

Session 5aSCa

Speech Communication: Speech and Hearing in Targeted Populations (Poster Session)

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All posters will be on display from 8:00 a.m. to 11:00 a.m. To allow contributors an opportunity to see other posters, contributors of odd-numbered papers will be at their posters from 8:00 a.m. to 9:30 a.m. and contributors of even-numbered papers will be at their posters from 9:30 a.m. to 11:00 a.m.

5aSCa1. Making young ears old and old ears even older: Simulating a loss of synchrony. Ewen MacDonald, Kathy Pichora-Fuller, Bruce Schneider, and Willy Wong (Univ. of Toronto, Toronto, ON Canada M5S 3G9)

Age-related changes in the auditory system have been attributed to three independent factors: OHC damage, changes in endocochlear potentials, and loss of neural synchrony. In previous studies, a jitter algorithm has been used to simulate the loss of synchrony in young adults (MacDonald *et al.*, 2005). In this study, the effect of jitter on old adults with good audiograms in the speech range is explored. SPIN-R sentences were presented in two SNR and three processing conditions: intact, jitter, and smear. The parameters of the jittering algorithm were the same as those used with young adults. The parameters of smearing algorithm were chosen to match the spectral distortion produced by jitter algorithm. While both the jitter and smear conditions resulted in a significant decline in word identification, the decline was largest in the jitter condition. Psychometric functions were fitted to the data and compared to previous work with young adults. The comparison supports the hypothesis that loss of synchrony can adversely affect speech intelligibility in noise, and is consistent with the hypothesis that loss of synchrony occurs with age. As well, the comparison suggests that the effect of jitter may be linear.

5aSCa2. Adult age differences in the use of envelope cues to identify noise-vocoded words with a varying number of frequency bands. Signy Sheldon, Kathy Pichora-Fuller, and Bruce Schneider (Univ. of Toronto at Mississauga, Rm. CCIT 4163, 3559 Mississauga Rd., Mississauga, ON, L5L1C6, Canada, signy.sheldon@utoronto.ca)

Older adults with good audiograms have difficulty understanding speech in noise. Age-related differences have been found on some temporal processing measures such as gap detection; however, older adults are believed to have well-preserved ability to use envelope cues to identify words. Following Shannon *et al.* (1995), we used noise-vocoded speech such that the amplitude envelope of speech was retained in frequency bands but filled with noise, thereby obliterating fine structure cues within each band. In experiment 1, younger and older listeners heard a list of words. Each word was presented first with one vocoded frequency band, and the number of bands was incremented until the listener correctly identified the word. The average number of bands required for correct identification was found to be identical for both age groups. In experiment 2, both age groups identified words in four blocked noise-vocoded conditions (16, 8, 4, and 2 bands). Younger adults outperformed older adults. Al-

though older adults were as able as younger adults to use envelope cues cumulatively in experiment 1, they were less able to use these cues without the benefit of repetition.

5aSCa3. Audiovisual perception of voicing with age in quiet and cafe noise. Dawn Behne (Dept. of Psych., Norwegian Univ. of Sci. and Technol., 7491 Trondheim, Norway), Yue Wang (Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada), Magnus Alm, Ingrid Arntsen, Ragnhild Eg, and Ane Valsø (Norwegian Univ. of Sci. and Technol., 7491 Trondheim, Norway)

Research has shown that voicing is difficult to discern in noisy environments. While voicing may be difficult to resolve from visual cues, acoustic cues for voicing are relatively robust. This study addresses these factors with normally aging audiovisual perception. Identification responses were gathered with 19–30-year-old and 49–60-year-old adults for audiovisual (AV) CVs differing in voicing and consonant place of articulation. Materials were presented in quiet and in cafe noise (SNR=0 dB) as audio-only (A), visual-only (V), congruent AV, and incongruent AV. Results show a tendency toward use of visual information with age and noise for consonant place of articulation. Notably for voicing, incongruent AV materials that had one voiced component, regardless if it was A or V that was voiced, were consistently perceived as voiced in both age groups and regardless of noise. Only if the A and V components were both voiceless was the syllable perceived as voiceless. These findings indicate the influence of age and noise in the use of perceptual information to identify place of articulation. That voicing is robustly salient from either audio or visual information, despite the unlikely presence of strong visual cues for voicing, indicates a possible bias toward the perception of voicing.

