

source are available and that source directivity is known, a mathematical method can be built up for estimating source orientation by looking for the best match between all possible source orientations and the true one using a comparison of recorded data, with values calculated from knowledge of source directivity and microphone positions with respect to source. Such a method has been tested in a laboratory environment with a Polaroid transducer as the source. Experiments show that the method estimates orientations very close to the true ones and point out the limits within which the method guarantees good performance and why. The same estimation method has been applied to calls emitted by the trawling bat *N. leporinus* performing hunting tasks.

4:45

5pABb6. The acoustic features of the long distance advertisement call produced by *Panthera tigris altaica*, the Amur (Siberian) tiger. Edward J. Walsh (Developmental Auditory Physio. Lab., Boys Town Natl. Res. Hospital, 555 North 30th St., Omaha, NE 68131), Douglas L. Armstrong (Omaha's Henry Doorly Zoo, Omaha, NE 68107), Adam B. Smith, and JoAnn McGee (Boys Town Natl. Res. Hospital, Omaha, NE 68131)

The long distance advertisement call (LDAC) frequently referred to as a moan, an intense mew or a territorial roar, is commonly exchanged by adult members of *Panthera tigris* living both in captivity and in the wild. While the functionality of the call is not understood ethologically, its social nature is unambiguous, and isolated individuals living in captivity exchange the call repeatedly over extended periods of time. In this report, we concentrate on LDACs produced by *P. tigris altaica*. The average duration of the LDAC was just under 2 s. The average fundamental frequency, f_0 , was 0.155 kHz, ranging from ~0.113 to 0.176 kHz. Spectrograms were dominated by distinct harmonically related frequency modulated frequency sweeps, although subharmonics were also observed. Overall peak frequency, the frequency exhibiting maximum acoustic power, was centered at ~0.330 kHz and instantaneous peak frequency frequently shifted from one harmonic to another throughout the call's time course. The bulk of broadcast energy was contained in a band of frequencies ranging from ~0.1 to 0.8 kHz at 20 dB down from the peak frequency, and bandwidth expanded to ~3.7 and 4.9 octaves at the 30 and 40 dB down points, respectively. [Funding provided by NSF Grant 0823417.]

FRIDAY AFTERNOON, 19 NOVEMBER 2010

GRAND CORAL 3, 1:00 TO 5:00 P.M.

Session 5pSC

Speech Communication: Second-Language Learning: Perception and Production of Phonemes, Words, and Sentences (Poster Session)

Tessa C. Bent, Chair

Speech and Hearing Science, Indiana Univ., 200 S. Jordan Ave., Bloomington, IN 47405

Contributed Papers

All posters will be on display from 1:00 p.m. to 5:00 p.m. To allow contributors an opportunity to see other posters, contributors of odd-numbered papers will be at their posters from 1:00 p.m. to 3:00 p.m. and contributors of even-numbered papers will be at their posters from 3:00 p.m. to 5:00 p.m.

5pSC1. Second-language experience and speech-in-noise recognition: The role of talker-listener accent similarity. Melanie Pinet, Paul Iverson, and Mark Huckvale (Div. of Lang. Sci., Dept. of Speech, Hearing and Phonetic Sci., UCL, Chandler House, 2 Wakefield St., London WC1N 1PF, UK, m.pinet@ucl.ac.uk)

There is a clear interaction between native and non-native accents in speech-in-noise recognition, with listeners being better at accents that match their own speech. This study investigated how this talker-listener interaction is modulated by L2 experience and accent similarity. L1 southern British English (SE) and L1 French listeners with varying L2 English experience (inexperienced, FI; experienced, FE; and bilinguals, FB) were tested on the recognition of English sentences mixed in speech-shaped noise that were spoken with a range of accents (SE, FE, FI, Northern Irish, and Korean-accented English). The results demonstrated that FI listeners were more accurate with FI talkers and showed graded sensitivity for all accents. The SE listeners, however, had their recognition processes selectively tuned to their own accent. FE and FB listeners were more similar to SE listeners as their L2 experience increased. In order to account for this interaction, an accent similarity metric was applied to the talkers' and listeners' speech. The results demonstrated that there were significant correlations between speech-in-noise recognition and the acoustic similarity of the talkers' and listeners'

accents. Overall, the results suggest that L2 experience affects talker-listener accent interactions, altering both the intelligibility of different accents and the selectivity of accent processing.

