phonemic context and speaking modality and on the spatial and temporal extent of anticipatory nasal coarticulation in English. Target words are English (C)VNCvoiced (e.g., *bend*) and (C)VNCvoiceless (e.g., *bent*) words spoken in either clear or citation speech modes. In order to enhance the percept of /n/ in clear speech, speakers increase the duration of the nasal consonant in CVNCvoiced words but marginally increase, or even decrease, /n/ duration in CVNCvoiceless words. While highly variable, airflow results suggest little difference on anticipatory nasalization as a function of speech mode. These results argue against models predicting a global reduction in coarticulation in clear speech.

**1pSC11. Tone-glottal coarticulation in a complex tone language.** Christian T. DiCanio (CNRS-Dynamique du Langage, UMR 5596, Université Lyon-2, 14 Ave. Berthelot, Lyon 69363, France, cdicanio@gmail.com)

A majority of the research on coarticulation has focused on consonant and vowel timing, but work on the coarticulation of tone or phonation-type contrasts has received relatively less attention until recently [Brunelle (2003); Miller (2007); Peng (1997); Silverman (1997); Xu (1994); (1997); (1998); (1999); (2004); (2005); Xu *et al.* (2006); Xu and Liu (2006); Xu and Sun (2002); Xu and Wang (2001)]. The present work investigates the coarticulatory timing relationships between the nine tonal contrasts and three laryngeal contrasts (creak, glottal closure, and breathiness) of Itunyoso Trique [DiCanio (2008)]. Acoustic and electroglottographic (EGG) data from Trique were collected, comparing the realization of the tones in the different laryngeal conditions. While creaky phonation induces an equivalent pitch lowering for a variety of tones, breathy phonation induces pitch lowering in an asymmetrical fashion where higher tones have a greater pitch decrease than lower tones. These particular effects are not predictable from a perceptually-driven model of coarticulation, but accord well with the body-cover model of vocal-fold vibration [Titze (1994); Story & Titze (2003)]. The timing of non-modal phonation in Itunyoso Trique reflects a language-specific coarticulation strategy, but the observed pitch perturbation effects are best-explained with a speaker-oriented model of coarticulation.

**1pSC12. Lexical tone and segmental coarticulation.** Augustine Agwuele (Dept. of Anthropology, Texas State Univ. San Marcos, San Marcos, TX 78666)

In studying anticipatory coarticulation in emphatic CV sequences [Lindblom *et al.*, J. Acoust. Soc. Am. **121**, 3802–3813 (2007)] and in fast speech [Agwuele *et al.*, Phonetica **68**, 194–209 (2008)], it was shown that prosodically induced modulations of speech introduce additional sources of phonetic variation separate from those generated by vowel context. Both studies were successful in dissociating these additional prosodic effects from the underlying contextual vowel variation and quantifying them. The focus of this current investigation was to study CV coarticulation, using a similar set of regression metrics, but now applied to a tonal language (Yoruba). It is to be determined whether lexical tone impacts the coarticulation of consonant and vowel. Specifically, words, do tones, produce additional effects on anticipatory CV coarticulation separate from those generated by vowel-context similar to emphatic stress and increased tempo as documented by the aforementioned studies? Finally, of interest also is to examine whether different lexical tones impact C+V coarticulation differently.

**1pSC13. Vowel normalization using stop consonant loci.** Christian Koops (Dept. of Linguist., Rice Univ., 6100 S. Main St., Houston, TX 77005, ckoops@rice.edu)

Vowel normalization techniques used in sociophonetics aim to eliminate the influence of vocal tract length differences on resonant frequencies so that speaker-specific vowel configurations can be compared more precisely. In vowel-extrinsic methods, a speaker's F1-F2 range is scaled up or down, and vowel spaces are aligned using the geometrical F1-F2 mean. However, a speaker's F1-F2 mean may be systematically biased if his or her vowel configuration is affected by a set of parallel vowel shifts, e.g., fronting or raising of several vowels in a chain shift. To address this problem, an alternative method of deriving speaker-specific scaling factors was tested based on a vowel-independent acoustic measure: the locus (virtual origin) of the second formant transition following the /d/-release. Forty adult speakers of American English (20 male, 20 female) were recorded reading ten repetitions of 16 /dVd/-words. From these data, individual F1-F2 means and locus equations were calculated, including each speaker's F2 locus frequency for /d/. Preliminary results based on the corner vowels /i, a, u/ show that F2 locus and F1-F2 mean are strongly correlated ($r$-squared=0.84). Statistical modeling is underway to determine whether scaling factors derived from locus analysis are superior to scaling factors derived from F1-F2 means.

