurophysiological studies with adults confirm behavioural findings by showing enhanced cortical entrainment to an auditory-visual, compared with an auditory naturalistic speech envelope (e.g., Crosse et al., 2015). Cortical entrainment is indexed by the accuracy with which neural oscillations lock onto the phase of the amplitude envelope of incoming speech.

To date, no study has examined whether visual speech information augments neural entrainment to speech in infants and children even though behavioural studies conducted with infants (Hollich et al., 2005; Teinonen et al., 2008) and children (Ross et al., 2011) suggest that visual speech information enhances speech perception. Such investigations are possible – Kalashnikova and colleagues (under review) showed entrainment of neural oscillations to auditory-only speech envelope in infants suggesting that neural entrainment to continuous auditory-visual speech stimuli can be measured in infants. The primary goal of this study is to investigate neural entrainment to the auditory visual speech envelope in infants and children. Additionally, as gaze behaviour to specific facial regions— the eyes and mouth —has been found to modulate the influence of visual speech information (Gurler et al., 2015), a secondary aim is to examine whether gaze behaviour modulates VSB in neural entrainment.

To address these two aims, electroencephalography (EEG) and eye-tracking data are measured simultaneously in 5-month and 4-year-old children in a within-subjects design. Stimuli consist of thirty recordings of a female native speaker of Australian English talking in infant-directed speech. In the auditory-only (A) condition a still image of the speaker was paired with the auditory recordings; in the visual-only (V) condition the dynamic video of the speaker's talking face was presented in silence; and in the auditory-visual (AV) condition, both the dynamic video and its soundtrack were played.

Data collection is ongoing and results will be discussed in terms of the following hypotheses. First, VSB will be evident and quantified by a significant difference in how accurately the optimized AV and A+V models derived from the EEG data reconstruct the broadband speech envelope. Second, the proportion of looking time to the mouth region will be positively correlated with the accuracy at which cortical oscillations entrain to the auditory-visual speech envelope. Third, developmental differences in VSB will be indexed by a greater advantage of the AV model over the A+V model in 4-year-olds compared to 5-month-olds. These results will provide an additional dimension to understanding VSB in auditory-visual speech perception in infants and children and set the path for future studies to determine the exact role of visual speech information in language development.

School-aged sequential bilingual children exhibit no “bilingual verbal deficit”

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Previous bilingualism studies have shown that compared with their age-matched monolinguals: 1) bilinguals enjoy an advantage in the cognitive domain such as enhanced attention (e.g., Bialystok & Martin, 2004) and inhibitory control (e.g., Bialystok et al., 2005; Bialystok, Craik, & Luk, 2008), especially during childhood (Bialystok, Martin, & Viswanathan, 2005); 2) on the other hand, they have been reported to suffer from a “bilingual deficit” (Bialystok & Feng, 2009) in the verbal domain, such as smaller receptive vocabulary and expressive vocabulary sizes (Portocarrero, Burright, & Donovan, 2007), lower verbal fluency (Gollan & Kroll, 2001; Michael & Gollan, 2005), and more tip-of-the-tongue states (TOTs) (Gollan & Acenas, 2004). Nonetheless, when performance is assessed via different linguistic and cognitive tasks across different bilingual groups with varying bilingual status, a more complex pattern of results is observed (Paap, Johnson, & Sawi, 2015). This suggests that understanding the effects of bilingualism in cognitive and linguistic domains requires the consideration of demographic characteristics, such as age, age of second language acquisition, language exposure and language usage (see Kroll & Bialystok, 2013 for a review), in addition to the task choice.

The aim of this study was to investigate how school-aged bilingual performance in inhibitory control and in lexical retrieval tasks relate to age, age of second language acquisition, language exposure and language usage. Taking into consideration the demographic variables mentioned above, the present study compared 6-12 year-old primary school monolingual children (n=20) and early sequential bilingual children (ESB) (n=20) in their inhibitory control skills, verbal (retrieval) fluency, receptive vocabulary, expressive vocabulary as well as TOT rates (the percentage of TOTs out of the total lexical retrieval trials). Tasks used included the SWSimon Arrows Task (Bialystok, Craik, & Luk, 2008b), verbal fluency tasks (Strauss, Sherman, & Spreen, 2006), PPVT (Dunn & Dunn, 2007), and EVT (Williams, 1997). Results indicated that, the primary school ESBs were on par with their age-matched monolingual peers in receptive and expressive vocabulary sizes as well as in lexical retrieval performance. In addition, they showed an advantage in inhibitory control in comparison to their monolingual peers. We concluded that, under similar social and educational opportunities and exposure to English in the educational setting, the ESBs were able to catch up with their monolingual counterparts in their lexical retrieval abilities despite growing up as sequential and not simultaneous bilinguals.

