It has been shown that pairs of segments that are allophonic in a language are perceived as being more similar than pairs that are contrastive in a language [Boomershine et al., (2008)]. There is also evidence that neutralized contrasts in a language are perceived as more similar than non-neutralized contrasts [Hume and Johnson (2003)]. Third, there is evidence that phonological relationships should be defined along a continuum of predictability, rather than as a categorical distinction between "allophonic" and "contrastive" [Hall (2008)]. In combination, these facts predict that pairs of segments that fall along a cline of predictability of distribution should also fall along a cline of perceived similarity. This paper presents results of a perception experiment that tests this prediction by examining the perceived similarity of four pairs of sounds in German: (1) [t]-[tʃ], which is almost fully contrastive (unpredictably distributed); (2) [t]-[d] and (3) [s]-[ʃ], which are each partially contrastive (partially predictably distributed); and (4) [x]-[ç], which is almost fully allophonic (completely predictably distributed). If the notion of a cline of predictability is correct, these four pairs will align themselves along a cline of similarity with [t]-[tʃ] being rated as the most distinct and [x]-[ç] as the most similar.

Session 5aSWa

Speech Workshop: New Perspectives on Models of Cross-Language Speech Perception

Ann R. Bradlow, Chair
Dept. of Linguistics, Northwestern Univ., Evanston, IL 60208

Chair's Introduction—8:45

Invited Papers

9:00

5aSWa1. Accounting for the accented perception of vowels: Universal preferences and language-specific biases. Ocke-Schwen Bohn (English Dept., Arhus Univ., J.-C.-Skous Vej 5, DK-8000 Arhus C, Denmark) and Linda Polka (School of Commun. Sci. and Disord., Montreal, PQ, H3G1A8, Canada)

Strange things happen in cross-language and second-language vowel perception: Nave non-native listeners have been reported to rely on acoustic properties which are nonfunctional in their L1 and dysfunctional for the perception of non-native vowels; naïve non-native listeners' perception is guided by a preference for vowels that are peripheral in the articulatory/acoustic vowel space; and, in general, naïve non-native listeners' perception is not well predicted by comparative analyses of vowels of the native and the non-native language. This presentation reviews the accented perception of vowels by focusing on two forces which shape non-native vowel perception: universal perceptual preferences which non-native listeners (and infants) bring to the task of vowel perception, and perceptual biases which non-native listeners transfer from their native to the non-native language. Strange and her colleagues have shown that these biases cannot be predicted from acoustic comparisons; rather, they have to be examined directly through assessments of the perceived cross-language similarity of vowels. This presentation addresses several of the still unresolved questions regarding the design and the interpretation of perceptual assimilation tasks used to account for the accented perception of vowels. [Work supported by Danish Research Council for the Humanities, Canadian Natural Sciences and Engineering Research Council.]

9:35

5aSWa2. Articulating the Perceptual Assimilation Model (PAM): Perceptual assimilation in relation to articulatory organs and their constriction gestures. Catherine T. Best (MARCS Auditory Labs, Univ. Western Sydney, Locked Bag 1797, Penrith NSW 1797, Australia, and Haskins Labs, 300 George St., New Haven, CT 06511, c.best@uws.edu.au), Louis Goldstein (Univ. Southern Calif., Los Angeles, CA 90089-1693), Michael D. Tyler (Univ. Western Sydney, Penrith NSW 1797, Australia), and Hosung Nam (Haskins Labs, New Haven, CT 06511)

A core premise of the Perceptual Assimilation Model of non-native speech perception (PAM) [Best (1995); Best & Tyler (2007)] is that adults perceive unfamiliar non-native phones in terms of articulatory similarities/dissimilarities to native phonemes and contrasts. The implied attunement to native speech emerges early: As infants begin to discern the articulatory organization of native speech, language-specific effects in non-native speech perception appear (≈6–10 months). Given that non-native phones, by definition, deviate phonetically from native ones, how can we characterize articulatory similarity in concrete, testable ways? The Articulatory Organ Hypothesis (AO) [Studdert-Kennedy & Goldstein (2003); Goldstein & Fowler (2003)] offers a possible approach, positing that infants decompose the oral-facial system into distinct articulatory organs (e.g., lips, tongue tip, tongue dorsum) and are sensitive to their actions in producing vocal tract constrictions. Thus, between-organ contrasts should be easily perceived/learned by infants and adults, whereas detection of within-organ contrasts must become attuned to the distribution of differing constriction locations/types by that organ in input speech. We discuss articulatory, attunement modeling, and perceptual evidence consistent with these predictions, and present a revised version of PAM that incorporates the AO Hypothesis and related principles of articulatory phonology [Browman & Goldstein (1991)]. [Work supported by NIH.]

Session 5aSWb

Speech Workshop: Research and Applications to Second Language (L2) Speech Perception

Susan G. Guion, Chair
Dept. of Linguistics, Univ. of Oregon, Eugene, OR 97403-1290

Invited Papers

10:30

5aSWb1. Accent and intelligibility from an applied perspective. Murray J. Munro (Dept. of Linguist., Simon Fraser Univ., 8888 University Dr. Burnaby, BC V5A 1S6, Canada)

Listeners are remarkably sensitive to non-native patterns of speech, whether they are presented with full sentence productions, or with very short or severely degraded speech, including noisy, filtered, and temporally disrupted utterances. Furthermore, even phonetically unsophisticated listeners can reliably scale accents. From the standpoint of second language (L2) users, speaking with a detectible accent has important social consequences. One is that L2 speech is sometimes less intelligible or may require listeners to allocate more processing resources than does native speech. However, evidence also indicates that some salient phonological markers of L2 status have little or no impact on listener comprehension. Distinguishing these from accent features that reduce intelligibility is a critical concern in language pedagogy. Another consequence noted in empirical research is that accent stereotyping and negative social evaluation of accented speakers are linked to discrimination in remuneration, employment, and services. They may also be implicated in the exploitation of L2 speakers through questionable claims about the value of "accent reduction." This synthesis of previous and new research findings highlights a number of issues concerning methodology and interpretation in L2 speech research that are relevant to language teaching and assessment, and to human rights litigation. [Research supported by SSHRC.]

11:05

5aSWb2. The role of linguistic experience in lexical recognition. Andrea Weber (Max Planck Inst. for Psycholinguistics, Wundtlaan 1, 6525 XD Nijmegen, The Netherlands, andrea.weber@mpi.nl)

Lexical recognition is typically slower in L2 than in L1. Part of the difficulty comes from a not precise enough processing of L2 phonemes. Consequently, L2 listeners fail to eliminate candidate words that L1 listeners can exclude from competing for recognition. For instance, the inability to distinguish /r/ from /l/ in *rocket* and *locker* makes for Japanese listeners both words possible candidates when hearing their onset (e.g., Cutler, Weber, and Otake, 2006). The L2 disadvantage can, however, be dispelled: For L2 listeners, but not L1 listeners, L2 speech from a non-native talker with the same language background is known to be as intelligible as L2 speech from a native talker (e.g., Bent and Bradlow, 2003). A reason for this may be that L2 listeners have ample experience with segmental deviations that are characteristic for their own accent. On this account, only phonemic deviations that are typical for the listeners' own accent will cause spurious lexical activation in L2 listening (e.g., English *magic* pronounced as *megic* for Dutch listeners). In this talk, I will present evidence from cross-modal priming studies with a variety of L2 listener groups, showing how the processing of phonemic deviations is accent-specific but withstands fine phonetic differences.

11:40

5aSWb3. Designing the foreign language learning environment: From basic research towards product development. Reiko Akahane-Yamada (ATR Learning Technol. Corp., 2-2-2, Hikaridai, Seika-cho, Soraku-gun, Kyoto, 619-0288, Japan, yamada@atr-lt.jp)

In order to examine the acquisition of English by native speakers of Japanese, a series of training studies were conducted under various environments, that is, in the laboratory, at schools, or in virtual spaces over the Internet, and learners of various ages participated. The results demonstrated that web-based training methods using computers can improve even adult learners' ability to perceive and produce L2, and that the acquisition of phonological categories plays an important role in the language learning. Based on these results, an L2 training system, dubbed ATR CALL BRIX, was developed by putting emphasis on speech learning. The system is a collection of training tools for speech perception, production, and comprehension. Each component focuses on the acoustic-phonetic, prosodic, lexical, or semantic decoding level of spoken language. Speech analysis and pronunciation evaluation tools are also provided. The target users vary from children to adults and from beginners to advanced learners. The content is designed with Learning Object concept and each component is adjustable on the learner characteristics and curricula. The system is already in the market. It is suggested that the cross-language and L2 acquisition studies are readily applicable to designing actual foreign language learning environment. [Work supported by JSPS.]

Session 5pSWa

Speech Workshop: Cross-Language Speech Perception and Linguistic Experience: Poster Session B

Rajka Smiljanic, Chair
Dept. of Linguistics, University of Texas at Austin, Austin, TX 78712-0198

Contributed Papers

All posters will be on display from 1:30 p.m. to 3:00 p.m. To allow contributors an opportunity to see other posters, contributors of odd-numbered papers will be at their posters from 1:30 p.m. to 2:15 p.m. and contributors of even-numbered papers will be at their posters from 2:15 p.m. to 3:00 p.m.

