this work, we examine acoustic feature changes in time-compressed speech processed using synchronized overlap-add (SOLA) method. Also, we discuss which parts of speech (consonants or vowels) are more affected by time compression. In the temporal domain, we compare the duration of consonants, vowels and voice onset times (VOT) in both 50% compressed speech and natural speech. We also examine the long-term power spectra of both signals. Possible effects on speech intelligibility will be discussed.

4aPP11. Correlation of speech recognition by cochlear implant users with metrics based on thresholds and loudness levels. Li Xu (School of Hearing, Speech and Lang. Sci., Ohio Univ., Athens, OH 45701) and Bryan Pfingst (Univ. of Michigan, Ann Arbor, MI 48109-0506)

Intersubject variability in speech recognition is a persistent characteristic of cochlear implant users, despite significant improvements in average performance. This study examines simple psychophysical measures, maximum comfortable loudness levels (C-levels) and dynamic ranges (DRs) that may serve for diagnosis of conditions that affect speech recognition. Eighteen subjects who had used Nucleus CI24 cochlear implants for a minimum of 1 year participated in the study. T and C levels were measured using the method of adjustment. Consonant, vowel, and sentence recognition were tested using the subjects everyday speech processors (SPEAK or ACE). Across-site variation (ASV) was quantified for each subject using the variance of the T and C levels across all tested stimulation sites. Mean DRs (C levels minus T levels) for all tested sites were calculated for each subject. The results showed a moderate but significant negative correlation between speech-recognition performance and ASV of the T and C levels measured with both monopolar and bipolar electrode configurations. Mean DRs also correlated with speech performance. These results support the hypothesis that the large across-site variation in detection thresholds and small dynamic range reflect conditions that are detrimental to speech-recognition with cochlear implants. [Work supported by NIDCD Grant DC03808.]

4aPP12. Effects of short-term training on the recognition of spectrally shifted vowels by non-native listeners. Tianhao Li, Qianjie Fu, and Geri Nogaki (DAIP, House Ear Inst., 2100 W. 3rd St., Los Angeles, CA 90057, tianhaol@usc.edu)

Previous studies have shown that normal-hearing (NH) native listeners can rapidly adapt (though not always completely) to spectrally mismatched speech with short-term training. However, it is unclear how short-term training might affect the performance of non-native listeners. The present study investigated whether non-native listeners' recognition of spectrally shifted English vowels could be improved by moderate short-term training. Recognition of 12 American English vowels (in c/V/c format) was trained and tested in five Chinese-speaking NH subjects; speech tokens were processed by an eight-channel noise-band vocoder in which the spectrum was upwardly shifted by one octave. After baseline testing subjects were trained with shifted speech for 5 consecutive days; daily training consisted of three to four sessions, each of which included a 5-min preview of the test tokens and a 10-min test. Results showed that for all subjects, recognition of spectrally shifted English vowels improved significantly over the 5-day training period. These results show that non-native listeners are able to rapidly adapt to spectrally mismatched speech with short-term training. The ability to fully accommodate spectrally shifted speech may depend on non-native listeners experience with the second language. [Research supported by NIDCD R01-DC-04993.]

THURSDAY MORNING, 18 NOVEMBER 2004 ROYAL PALM SALON 5, 9:00 TO 11:15 A.M.

Session 4aSA

Structural Acoustics and Vibration: Vibration of Sports Equipment

Daniel A. Russell, Chair

Science and Mathematics Departments, Kettering University, 1700 West Third Avenue, Flint, Michigan 48504-4898

Invited Papers

9:00

4aSA1. Vibration and sound radiation of solid wood and tubular metal baseball bats as a function of ball–bat location. Robert D. Collier (Thayer School of Eng., Dartmouth College, Hanover, NH 03755), Kenneth Kaliski (Resource Systems Group, Inc., White River Junction, VT 05001), and James A. Sherwood (Univ. of Massachusetts Lowell, Lowell, MA 01854)

The ''crack of the bat'' is an important part of the game of baseball played with solid wood bats. The spectral characteristics of the radiated sound depend on the location of the ball–bat impact location along the length of the barrel and the resulting bat vibration. Balls hit on the sweet spot generally are hit harder and result in a distinct and recognizable ''crack'' sound. On the other hand, balls hit in on the handle or off the end of the barrel result in different modes of vibration and low-frequency radiation, i.e., a ''thunk-like'' sound. Analytical predictions and modal analyses, supported by both laboratory and field measurements, provide a more comprehensive picture of bat vibration and radiated sound relationships. Comparisons are made with tubular metal bats which exhibit the narrow-band signature due to excitation of the cylindrical breathing (bell) modes which are essentially independent of hit location. The differences in bat vibration and sound radiation can provide important clues for baseball players in the field.

