Articulatory patterns underlying regressive place assimilation across word-boundaries in German

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Abstract

The aim of this EMA-study was to investigate whether the greater tendency of C_1 nasals as compared to C_1 plosives to undergo regressive place assimilation could be the result of differences in tongue tip (TT) reductions due to acoustic-perceptual properties of nasality and word frequency rather than acoustic-perceptual properties of nasality by itself.

1 Introduction

Several cross-linguistic surveys (Mohanan, 1993; Jun, 1996) reveal typological patterns that govern regressive place assimilation. Of particular interest to our current research concerning *articulatory patterns* underlying regressive place assimilation is that alveolar nasals show a greater tendency to assimilate than alveolar plosives.

Up until now, no articulatory study has investigated the possibility that the acoustic properties of nasals may allow the tongue tip (TT) to move more freely and as a result permit speakers to ease articulation by means of greater TT reductions in alveolar nasals as compared to alveolar plosives, and by doing so making perceived assimilation in nasal#plosive sequences across word-boundaries (indicated by #) more likely.

Moreover, previous articulatory studies that have investigated regressive place assimilation looked at place of articulation either in plosive#plosive (Byrd, 1996) or nasal#plosive (Ellis and Hardcastle, 2002) sequences but not both. Additionally, we know of no EMA study that investigated the influence of word frequency upon regressive place assimilation, despite the fact that first, TT reduction is often assumed to be a prerequisite for regressive place assimilation (Jun, 2004) and second, several studies (Jurafsky et al., 2001; Bell et al., 2003) indicate that articulation is more reduced in words and phrases with higher word-frequency and greater lexical probability.

The current project was thus designed to test and compare the effect of several phonetic and lexical factors upon the intra- and interarticulatory timing and movement magnitude of various articulators in $V_1C_1\#C_2V_2$ sequences in German speakers with a main focus on manner of articulation and word frequency.

2 Results

Until now, data of three speakers who participated in a reading task, have been analyzed. In the non-palatal vowel context [a], for all speakers, the vertical TT position at a point in time 25% into the acoustic closure phase of the CC cluster is lower in nasal than oral C_1 items (S1, S2, S3) and lower in high than low frequency words (S1, S3). In addition, the vertical TT position is lower in high frequency words with a nasal vs. a plosive C_1 (S1, S2, S3).

Consonantal overlap in non-palatal vowel context show greater TT#TB onset overlap in words with a nasal vs. a plosive C_1 (S2), greater TT#TB onset overlap in high frequency words with nasal C_1 (S1), and greater TT#LL onset overlap in high frequency words with nasal C_1 items (S1, S2, S3).

TT reduction and CC onset overlap do not correlate in items with measurable TT excursions and incomplete assimilation. However, word pairs with a high frequency word or a significant co-occurrence frequency exhibit patterns that are akin to a nasal velar or nasal labial stop in control items and are perceived as such by listeners (Figure 1 and Figure 2 for illustration).

References

Bell A. Jurafsky D., Fosler-Lussier, E. Girand., Gregory M., Gildea D. (2003) Effects of disfluencies, predictability, and utterance position on word form variation in English conversation. *Journal of the Acoustic Society of America* 113, 1001-1024.

Byrd D. (1996b) Influences on articulatory timing in consonant sequences. *Journal of Phonetics* 24, 209-244.

Ellis L., Hardcastle W. J. (2002) Categorical and gradient properties of assimilation in alveolar to velar sequences: evidence from EPG and EMA data. *Journal of Phonetics* 30, 373-396.

IDS-Korpus. http://www.ids-mannheim.de.

Jun J. (2004) Place assimilation. In B. Hayes, R. Kirchner, D. Steriade (Eds.) *Phonetically based Phonology*. Cambridge: CUP, pp. 58-86.

Jurafsky D. , Bell A., Gregory M., Raymond W. (2001) Probabilistic relations between words: Evidence from reduction in lexical production. In J. Bybee, P. Hopper (Eds.) *Frequency and the Emergence of Linguistic Structure*. Amsterdam: John Benjamins Publishing, pp. 299-254.

Kühnert B., Hoole P. (2004) Speaker-specific kinematic properties of alveolar reductions in English and German. *Clinical Linguistics & Phonetics* 18, 559-575.

Mohanan K.P. (1993) Fields of attraction in phonology. In J. Goldsmith (Ed.) *The Last Phonological Rule: Reflections on Constraints and Derivations*. Chicago: UCP, pp. 61-116.