5pSWa1. Foreign accented speech: Energetic or informational masking? Lauren Calandruccio, Christina Yuen, Sumitrajit Dhar (The Roxelyn and Richard Pepper Dept. of Commun. Sci. and Disord., Northwestern Univ., 2240 N. Campus Dr., Evanston, IL 60208, lauren.calandruccio@gmail.com), and Ann Bradlow (Northwestern Univ., Evanston, IL 60208)

Normal-hearing monolingual listeners whose native language is English experience a release from masking when the competing speech stimuli are spoken in a language other than English [e.g., K. J. Van Engen and A. R. Bradlow, J. Acoust. Soc. Am. **121**, 519 (2007)]. It is unclear whether this release is due to the fact that the masking speech is not spectrally matched to the target speech (energetic influence), or that listeners are unable to understand the masking speech and therefore find it less "distracting" when spoken in a non-native language (informational influence). This study investigates listeners' recognition of English speech presented in the presence of a continuum of five two-talker babble maskers. The two-talker maskers (all created using male voices) include English babble, Mandarin-accented English babble with high intelligibility, Mandarin-accented English babble with moderate intelligibility, Mandarin-accented English babble with low intelligibility, and Mandarin babble. We hypothesize that, due to increased informational masking across the accented English continuum (from unaccented to heavily accented) in the masker speech, we will observe a increase in the target English speech intelligibility. These data will provide insight into the balance of energetic and informational influences on the release in masking observed for monolingual listeners when listening to English in a noncompeting masker language.

5pSWa2. Perceptual training really matters: evidence of a study with English as a foreign language (EFL) vowels. Denize Nobre-Oliveira (Federal Ctr. of Technolog. Education of Santa Catarina, Av. Mauro Ramos 950, Florianopolis, SC, Brazil, 88020-300, denizenobre@yahoo.com.br) and Andreia S. Rauber (Univ. of Minho, Campus de Gualtar, Braga, Portugal 4715-057)

This study aimed at: (i) investigating the perception of English vowels by Brazilian English as a foreign language (EFL) highly proficient speakers, and, based on the findings; (ii) designing and testing perceptual training tasks that could possibly minimize perception difficulties by EFL learners. Two experiments were conducted. Experiment 1 tested vowel perception by means of an identification test elaborated with synthetic stimuli. The results showed that the vowels most often misidentified were /i/, /I/, /E/, /æ/, /U/, and /u/, and that duration does not seem to play a role on the perception of each vowel, suggesting that participants rely primarily on spectral cues. Experiment 2 then tested the effect of perceptual training of the difficult vowels by means of exposure to both natural and synthetic stimuli (with spectral manipulation). The training on these vowels was given over a 3-week period to 29 Brazilian EFL learners, which were divided into the natural stimuli (NatS) group and the synthesized stimuli (SynS) group. The results show that: (i) both experimental groups improved significantly after training; (ii) there was more improvement in the SynS group than in the NatS group; and (iii) knowledge acquired with artificially enhanced stimuli was transferred to stimuli produced naturally. [Work supported by CAPES (Committee For Postgraduate Courses in Higher Education, Brazilian Ministry of Education) grants to both authors.]

5pSWa3. Perception of Arabic and Japanese vowel length contrasts by native versus non-native Japanese listeners. Kimiko Tsukada (Dept. of Int. Studies, Macquarie Univ., NSW 2109, Australia ktsukada@mq.edu.au) and Yukari Hirata (Colgate Univ., Hamilton, NY 13346)

The perception of short versus long vowel contrasts in Arabic and Japanese was examined for native Japanese [(NJ), $n=5$] and non-native Japanese [(NNJ), $n=5$] listeners. The length contrast is phonemic in both languages. The question addressed was whether experience with Japanese helps NNJs to process the length contrast in Arabic. The listeners' discrimination accuracy was assessed in an AXB test. The stimuli were CV_1C words in Arabic and CV_1CV words in Japanese (where V_1 was either short or long). As expected, NJs were more accurate than NNJs in discriminating the Japanese contrast. While NJs made more errors in Arabic than Japanese, NNJs showed a similar level of discrimination accuracy for the two languages. Finally, the number of errors for the Arabic stimuli was comparable for NJs and NNJs. Thus, the between-group difference existed for the Japanese but not for the Arabic contrast. The possibility that familiarity with phonetic characteristics of a recently acquired language may influence the processing of sounds in an unknown language with similar characteristics to the target language will be discussed. Native Arabic perception is currently under investigation. [Work supported by Macquarie University New Staff grant.]

5pSWa4. Perception of English voiceless alveolar and postalveolar fricatives by Korean speakers. Yunju Suh (Dept. of Linguist., Stony Brook Univ., Stony Brook, NY 11794, yunjusuh@gmail.com)

Korean lacks place contrast of coronal fricatives before i. Yet three alveopalatal fricatives, fortis, lenis, and labialized, occur in this context. Fortis and lenis alveopalatals are intermediate between English alveolar and postalveolar in spectral peak location, though fortis has peak at higher frequencies, and thus is closer to English s. Peak location of labialized alveopalatal is the lowest, largely overlapping with that of English ʃ. The presence of L1 contrast among alveopalatals seems to facilitate Korean listeners' perception of English si-ʃi contrast, especially that between plain and labialized alveopalatals. Korean listeners were presented with eight-step continuum of English si (step 1) to ʃi (step 8), and asked to identify them with an L1 category. The percentage of fortis answer gradually decreased from steps 1 to 4, as lenis answer gradually increased. Labialized answer appeared below 3% until step 4, and increased above 68% at step 5, indicating categorical change of the percept from plain to labialized alveopalatals. There was no categorical change from fortis to lenis, presumably because Korean fortis-lenis contrast involves complex acoustic cues such as vowel f0, frication duration, and amplitude difference between harmonics, in addition to frication noise frequency.

5pSWa5. Electrophysiological indices of vowel discrimination in late bilinguals. Carol A. Tessel, Arild Hestvik, Dolors Girbau, Richard G. Schwartz, and Valerie L. Shafer (The Graduate Ctr.-CUNY, 365 5th Ave., Speech and Hearing-7th floor, New York, NY 10016, ctessel@gc.cuny.edu)

The purposes of the current study are: (1) To investigate discrimination of a vowel contrast not found in Spanish by late learners of English with Spanish as a first language; (2) to assess whether the use of natural consonant-vowel-consonant stimuli and multiple exemplars will show the same pattern of results as found in studies using synthetic stimuli; and (3) examine whether better speech perception as examined by the event-related potential, mismatch negativity (MMN) correlates with greater language usage as measured by a language background questionnaire. The results indicate that late-bilinguals are slower at discriminating the vowel contrast than the English monolinguals, as indexed by MMN. Monolingual English listeners showed significant MMN from 200 to 300 ms, whereas for late learners of English, the MMN was significant 50 ms later between 250 and 300 ms. Both groups showed excellent behavioral discrimination of the vowel contrast. Results also suggest that vowel category reshaping is less flexible in adult learners of a second language. The results will be discussed in relation to language usage.

5pSWa6. Allophonic alternations influence non-native perception of stress. Christine E. Shea and Suzanne Curtin (Dept. of Linguist., Univ. of Calgary, 2500 University Dr. NW, Calgary, AB T2K ON4, Canada)

We examined the identification of stressed syllables by adult L2 Spanish learners to see if it is influenced by an allophonic alternation driven by word position and stress. We utilized the Spanish voiced stop-approximant alternation, where stops occur in word onsets and stressed-syllable onsets. If L2 learners track the distribution of this alternation, they should link stops to stressed syllables in word onset position and approximants to unstressed, word medial position. Low- and Intermediate-level L1 English/L2 Spanish learners, Native Spanish and monolingual English speakers listened to a series of CVCV nonce words and determined which syllable they perceived as stressed. In Experiment 1, we crossed onset allophone and vowel stress. In Experiment 2, we alternated the onset allophone and held the vowel steady. Our results show that less experienced groups were more likely to perceive stressed vowels and approximant onset syllables as stressed. This suggests that learning the interplay between allophonic distributions and their conditioning factors is possible with experience. L2 learners track distributions in the input and this, in turn, influences their perception of other properties in the language, in this case, syllable stress. Native language distributions and target language proficiency play a role in this process.

5pSWa7. Lexical encoding of the second language vowel length contrasts. Jeong-Im Han (Dept. of English, Univ. of Konkuk, Hwayang-dong 1, Gwangjin-gu, Seoul, 143-701, Korea, jhan@konkuk.ac.kr)

Given the previous results for the L2 learners' processing difficulties of suprasegmentals as compared to segmentals, this study tests whether L2 late learners lack a proper phonological representation of suprasegmentals they could use to encode those contrasts. In Experiment 1, two groups of Korean late learners of Japanese (beginner versus advanced) as well as Japanese controls took a simple AX discrimination of the nonword pairs that varied in vowel length only, and showed that both groups of Korean learners had no difficulty to perceive the acoustic differences of the long versus short vowels in Japanese. However, in Experiment 2, when the same groups of learners participated in a more demanding lexical decision task using word-nonword pairs with vowel length differences, they had much difficulty in the use of such vowel length to access the lexicon. Even though there was significant improvement between the beginner and the advanced groups, there were still significant differences between the advanced group and the Japanese natives. These results suggest that L2 late learners might have a true processing deficits for suprasegmental properties in their phonological representation which were not in their L1, which cannot be easily eliminated with a significant exposure to L2.

