Prevoicing as a perceptual cue for voicing in Spanish

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In perception of speech the listener tends to focus on certain aspects while others are neglected. This priority process could partly be disturbed by distortions of different kinds but is in general based on the listener's knowledge of the language in question. Descriptive models of temporal interactions mostly don't take into account the perceptual importance of observed or predicted regularities. This paper is concerned with the question of how perception of segmental duration reveals temporal interaction on syllable, word, and phrase levels. One of the techniques used was a production experiment with synthetic speech. In this experiment the task was to interactively manipulate a segment duration in a sentence while the duration of another segment was randomized. Both positive and negative correlations were found.

4:00

T11. Prevoicing as a perceptual cue for voicing in Spanish. Lee Williams (Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA 02139)

Prevoicing, or glottal vibration preceding articulatory release, characterizes only the voiced member of a contrasting voiced–voiceless, work–initial stop consonant pair in Spanish. Then is prevoicing a sufficient or necessary voicing cue for the Spanish listener? Eight monolingual Peruvian–Spanish listeners labeled either "voiced" or "voiceless" synthetically produced, syllable-initial stops for which voice-onset time (VOT) varied from 40 msec of prevoicing to 40 msec of voicing lag. Seven out of eight listeners divided the series into voiced and voiceless portions within the prevoiced region and for six at least 15 msec of prevoicing was required for "voiced" judgments greater than 75% of the time, suggesting that prevoicing can be a *sufficient* voicing cue when only that provides positive voicing information in Spanish using *synthetic speech*. Prevoicing was edited from naturally-produced, Spanish, word–initial voiced stops and presented for identification with unedited originals and voiceless minimal pairs to eight Peruvian–Spanish monolinguals. Removing prevoicing did not consistently induce "voiceless" judgments of edited words suggesting that prevoicing is not a *necessary* voicing cue in *real speech*. Other properties must supply positive voicing information in its absence.

4:12

T12. Voice onset time of spontaneously spoken Spanish voiceless stops. Laurel Dent (Department of Linguistics, University of Pennsylvania, Philadelphia, PA 19174)

Spectrographic measurements were made of voice onset time for 161 tokens of Spanish voiceless stops from one individual's conversational speech in an attempt to replicate laboratory findings on VOT. In running Spanish, occlusive allophones of voiced-stop phonemes occur only in absolute initial position and after nasal consonants. In other environments, voiced-stop phonemes are phonetically voiced fricatives. Therefore the contrast between voiced- and voiceless-stop phoneme categories is maintained not only by the presence or absence of voicing, but also by the presence of frication (voiced phonemes) or its absence (i.e., closure for voiceless phonemes). Due to the limited distribution of voiced-stop allophones, these are scarcely represented in the present sample, and their VOT values are not reported. In spite of VOT's "reduced" work load, however, the VOT values for voiceless stops in this study conform quite closely to earlier observations of production and perception of Spanish stop phonemes. VOT values for voiceless stops in utterance-initial and post-nasal positions are not significantly different from those for stops in other positions.

4:24

T13. Properties of feature detectors for VOT. J. L. Miller (W. S. Hunter Laboratory of Psychology, Brown University, Providence, RI 02912)

Certain properties of a feature detector system sensitive to VOT were investigated with a binaural adaptation–dichotic testing paradigm. On each dichotic test trial, a nonboundary voiced stop was paired with one of a set of voiceless stops. The voiceless stops varied in VOT, from values close to the phonetic boundary to values well within the voiceless category. The relative effectiveness of each of the voiceless stimuli in competing for processing with the voiced stimulus was assessed before adaptation and after adaptation with voiceless stops with a range of VOT values. During both pre- and postadaptation, the number of correct voicing responses when targeting for the voiceless stop, and the number of voicing intrusions when targeting for the voiced stop, systematically varied as a function of the VOT value of the voiceless stimulus. In addition, the VOT value of the adapting stimulus determined the amount of adaptation obtained. These results indicate first, that the output of the detector is a graded signal, and second, that the magnitude of decrease in detector sensitivity during adaptation is a function of the VOT value of the adapting stimulus. [Supported by NIH grants.]

4:36

T14. Fundamental frequency and voice onset time cues to voicing. Dominic W. Massaro and Michael M. Cohen (University of Wisconsin, Madison, WI 53706)

The acoustic cues that contribute to the perception of the voicing difference in /zi/ and /si/ were the focus of the present experiments. Rather than simply varying the acoustic signal along a single dimension and observing the effect on perception, changes along two acoustic dimensions were covaried in a factorial manner. The time between the onset of the syllable and the onset of vocal-cord vibration called voice-onset time (VOT) was covaried with the fundamental frequency (F_0). Observers were asked to indicate where each stimulus fell on a scale from /zi/ to /si/. The results showed that both VOT and F_0 contribute to the perception of voicing. Sounds were judged as more /zi/-like with decreases in VOT and with decreases in the F_0. The frequency contour of F_0 during the syllable had no effect beyond that accounted for by the frequency of F_0 at the onset of vocal cord vibration. Other experiments showed that the role of F_0 could not be attributed to the possibility that there was less energy at the first formant with higher frequency values of F_0. A quantitative model assuming that VOT and F_0 are perceived independently and combined multiplicatively provided a good description of the perception of voicing. [Work supported by NIMH.]

4:48

T15. Speech rate influences on the perception of stop voicing. Quentin Summerfield (Haskins Laboratories, New Haven, CT 06510)

Measures from speakers of British English show that voice-onset times (VOT's) produced in prestressed, prevocalic stop–consonants decrease as speech rate increases. Complementary adjustments occur in perception: if the syllabic rate of a synthetic precursor phrase which introduces test syllables drawn from a CV VOT continuum is increased, phoneme boundaries shift to shorter VOT's. The perceptual effect (a) is dependent upon timing variations in at most the 750 msec of the precursor immediately preceding the test syllable; (b) is almost unaffected by a mismatch of vocal tract length between precursor and test syllable; and (c) is substantially diminished if the silent closure interval between precursor and test syllable is longer than about 100 msec. These results suggest that the effect is not subsumed by the perceptual extraction and application of a speaker-dependent, speech-rate parameter but depends upon immediate computations of timing relations over short stretches of perceptually continuous running speech. Further experimentation is required to specify how perceptual measures of the durations of the vowels, the closure interval and the VOT, in VCV contexts, interact and so to determine the status of these variables as cues and/or contexts for the perception of stop voicing in running speech. [Work supported by J.S.R.U. at The Queen's University of Belfast, U.K.]

5:00

T16. Influence of tempo on the closure interval cue to the voicing and place of intervocalic stops. Robert Port (Department of Speech, Brooklyn College, Brooklyn, NY 11210, and Haskins Laboratories, New Haven, CT 06510)

The silent closure interval (CI) of medial stops is known to effectively cue their phonological voicing, so that *ruby* converts to *rupee* by splicing in a longer and silent CI [L. Lisker, Language 33,