The influence of phonological neighbourhood density on spoken-word comprehension in Russian children: Evidence from eye-tracking

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Several studies have reported the influence of phonological neighbourhood density (PND) on spoken-word comprehension (e.g., Garlock et al., 2001; Zeigler et al., 2003). PND refers to the number of words that can be formed from a given word by substituting, adding or deleting one phoneme. Some words have dense neighbourhoods, DN (e.g., pin – spin, in, tin...), and some words have sparse neighbourhoods, SN (e.g., squirrel). Importantly, Hansen (2017) reported that children acquire words with DN earlier and faster than words with SN.

Previous studies showed that words with SN are perceived more accurately and faster than words with DN in both English speaking children and adults (Metsala, 1997; Yates et al., 2008). Similar results were found for French adults (Dufour & Frauenfelder, 2010), and the opposite PND effect was observed for Spanish adults (Vitevitch & Sommers, 2003; Vitevitch & Stamer, 2006). Thus, a more detailed study is needed, especially in language, which differs from English.

The present study aims to examine the influence of PND on spoken-word comprehension in 4-6-year-old Russian children. We use the visual world paradigm framework in which participants are shown a display with three pictures and are asked to look at relevant picture as soon as they hear the word denoting the object in the picture. Our experiment comprises 30 trials (words with DN and words with SN half-and-half). We assume that pictures that are referred to with SN-words will be attended more quickly than those referred to with DN-words. The data is now being collected.

The expected results will help to understand the influence of PND on spoken-word comprehension in Russian children as well as will make the specific contribution in mechanisms of early lexical development.

Comprehension of Chinese classifiers in preschool normal hearing and Cochlear Implanted children

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Previous studies have examined the relationship between phonological processing skills and language performance of children with cochlear implants. Their limited and deficient auditory access is one of the primary causes of speech and language development delay. The present research aimed to investigate the differences between preschool normal hearing (NH) and CI children's comprehension of Chinese classifiers (CL). Age-matching normal hearing and CI Chinese-speaking children between age of 4 and 6 were recruited and participated the experiment. Both shape-based and features-shared classifiers were prepared for the test of CL-picture pairing, in which one target CL was presented with three object pictures. The finger-touching responses were recorded as scores of comprehension. The results showed that, compared to NH children, CL children had lower comprehension level for the 3 and 4 age groups. Particularly, CL children performed better for the shape-based classifiers than the features-shared classifiers. However, NH children performed evenly on the two types of classifiers across the age groups, suggesting that NH, not CL, children not only use shape salience to learn Chinese classifiers, but they are also sensitive to feature relations between objects categorised by classifier. It is suspected that the semantic transparency between classifiers and objects varies considerably in CL children at earlier ages, possibly due to their deficits of hearing. Nevertheless, learning experiences might override the inferiority of establishing the semantic form of classifier-noun bound.

Using eye-movement data as a developmental measure in Thai and Chinese readers

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Modern eye tracking systems make it feasible to track the eye movements of young readers relatively unobtrusively. This has allowed us to gather longitudinal data on developing readers to quantify growth patterns in various eye-movement parameters and relate them to lexical, sentential, and text characteristics (e.g., Levy, 2013). This talk will motivate the use of eye-movement data in reading as a tool for monitoring reading development and will demonstrate its use in two distinct longitudinal studies of reading, one involving Thai readers and the other Chinese.

The Chinese study involved a total of 100 Grade 4 students (ages ranged between 10-11 years), comprising three cohorts that differed in reading ability, but had approximately similar IQ as measured by the Raven Standard Reasoning Test (RSRT). Participants were asked to read short text messages displayed on a computer screen while their eyes were tracked using an SR-Research EyeLink 1000 eye-tracking system. The three cohorts of readers were tested on two occasions a year apart using age-appropriate texts with some overlap between the texts used in the two data collection sessions.

The Thai study involved 30 students from Grade 1 and 2 who were tested on three occasions, each approximately six months apart. Their ages ranged from 6-8 years. Of the 30 readers studied, 16 were classified as good and 14 as poor readers, based on their test scores before entering Grade 1. Eye movement data was gathered using an SR-Research EyeLink-II tracking system.

In both studies, we use corpus-based statistics to calculate n-gram derived surprisal measures to assess local word predictability (Levy, 2013) and sentence and paragraph level coherence using distributed representations of words and sentences (e.g., Sutskever et al., 2014). These measures are then used as predictors of various eye movement parameters and their change over time can also be measured. The results show similar growth patterns in sensitivity to supra-lexical properties such as lexical predictability and sentence coherence for both Thai and Chinese. Correlations are also apparent between reading ability and rate of growth in some parameters, suggesting that these could be used as early warning measures of reading difficulty.

