Assimilation: Articulatory Data

Kühnert, B. (1996). *Die alveolare-velare Assimilation bei Sprechern des Deutschen und des Englischen: Kinematische und Perzeptive Grundlagen*. FIPKM, 24, 175-392.

Tongue movement investigated in /t#k/ sequences (and control k#k sequences).

Methods:

Electromagnetic Midsagittal Articulography (EMMA)
Electropalatography (EPG)

Movies of 2 sentences, spoken at 2 speech rates.
For each utterance 2 movies:

1) Overview of complete sentence, shown at actual speed
2) Detail of target sequence, slowed down to 1/4 speed to show the full temporal resolution of the articulatory data (audio track manipulated to keep original pitch)

Top right: EMMA data as trajectories in the sagittal plane for 3 sensors on the tongue (not spaced very equidistantly)
Bottom right: EPG contact pattern
Left side: EMMA data (plus audio) as time functions. Separate traces for x (horizontal) and y (vertical) data of each sensor.

"*Das Blatt kam von der Eiche*"	Normal speed	Overview
"*Das Bla**tt k**am von der Eiche*"	Normal speed	Detail
"*Das Blatt kam von der Eiche*"	Fast speed	Overview
"*Das Bla**tt k**am von der Eiche*"	Fast speed	Detail
"*Dein Spott kam überraschend*"	Normal speed	Overview
"*Dein Spo**tt k**am überraschend*"	Normal speed	Detail
"*Dein Spott kam überraschend*"	Fast speed	Overview
"*Dein Spo**tt k**am überraschend*"	Fast speed	Detail

See next page for notes on the movement patterns.

(1) ***"Das Blatt kam von der Eiche"***

For the normal-speed utterance the EMMA trajectories show clear tongue-tip raising for the /t/ of "Blatt" followed by raising at the back of the tongue for the /k/ of "kam" (the tongue makes a kind of rocking movement). The corresponding EPG pattern shows complete closure in the front two rows for /t/ (note: row 8 is the front row). During the /k/ it is not in fact possible to see a complete closure, because the place of articulation was probably slightly behind the rear edge of the artificial palate (it only extends back to about the junction between hard and soft palate).

The release burst for the /t/ can be clearly heard (and seen in the audio trace at about 0.8s on the time axis) because it occurs before the tongue has formed complete closure for the following /k/.

In the fast utterance the main change for the target /t#k/ sequence is that there is much less raising of the tongue-tip. The highest point reached by the tongue-tip (at about 0.55s on the time axis) is about -10mm on the EMMA traces, whereas the corresponding point for the normal-speed utterance is about -5mm (note: 0mm on the y-axis corresponds to the upper incisors). The EPG pattern shows no contact at all in the region where /t/ was articulated in the normal-speed utterance.

Although the tongue-tip still reaches its highest point slightly before the tongue-back, and also starts its downward movement first, the rocking movement of the normal-speed utterance is no longer apparent: the tongue shows a simpler global raising-lowering movement.

(2) ***Dein Spott kam überraschend***

Comparing the normal and fast-speed utterance it will again be seen that the rocking movement pattern for the target sequence changes to a more global raising-lowering movement at the fast speed. Once again, no contact for /t/ is found in the EPG patterns at the fast speed.
In the EMMA traces the amount of raising at the tongue-tip does not look so different at the normal and fast speed. However, looking at the detail views of both the normal-speed utterances makes clear how little the tongue-tip (as seen in the EMMA traces) needs to lower to result in complete disappearance of contact in the EPG patterns.

[Note on an additional connected-speech effect visible in this utterance (at both speeds):
It can be observed that the / **n** / of "*dein*" is articulated slightly further back than the / **d** / of "*dein*", no doubt because of the influence of theimmediately following post-alveolar / ʃ / in "*Spott*" (similarly also for the /n/ following the / ʃ / of "*überraschend*").]

Final Remarks

Careful comparison of utterances with target /t#k/ of the kind shown here with control utterances containing /k#k/ sequences (e.g ... *Lack kam* ...) made it clear that /t#k/ sequences can range over a continuum of articulatory realizations, from fully articulated /t/, via residual raising of the tongue tip but without making contact with the palate (the case of the examples show here) to cases where /t/ seemed to have completely disappeared, the realization being indistinguishable from the /k#k/ cases.

Thus evidence for Browman and Goldstein's concept of "hidden gestures" can certainly be found, i.e sounds may be present in articulation but barely audible because of overlap with other gestures. However, in the present cases, at the fast speech rate there was typically more reduction in the size of the tongue-tip movement for /t/ than in their famous "perfect memory" example, where the /t/ of "perfect" was inaudible at the fast rate because of overlap with the adjacent dorsum and lip gestures, but was articulated with about the same amount of movement as at the normal rate. And clearly cases where the /t#k/ sequences are indistinguishable from /k#k/ sequences are difficult to interpret unambiguously. Do they simply represent extreme cases of the general process of reduction (residual activity for /t/ may just not have been detected by the instrumentation used)? Or has the speaker made a *categorical* change in his articulatory plan, completely eliminating /t/, as the traditional way of formulating assimilations in phonological rules would suggest?