Steriade D. (2001) Directional asymmetries in place assimilation. In E. Hume, K. Johnson (Eds.) *The Role of Speech Perception in Phonology*. London: Academic Press, pp. 219-250.

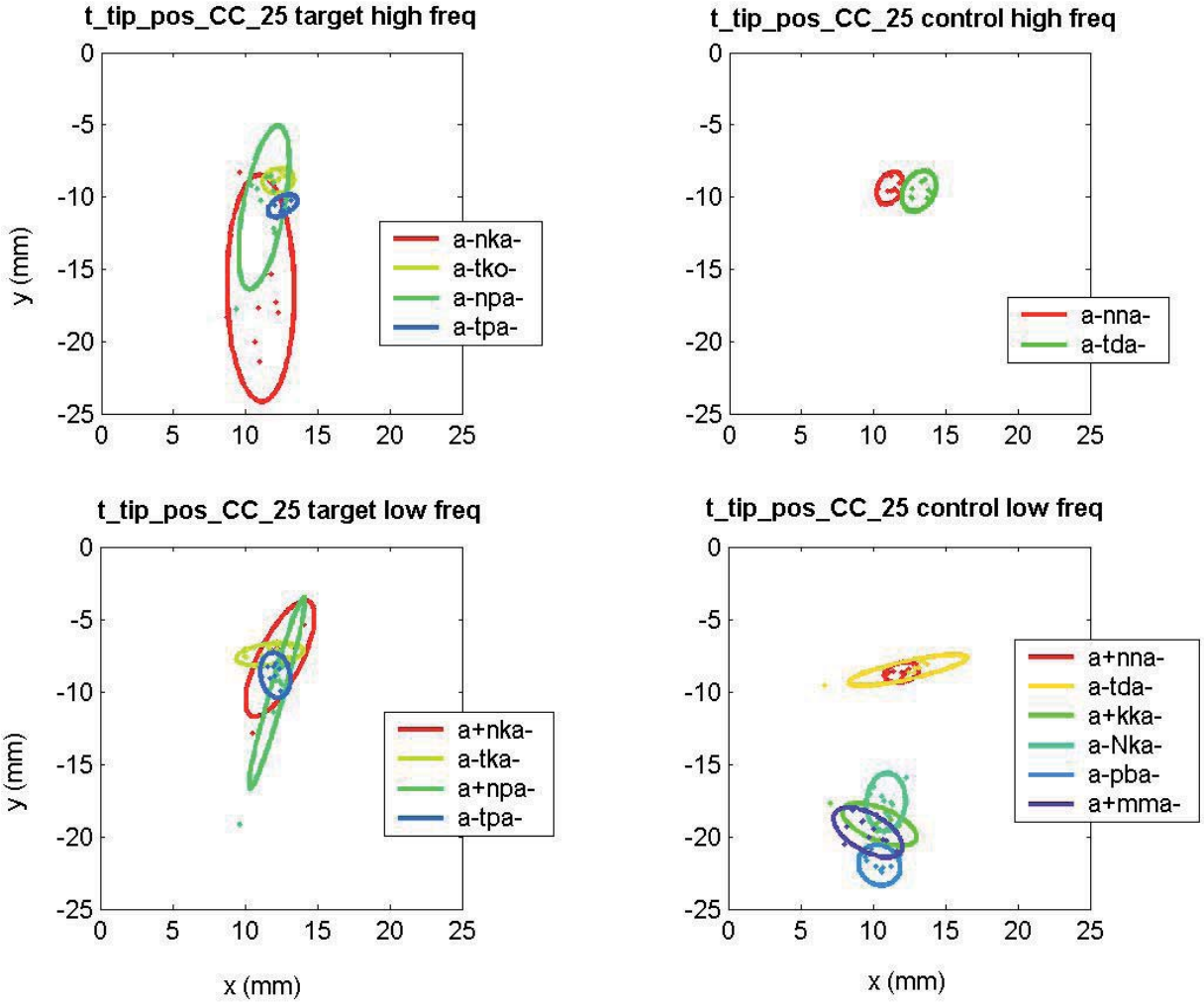

Figure 1: *Tongue tip position at a point 25% into the acoustically defined C_1C_2 closure phase for speaker S1. Reference point: upper incisors. Horizontal coordinates correspond to anterior-posterior location within the oral cavity. Left panels target items, right panels control items, top panels high frequency words, bottom panels low frequency words. Ellipses enclose two standard deviations from the mean. Legend: /$V_1C_1C_2V_2$/ of the word pair, + and – denote long and short vowel duration.*