5aSCa4. Energy suppression of steady-state portions of vowels while maintaining the energy of consonants better improves speech intelligibility for elderly listeners in reverberation. Yusuke Miyauchi and Takayuki Arai (Dept. of Elec. and Electron. Eng., Sophia Univ., 7-1 Kioi-cho, Chiyoda-ku, Tokyo 102-8554 Japan, m-yuusuk@sophia.ac.jp)

In a reverberant environment, overlap-masking renders speech perception difficult. Arai *et al.* proposed that energy suppression of steady-state portions of speech improves speech intelligibility with young subjects [Acoust. Sci. Technol. 23, 229–232 (2002)]. Audibility degrades with age. Therefore, reverberation can be a more critical barrier to speech perception by elderly listeners. To investigate the effect of suppressing reverberation for elderly people, a listening test was conducted with 25 elderly

subjects (mean age: 73.3 years) using the following three types of speech: (a) speech without energy suppression of steady-state portion, (b) speech with the suppression of steady-state portions of speech, and (c) speech with the suppression only of vowels, while maintaining the energy of consonants. As expected, speech intelligibility by method (b) (46.7%) was markedly improved from (a) (42.2%), but method (c) (52.0%) improved it more. Because the energy of consonants is less than that of vowels, overlap-masking attendant on previous vowels would largely affect perception of subsequent consonants. These results suggest that suppressing the steady-state portions of vowels while maintaining the energy of consonants serves elderly persons well to improve speech intelligibility in a reverberant environment. [Work supported by JSPS.KAKENHI (16203041).]

5aSCa5. Older adult's identification and memory of synthetic and natural speech in noise. Candice Q. McCarty and Aimee Surprenant (Purdue Univ., 703 Third St., West Lafayette, IN 47907)

This research tested older adult's performance on identification and recall when presented sentences taken from the Speech Perception in Noise Test [Bilger *et al.*, *J. Speech Hear. Res.* **27**, 32–48 (1984)] synthesized using AT&T Natural Voices speech synthesizer. Performance on synthesized speech was compared to identification and recall of natural speech in noise. In experiment 1, participants were instructed to identify the final word of high- and low- predictability natural and synthesized sentences presented at three signal-to-noise ratios. The results showed that natural speech was easier to identify than synthesized speech at every speech-to-noise ratio for high and low predictability sentences. In addition, replicating Pichora-Fuller *et al.* [*J. Acoust. Soc. Am.* **97**, 593–608 (1995)], pure tone thresholds were significantly correlated with identification performance for both natural and synthetic speech. In experiment 2, participants were given a sentence span task in which they were presented two to five natural and synthesized sentences and asked to recall the final words. These experiments show that, even with high context, synthetic speech is more difficult to understand and remember than natural speech. These results highlight concerns about the use of synthesized speech in assistive devices, particularly for elderly listeners. [Work supported by NIH.]

5aSCa6. Spectral shape discrimination and speech identification in noise in elderly hearing-impaired listeners. Mini Shrivastav (Dept. of Commun. Sci. and Disord., Univ. of Florida, 336 Dauer Hall, Gainesville, FL 32611)

Elderly hearing-impaired listeners have difficulties in the recognition and discrimination of consonants, particularly those that share the same manner of articulation. An important cue that distinguishes the manner of articulation of these consonants is spectral shape. A previous study (Shrivastav *et al.*, 2006) found a moderate predictive relation between spectral-shape discrimination thresholds and syllable identification scores of elderly hearing-impaired listeners, when all stimuli were presented in quiet. The present study examined the contribution of spectral-shape discrimination abilities to speech-identification performance of elderly hearing-impaired listeners in the presence of background noise. The study included a group of elderly hearing-impaired listeners, with a group of young normal-hearing adults included for comparison purposes. Listeners were tested on a series of speech-identification and spectral-shape discrimination tasks, while ensuring that all stimuli were at least minimally audible to all the hearing-impaired listeners. The contribution of spectral-shape discrimination abilities to speech-identification performance in background noise was examined and compared to the results in quiet for young normal-hearing and older hearing-impaired listeners.

