

## P1-9

**Segmental durations in loud speech**

Anja Geumann

*Institute of Phonetics and Speech Communication, Ludwig-Maximilians-University, Munich, Germany  
geumann@phonetik.uni-muenchen.de:*

In earlier work it has been demonstrated that acoustic segmental durations in loud speech are different from those in speech uttered at a modal voice level. Vowel durations are increased, while consonantal durations become shorter in loud speech. This was shown for French (Bonnot and Chevrie-Muller 1991) and German data (Geumann 2001), but no consonantal effect was found for Swedish (Traunmüller and Eriksson 2000). Additionally, it was pointed out that in loud speech vowels are more open, i.e. with a lower jaw position and a higher first formant (Schulman 1989, Rostolland 1982a, b), while jaw heights for consonant production do not change in loud speech (Geumann 2001). Hence it might be argued that higher vowel duration in loud speech is merely a side effect of intrinsic vowel duration. However, durational effects for consonants are also found, which suggests that durational changes are not merely caused by articulatory demands. Longer vowel durations combined with shorter consonant durations form a pattern in which a proportionally larger fraction of the speech signal is constituted by vowels. So besides heightened vowel intensity, in loud speech, the portions of the speech signal that are richest in intensity are extended. Interestingly, the intensity of /n/ and /l/ is the same as that of the vowel /i/, the durational behavior of /n/ and /l/ is the same as for the other consonants, and that of the vowel /i/ is as for other vowels. The temporal reorganization for loud speech thus has to be located at a level higher than that of single phonemes, possibly the syllabic level, which could account for the perceptual demands of most efficient enhancement of intensity.

The data of Geumann (2001) come from kinematic and acoustic recordings of 'VCV sequences, which were embedded in carrier phrases and read by 6 German speakers (one female, five male). The consonants in the 'VCV sequences were the German phonemes /s, ʃ, l, n, d, t/. They were placed in differing symmetric vowel height contexts /i: \_\_i:/, /e: \_\_e:/, /a: \_\_a:/. All phrases were produced in loud and normal speech, which was elicited by simple instruction of the speaker. The loud and normal phrases were presented in random order. For each target consonant with given loudness and vowel context, 12 repetitions were produced, totalling 72 repetitions of each consonant over all context and loudness conditions. [Partially funded by German Research Council Grant TI 69/31; thanks especially to Phil Hoole and an anonymous reviewer.]

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