

elasticity and viscosity were observed with the induced changes in hydration. These findings supported the hypothesis that hydration affects voice production by altering tissue viscoelastic properties.

3aSC11. Analysis of asymmetric vocal fold vibrations in a finite-element model. David A. Berry (UCLA School of Medicine, Div. of Head and Neck Surgery, 31-24 Rehab Ctr., Los Angeles, CA 90095-1794, daberry@ucla.edu) and Fari Alipour (Univ. of Iowa, Iowa City, IA 52242)

Asymmetric vibrations of a finite-element model of the vocal folds were analyzed using the method of empirical eigenfunctions. In a previous study of symmetric vibrations from the model, periodic vibrations yielded two dominant eigenfunctions, which were related to the theoretical normal modes of the model. In a more recent study, the method of empirical eigenfunctions was applied to high-speed endoscopic imaging of vocal fold vibration on human subjects, suggesting several mechanisms of irregular vibration. However, in the *in vivo* study, the investigation of empirical eigenfunctions was limited to the superior view provided by endoscopy. The results of the present computational study were compared with the *in vivo* study, while providing additional information regarding vocal fold vibration along the medial surface of the folds. Moreover, the computational study allowed the asymmetric vibrations to be studied systematically as a function of tissue stiffness. [Work supported by Grant No. R29 DC03072 from the National Institute on Deafness and Other Communication Disorders.]

3aSC12. Wavelet analysis of turbulence in the glottal jet flow. Fariborz Alipour (Dept. of Speech Pathol. and Audiol., Univ. of Iowa, Iowa City, IA 52242-1012)

Airflow from the lungs drives the vocal folds into oscillation and exits the glottis as a turbulent jet, even though laminar flow is documented entering the glottis. Incomplete glottal closure may result in air leakage that becomes turbulent. This turbulence is thought to be the main source of breathiness in the voice. Few studies have measured degree of turbulent noise in the glottis. This turbulent noise adds significant amounts of energy to the voice signal and cannot be extracted easily without changing the voice. In this study, the turbulent jet was investigated in an excised canine larynx model with simultaneous recordings of air particle velocity, subglottal pressure, airflow rate, and EGG signal for various conditions of phonation. The velocity was measured with a constant-temperature hot-wire anemometer system. To separate the turbulence from the periodic component of the velocity signal, the technique of wavelet denoising was employed. In this method, unlike the Fourier transform which decomposes the signal into periodic components, wavelet denoising uses template matching transform to approximate the signal with different resolution or scale. Results indicate that the high resolution part contains the turbulent noise. [Work supported by NIDCD Grant No. R01 DC03566.]

3aSC13. Effects of syllable position on F_0 and duration in Mandarin disyllabic words. Ching X. Xu and Yi Xu (Dept. of Commun. Sci. and Disord., Northwestern Univ., Evanston, IL 60208, xxq@nwu.edu)

In a previous attempt to fit a pitch target approximation model for F_0 contours in Mandarin disyllabic words [Xu *et al.* (1999)], it was found that the implementation of tonal targets required two sets of values for the model parameters, one for each of the two syllable positions. This suggests that syllable position may have an effect on the production of the syllable. The present study is designed to further examine this position effect. One-hundred-eleven disyllabic words with various tonal combinations were read by native Mandarin speakers with two carrier sentences. Duration and F_0 analyses were performed. Preliminary results indicate that a syllable has longer duration, higher F_0 , and closer-to-ideal F_0 shape when it is in the first position than in the second position. These results agree with previous acoustic-phonetics findings about Mandarin

disyllabic words, and together they seem to suggest that the first syllable in a disyllabic word is more stressed than the second one. Interestingly, this appears to be at odds with current phonological theories about Mandarin prosody, which maintain that the second syllable carries greater weight than the first in a disyllabic foot. Possible causes for this discrepancy will be discussed.

3aSC14. Experiment on pitch target approximation model for generating Mandarin F_0 contour. Xuejing Sun, Ching X. Xu, and Yi Xu (Dept. of Commun. Sci. and Disord., Northwestern Univ., 2299 N. Campus Dr., Evanston, IL 60208, sunxj@northwestern.edu)

In the present study, an experiment was conducted to generate F_0 contours for Mandarin with a pitch target approximation model proposed in Xu, Xu and Luo (1999). In this model, F_0 contours in speech are assumed to be resulting from asymptotic approximation to underlying pitch targets that are either static or dynamic. The model parameters were estimated through nonlinear regression using the Levenberg–Marquardt algorithm. The speech corpus consisted of sentences from Voice of America broadcasting news. After the regression analysis, sentences were re-synthesized with the generated F_0 using the TD-PSOLA technique. Preliminary results indicate that F_0 contours generated by the model are close to the original both numerically and perceptually. Furthermore, most underlying pitch targets obtained through the regression analysis seem to match the models basic assumptions. However, it is also apparent that information about both higher-level linguistic functionality and additional low-level articulatory constraints is needed to account for the numerical variations in the estimated parameters. In general, the results are encouraging as they show that the model can generate close-fitting F_0 contours even with strong linguistic assumptions. This suggests that it has the potential to evolve into a system with the predictive power desirable for intonation modeling.

3aSC15. Pitch peak alignment as a function of lexical and pragmatic factors in two dialects of Serbian/Croatian. Rajka Smiljanic (Univ. of Illinois at Urbana–Champaign, 707 S. Mathews, Urbana, IL 61801)

This study examines the patterns of pitch peak retraction under focus in Serbian/Croatian (S/C). Acoustic measures of pitch peak alignment were used to identify the effect of pragmatic focus on pitch realization in two dialects of S/C with typologically distinct prosodic systems. In the Belgrade dialect there is a lexically determined contrast between two tonal alignments: early peak (“falling accent”) and late peak (“rising accent”). In the Zagreb dialect there is no such lexical distinction; instead, each word typically receives a pitch prominence on the stressed syllable. Subjects produced target words with neutral intonation and with narrow/contrastive focus. The peak alignment under these two pragmatic conditions was shown to vary in the two dialects. Zagreb shows peak retraction from late (neutral intonation) to early peak (narrow focus). In this way it is similar to other stress languages (e.g., Spanish). Belgrade, with lexically contrastive peak alignment, shows much less pragmatically conditioned variation in the position of accentual peaks. The two types of pragmatically conditioned alignment in Zagreb correspond closely to the two lexically determined alignments of Belgrade. This suggests that the existence of the lexical contrast limits the pitch variation due to the pragmatic influence, while in the absence of such contrast, pragmatic factors entirely determine peak alignment.

3aSC16. Acoustic/prosodic characteristics of repetitions and substitutions in medical dictations. Guergana K. Savova (Univ. of Minnesota, Minneapolis, MN and Lernout & Hauspie, 5221 Edina Industrial Blvd., Edina, MN 55439)

This paper describes the results of a pilot study on the acoustic characteristics of two types of disfluencies exact repetitions and exact substitutions. The study was conducted at Linguistic Technologies, Inc., a com-