

4pSC10. Speech articulator movements recorded from facing talkers using two electromagnetic articulometer systems simultaneously. Mark Tiede (Haskins Labs., 300 George St., New Haven, CT 06511), Rikke Bundgaard-Nielsen, Christian Kroos, Guillaume Gibert, Virginie Attina, Benjawan Kasisopa (Univ. Western Sydney, Bankstown, NSW, Australia), Eric Vatikiotis-Bateson (Univ. of British Columbia, Vancouver, BC, Canada), and Catherine Best (Univ. Western Sydney, Bankstown, NSW, Australia)

Two 3-D electromagnetic articulometer systems, the Carstens AG500 and Northern Digital WAVE, have been used simultaneously without mutual interference to record the speech articulator movements of two talkers facing one another 2 m apart. A series of benchmark tests evaluating the stability of fixed distances between sensors attached to a rotating rigid body was first conducted to determine whether the two systems could operate independently, with results showing no significant effect of dual operation on either system. In the experiment proper, two native speakers of American English participated as subjects. Sensors were glued to three points on the tongue, the upper and lower incisors, lips, and left and right mastoid processes for each subject. Independent audio tracks were recorded using separate directional microphones, which were used to align the kinematic data from both subjects during post-processing. Data collected were of two types: extended spontaneous conversation and repeated incongruent word sequences (e.g., talker one produced “cop top...;” talker two “top cop...”). Both talkers show strong positive correlations between speech rate (in syllables/s) and head movement. The word sequences also show error and rate effects related to mutual entrainment. [Work supported by ARC Human Communication Science Network (RN0460284), MARCS Auditory Laboratories, NIH.]

4pSC11. Analyses of fundamental frequency in infants and preschoolers with hearing loss. Mark VanDam, Mary Pat Moeller (Ctr. for Childhood Deafness, Boys Town Natl. Res. Hosp., 555 N 30th St., Omaha, NE 68131, mark.vandam@boystown.org), and Bruce Tomblin (Dept. Comm. Sci. & Disord., Univ. Iowa, Wendell Johnson Speech & Hearing Ctr., Iowa City, IA 52242)

Technological advances in the last 15 years have resulted in earlier identification of children with mild and moderate hearing loss. Little is known about the impact of early provision of amplification on the development of prosodic speech characteristics such as fundamental frequency (F_0). This study aims to address that gap. Children enter this study at 12–36 months of age and contribute 1 whole-day audio recording each month for one year. The wearable recorder and associated software (*LENA Foundation*) output (i) a continuous (PCM) audiofile of the whole day and (ii) a time-aligned, XML-coded file at millisecond resolution identifying periods of speech (adult female or male, other children, target child) and other acoustic events (overlapping vocals, noise, silence, etc). In this study, children’s F_0 is examined directly and in response to certain talkers or in selected turn-taking relationships (e.g., child-directed speech, father-child turn-taking exchanges). This work includes a detailed methodological description of the use of the LENA system and the customization of that technology relevant to speech and language science. Data from F_0 analyses are interpreted in descriptive and theoretical terms, complementing an ongoing, multi-center study investigating outcomes of children with mild and moderate hearing loss. [Work supported by NIH/NIDCD Grant Nos. DC009560 and DC009560-01S1.]

4pSC12. The development of temporal structure in mother-child speech. Nicholas A. Smith (Boys Town Natl. Res. Hospital, 555 North 30th St., Omaha, NE 68131, nicholas.smith@boystown.org)

The present study examined age-related changes in the timing of mothers’ and children’s utterances during free interaction. Using a longitudinal database of recordings of mother-child speech between 4 and 48 months of age, the onset and offset times of maternal and child utterances were coded and analyzed. The goal of the analysis was to use changes in the temporal intervals between adjacent utterances as a measure of mutual responsiveness and coordination. Although considerable individual variation was found across mother-child dyads between 4 and 18 months of age, at 24 months both mothers and children showed tighter temporal coupling, indicated by

consistently shorter latencies in their responses to each other’s utterances. This change in the temporal pattern likely corresponds to the emergence of turn-taking and reciprocity in dialogue. This study is part of a large project examining the effects of hearing loss on mother-child vocal interaction, and a parallel analysis of dialogue between mothers and their hearing-impaired children is currently underway. [Work supported by NIH Grant R03DC009884.]