5pSC2. Influence of talker-specific information on recognition memory for accented speech. Rachel M. Miller, Kaoyumari Sanchez, Lawrence D. Rosenblum, and James W. Dias (Dept. of Psych., Univ. of California, 900 Univ. Ave., Riverside, CA 92521)

Talker-specific (idiolectic) information aids memory for words repeated in the same voice. [Palmeri *et al.*, *J. Exp. Psychol. Learn. Mem. Cogn.* **19**, 2 (1993).] However, there is some evidence that the influence of idiolect on the perception of accented speech occurs differently. The current studies tested the impact of talker and accent change on memory for words using a continuous recognition memory task. Native English listeners were presented with accented words which were later repeated in the same or in a different voice. Subjects were asked to identify if the words were old (previously presented) or new (never presented). Memory performance was measured in terms of reaction time and recognition accuracy. In experiment 1, words were repeated in the same or in a different voice across repetitions, with the voices sharing an accent. Preliminary results suggest that hearing the words in the same voice improves recognition memory for accented words. In experiment 2, different voice repetitions represented models from

the same or a different accent background. Listeners were asked to identify old words as being produced in the same or a different voice. Initial results indicate that hearing repetitions in the same accent improves recognition memory, but interferes with voice identification.

5pSC3. Rapid and long-lasting adaptation to foreign-accented speech.

Marijt J. Witteman (Max Planck Inst. for Psycholinguistics, Post box 310, 6500AH Nijmegen, The Netherlands, marijt.witteman@mpi.nl), Andrea Weber (Max Planck Inst. for Psycholinguistics, 6500AH Nijmegen, The Netherlands), and James M. McQueen (Behavioral Sci. Inst., Radboud Univ. Nijmegen, 6500HE Nijmegen, The Netherlands)

In foreign-accented speech, listeners have to handle noticeable deviations from the standard pronunciation of a target language. Three cross-modal priming experiments investigated how short- and long-term experiences with a foreign accent influence word recognition by native listeners. In experiment 1, German-accented words were presented to Dutch listeners who had either extensive or limited prior experience with German-accented Dutch. Accented words either contained a diphthong substitution that deviated acoustically quite largely from the canonical form (*huis* [hɛys], “house”, pronounced as [hoys]), or that deviated acoustically to a lesser extent (*lijst* [lst], “list”, pronounced as [lst]). The mispronunciations never created lexical ambiguity in Dutch. While long-term experience facilitated word recognition for both types of substitutions, limited experience facilitated recognition only of words with acoustically smaller deviations. In experiment 2, Dutch listeners with limited experience listened to the German speaker for 4 min before participating in the cross-modal priming experiment. The results showed that speaker-specific learning effects for acoustically large deviations can be obtained already after a brief exposure, as long as the exposure contains evidence of the deviations. Experiment 3 investigates whether these short-term adaptation effects for foreign-accented speech are speaker-independent.

5pSC4. Lexical influences on children’s perception of foreign-accented speech. Tessa Bent (Dept. of Speech and Hearing Sci., Indiana Univ., 200 S. Jordan Ave., Bloomington, IN 47405, tbent@indiana.edu)

The ability to perceive speech accurately in the face of multiple sources of variability appears to develop during early and middle childhood. However, the cognitive-linguistic skills that underlie these improvements are unknown. Early-middle childhood is a time of rapid development in many areas of cognition and language, including the expansion of the lexicon. Lexical development includes both changes in lexicon size and changes in lexicon structure. Research suggests that as the lexicon grows, the words within the lexicon become more highly specified moving from more holistic representations to more fine-grained, segmental representations. This study tested how the expansion and restructuring of the lexicon are related to the ability to perceive highly variable speech signals. Specifically, the perception of foreign-accented speech — a common, real-world source of speech variability — was tested. The relationship between lexicon size and the perception of lexically easy (i.e., high-frequency words from sparse neighborhoods) and lexically hard (i.e., low-frequency words from dense neighborhoods) foreign-accented words was investigated for 5- and 6-year-old children. [Work supported by NIDCD 1R21DC010021.]