5pSWa8. Perception of complex word-initial onsets in English by native speakers of Japanese. Mieko Sperbeck (Dept. of Linguist., City Univ. of New York, the Graduate Ctr., 365 Fifth Ave., New York, NY 10016, msperbeck@gc.cuny.edu)

Past studies have shown that English L2 learners whose native languages have relatively simple syllable structure have different degrees of difficulty in producing complex syllable and word onsets in English. For instance, more marked clusters (e.g., /bj/) were harder to produce than the less marked ones (e.g., /pj/) for Japanese learners of English [E. Broselow and D. Finer, Second Language Research 7, 35–59 (1991)]. However, what is unknown is whether such difficulties reflect problems in perceiving complex syllable structures. The current study tested Japanese L2 learners and American English controls in a categorial ABX discrimination test of eight contrasts between nonsense words with consonant cluster onsets CC(C)VCV versus CəC(C)VCV sequences (e.g., /spani/versus/səpani/) and included /sp, sk, pl, bl, kl, gl, spl, skl/ clusters. Words were imbedded in short sentences to increase task difficulty. Results showed that overall accuracy by the Japanese group was significantly poorer than for the Americans (72% and 98% correct respectively). Certain clusters were harder for Japanese listeners (e .g., 76% correct for /pl/ but 64% for /bl/). Productions of the words were also obtained and are related to perceptual performance.

5pSWa9. Discrimination of Mandarin disyllabic tone contrasts by American English-speaking adults and children. Shari Berkowitz (CUNY Graduate Ctr., Speech Acoust. and Percept. Lab., 365 Fifth Ave., New York, NY, 10016, shariellen@gmail.com)

Most research on cross-language perception of Mandarin tones has used monosyllabic stimuli, despite the fact that Mandarin words are predominantly disyllabic. Previous work on disyllable discrimination (Berkowitz and Strange, 2007) suggested that perception by English-speaking adults is influenced by coarticulation and context effects. In this series of studies, subsets of stimuli were chosen to attempt to isolate the effects of fundamental frequency height, contour, turning point and timing on English speakers' ability to perform a same/different task. Three balanced blocks of approximately 10 min each were given, to keep the task appropriate for preschoolers. Feedback conditions varied; some subjects received feedback throughout and others on the first block only. Early results suggest that discrimination of disyllabic Mandarin stimuli is easier for American English speakers if the differences between disyllables occur at onset or offset of the complete utterance; differences in the middle pose more of a challenge. Subjects appear to evaluate disyllabic contours as a whole, rather than on a syllable-by-syllable basis. Implications for future research and training protocols will be discussed.

5pSWa10. Factors inducing cross-linguistic perception of illusory vowels. Jiwon Hwang (Dept. of Linguist., Stony Brook Univ., Stony Brook, NY 11794-4376, jihwang@ic.sunysb.edu)

Japanese speakers tended to hear an illusory vowel in illegal consonant sequences (Dupoux *et al.*, 1999). Korean has no sequences of stop followed by nasal; therefore, it is expected that Korean speakers would perceive an illusory vowel in stop-nasal. In an identification task comparing Korean and English listeners on stimuli along a continuum that ranged from no vowel (igna/ikna) to a full vowel (igVna/ikVna), Korean listeners reported the presence of a vowel significantly more often than English listeners, even when there is no vowel in the stimuli. However, this effect was found only when the stop was voiced, even though [kn] and [gn] are both illegal Korean sequences. In an AXB discrimination task, Korean participants had more difficulty discriminating 'stop-nasal' from 'stop-V-nasal' than English participants, again only when the stop was voiced. The results suggest that voicing, rather than simple illegality, induces bias toward perception of illusory vowel in Korean. This is explained by the fact that in Korean, voiced stops occur only prevocalically in intersonorant position (as an allophone of voiceless obstruents). This voicing effect is reflected in Korean L2 learners' production patterns in which they insert a vowel more often in voiced stop-nasal sequences than in voiceless stop-nasal sequences. [Work supported by NSF BCS-07460227.]

5pSWa11. Individual differences in the perception of final consonant voicing among native and non-native speakers of English. Bruce L. Smith (Dept. of Commun. Sci. and Disord., Univ. of Utah, 390 S. 1530 E., Rm. 1201, Salt Lake City, UT 84112, bruce.smith@hsc.utah.edu) and Rachel Hayes-Harb (Univ. of Utah, Salt Lake City, UT 84112)

Various studies have provided modest evidence supporting the ideas: (1) that non-native listeners outperform native listeners in judging productions by other non-native speakers with whom they share a first-language (L1) background and (2) that non-native listeners are more accurate judging productions by subjects with whom they share an L1 background than they are judging speech contrasts of native English speakers. Research regarding these issues has typically been based on group findings, so it is not clear to

what extent these tendencies may occur among individual listeners. The present investigation reports findings for 15 native English (NE) listeners and 15 non-native listeners (native Mandarin: NM), who made judgments about English voiced/voiceless minimal pairs produced by six other NE and six other NM talkers. When listening to the six NM talkers, fewer than half of the 15 NM subjects performed better than the range shown by the 15 NE listeners. Further, the 15 NM listeners were more accurate than the 15 NE listeners in judging the voicing contrast for just two of the six NM speakers. Thus, limited evidence was found that individual, non-native subjects demonstrate patterns that might have been expected on the basis of previous group findings.

5pSWa12. Perceptual confusions of American English vowels and consonants in Arabic-English bilinguals. Valeriy Shafiro (Dept. Comm. Disord. Sci. Rush Univ. Medical Ctr., 600 S. Paulina Str.,1015 AAC, Chicago, IL 60612), Anatoliy Kharkhurin (American Univ. of Sharjah, Sharjah, UAE), and Erika Levy (Columbia Univ., New York, NY 10027)

This study investigated the perception of American English (AE) vowels and consonants by proficient adult Arabic-English bilinguals studying in the United Arab Emirates (UAE). The native language of all participants was Arabic, and their average age of English acquisition was 6 years. In a closed set format, 29 participants were asked to identify 12 AE vowels presented in /hVd/ context and 20 AE consonants in three vocalic contexts: /ɑCɑ/, /iCi/, and /uCu/. Overall vowel identification was 70% correct. The three least-accurately identified vowels were /ɑ/, /ɔ/, /æ/, which were 17%, 38%, and 54% correct, respectively. Most confusions were found among low and back vowels. Overall, perception of consonants was more than 90% correct in all three vocalic contexts. The most errors on consonants were found for /ð/, i.e., 63% and 46% correct in /ɑCɑ/ and /iCi/ contexts, respectively. In both contexts, /ð/ was most frequently confused with /v/. However, identification of /ð/ in /uCu/ context was far more accurate; i.e., 97% correct. These results suggest a phonetic context effect on the cross-language perception of consonants.

5pSWa13. Experience with foreign accent influences non-native (L2) word recognition: The case of th-substitutions. Adriana Hanulikova and Andrea Weber (Max Planck Inst. for Psycholinguistics, Nijmegen, The Netherlands)

Effects of mispronunciations on word recognition are often explained in terms of perceptual similarity: the less similar mispronunciations are to target words, the more lexical activation is disturbed. Using th-mispronunciations that occur in foreign-accented English, this study investigated whether, irrespective of perceptual similarity, experience with mispronunciations influences word recognition. While Dutch speakers of English frequently substitute voiceless *th* with /t/ (e.g., /tɛft/ for *theft*), German speakers prefer /s/ (e.g., /sɛft/); the perceptually close /f/ occurs infrequently in both groups. Four eye-tracking experiments examined whether familiar substitutions cause stronger lexical activation than less familiar ones. German and Dutch participants listened to sentences spoken with a German or Dutch accent (e.g., "Now you will hear /tɛft/"), while they were looking at a display with four printed words (e.g., *theft*, *left*, *kiss*, *mask*). The time course of lexical activation was measured as a function of amount of looks to printed th-words after hearing mispronounced words with a /t/, /s/, or /f/ substitute. Irrespective of the heard accent, th-words were fixated more often when hearing /t/ for Dutch listeners but /s/ for German listeners, while /f/ never outperformed the accent-specific dominant substitute. The results suggest an influence of accent-specific experience on L2 word recognition.

5pSWa14. Cross-linguistic evidence for the influence of native language prosody in infant speech segmentation. Suzanne Curtin (Depts. of Psych. and Linguist., Univ. of Calgary, 2500 University Dr. NW, Calgary, AB T2N 1N4, Canada, scurtin@ucalary.ca), Linda Polka, Shani Abada (McGill Univ., Montreal, QC H3G 1A8, Canada), and Reaper Sally-Joy (Univ. of Alberta, Alberta, Canada)

Research using artificial languages with English-learning infants has shown both prosodic and distributional cues are used for speech segmentation by 7 months. When these cues conflict, infants younger than 7 months rely on distributional cues while older infants rely on prosodic cues). In the present study we assessed the role of prosodic information in segmentation when it is not favorably aligned with distributional cues, to determine whether language-specific rhythmic biases guide segmentation as suggested by studies using natural speech. Two continuous streams of naturally produced syllables (English and French) were constructed using nines syllables that are permissible in both languages. Within each stream statistical cues were manipulated independently of language-appropriate stress cues. English- and French-learning 8-month-olds were familiarized with their native language stream and then present test probe strings to determine what syllable sequences were extracted from the stream. Probes were selected to assess the role of stress cues in segmentation. Findings show that English infants make use of a trochaic template; Canadian-French infants show a weaker and less focused reliance on stress cues to segment words from connected speech. These cross-linguistic differences reflect processing biases that may be set by language experience and/or elicited by speech input properties.