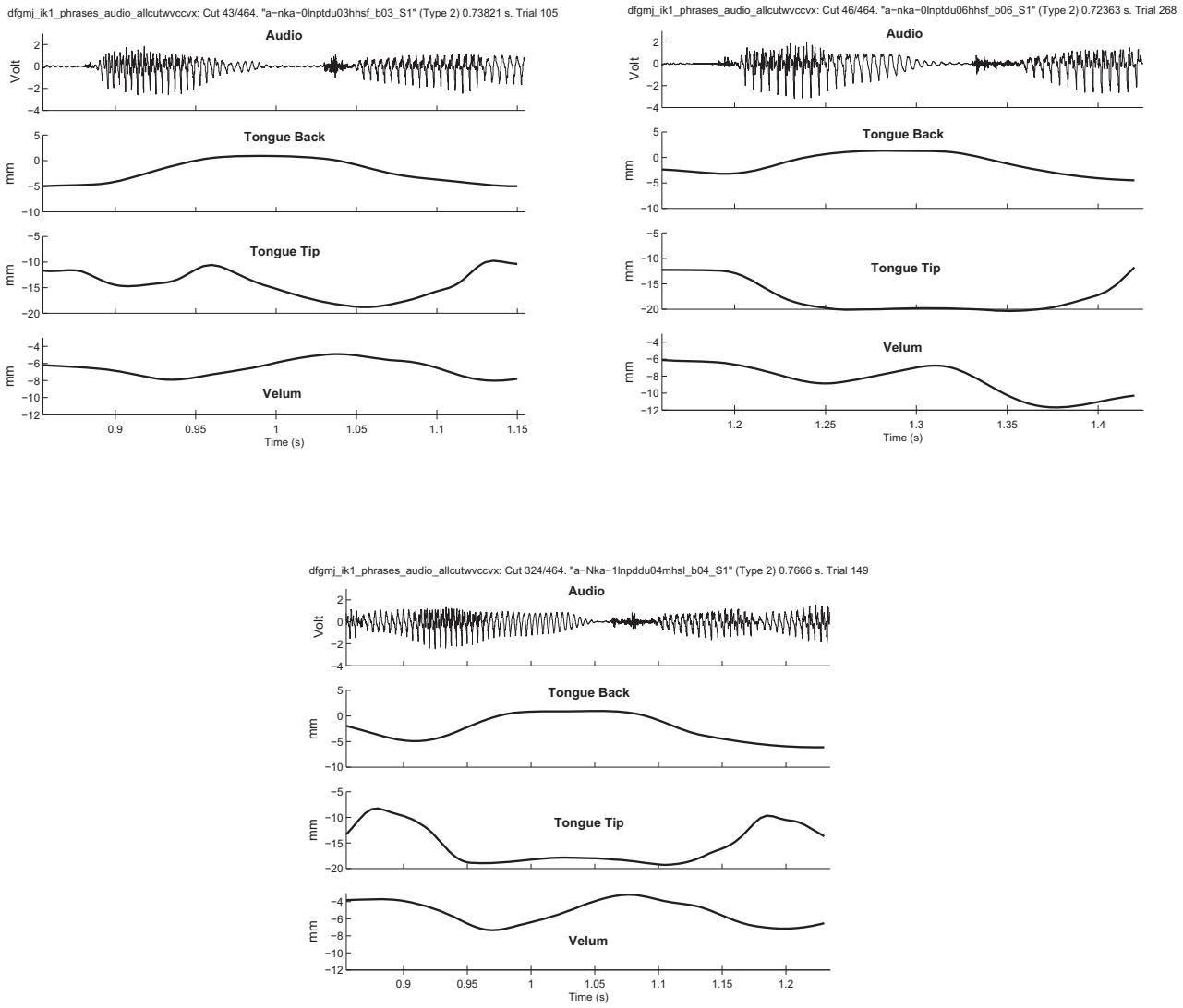

Figure 2: *Illustration of "dann kann" with visible tongue tip excursion (left chart, top) and without visible tongue tip excursion (right chart top) during the nasal-plosive closure phase and control "lang kann" item (bottom). Top: audio, top mid: tongue back movement, bottom mid: tongue tip movement, bottom: velum movement.*