5pSC5. Studying dimensions of perceptual change in Spanish-English bilinguals. Annie J. Olmstead (Dept. of Psych., SUNY, 600 Hawk Dr., New Paltz, NY 12561), Leah Fabiano-Smith (Dept. of Commun. Disord., SUNY, New Paltz, NY 12561), and Navin Viswanathan (Dept. of Psych., SUNY, New Paltz, NY 12561)

The differences between perception and production in Spanish-English bilinguals and English monolinguals are well-documented. [Goldstein (2001).] These differences are sometimes attributed to changes in the language users’ perceptual sensitivities as a function of learning a second language. [Best (1994); (1995).] In the current study, we focus on the covariation of perceptual sensitivities and proficiency in L2 in Spanish-English bilinguals with the goal of developing a composite measure of perceptual accentedness. Specifically, we focus on categorization along a voicing continuum, goodness of category fit, vowel identification and discrimination, and bilabial stop/aspirant detection tasks. Through a combination of these perceptual tasks we seek to determine whether certain dimensions change more readily than others and if certain changes are strongly correlated. Fi-

nally, we determine whether these changes precede, follow, or are concurrent with corresponding changes in production. The results of this project have implications for understanding cross-linguistic influences on speech perception and production and understanding the relationship between perception and production.

5pSC6. Short term phonetic and phonological changes during Spanish instruction. Navin Viswanathan, Janna M. Losow, Leah Fabiano-Smith, and Anne J. Olmstead (Dept. of Psych., State Univ. of New York, New Paltz, NY 12561)

Several studies have shown that phonetic and phonological categories of both languages interact in bilingual speakers [e.g., speech learning model; Flege (1995)]. Interestingly, these categories continuously change over a period of time, drifting toward the characteristics of the ambient language. [Sancier and Fowler (1997)]. In this study, we studied how categories change in a short term bilingual interaction. Specifically, we were interested in whether cross linguistic influences were moderated by the extent of concurrent use of the two languages as well as the linguistic abilities of the target audience. To examine these questions, we recorded the production of Spanish language instructors. Their productions were studied before, during, and after a classroom interaction to determine changes in production. Furthermore, these productions were recorded in Spanish language courses of varying levels to determine specifically whether there was an increased influence of Spanish phonology on English productions in higher-level courses. The speech samples were phonetically transcribed and analyzed. Acoustic analyzes were performed to detect changes in voice onset time [Lisker and Abramson (1964)], vowel space, consonant manner class, and stress patterns. This study has implications for theories of bilingual speech production as well as for second language instruction and education.

5pSC7. Phonetic and phonological dimensions of accent change in bilinguals. Leah Fabiano-Smith, Navin Viswanathan, and Anne Olmstead (Dept. of Commun. Disord. and Dept. of Psych., SUNY New Paltz, 1 Hawk Dr., New Paltz, NY 12561)

The current study aimed to specify the phonetic and phonological dimensions along which accent change occurs in both languages in bilingual Spanish-English speakers. Previous studies examining accent change have done so in a variety of contexts [e.g., Colantoni and Steele (2008); Marian *et al.* (2008); Flege *et al.* (2002); MacKay *et al.* (2001); Flege *et al.* (1997)]. We aimed to observe how various phonetic and phonological variables that have already been examined interact to contribute to accent change. Four experiments examining between-language interaction on phonetic and phonological components focused on the following areas: (1) voice onset time (VOT) of initial voiceless consonants; (2) vowel space; (3) consonant manner classes, and (4) phonological changes that might be occurring cross-linguistically. Fifteen bilingual Spanish-English speakers, 10 monolingual English speakers, and 10 monolingual Spanish speakers participated in the current study. Participants were engaged in four experiments that involved both perception and production tasks in both languages. The results of this study could supplement theories on between-language interaction in second language learners. This interaction might shed light onto how rules of L1 might contribute to accent change in L2, and how language attrition might contribute to accent change.