4pSC13. Comparison of acoustic characteristics of American English tense and lax vowels in maternal speech to prelingually deaf infants, normal-hearing infants, and adults. Maria V. Kondaurova (Dept. of Otolaryngol.—Head and Neck Surgery, Indiana Univ. School of Medicine, Indianapolis, IN 46202, mkondaur@iupui.edu), Tonya R. Bergeson (Indiana Univ. School of Medicine, Indianapolis, IN 46202), and Laura Dilley (Michigan State Univ., MI 48824)

Recent studies have demonstrated that mothers exaggerate phonetic properties of infant-directed (ID) speech. However, these studies focused on a single acoustic dimension, i.e., frequency, whereas speech sounds are composed of multiple acoustic cues. Moreover, little is known how mothers adjust phonetic properties of speech to children with hearing loss. This study examined the mothers’ production of frequency and duration cues to the American English tense/lax vowel contrast in speech to profoundly deaf ($N = 12$) and normal-hearing ($N = 12$) infants and to an adult experimenter. First and second formant frequencies and vowel duration of tense ([i, u]) and lax ([ɪ, ʊ]) vowels were measured. Results demonstrated that mothers exaggerated vowel duration in ID relative to adult-directed speech. However, only a trend suggesting an exaggeration of vowel space in ID speech was observed. These findings suggest that although both spectral and duration cues to the tense/lax distinction are modified in a systematic way in ID speech, vowel duration is exaggerated to a greater extent relative to spectral properties. Future analysis will include larger groups of hearing-impaired and normal-hearing infants to identify effects of hearing loss on the relationship between segmental and prosodic characteristics in ID speech.

4pSC14. Naturalistic social communication and speech development in monolingual and bilingual infants. Nairan Ramirez-Esparza, Adrian Garcia-Sierra, and Patricia K. Kuhl (Inst. for Learning and Brain Sci., Univ. of Washington, Box 357988, Seattle, WA 98195)

This investigation explores how everyday social communication between parents and infants relates to speech development. This goal is accomplished by using the digital recorder LENA that monolingual ($N=11$) and Spanish-English bilingual ($N=10$) 14-month-old infants wore for 4 days. Infants’ sample files (i.e., 160, 30-s intervals per infant) were coded according to the social communication coding inventory, which includes categories such as “babbling” (e.g., canonical versus variegated babbling), “social interactions” (e.g., baby was with one other person or with a group of people), “how adults are talking” (e.g., “motherese” versus adult talk), and “activities” (e.g., adult is reading and/or teaching). The results showed that babbling relates to relevant social communication categories in both groups. For example, the percentage of time “motherese” is used relates positively to babbling, but adult directed speech relates negatively to babbling. Interestingly, the amount of time monolingual parents spend teaching and reading to their infants relates positively to variegated babbling, but the amount of time bilingual parents have the TV on relates negatively to variegated babbling. These findings shed some light about how natural everyday social communication influences speech development in monolingual and bilingual infants. [Work supported by an NSF grant to the UW LIFE Center.]

4pSC15. Cross-correlation based detection of self-vocalization for the purpose of minimizing the perceived effects of occlusion. Matthew Green and Thomas Burns (6600 Washington Ave. S., Eden Prairie, MN 55344, matthew.green@starkey.com)

Partial or complete occlusion of the ear canal by an assistive listening device results in an unnaturalness in the sound of a person’s own voice, known as the occlusion effect. When the occlusion effect is present, if the sound presented to the eardrum is dominated by the amplified output of the assistive listening device, then the frequency response of the device could be