5pSWa15. Individual gains from auditory training of English vowels for Greek native speakers. A. Lengeris (Dept. of Speech Hearing and Phonetic Sci., Univ. College London, 2 Wakefield St., London WC1N 1PF, UK, a.leggeris@ucl.ac.uk)

Several studies have shown that high-variability auditory training can improve the perception of second-language (L2) sounds by adult learners. However, even when testing a homogenous L2 group, considerable differences are commonly found between individuals not only in pre-training performance but also in how each trainee responds to training. Additionally, it is not clear what aspects of perceptual processing are actually being trained. To address these issues the present study trained Greek native speakers in perceiving the vowels of Southern British English. The trainees received five sessions of high-variability auditory training (including multiple words spoken by multiple talkers). The pre- and post-training tests included identification and discrimination tasks in L1 (Greek) and L2 (English), and a nonspeech (F2 only) discrimination task. Preliminary results show significant improvement in the trainees' identification of L2 vowels, but no significant change in their L2 discrimination. The relationships between pre-training L1, L2, and nonspeech performance and gains in L2 identification for individuals will be discussed.

5pSWa16. Vowel quantity and quality perception in Finnish and Estonian speakers. Stefan Werner (General Linguist. and Lang. Technol., Univ. of Joensuu, Finland, stefan.werner@joensuu.fi) and Einar Meister (Tallinn Univ. of Technol., Estonia)

Vowel quality perception in quantity languages might be expected to be unrelated to duration of the vowels since duration is used to realize phonemic duration oppositions. Our studies, both earlier reported ones and our latest project, indicate, though, that vowel-intrinsic duration changes have a consistent effect on vowel identification in Estonian and Finnish speakers. Our latest experimental setup for investigating perceptional effects of microduration consists of two blocks, first a set of tests to identify the subject's formant-based categorial boundaries between vowel pairs on the close-open axis, then the accordingly selected listening tests presenting formant-wise ambiguous vowel exemplars produced with varying durations. Results from ten Estonian and ten Finnish speakers will be presented. In addition, the phenomenon observed will be compared with formant structure and duration perception in languages where these parameters co-vary (e.g., English) and thus an influence of sub-phonemic durational changes on vowel perception would seem much likelier.

5pSWa17. The phonotactic influence on the perception of a consonant cluster /pt/ by native-English and native-Polish listeners: A behavioral and ERP study. Monica Wagner and Valerie L. Shafer (Ph.D. Prog. in Speech-Lang.-Hearing Sci. The Graduate Ctr., 365 Fifth Ave., New York, NY 10016-4309, mpwspl@aol.com)

The perception of the cluster /pt/ in word onset in native-Polish and native-English adult listeners was compared using behavioral and event-related potential (ERP) measures to explore the language-specific phonotactic influence on speech perception. Acoustic-phonetic features of phonemes vary with context and phonotactic rules specify all allowable phoneme contexts. Both native-Polish and native-English groups are exposed to the cluster /pt/ in their language but only one group, native-Polish, experience the cluster in the context examined, word onset. Word onset consonant cluster /st/ is used as a control. Participants were asked to determine whether

they heard the second word of a pair as consisting of two syllables or three (e.g., pteva versus peteva). Behavioral results revealed that Polish listeners perceive the /pt/ cluster with greater accuracy than English listeners. ERPs revealed late components that differ for the two language groups reflecting linguistically-relevant aspects of the /pt/ contrast and early components that are essentially the same in the two language groups reflecting physical-acoustic differences. ERP results suggest the /st/ contrast to be more salient than the /pt/ contrast consistent with the higher behavioral accuracy for the /st/ cluster. These findings support the suggestion that psychoacoustic salience of acoustic-phonetic features influences speech perception.

5pSWa18. The roles of second-language experience and accent in speech recognition in noise. Melanie Preece-Pinet and Paul Iverson (UCL, Dept. of Lang. Sci., Chandler House, 2 Wakefield St., London WC1N 1PF, UK, m.pinet@ucl.ac.uk)

Previous work has demonstrated that there is an interaction between native (L1) and non-native (L2) accents in speech recognition in noise, with listeners being better at L1 or L2 accents that match their own speech. This study investigated how L2 experience modulates this talker-listener interaction. 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 was 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 strongly accented FI talkers, and were progressively worse for the other accents, perhaps based on accent similarity. The SE listeners, however, had a strong advantage for SE speech, but were similarly poor at understanding the other accents. Their recognition processes were thus selectively tuned to their own accent, rather than having the graded sensitivity of FI listeners. FE and FB listeners were more similar to SE listeners as their experience with English increased. The results thus suggest that increased exposure to L1 speech changes both the intelligibility of accents and the selectivity of accent processing.

5pSWa19. Second language word segmentation in a fluent speech listening task. Tuuli M. Adams (Dept. of Linguist., New York Univ., 726 Broadway, New York, NY 10003, tuuli.adams@nyu.edu)

Extracting words from a continuous speech stream is a complex task involving the integration of multiple linguistic cues. Like infants, adults have been shown to use both distributional information through statistical learning, and metrical and intonational information, when segmenting words in a second language. This study investigates adults' native language influence on speech segmentation, and the extent to which linguistic knowledge is augmented by exposure to fluent, natural speech in a second language. In the experiment, English listeners completed a word learning task in an unfamiliar language, Finnish. Next, they listened to a fluent speech passage which contained learned words, as well as syllable sequences controlled for the same frequencies and transitional probabilities as the real words. English speakers have been shown to use acoustic stress cues to locate word boundaries, and while Finnish has a regular stress pattern, other phonotactic patterns could affect English listeners' segmentation abilities. Afterwards, they completed a forced-choice identification task, choosing from pairs of real and non-words, including incorrectly segmented syllable sequences, to identify the token which is more likely a word in Finnish. The behavioral data are analyzed for patterns reflecting the integration of native language linguistic knowledge and statistical learning abilities.

5pSWa20. Assessing the contribution of second language experience and age of learning in Catalan/Spanish bilinguals' perrception and production of English sounds. Natalia Fullana and Ian R. A. MacKay (Dept. of Linguistcs, Univ. of Ottawa, 70 Laurier Ave. East, Ottawa ON, K1N 6N5 Canada, fullnat@gmail.com)

Previous research in immersion settings has shown that an early age of onset of second language (L2) learning, together with long-term exposure to the L2, are determinant factors for perceiving and producing L2 sounds accurately [e.g., Flege, MacKay, & Meador (1999)]. However, research in formal learning contexts has resulted in negative evidence for an early age of learning advantage [e.g., Garcia-Lecumberri & Gallardo (2003)] or in divergent experience effects (Cebrian, 2003, 2006). This study aimed to further examine the contribution of the factors of age of onset of L2 learning (AOL) and experience in a foreign language learning environment. Catalan/Spanish bilinguals studying English at university, with AOLs of 4 to 14 years and a minimum of 7 years of formal instruction, performed an AXB discrimination task, a picture narrative, and a delayed sentence repetition task. Results revealed that Catalan/Spanish bilinguals with somewhat longer exposure to English and an earlier AOL tended to discern English sounds at higher correct rates. By contrast, a great degree of variability was found across the bilinguals' extemporaneous and prompted production of English segments. Findings are discussed in terms of current models of L2 speech acquisition and their application to formal learning settings. [Work supported by postdoctoral fellowship from the Ministerio de Educacion y Ciencia and the FECYT (Spain).]

5pSWa21. Asymmetric development of perception and production of lexical stress in Korean second-language (L2) learners of English. Jeonghwa Shin and Shari/R. Speer (Dept. of Linguist., Ohio State Univ., 1712 Neil Ave., Columbus, Ohio 43210, jshin@ling.osu.edu)

This study explores perception and production of lexical stress information in L2 English learners whose L1 employs a fixed rhythmic pattern at the lexical level. Nineteen English L1 speakers and 14 Korean L2 learners of English were trained to learn 16 minimal stress nonword pairs with picture referents which are segmentally disambiguating in the last syllable (/dʒákunaɪ/ vs /dʒakúnəɹ/). The eye-tracking perception experiment revealed that English L1 speakers exploited lexical stress information of the first two syllables to spot the target word in the instruction, "Click on the (target word)," whereas Korean L2 learners' identification of the target word was delayed until the last syllable. In their production of words in a carrier, "This is the (target word)," however, L2 learners used loudness and durational cue to indicate alternative prominence of the first two syllable as did English L1 speakers. These results imply the development of production and processing of lexical stress in L2 word learning can be asymmetrical. This asymmetry is attributable to the L1 which has a fixed (T)HLH accentual phrase pattern at the lexical level and thus provides little incentive for the lexically specified stress processing. [Work supported by Linguistics Dept., Ohio State University.]

5pSWa22. Do first-language (L1) phonemic categories play a role in the perception of second-language (L2) phonemic contrasts? A look from the perception of Cantonese codas by Mandarin speakers. Patrick Chun Kau Chu (School of Psych., The Univ. of New South Wales, Sydney, Australia and Dept. of Linguist. and Modern Lang., The Chinese Univ. of Hong Kong, Hong Kong, China, patrickhk83@hotmail.com)

This study investigated whether the phonological system of L1 or universal hierarchy of perceptual similarities has a larger effect on Mandarin speakers' perception of Cantonese phonemic categories. In Mandarin and Cantonese, there are differences in the distribution of nasals and plosives in the coda position. Both nasals (/m/, /n/, and /ng/) and plosives (/p/, /t/, and /k/) are possible codas in Cantonese while only nasals (/n/ and /ng/) can appear in the coda position in Mandarin. Non-native phonemic categories (e .g., /t/) will be assimilated to a native phonemic category (e.g., /n/) if L1 plays a larger role while assimilation to a non-native phonemic category (e .g., /p/ or /k/) may support the idea that universal hierarchy of perceptual similarities plays a more important role. An AX discrimination task is carried out to see whether Mandarin and Cantonese speakers can discriminate these six phonemic contrasts in Cantonese monosyllabic words. Results showed that Mandarin speakers have poorer discrimination ability in the later type (e.g., /t/ vs /k/) than the former type (e.g., /t/ vs /n/). This suggests that the Perceptual Assimilation Model may need to take universal hierarchies of perceptual similarities into account when predicting L2 learners' discrimination ability in a second language.