9:30

4aSA2. Cricket bats: Some performance and vibration control issues. Sabu John, Cao Jialong, Fatmir Gutaj (RMIT Univ., School of Aerosp., Mech. and Manuf. Eng., Bundoora East Campus, Bundoora, VIC 3083, Australia), and Tom Molyneaux (RMIT Univ., Melbourne, VIC 3001, Australia)

This paper will address some of the issues in an on-going research project involving the performance optimization and vibration control of Cricket bats. In many ways, the rules of the game have made our task a little easier by restricting exactly what we can modify in order to improve performance. For example, the blade or the hitting proportion of the Cricket bat has to remain as wood but

its geometry can be altered to fit within a volume-based specification. The handles specification, however, is not specified. Hence by our interpretation of the rules of the game, this lack of specificity for the handle in the rules provides an opportunity to improve the performance of the Cricket bat as a whole by making material and geometric modifications to the handle. This paper will address the investigation of bat performance from a dynamics and vibration analyses perspective. This paper will report on parameters such as bat–ball contact time and translation, clustering of distal node points (DNPs) to mimic an enhanced sweet spot. Results showing performance comparisons between traditional and composite material-handle bats will be presented along with computational and analytical results for various handle shapes.

10:00–10:15 Break

10:15

4aSA3. Dynamic characterization of golf equipment. Tom Mase (Composite Mater. and Structures Ctr., Michigan State Univ., East Lansing, MI 48824)

In the golf swing the shaft, head, and ball respond at different time scales. The shaft is swung from the top of the back swing to impact in less than a half second. In that time, the shaft loads and unloads in different ways for different shafts. Natural frequencies and mode shapes characterize different shafts uniquely making some shafts better than others for individual golfers. Shafts are benchmarked by measuring their stiffness profile along the length of the shaft. Knowing this, a shaft finite element model is generated from which the natural frequency is found. Shaft zone frequencies, an important fitting method, are cantilevered natural frequencies found from the stiffness profile. As for golf balls, their core and cover mechanical properties influence performance and feel. The loading of the golf ball occurs in 0.0005 s. Golf ball stiffness and damping properties are measured using DMA and universal testing machines. Distance balls have cores that are nominally twice as stiff as performance balls, making them feel harder to the golfer. Performance and distance balls also respond to strain rate changes differently. Ultimately, stiffness properties affect the initial velocity, spin, and launch angle which dictate the distance the ball flies.

10:45

4aSA4. The sweet spot of a hollow baseball or softball bat. Daniel Russell (Sci. and Mathematics Dept., Kettering Univ., Flint, MI 48504)

The ''sweet spot'' of a baseball bat is often defined as a region approximately 5–7 in. from the barrel end of the bat where the performance (as measured by a batted-ball speed) is the greatest and the vibrational sensation (the sting felt in the hands) is minimized. In terms of the vibrational properties of a bat, the sweet spot region includes the nodes of the first two bending vibrational modes and is often also identified as being related to the center-of-percussion (COP). This paper will discuss recent research which shows that the COP has no bearing on performance and little, if any, on the perception of feel. We will also discuss the contribution of the bending vibrational modes to the location of the sweet spot and compare results for a wide variety of wood, metal and composite baseball and softball bats. We will attempt to correlate the sweet spot defined in terms of performance and that defined in terms of vibrational sensation. Finally, we will discuss the contribution of the hoop mode, unique to hollow bats, which correlates strongly to performance, and which may also influence the perception of feel.

THURSDAY MORNING, 18 NOVEMBER 2004 SUNRISE AND SUNSET ROOMS, 8:00 A.M. TO 12:00 NOON

Session 4aSC

Speech Communication: Foreign-Accented Speech: Production, Perception and Applications (Lecture/Poster Session)

Amee P. Shah, Chair

School of Communication Sciences and Disorders, McGill University, 1266 Pine Avenue West, Montreal, Quebec, H3V 1C2 Canada

Chair's Introduction—8:00

Invited Papers

8:05

4aSC1. Why do non-native speakers have a foreign accent? A three-dimensional perspective. Amee P. Shah (School of Commun. Sci. and Disord., McGill Univ., 1266 Pine Ave. West, Montreal, QC H3V1C2, Canada, amee.shah@mail.mcgill.ca)

A three-dimensional perspective, following the speech-chain model, is taken in arriving at the variables that influence the production and perception of foreign-accented speech. Essentially, research to date indicates the interactive role of all three communication components of the speech-chain model. First, speech-related variables, i.e., the interlanguage differences in the phonetic patterns of the speech, of L2 speakers compared to the L1 speech patterns influence listeners perception of accentedness of non-native