5aSCa7. The use of subsegmental information in sentence comprehension with or without formant transitions by normal-hearing and hearing-impaired listeners. Jae Hee Lee and Diane Kewley-Port (Dept. of Speech and Hearing Sci., 200 S. Jordan Ave., Bloomington, IN, 47405, jaejalee@indiana.edu)

Using a noise replacement paradigm, Lee and Kewley-Port [*J. Acoust. Soc. Am.*, **119**, (2006)] examined sentence comprehension by young normal-hearing (YNH) and elderly hearing-impaired (EHI) listeners when sentences were processed to present only subsegmental information (i.e., either steady-state or formant transitions) in sentences processed in four different ways. Results showed that correct word responses by EHI listeners were more affected by the type of information in the four conditions compared to YNH listeners. To compare the use of subsegmental information between listener groups who were carefully matched for audibility and age, new analyses of correctly identified phonemes and different word-error patterns were made for both correct and incorrect word responses. Correlation analyses examined the relations among correct and incorrect word responses, phoneme scoring, hearing thresholds, and age. Despite a larger number of incorrect answers by EHI listeners, word-error patterns, as well as an ability to extract phonemes using subsegmental information, were similar between YNH and EHI listeners. Analyses for EHI listeners showed correct word responses were strongly correlated with correct phoneme identification and with hearing thresholds, but not with age. [Work supported by NIHDCD-02229.]

5aSCa8. Auditory-visual integration and lipreading abilities of older adults with normal and impaired hearing. Mitchell S. Sommers (Dept. of Psych., Washington Univ., Campus Box 1125, St. Louis, MO 63130, msommers@wustl.edu), Nancy Tye-Murray, and Brent Spehar (Washington Univ. School of Medicine, St. Louis, MO 63130)

The current study investigated how age-related hearing impairment affects lipreading and auditory-visual integration in older (above age 65) individuals. The performance of 53 normal-hearing and 24 mild-to-moderate hearing-impaired older adults was compared on auditory-only (A), visual-only (V), and auditory-visual (AV) speech perception, using consonants, words, and sentences as stimuli. All testing was conducted in the presence of individually specified multi-talker background babble, to obtain approximately equivalent A-only performance across the groups. In addition, we compared normal-hearing and hearing-impaired individuals on measures of auditory enhancement, visual enhancement, and auditory visual integration that were derived from the A, V, and AV performance scores. In general, normal-hearing and hearing-impaired older adults performed similarly on measures of visual-only and auditory-visual speech perception. The one exception to this finding was that hearing-impaired adults performed significantly better than normal-hearing participants on visual-only identification of words. Measures of visual enhancement, auditory enhancement, and auditory-visual integration did not differ as a function of hearing status. Overall, the results of the current study suggest that despite increased reliance on visual speech information, hearing-impaired older adults do not exhibit better visual-only speech perception or auditory-visual integration than age-matched normal-hearing individuals.

5aSCa9. Effects of intermodal timing difference and speed difference on auditory-visual speech perception. Akihiro Tanaka (Dept. of Psych., Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, 113-0033 Tokyo, Japan, tanaka@L.u-tokyo.ac.jp), Shuichi Sakamoto, Komi Tsumura, and Yo-iti Suzuki (Tohoku Univ., Sendai 980-8577, Japan)

Previous studies have shown that lipreaders possess insufficient sensitivity to intermodal timing differences and adapt to the timing difference when it is kept constant. This study investigated effects of intermodal timing differences and speed differences on auditory-visual speech perception. We used 20 minimal pairs of Japanese four-mora words such as *mizuage* (catch landing) versus *mizume* (starch syrup). We administered intelligibility tests to younger and older adults. Words were presented