5pSWa23. Implicit learning of non-native speech stimuli. Eleni L. Vlahou, Athanassios Protopapas (ILSP/Athena, Artemidos 6 & Epidavrou, GR-151 25 Maroussi, Greece, evlahou@ilsp.gr), and Aaron Seitz (Univ. of California-Riverside, Riverside, CA 92521)

Previous studies have induced robust adult learning of non-native natural speech stimuli using explicit instructions and feedback. Here, Greek adults were exposed to non-native Hindi phonemes for six sessions in which they were unaware of the phoneme distinctions and the phonemes had no relevance to their main task. Stimuli were natural recordings of CV syllables (a

retroflex or dental unvoiced stop followed by [a]) from a Hindi speaker. On each trial, participants heard two identical dental sounds and two retroflex sounds differing in intensity by an adaptively varied amount between 0.5–3 dB. The explicit task was to identify which pair differed in intensity, while the implicit learning goal was the phonetic contrast. After training, participants were tested on explicit phonetic identification and discrimination of trained and untrained stimuli spoken by the same and a novel speaker. The trained group outperformed an untrained group who were administered the same tests. Our results are compatible with a perceptual learning model where task-irrelevant stimuli (Hindi sounds) are learned due to a systematic pairing with task targets (intensity difference). Learning did not extend to the novel speaker, in agreement with previous studies showing that variability in training is crucial for generalization.

5pSWa24. Duration as a phonetic cue in the categorization of /i:/-/ɪ/ and /s/-/z/ by spanish/Catalan learners of English. Eva Cerviño and Joan C. Mora (Dept. Filologia Anglesa, Universitat de Barcelona, Gran Via 585, 08007-Barcelona, Spain, ecervino@ub.edu)

Previous research has shown that Spanish/Catalan learners of English (SCLs) rely on duration rather than spectral cues in the categorization of contrastive English vowel pairs such as /i:-/ɪ/, despite length being nondistinctive in Spanish/Catalan. Native English speakers (NESs) rely more heavily on V-C duration ratio than on glottal pulsing in the perception of voicing contrasts in -VC contexts. This study investigated whether SCLs' overreliance on duration in vowel categorization also applied to consonants in contexts (-VC) where lack of closure voicing makes duration the main cue to voicing for NESs. SCLs ($N=40$) and NESs ($N=15$) participated in two lexical decision tasks consisting of /f/+V+/t/ stimuli drawn from two 8-step continua with shortened (/i:/) and lengthened (/ɪ/) vowels; and /p/+/i:/+C stimuli drawn from six 8-step continua with simultaneously and independently modified vowels and final consonants (/i:s/-/i:z/). Manipulating duration had a significant effect on SCLs' categorization of /i:/ and /ɪ/, but not on SCLs' categorization of /s/ and /z/, suggesting that SCLs made use of duration as a cue to vowel categorization, but did not use duration as a cue to voicing. These results are interpreted and further discussed in light of Bohn's Desensitization Hypothesis and McAllister's Feature Hypothesis.

5pSWa25. Phonetic cue-weighting in the acquisition of a second language: Evidence from Greek speakers of English. Anastasia Giannakopoulou, Maria Uther (Ctr. for Cognition and Neuroimaging, Dept. of Psychol., Brunel Univ., Uxbridge, Middlesex, UB8 3PH, UK), and Sari Ylinen (Univ. of Helsinki, PL 9, Helsinki, 00014, Finland)

The most difficult speech-sound contrasts for foreign-language learners are often the ones that have multiple phonetic cues, especially if the cues are weighted differently in the foreign and native languages. Greek speakers of English were studied to determine on what basis they are making discrimination and identification between English vowels. The use of spectral and duration cues of English vowel minimal pairs (e.g., "beat" versus "bit") in Greek speakers were studies using perception and discrimination tasks. There were two forms of perceptual, minimal pair identification tasks. One used natural stimuli and the other used matched vowel duration words to "force" the use of spectral cues. Performance was impaired for Greek speakers across both perceptual identification tasks compared to native speakers. But performance was the worst for Greek speakers for the matched duration condition. Interestingly, an AB-X discrimination task with the same stimuli did not hamper the performance of the Greeks compared to the English in the same way. Pilot data from Greek children also showed similar patterns of performance across conditions to the Greek adults, but with a somewhat reduced ceiling. These results are discussed in terms of the strategies used to acquire new languages.

5pSWa26. Role of rhythmic and intonational cues in language discrimination. Chad Vicenik and Megha Sundara (Dept. of Linguist., 3125 Campbell Hall, UCLA, Los Angeles, CA 90095)

Languages differ in rhythm as well as intonation. Research indicates that adult listeners are able to use rhythm to discriminate between two languages from different rhythm classes [Ramus Mehler, (1999)]. For languages within the same rhythm class, adults are able to use to use intonation to discriminate between languages like English and Dutch, but only when one of the languages is familiar [Ramus and Mehler, (1999); Pijper, (1983)]. It remains unclear if the rhythmic differences between languages in the same rhythm class are enough to support language discrimination. In this paper, we tested American English listeners' ability to categorize re-synthesized American English and German sentences or American and Australian English sentences from which all segmental information had been removed. English and German are from the same rhythm class and differ in intonation; whereas American and Australian English can be thought to be rhythmically identical, but differ in intonation. Subjects were tested in three conditions: (a) with only intonational cues; (b) with only rhythmic cues; and (c) both intonational and rhythmic cues. Preliminary results indicate that listeners rely on rhythm, but not intonation, to distinguish between English and German, and only on intonation to distinguish between American and Australian English.

5pSWa27. Discrimination of American vowels in disyllables mixed in speech babble by experienced Japanese and Russian learners of English. Kikuyo Ito, Yana, D. Gilichinskaya, and Winifred Strange (Speech Acoust. and Percept. Lab., CUNY-Graduate Ctr., 365 Fifth Ave., New York, NY, 10016-4309, kikuyoito@hotmail.com)

Previous studies in this laboratory examining speeded discrimination of American English (AE) vowels in quiet by Japanese (JP) and Russian (RU) late L2 learners indicated differences in relative difficulty of non-native contrasts that were predictable from L1 phonological differences. Response latencies were a sensitive measure of continuing L2 perceptual difficulties. In the present study, the same task (a speeded categorial ABX task with disyllabic stimuli) was administered to Japanese and Russian listeners, with stimuli mixed in speech babble at three levels (SNR 0, 6, 12). Eight experimental contrasts (four with spectral plus duration differences and four with spectral differences only) and four control contrasts were tested in lists with both vowel contrast and noise level varying randomly. Results indicated that both L2 groups performed more poorly than native AE control subjects on many of the experimental contrasts, including those differentiated by duration as well as spectral differences. Again differences in relative perceptual difficulty across L2 groups emerged. Perceptual assimilation patterns and performance on a test of English fluency and pronunciation (versant) were correlated with discrimination performance across individuals. [Work supported by NSF.]

5pSWa28. Phonetic accommodation in conversations between native and non-native speakers. Midam Kim (Linguist., Northwestern Univ., 2016 Sheridan Rd., Evanston, IL 60208, midamkim@gmail.com)

We explored phonetic accommodation during native speaker interactions (four native English pairs and four native Korean pairs) and native–non-native interactions (four native–non-native pairs, all speaking English). Speakers engaged in a collaborative picture description task that lasted approximately 20 min. Utterances from relatively early and late in the task were subsequently presented to native English listeners (or Korean listeners, for the Korean-language dialogues), who were asked to carry out *XAB* similarity judgments, where X=one talker's utterance and A/B=early and late utterances from the partner. Phonetic accommodation is indexed by how frequently listeners select the "late" utterance as sounding more similar to the target utterance. An independent group of native English speakers rated the nonnative utterances for degree of accentedness. Phonetic convergence was observed for native-native conversations (English or Korean), and this was stronger when speakers shared the same or similar dialects. In native–non-native conversations, none of the native speakers converged towards a non-native partner, while non-native speakers showed different patterns depending on their proficiency, with greatest convergence for moderately accented nonnatives. The results suggest that phonetic accommodation can occur cross-linguistically, and that it may be constrained both by speakers' dialect and by their language proficiency.

5pSWa29. Speeded discrimination of American English vowel contrasts by Spanish-speaking late second-language (L2) learners. Jason Rosas, Arsenia Barias, Yana D. Gilichinskaya, and Winifred Strange (Speech Acoust. and Percept. Lab., CUNY-Graduate Ctr., 365 Fifth Ave., New York, NY 10016-4309)

This study is the third in a series exploring discrimination of American English (AE) vowel contrasts by late L2-learners of English whose native languages have small vowel inventories (Japanese, Russian, Spanish). On a speeded ABX task, adult Spanish-speaking listeners discriminated multiple

AE vowel contrasts including adjacent height pairs that differed in both spectral and duration parameters, front/back pairs (differing only in spectral characteristics, and four nonadjacent control pairs). It was hypothesized that Spanish listeners, who do not distinguish native vowels based on duration, would have difficulties with both types of experimental contrasts, relative to control pairs. Additionally, mean reaction time (RT) difference scores (relative to mean RTs for control pairs) for Spanish listeners were expected to be slower than for AE controls. Preliminary findings confirm these predictions. Differences in relative difficulty of experimental pairs compared with earlier data for Japanese and Russian L2-learners showed L1-specific patterns of performance that were related to L1/L2 perceptual similarity patterns. Spanish subjects also completed the Versant Test, an English language proficiency examination conducted by phone. A correlational analysis of discrimination accuracy and speed with Versant Test fluency and pronunciation measures will be presented. [Work supported by NSF.]