Seeds of Literacy: An exploration of possible precursors to reading difficulty in infant speech perception

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The research described here explores the possibility of detecting early indications of dyslexia in infancy. Specifically, we study the emergence of an infant's ability to distinguish between the speech sounds of its native language and those of other languages. Given the widely held view that problems with phonological awareness are implicated in the emergence of dyslexia, early indications of anomalous developmental patterns in speech perception might presage subsequent reading difficulties (Stanovich, 1988).

The current study is of a longitudinal design, where each of approximately 50 infants was tested at 5, 8, 11, 14, and 18 months. We were interested in looking at differences in performance between groups at risk and not at risk for dyslexia. Infants were designated as being at risk if they had at least one parent diagnosed with the condition. We were also interested in exploring differences in the developmental trajectory of the two groups. For example, at-risk babies may be different at all ages or they may be delayed compared to those not at risk.

The language perception task used was an habituation task whereby the infant habituates to a native stimulus (e.g., [pa]), and is then tested on alternations of the habituated sound and a test stimulus in a non-native contrast. For example, a test stimulus might be [pa-ba] and in a native contrast [pa-pha]. The motivation for this task is that infants should only increase their looking times towards the source of a test stimulus (i.e., recover from habituation) when they can notice the stimulus alternating.

We analyse the overall growth patterns in the data from the habituation study and link the results to, among other factors, measures relating to vocabulary development as the cohort ages.

Measuring early language developmental trend in Malaysia using the Malaysian Communicative Developmental Inventories

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There was a lack of early language norms for Malaysian children (Joginder Singh, Iacono & Gray, 2011). Here, we present vocabulary findings collected using a Malaysian-based Communicative Developmental Inventories (CDI: see Low, 2009; as cited in Low, Nicholas, & Wales, 2010) for the study of early language development in young children learning Malay, English and Chinese. The CDI was distributed to Malaysian parents over the internet, via parental groups on social media platforms and parental chat groups on messaging applications. Vocabulary data of 207 infants (114 boys) aged between 6 to 49 month-old was collected. Multiple regression analyses were conducted with age, gender, language exposure and SES as the predictors for vocabulary score of all three languages in both production and comprehension respectively. The language exposure and age were significant predictors in detecting developmental trend of the vocabulary score for all languages in both production and comprehension. The girls outperformed the boys in terms of expressive vocabulary in all three languages. This finding supports previous studies, which suggested girls' advantage in the development of socio-cognitive skills (Barbu, Cabanes and Le Maner-Idrissi, 2011). The children of parents with lower education had more Malay vocabulary items in both comprehension and production. First, it is likely that the parents with higher education are able to expose the child to more English, resulted in lower exposure to Malay. Second, it is also possible that parents with lower education overestimated their children's word comprehension (Dolloghan et al., 1999; Feldman, et al., 2000; Feldman, et al., 2003; Fenson, et al., 1993; Reznick, 1990). All in all, it is suggested that current online CDI is a reliable tool in identifying developmental milestones while still covering the variation in terms of language exposure and gender.

Grandparents as key agents in deciding what children hear in Singaporean homes

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Studies in family multilingualism often focus on parent-child dyads (Lanza, 2007). Yet, it is vital to consider the complex relationships of mutual influence and inter-generational negotiation in multi-generational families, very common in Asia. Our research looks at how parents and grandparent caregivers relate to each other's language use and ideologies in the homes of Singapore families, where Confucian values of harmony and respect for elders has deep roots (Low & Goh, 2015; Thiele & Whelan, 2006). From ethnographic observation and in-depth interviews with three multigenerational Chinese Singaporean families over a period of 8 months, we observed how both young parents and grandparental caregivers in ubiquitous dual-income families respond to the changes in the societal and cultural milieu. A language belief and practice survey involving 338 participants stratified into in four age groups was also administered and further supplemented with interviews from 10 grandparent caregivers. Our findings reveal an ideological continuum which reveal both convergent and conflicting ideologies between parents and grandparent caregivers. Intergenerational Family Language Policy (FLP) continues to be motivated by traditional cultural values such as harmony and mutual respect, as well as parental recognition of their dependence on grandparents for caregiving. Given the local context, it is not surprising that parents and grandparents display a high level of awareness of state language policies and in some families these policies are overtly discussed and implemented. In contrast to the common view of grandparents as maintainers of the heritage languages and 'mother tongues' (Pauwels, 2016), we found that many Chinese Singaporean grandparents or grandparents-to-be had stronger pro-English sentiments, expectations, and attitudes when compared to young parents. These findings have implications not only for scholars examining multilingualism and family language policy, but also for those interested in language maintenance and shift, especially as agentive grandparent caregivers influence and insert their ideologies into the day-to-day linguistic practices of both parents and their young children, inevitably shaping FLP in the Singaporean household.