**1pSC14. Fine-grained control of voice-onset time production, lexical usage-frequency, and phrasal context.** Mark VanDam (Boys Town Natl Res. Hospital, 555 N 30 St., Omaha, NE 68131, vanmarj@boystown.org), Noah H. Silbert, and Robert F. Port (Indiana Univ., Bloomington, IN 47405)

Voice-onset time (VOT) in English maps onto the phonological categories voiced or voiceless, but fine-grained control of VOT production may vary as a function of additional linguistic features (e.g., lexical frequency, phrasal context, indexical features). This study investigated the patterns of VOT production in words that varied (a) by lexical usage-frequency (high versus low) and (b) in selected linguistic contexts (isolation, carrier phrase, unfamiliar phrase, familiar phrase). Results show that talkers produced longer VOT for voiceless stops in low-frequency words in unfamiliar and familiar phrases but not in isolation or carrier sentences. Neither lexical frequency nor phrasal context seemed to induce changes in VOT in voiced stops. Thus, it appears that talkers make use of fine temporal distinctions within the voiceless category but not the voiced. This suggests a complex asymmetry in how continuously varying VOT maps onto more discretely varying phonological categories.

**1pSC15. Gestural drift in Serbian-English speakers.** Stephen Tobin (Dept. of Psych., Univ. of Connecticut, 406 Babbidge Rd., Unit 1020, Storrs, CT 06269-1020, stephen.tobin@uconn.edu)

Following Tobin [J. Acoust. Soc. Am. **125**, 2757 (2009)], perceptually guided changes in speech production were examined in a group of Serbian-English speakers. Participants were recorded producing Serbian and English sentences after periods of time in the US and in Serbia. Voice onset times (VOTs) and vowel formants were examined with the aim of determining whether gestural targets as well as patterns of gestural timing are affected by exposure to a language. It is predicted that in both Serbian and English, VOTs will be longer after time in the US and shorter after time in Serbia. Based on comparisons of available American English and Serbian vowel formant data, it is expected that F1's will increase and F2's will decrease after time in Serbia while F1's will decrease and F2's will increase after time in the US. The results will be compared with those of Tobin's Spanish-English speakers and discussed with relation to recent research on phonetic convergence, attunement, and articulatory setting.

**1pSC16. Acoustic correlates of devoiced Japanese vowels.** J. Kevin Varden (Ctr. for Liberal Arts, Meiji Gakuin Univ., 1518 Kamikurata-cho, Totsuka, Yokohama 244-8539, Japan, varden@gen.meijigakuin.ac.jp)

The analysis of acoustic correlates of devoiced vowels produced by young native Japanese speakers is presented. In addition to gradient amounts of voicing seen in vowels undergoing devoicing, gradient amounts of fricativization can be observed, supporting an analysis of devoicing in Japanese as gestural overlap of both glottal gesture and oral stricture. Specifically, the surfacing of voiceless consonant-devoiced vowel sites as voiceless fricatives, evidenced by high-frequency frication in spectrograms and a significantly higher number of zero crossings, will be discussed, as will the interplay between devoicing and fricativization in the data set. Analysis of the formant frequency information at the vowel sites, preserved in the frication and allowing the perception of the original vowels even in the face of heavy loss of vocality, is also presented.

**1pSC17. Preliminary report of devoiced vowels in Chinese.** Setsuko Shirai, Li-Chin Yang, and Yuda Lai (Univ. of MingDao, 369 Wen-Hua Rd., Peetow, ChangHua, Taiwan, 52345 Republic of China)

This is the preliminary report of the devoiced vowels in Chinese spoken in Taiwan. We are currently investigating the environments of devoiced vowels. We recorded the sentences read by ten Taiwanese who were born and grew up in the center of Taiwan. The sentences ended with high vowels ([i] or [u]) following aspirated consonants. The tones of these final vowels varied. We observed no voice marks after the final consonants in some sentences. In addition, some vowels consist of a couple of waves. The observed devoiced vowels are as follows: [i] in [xuechi] "wiping out of dis-