5pSWa30. Spoken word recognition in quiet and noise by native and non-native listeners: Effects of age of immersion and vocabulary size. Astrid Z. Doty, Catherine L. Rogers (Dept. of Comm. Sci. and Dis. and Psych., Univ. of South Florida, 4202 E. Fowler Ave. PCD1017, Tampa, FL 33620), and Judith B. Bryant (Univ. of South Florida, Tampa, FL 33620)

In spoken word recognition, high-frequency words with few and less frequently occurring minimal-pair "neighbors" (lexically easy words) are recognized more accurately than low-frequency words with many and more frequently occurring neighbors (lexically hard words). [Bradlow and Pisoni, J. Acoust. Soc. Am.,106, 2074–2085 (1999)] found a larger "easy-hard" word effect for non-native than native speakers of English. The present study extends this work by specifically comparing word recognition by non-native listeners with either earlier (age 10 or earlier) or later (age 14 or later) ages of immersion in an English-speaking environment to that of native English speakers. Listeners heard six lists of 24 words, each composed of 12 lexically easy and 12 lexically hard target words in an open-set word-identification task. Word lists were presented in quiet and in moderate background noise. A substantially larger easy-hard word effect was obtained only for the later learners, but a measure of oral vocabulary size was significantly correlated with performance for the non-native listener groups only. Thus, the increased easy-hard effect for non-native listeners appears to be better explained as an effect of phonetic proficiency and/or the effect of vocabulary size on the structure of lexical neighborhoods than as an effect of language competition.

5pSWa31. Perceptual adaptation to foreign accented speech. Melissa Baese-Berk (Dept. of Linguist., Northwestern Univ., 2016 Sheridan Rd., Evanston, IL 60208, m-baese@northwestern.edu)

Previous research on native listener adaptation to foreign-accented adaptation has demonstrated that training on a single non-native speaker results in talker-dependent learning (i.e., training does not generalize to new talkers). However, training on multiple foreign-accented speakers from a single language background results in talker-independent, but accent-dependent learning (i.e., training generalizes to new speakers of the trained accent, but not to new accents). The current study extends these findings, examining whether training on multiple accents can result in accent-independent learning. Native English listeners were trained on recognition of foreign-accented speech by five speakers from different language backgrounds. They were then tested on the speech of two novel speakers. One of the speakers was a native speaker of a language included in the training set (Mandarin), and the other was a native speaker of a language not included in the training set (Slovakian). Listeners demonstrated better performance on both the Mandarin and Slovakian tests than untrained control subjects, demonstrating accent-independent learning after training on multiple foreign accents. This suggests that individuals in multilingual communities, who are exposed to significant variation in the input, may be able to achieve highly flexible speech perception systems.

5pSWa32. Effects of audiovisual auditory and articulatory training on second-language (L2) vowel category learning. Cristina Aliaga-Garcia (Departamento de Filologia Inglesa y Alemana, Universitat de Barcelona, Gran Via Corts Catalanes 585, 08007 Barcelona, Spain, cristinaaliaga@ub.edu)

Cross-language speech perception research has documented learners' difficulties in using and accessing L2 durational and spectral information. This study investigated the short-term effects of two types of audiovisual high-variability phonetic training—auditory versus articulatory training—on the perception of the 11 English RP monophthongal vowels. Bilingual Catalan /Spanish learners of English ($N=20$ in each training condition) and one control group ($N=20$) were tested before and after training. Perceptual gains were assessed through a four-choice categorization task with natural CVC words, a forced-choice categorization task based on four synthesized /hVd/ continua (/i:/-/ɪ/, /æ/-/ʌ/, /ʌ/-/ɑ:/ and /u:/-/ʊ/), and an AX discrimination task including 16 contrasting pairs. Significant perceptual accuracy gains were obtained in both auditory and audiovisual conditions. Pre- and postcategorization of synthesized vowels suggests that vowel perception improved, and that both training modalities had a similar positive effect on the learners' use of spectral and duration information in vowel categorization. These results are further discussed in terms of input effects on vowel category learning and the reweighting of acoustic cues through phonetic training.

5pSWa33. Semantic contextual cues and listener adaptation to foreign-accented English. Page Piccinini (2146 Sherman Ave., Apt. 1D, Evanston, IL 60201, p-piccinini@u.northwestern.edu) and Ann Bradlow (Northwestern Univ., 2016 Sheridan Rd., Evanston, IL 60208, abradlow@northwestern.edu)

The context surrounding words can facilitate word recognition for native and non-native listeners. However, for degraded speech signals, (e.g., with noise), non-natives may lose the ability to take advantage of contextual cues unless the speech is clearly produced [Bradlow and Alexander (2007)]. This study investigated whether: (1) foreign-accented speech degrades the signal such that natives show reduced ability to take advantage of context, and (2) both native and non-native listeners adapt to foreign-accented speech. Native and non-native listeners were exposed to accented speech in two blocks. In each block, half the sentence final words were in high and half were in low predictability contexts. Listeners were asked to identify sentence final words. In a single talker condition, natives benefited from context and adapted to the accent; non-natives could not use context but showed adaption. In a multitalker condition, natives neither benefited from context nor adapted to the accent. Non-natives benefited from context and adapted; however, the context effect was only seen when listener and speaker L1 matched. These results suggest that accented speech disrupts the native ability to take advantage of context, but this can be overcome by adaptation to the speaker. Non-natives benefit substantially from a talker-listener L1 match.

5pSWa34. Perception of dialectal variation: Can speakers of Western Canadian English perceive New Zealand English /r/-sandhi? Verona J. Dickout and Benjamin V. Tucker (Dept. of Linguist., Univ. of Alberta, 4-32 Assiniboia Hall, Edmonton, AB, Canada T6G 2E7)

The current study investigates perception of New Zealand English /ɾ/-sandhi by speakers of Western Canadian English. It investigates whether speakers of Western Canadian English can differentiate between intrusive-/r/ (e.g., *sawing* [sæoɹəŋ]) and linking-/ɾ/ (e.g., *soaring* [sæoɹəŋ]) of /ɾ/-sandhi across morpheme boundaries and across word boundaries (e.g., linking: *boar and*, intrusive: *boa and*). Reaction time and accuracy were recorded in a two-alternative forced choice experiment. Stimuli showed significant acoustic differences between the linking-/r/ and intrusive-/r/ environments, with intrusive-/r/ having a shorter duration than linking-/r/. Participants were highly accurate and faster at recognizing words with linking-/r/ (e.g., *soaring*) and extremely inaccurate and slower at recognizing intrusive-/r/ (e.g., *sawing*). Participants' responses to linking-/r/ at a morpheme boundary were significantly more accurate and faster than responses with linking-/r/ across word boundaries. The results of this experiment address the phonetic variability present in cross-dialect perception and begin to investigate strategies listeners utilize to accurately perceive speech.

5pSWa35. Perception of phonemic and allophonic contrasts in English- and Spanish-learning infants. Morgan Meredith (Commun. Sci. & Disord., Northwestern Univ., 2240 Campus Dr., Evanston, IL 60208, morgan.leigh@me.com) and Jessica Maye (Northwestern Univ., Evanston, IL 60208)

Infants from monolingual English- and Spanish-speaking homes were compared in their perception of two phonetic contrasts that differ in their phonemic status in the two languages. The contrast [d]-[ð] is phonemic in English but allophonic in Spanish; while the contrast [d]-flap is phonemic in Spanish but allophonic in English. Infants ranged from 6 to 16 months of age. Each infant was tested on discrimination of both contrasts. For half of the infants the stimuli were produced by a Spanish speaker, while for the other half of the infants the stimuli were produced by an English speaker. Data collection from Spanish-learning infants is still in progress. However, preliminary results indicate that infants in the youngest age group (6–8 months) are able to discriminate the [d]-flap contrast regardless of infant language background, while the [d]-[ð] contrast is discriminated poorly at this age in both language groups. English-learning infants lose sensitivity to the allophonic [d]-flap contrast with age, and it is not until 14–16 months that discrimination of the phonemic [d]-[ð] contrast improves in these infants. Spanish-learning infants are expected to remain proficient at discriminating the phonemic [d]-flap as they age and to remain poor at discriminating the allophonic [d]-[ð] contrast. [Work supported by NIH1R03HD048538 to JM.]

5pSWa36. The effects of linguistic experience on the perception of breathy phonation. Christina Esposito (Dept. of Linguist., Macalester College, 1600 Grand Ave., St. Paul, MN 55105, esposito@macalester.edu)

This study investigates the role linguistic experience has on the perception of phonation and the acoustic properties that correlate with this perception. Listeners from Gujarati (contrasts breathy versus modal vowels), Spanish (no breathiness), and English (allophonic breathiness) participated in two tasks. In the visual sort, subjects sorted breathy and modal vowels from a variety of languages into two groups based on perceived similarity of the talkers' voices. In the multidimensional scaling task, listeners heard pairs of Mazatec vowels, and moved a slider to indicate perceived similarity of vowels in each pair. Results showed that judgments were more uniform across subjects who had breathy categories present in their native language and varied across subjects who lack a breathy category. Despite allophonic breathiness, English listeners did no better at distinguishing phonations than Spanish listeners. The perceived similarity among the stimuli correlated with measurable acoustic properties (H1-H2, H1-A3, H1-A1, etc.). H1-H2 was the most salient acoustic property for Gujarati listeners (which correlates with their production of breathy vowels). English listeners relied weakly on the measure H1-H2, which is associated with the production of phonation in English. In addition, Spanish listeners, despite lacking a breathy category, relied on H1-H2 and H1-A1.