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FOOD AND BEVERAGE, AND OTHER AMENITIES IN NTU

SOUTH SPINE

CO-OP CAFÉ

Atrium at The HIVE
Mon to Fri: 9am to 2.30pm;
3.30pm to 7.30pm

EIGHT FLAGS

**COMPUTER
SYSTEMS AND SUPPLIES**
B3-04
Mon to Fri: 9am to 6pm
Sat: 9.30am to 1pm

KOUFU (Food Court)

B4
Mon to Fri: 7am to 9am
Sat: 7am to 3pm
PH: Open (except Sun)

NORTH SPINE

KFC

Blk N2.1, #01-04
Mon to Fri: 7.30am to 10pm
Sat: 7.30am to 9pm
Sun & PH: 10am to 8pm

MCDONALD'S

Blk N2.1, #01-08
Mon to Sat: 7am to 10pm
Sun: 10am to 9pm

PEN & INC

Blk N2.1, #01-01
Mon, Tues, Wed & Fri:
11am to 11pm
Thu: 11am – 12am
Sat: 11am to 9pm

PIZZA HUT EXPRESS

Blk N2.1, #01-04
Mon to Fri: 11am to 10pm
Sat: 11am to 9pm
Sun & PH: 11am to 8pm

STARBUCKS COFFEE

Blk N2.1, #01-06
Mon to Fri: 7am to 10pm
Sat & Sun: 7am to 5pm

SUBWAY

Blk N2.1, #01-07
Mon to Fri: 7am to 9pm
Sat & Sun: 11am to 6pm

MR. BEAN

NS3-01-16
Mon to Fri:
7.30am to 8.30pm
Sat: 7.30am to 5pm

MIA PIZZA & PASTA EXPRESS

NS3-01-23
Mon to Fri: 11.30am to
8.30pm Sat: 11.30am to
3pm

PAIK'S BIBIM

NS3-01-15
Mon to Fri: 10am to 9pm
Sat: 10am to 3pm

PRIME SUPERMARKET

NS3-01-26/27 /28
Daily: 8am to 9pm

THE SOUP SPOON UNION

NS3-01-14
Mon to Fri: 11am to 9pm
Sat: 11am to 3pm

LONG JOHN SILVER

N2.1-01-05
Mon to Sun: 7.30am to
10pm

For a comprehensive list of the food and beverage options in NTU, please refer to this page:
<http://www.ntu.edu.sg/has/FnB/Pages/NorthSpine.aspx>

Getting Around Singapore

SHOPPING MALLS NEAR NTU

Lots of eateries in these places.

JEM and WESTGATE MALLS (JURONG EAST MRT)

Crystal Jade kitchen (Westgate #04-42)

Din Tai Fung (JEMS #02-07)

Tim Ho Wan (Westgate #01-13/14)

JURONG POINT SHOPPING CENTRE (BOON LAY MRT STATION)

Crystal Jade La Mian Xiao Long Bao, #03-18

Din Tai Fung, #B1-68

LOCAL ATTRACTIONS

ASIAN CIVILISATIONS MUSEUM

Address: 1 Empress Place Empress Place Building, Singapore 179555, Singapore

The Asian Civilisations Museum is devoted to exploring Asia's rich artistic heritage as a port city and Singaporeans' diverse ancestral cultures.

NATIONAL GALLERY SINGAPORE

Address: 1 St. Andrew's Road National Gallery Singapore, Singapore 178957, Singapore

Opened in November 2015, National Gallery Singapore is a brand new visual arts museum that engages, excites and inspires with the art of Singapore, Southeast Asia and the world. The Gallery's comprehensive collection presents the development of Singapore and regional cultures to tell their social, economic and political histories.

HAJI LANE

Haji Lane is in the Kampong Glam neighbourhood. Young people frequent the shop houses along this lane for the independent fashion boutiques and Middle Eastern cafes. Haji Lane got its name from Arab pilgrim-brokers who arranged the haj for Muslims in Singapore and neighbouring islands such as Java.

MARINA BAY SANDS

Address: 10 Bayfront Avenue, Singapore 018956, Singapore

Located along the Marina Bay waterfront, Marina Bay Sands features three cascading hotel towers topped by an extraordinary sky park, 'floating' crystal pavilions, a lotus-inspired ArtScience Museum, retail stores and international luxury brands, restaurants, night clubs and a Las Vegas-style casino.

GARDENS BY THE BAY

Address: 18 Marina Gardens Drive, Singapore 018953, Singapore

An integral part of Singapore's "City in a Garden" vision, Gardens by the Bay spans a total of 101 hectares comprising of three waterfront gardens showcasing horticulture and garden artistry. Night views of the "Super Trees".