5pSC8. Development of the non-native English sentence test for speech recognition. Rajka Smiljanic (Linguist., Univ. of Texas at Austin, Calhoun Hall 407, 1 University Station B5100, Austin, TX 78712-0198) and Lauren Calandruccio (Queens College-CUNY, Flushing, NY 11367)

Though the US population is becoming more diverse, there are no normalized sentence recognition tests for non-native English listeners. It is, therefore, difficult to examine sources of perceptual problems in speech recognition tasks by non-native listeners in laboratory and audiology clinics. The goal of this project is to develop test materials appropriate for assessing non-native listeners’ speech recognition and hearing abilities. In order to limit linguistic biases, we recorded naturally elicited conversations with 100 non-native talkers from 28 nations and with 15 different native languages on 20 topics. The recordings were transcribed and a lexicon of over 5000 unique words was compiled. The most frequent words across speakers of varying proficiency levels and language backgrounds were used to create test sentences with an equal number of keywords and with the syntactic

structure appropriate for non-native listeners. The sentences will be recorded by four native talkers of English and evaluated for difficulty by 40 non-native listeners of English who will participate in sentence-in-noise tests. A final set of 500 normalized sentences will be used to explore speech-in-noise recognition of non-native listeners. Non-native English sentence test along with the high quality audio recordings will be made available for use in the laboratory and clinics.

5pSC9. Examining the role of talker-specific details in bilingual listeners' perception of spoken words. Conor T. McLennan, Maura L. Wilson (Cleveland State Univ., Cleveland, OH 94115), and Julio González (Universitat Jaume I)

Previous studies demonstrate that listeners are faster to recognize words recently spoken by the same talker, relative to a different talker. However, there is evidence that such talker effects are more robust when processing is relatively slow. The purpose of the present study was to examine talker effects in bilingual listeners as a function of whether the listeners were hearing words in their first (L1) or second (L2) language. More specifically, in the present study, conducted in Spanish, we examined whether talker changes would affect bilinguals differently, depending on whether Spanish was their L1 (Spanish-English bilinguals) or their L2 (English-Spanish bilinguals). Given that bilinguals typically process their L2 more slowly than their L1, the results were expected to reveal greater talker effects in English-Spanish than in Spanish-English bilinguals. The present study should provide a greater understanding of the role that talker variability plays in bilingual listeners' online perception of spoken words.

5pSC10. Effects of age of immersion, task demand, and word type on word-recognition response times by native and non-native English-speaking listeners. Astrid Z. Doty (Dept. of Comm. Sci. & Dis. and Dept. of Psych., Univ. of So. Florida, 4202 E. Fowler Ave., PCD1017, Tampa, FL 33620), Catherine L. Rogers, and Judith B. Bryant (Univ. of So. Florida, Tampa, FL 33620)

Although listeners can adapt to many challenging listening conditions, often with little apparent effect on recognition accuracy, speed of processing may also affect an individual's ability to cope with such challenges in everyday contexts. Native and non-native listeners with either earlier (age 10 or earlier) or later (age 14 or later) ages of immersion in an English-speaking environment heard six lists of 24 words, each composed of 12 lexically easy target words (high-frequency words from sparse, low-frequency phonological neighborhoods) and 12 lexically hard target words (low-frequency words from dense, high-frequency phonological neighborhoods) in an open-set word-identification task. Word lists were presented in quiet, in a moderate degree of background noise, and with or without a competing digit-recall task. In the digit-recall task, listeners saw three or six digits on the monitor prior to presentation of the word list and were asked to recall the digits at the end of the word-recognition task. While there was no effect of the added digit-recall task on word-recognition accuracy, response times for correctly identified items were significantly longer for the digit-recall condition, for the later learners of English only. Group and word type effects on response times will also be addressed.

5pSC11. Phonemic verbal fluency test analysis for Japanese learners of English. Keiko Asano and Keiko Fusegi (Dept. of Medicine, Juntendo Univ., 1-1 Hiragakuidai, Inzai-city, Chiba 270-1965, Japan, sano@sakura.juntendo.ac.jp)

Verbal fluency tests commonly used in clinical and neuropsychological assessments were conducted on Japanese second-language learners of English. The most frequently used scores from these tests provide quantitative information such as the total number of words the subjects generated. This study investigated how the different proficiency levels of the learners generate words not only on the quantitative but also qualitative aspects of phonemic verbal fluency. Regarding the procedures of the phonemic verbal fluency test, the subjects were asked to generate orally as many different words as possible beginning with the letter "S" within a limited time of one minute. The results show that the higher proficiency level group of Japanese learners of English generated the greatest number of words, as well as those consisting of more syllables. Moreover, in terms of the qualitative aspect, there was particular tendency for the characteristics of the generated words to vary between the different proficiency level groups: the lower intermedi-

ate level group learners tried to generate loanwords in their native language, while the higher level proficiency group used the phonemic cue to produce the words. Further studies will focus on the way the words generated by different level group are categorized and clustered.