5pSWa37. Native language experience influences the perceived similarity of second language vowel categories. Thomas A. Farmer, Ran Liu, Neha S. Mehta, and Jason D. Zevin (Dept. of Psychiatry, Sackler Inst. for Develop. Psychobiol., Weill-Cornell Medical College, Box 140, New York, NY 10021, taf22@cornell.edu)

Most studies of L2 speech perception seek to characterize—at least implicitly—how the similarity among L2 speech sound categories is shaped by L1 experience. Intercategory similarity for native language speakers is rarely considered, however. Here, we derive two indices of graded intercategory similarity for a front vowel series (pin, pen, and pan): One from an off-line perceptual similarity judgment task and a second from online measures of arm-movement trajectories in a word recognition task. Both tasks revealed graded effects of intercategory similarity, but the similarity spaces differed between language groups. Both groups perceived /ae/ and /E/ to be most similar, but the native Italian speakers perceived /I/ to be equally similar to /E/ and /ae/, whereas English speakers perceived the /I/ and /E/ to be more similar than /I/ and /ae/. The Italian speakers' performance in both tasks suggests a similarity space that is dominated by dimensions that are contrastive for /I/ with respect to the other vowels. This may reflect a compensatory strategy for L2 vowel perception that may derive from experience with the distributional properties of their native vowels.

5pSWa38. The role of linguistic experience in the hemispheric perception of Mandarin tone. Shuang Lu (Prog. in Linguist., Univ. of Florida, Gainesville, FL 32611-5454, shuanglu@ufl.edu), Vincent J. van Heuven (Leiden Univ., 2300 RA Leiden, the Netherlands), and Ratree Wayland (Univ. of Florida, Gainesville, FL 32611-5454)

The current study investigated whether and to what extent lexical tone is processed as linguistic information by native Mandarin listeners, early Mandarin-Dutch bilinguals, second year Dutch students of Chinese, and monolingual Dutch students. Dichotic listening task was conducted in each of the four groups in order to determine to what extent the processing of lexical tones in Mandarin was lateralized to the left hemisphere. The majority of native Mandarin listeners revealed a right-ear advantage (REA) corresponding to a left-hemisphere lateralization in the perception of Mandarin tones. Similar to the native Chinese listeners, the Dutch-Mandarin bilinguals also exhibited an REA. Moreover, the left-hemisphere dominance was even more evident for these proficient bilinguals than for the native listeners. However, the Dutch listeners without any experience with Mandarin or other tonal languages showed no ear advantage. For the second year Chinese major listeners, five listeners revealed an REA, while others exhibited a bilateral pattern. The results suggested that there is a tendency for a right-ear advantage corresponding to left-hemisphere superiority for listeners with at least some basic experience of Mandarin tones.

5pSWa39. Category formation and lexical encoding of a new contrast. Isabelle Darcy, Laurent Dekydtspotter, Rex A. Sprouse (Dept. of Second Lang. Studies, Indiana Univ., 1021 E Third St., Bloomington, IN 47405, idarcy@indiana.edu), Christiane Kaden, John H. G. Scott, Vance Schaefer, and Michael McGuire (Indiana Univ., Bloomington, IN 47405)

The question whether category formation is a prerequisite for U.S.-English learners of French to encode a non-native contrast in lexical representations is investigated, looking at front [y-œ] and back [u-ɔ] rounded vowels. An ABX categorization experiment revealed no group difference between advanced ($N=18$) and inexperienced learners ($N=18$). Both made significantly more errors than French controls ($p<0.01$) on the [u-y] contrast, despite a good global discrimination (15% error). The possibility that minimal pairs of difficult contrasts (e.g., *sourd* [sur] deaf vs *sur* [syr] sure) are stored as homophones was tested in a lexical decision task with repetition priming. French words and non-words were paired with either themselves (*repetition*) or a minimal-pair-counterpart (*minimal pair*) in a 260 item list. Correct RTs were measured for each item. Given a comparable RT-advantage on the *repetition* and the *minimal pair* condition, merged lexical representations were assumed. Advanced learners, like native speakers, showed no RT-advantage for *minimal pair* conditions; inexperienced learners displayed significant facilitation for [u-y] and [ɔ-œ] minimal pairs (but not [i-y] control condition). This suggests that successful lexical contrast is possible for advanced English-French users despite persistent perception errors—the hallmark of an insecure category establishment—presenting an argument for the dissociation of both mechanisms.

5pSWa40. Relationship of prosody by Spanish speakers of English as a second language on the perception of intelligibility and accentedness by native English listeners. Paul Edmunds (Dept. of Linguist., Univ. of New Mexico, MSC06 3850, 1 University of New Mexico, Albuquerque, NM 87131)

The degree to which prosodic features related to English lexical stress affect the perception of factors such as intelligibility and accentedness by native English listeners was investigated. Acoustic analyses of English multi-syllabic words spoken by native Spanish speakers who learned English as a second language (ESL) were used to determine the values of the acoustic correlates of lexical stress of these speakers on a set of target words. Values for vowel duration, intensity, and fundamental frequency produced by the Spanish ESL speakers were compared to those values produced by native English speakers. Prosodic variation observed in the ESL speakers was used to formulate a range for manipulations to the target words. To focus solely on prosody and not take into account consonant and vowel quality, manipulations, using the PSOLA algorithm in Praat, were done to the

voices of native English speakers. These manipulations captured increases and decreases in duration, intensity, and fundamental frequency on vowels that should or should not carry lexical stress in a particular target word. Listeners rated the resynthesized tokens for factors such as intelligibility and accentedness, and the results suggest that a speaker's prosody alone can influence a native listener's judgments on these variables.

5pSWa41. The benefit of variation in cross-language perception of voice onset time (VOT). Meghan Sumner (Dept. of Linguist., Margaret Jacks Hall, Bldg. 460, Stanford Univ., Stanford, CA 94305-2150)

Listeners are consistently able to adjust to perceptually ambiguous sounds (Norris *et al.*, 2003; among others). When listeners are exposed to sounds ambiguous between two phonetic categories, boundaries adjust to the ambiguous signal. Perceptual learning has been suggested to account for adjustment to unfamiliar accents. It is not necessarily true, though, that this flexibility extends to more extreme cases of variation. Many sounds in accented speech are unambiguously mapped to the wrong category (e.g., unaspirated voiceless stops in French-accented English are perceived as voiced by native English listeners). We examined English listeners' perception of accented English in a perceptual learning paradigm with two exposure conditions: native French VOT mean and range in words that are lexically unambiguous (e.g., poach, *boach, not pet bet). Perceptual learning completely fails when listeners are exposed to the mean VOT, and in fact, this is coupled with an expanded voiced category, even though the words are lexically biased. Listeners make large adjustments when exposed to a range of VOTS, even those that are not good exemplars of English voiceless stops. The results are counter to models that suggest less variability improves learning, and suggest that variability in speech is used by and beneficial for listeners.

5pSWa42. The impact of native inventory versus native contrast on vowel discrimination. Marc Ettlinger (The Roxelyn and Richard Pepper Dept. of Commun. Sci. and Disord., Northwestern Univ., 2240 Campus Dr., Evanston, IL 60208, marc@northwestern.edu) and Keith Johnson (Univ. of California, Berkeley, Berkeley, CA 94720)

Theories of speech perception differ as to whether experience with sounds or with sound contrasts is more important when discriminating novel sounds. To explore this question, 21 American English, 16 Turkish, and 16 French speakers were tested on their ability to discriminate high front vowels in German (/i/~/y/~/Y/~/I/). The crucial difference between the participant languages is that English only uses the tense-lax contrast (/i/~/I/), while Turkish and French only use the rounding contrast (/i/~/y/). If contrast is crucial, then English speakers should be better at discriminating /y/~/Y/, whereas if the inventory is crucial, then they should be better at discriminating /I/~/Y/. The results of a fixed discrimination task show that there is no significant effect of language and that the tense-lax contrast (/i/~/I/; /y/~/Y/) is universally more easily discriminated than the rounding contrast (/i/~/y/; /I/~/Y/). The results of a rating task do reflect an influence of language, however with English-listeners rating /I/~/Y/ as more distinct and French and Turkish speakers rating /y/~/Y/ as more distinct. So, because English has /I/, but no rounding contrast, what matters in the perception of new sounds is not experience with contrasts, but rather experience with particular sounds.

FRIDAY AFTERNOON, 22 MAY 2009 SKY BRIDGE AUDITORIUM, 3:15 TO 4:45 P.M.

Session 5pSWb

Speech Workshop: Training and Adaptation of Speech Perception in Laboratory Contexts

Paul Iverson, Chair
Phonetics and Linguistics, University College London, London NW1 2HE, U.K

Contributed Papers

3:15

5pSWb1. Experience with computerized speech-perception training (SPATS-ESL) for speakers of other languages learning English. James D. Miller, Roy Sillings, Charles S. Watson (Commun. Disord. Technol., Inc., 501 N. Morton Str., Sta. 215, Bloomington, IN 47404), Isabelle Darcy, and Kathleen Bardovi-Harlig (Indiana Univ., Bloomington, IN 47405)

SPATS-ESL evolved as it was used by volunteers and as a supplement to classes in the Intensive English and English Enhancement Programs at Indiana University (Bloomington). These trials with eighty ESL-learners representing 12 L1s resulted in the curriculum described in the companion poster. Before training, the ESL learners exhibited significant problems with perceiving spoken English. These were greatest for syllable nuclei, least for syllable onsets, and intermediate for syllable codas. Recognition of spoken sentences was also inferior to that of native speakers of English. Improvement on all tasks including sentence recognition was proportional to the total time spent with SPATS. Based on the data and on reasonable extrapolations therefrom, many ESL-learners, after 20–30 hours of spaced practice with SPATS-ESL, appear to be approaching the performance of native-speakers of English on all SPATS-ESL tasks. Responses to questionnaires and comments indicate that the participants believed that SPATS-ESL training (a) was useful, (b) should be used in other classes, (c) helped them understand native speakers in real-life situations, and (d)would help them to improve their pronunciation of English. More advanced students were more enthusiastic about SPATS-ESL than less advanced students. Individual and group data supporting these generalizations and extrapolations will be presented.

3:33

5pSWb2. The role of selective attention in the acquisition of English tense and lax vowels by native Spanish listeners: Comparison of three training methods. Maria V. Kondaurova (Dept. of Otolaryngol., Head and Neck Surgery, Indiana Univ. Sch. of Medicine, 699 West Dr., RR044, Indianapolis, IN 46202, mkondaur@iupui.edu) and Alexander L. Francis (Purdue Univ., West Lafayette, IN 47906)

This study investigates the role of two processes, cue enhancement (learning to attend to acoustic cues which characterize a speech contrast for native listeners) and cue inhibition (learning to ignore cues that do not), in the acquisition of the American English tense and lax ([i] and [ɪ]) vowels by native Spanish listeners. This contrast is acoustically distinguished by both vowel spectrum and duration. However, while native English listeners rely primarily on spectrum, inexperienced Spanish listeners tend to rely exclusively on duration. Twenty-nine native Spanish listeners, initially reliant on vowel duration, received either enhancement training, inhibition training, or training with a natural cue distribution. Identification results demonstrated that, although listeners in all training groups increased their reliance on spectrum while decreasing reliance on duration, inhibitory and enhancement methods were significantly better than natural distribution training. Adaptive training was also more successful than the other methods for increasing be-

tween category distinctiveness on a discrimination task. These results suggest that phonetic learning may involve two distinct cognitive processes, cue enhancement and cue inhibition, that function to shift selective attention between separable acoustic dimensions. Moreover, cue-specific training (whether enhancing or inhibitory) appears to be more effective for the acquisition of second language speech contrasts.

3:51

5pSWb3. Investigating non-native category learning using a video-game-based training paradigm. Sung-joo Lim and Lori L. Holt (Dept. of Psychol., Carnegie Mellon Univ., 5000 Forbes Ave., Pittsburgh, PA 15213, sungjol@andrew.cmu.edu)

Adults have difficulty learning non-native speech categories, presenting an opportunity to study adult learning and plasticity with non-native speech categorization. Long-term training within laboratory-based response-feedback paradigms has produced modest non-native category learning in previous studies. The current study investigates the effectiveness of a video-game-based categorization training paradigm, found to be effective in learning novel nonspeech auditory categories [W. Holt, (2005)], to train native Japanese adults to categorize English /r/ and /l/. This approach emphasizes functional associations between sound categories and players' responses to video-game characters rather than overt phonetic categorization. Although categorization is not explicit in the game it is helpful to overall performance, providing a functional and perhaps more ecologically valid training signal than traditional feedback in standard laboratory training procedures. Japanese participants who played the game for about 2.5 h across 5 days with /r/ and /l/ sounds matched to game characters showed more nativelike perception of English /r/ and /l/ than control participants who played the game with nonspeech sounds. Listeners' categorization performance furthermore reflected regularities of the /r/-/l/ input distributions. In particular, variability across second-formant (F2) frequency may have encouraged listeners to shift perceptual cue weights toward more nativelike use of third formant (F3) frequency.

4:09

5pSWb4. Perception-production loop in native–non-native dialogs: Phonetic convergence. Natalie Lewandowski and Grzegorz Dogil (Inst. for Natural Lang. Processing, Univ. of Stuttgart, Azenbergstr. 12, 70174 Stuttgart, Germany, natalie.lewandowski@ims.uni-stuttgart.de)

The present study investigated the relation between the ability to adapt to the speech of a foreign language dialog partner and the individual variable of language talent. It was assumed that the actual degree to which one can converge to another speaker's pronunciation actually depends on his/her ability to pay attention to fine phonetic detail, to encode it, and to immediately reuse it in running speech—which was defined as phonetic talent. In order to analyze convergence in dialog, ten speakers of German (classified into two groups according to their proficiency and talent) performed a Diapix-task with a British and an American English conversational partner. Our main research goal can be described as follows: Does phonetic talent play a role in the perception-production loop and influence the process of accommodation towards a foreign dialog partner? The statistical analysis of the acoustic measurements revealed a significant effect for the factor talent across the American/British English conditions and also within the AE condition, indicating that the talented speakers have converged more. All results will be discussed assuming an underlying dynamic process, possibly involving a simultaneous interplay of convergence as well as divergence within a conversation.

4:27

5pSWb5. Second language influence on perception of first language phonotactics. Cynthia Kilpatrick (UCSD Linguist., 9500 Gilman Dr., #0108, La Jolla, CA 92093-0108)

The results of a speech perception experiment are reported, examining the responses of speakers of the same L1 (Spanish) with varying experience in the L2 (English). Three groups of speakers participated in a wordlikeness rating task in Spanish, in which nonce words were presented in sets that varied as to whether the final consonant of the word was phonotactically legal or illegal: (1) bilinguals who learned both English and Spanish before the age of 5, (2) L1 Spanish speakers that learned English after the age of 12, (3) monolingual speakers without communicative exposure to a second language. All groups differed significantly in the strength of their overall ratings, even though all speakers were technically native speakers of Spanish. In addition, for both the bilingual and second language speakers, ratings for legal vs illegal codas were significantly different. For monolingual speakers, on the other hand, ratings for legal and illegal codas were similar, but response times for these two conditions were significantly different. These results support the idea that native speaker judgements are affected by the extent of language experience that a speaker possesses, and the processing of phonotactic legality may not proceed similarly for monolingual, second language, and bilingual speakers.

Session 5pSWc

Speech Workshop: Keynote Address

Catherine T. Best, Chair
MARCS Auditory Labs., Univ. of Western Sydney, Penrith South DC, NSW 1797, Australia

Chair's Introduction—5:00

Invited Paper

5:05

5pSWc1. Automatic selective perception (ASP) of first-language (L1) and second-language (L2) speech: A working model. Winifred Strange (Speech Acoust. and Percept. Lab., CUNY-Graduate School, 365 Fifth Ave., New York, NY 10016-4309, strangepin@aol.com)

In this model, speech perception by adults is characterized as an active, information-seeking process whereby native listeners detect the most reliable acoustic parameters that specify phonetic segments and sequences, using highly over-learned, automatic selective perception routines. In laboratory perceptual tasks, differentiation of native (L1) phonetic contrasts is rapid and robust in suboptimal listening conditions even when the listeners focus on other levels of language structure, or indeed on another task. In contrast, late L2 learners must employ greater attentional resources in order to extract sufficient information to differentiate phonetic contrasts that do not occur in their native language. Phonetic and phonological modes of speech perception are described, which can be tapped in the laboratory by manipulations of stimulus complexity and task demands. These experimental manipulations reveal complex interactions between the linguistic experience of listeners and phonetic similarity relationships between L1 and L2 phonological inventories. Illustrative experimental evidence from studies of vowel perception using perceptual assimilation (cross-language identification), speeded discrimination, discrimination in speech babble, and brain indices of discrimination (MMN) will be presented to provide operational definitions of these concepts. Similarities and differences from other current theories of cross-language and L2 speech perception will be discussed. [Work supported by NIH, NSF.]

5:50—6:15 panel-discussion

Session 6aSWa

Speech Workshop: New Perspectives on Developmental Models

Ann R. Bradlow, Chair
Dept. of Linguistics, Northwestern Univ., Evanston, IL 60208

Chair's Introduction—9:00

Invited Papers

9:05

6aSWa1. Infant magnetoencephalography studies exploring neural links between sensory and motor representations for speech. Patricia K. Kuhl (Univ. of Washington, Inst. for Learning & Brain Sci., Mailstop 357920, Seattle, WA 98195-7920, pkkuhl@u.washington.edu)

The adult brain exhibits anatomical and functional specialization specific to speech, but we have little information regarding the infant brain. Recent adult neuroimaging studies show that speech processing is left-lateralized and that two regions of the brain, the superior temporal (ST, auditory area) and inferior parietal (IF, motor area), contribute to the brain's response to speech. To explore brain activation to speech and nonspeech in infants, we used magnetoencephalography to image the whole brain. Experiment 1 examined infants at three ages: newborn, 6 months, and 12 months. Infants showed significant ST activation to both speech and nonspeech stimuli. IF activation was not observed in newborns but in the two older groups of infants we observed synchronous IF and ST activation that was unique to speech. Experiment 2 investigated the nature of this perceptual-motor coupling for speech—specifically, we asked whether synchronous activation reflects the detection of speech signals per se, or whether it signals the recognition of experienced (native-language) speech. Native, non-native, and nonspeech analogs were used to test these alternatives. Our results elucidate the developmental time course of the sensory-motor connections for speech, and address longstanding theoretical issues in speech perception.