5pSC12. Non-native speech segmentation of a prosodically dissimilar language. Tuuli M. Adams (Dept. of Linguist., New York Univ., 10 Washington Pl., New York, NY 10003)

Native English listeners completed different combinations of the following tasks: learning words of Japanese, listening to fluent speech in Japanese, and identifying possible words of Japanese. Participants identified possible words from pairs of correctly and incorrectly segmented syllable sequences occurring in the fluent speech. Results indicate that listeners in the word-learning conditions were better at identifying possible words than those who only listened to fluent speech. Since English listeners are hypothesized to use a stress-based speech segmentation strategy, the presence of lexical pitch accents, but lack of stress, in Japanese may have led to a mismatch between the phonetic cues that signal word boundaries in the non-native and native languages. Therefore, participants did not gain as much advantage from listening and attempting to segment fluent speech in Japanese as they have been shown to for a language metrically similar to English, like Finnish [Adams (2010)]. However, a combination of word-learning and fluent speech listening did lead to more consistent performance across subjects on the word identification task, indicating that listening to fluent speech may still aid in the perception of certain phonetic cues associated with the well-formedness of words in the non-native language.

5pSC13. The relationship between vowel identification in noise and vowel intelligibility for Chinese and Korean speakers. Su-Hyun Jin, Chang Liu, and Somang Moon (Univ. of Texas at Austin, 1 University Station, A1100, Austin, TX 78712)

The present study aims to investigate the effects of background noise on English vowel perception for non-native listeners and to examine the relationship between vowel perception and vowel intelligibility for non-native people. For experiment 1, vowel identification was measured in two noise types: multi-talker babble and long-term speech shaped noise at various signal-to-noise ratios (SNRs) for English-native (EN), Chinese-native (CN), and Korean-native (KN) listeners. For experiment 2, English vowels spoken by CN and KN speakers who served as listeners in experiment 1 were recorded. Preliminary data of vowel perception showed that at low SNRs (-18 to -15 dB SNR), all three groups of listeners performed poorly, and at relatively middle and high SNRs, vowel identification for both CN and KN listeners was significantly poorer than EN listeners. Even at +3 dB SNR, the average identification scores for non-native listeners were more than 20% less than those for EN listeners. Furthermore, there was significant individual variability in vowel identification within each non-native group. This variability in vowel perception might be related with variability in vowel intelligibility for the non-native individuals. Vowel intelligibility for the non-native speakers will be evaluated by EN listeners. The implication on bilingual speech perception and production will be discussed.

5pSC14. Speaker and listener variables affecting second language vowel intelligibility. Ron I. Thomson (Dept. of Appl. Linguist., Brock Univ., 500 Glenridge Ave., St. Catharines, ON L2S 3A1, Canada, rthomson@brocku.ca)

Research investigating the development of second language (L2) phonology often relies on native speaker evaluation of L2 productions. However, listener variables that might affect these judgments remain little understood. For example, Levi *et al.* (2007) argued that the lexical frequency of L2 speech tokens influences listeners. However, they used somewhat incommensurate measures to compare listener vis-a-vis speaker variables. The present study investigates the impact of speaker and listener variables on English vowel intelligibility using three distinct listening tasks and compares three speaker groups: first language (L1) English, L1 Mandarin, and L1 Slavic. Speakers repeated a word list comprising 10 target English vowels, each embedded in three separate monosyllabic verbs and varying in terms of lexical familiarity for speakers and lexical frequency for listeners. L1 English judges identified the recorded vowels in two conditions that included lexical information, and one condition in which the vowel portions of the recorded words were presented in isolation, preventing listener