Laryngeal contrast and phonetic voicing

Jansen, Wouter

Chapter 9

Summary, conclusions, remaining issues

> "Het is uiterst bezwaarlijk eenigszins betrouwbare gegevens omtrent de assimilatie bij de samenstelling en afleiding van woorden te verzamelen. Zoodra men iemand toch verzoekt een woord of zin te zeggen, zet hij zich schrap om het zo goed mogelijk te doen en het resultaat is gekunsteld. ... Het materiaal voor op te stellen regels kan derhalve slechts te hooi en te gras verzameld worden en moet noodzakelijk zeer onvolledig en van verschillende waarnemers zeer uiteenloopend zijn." (Zwaardemaker & Eijkman 1928: 223-224)

> "It is most troublesome to collect any reliable data with regard to assimilation under the compounding and derivation of words. As soon as one requests someone to say a word or sentence after all, he will strain to pronounce it as good as he can, and the result will be artificial. ... Material to base rules on can therefore be collected only in a haphazard fashion and will necessarily be very incomplete and very divergent for different observers."

One of the principal aims of this chapter was to develop a functionalist perspective on the phonetics and phonology of fortis-lenis systems, i.e., obstruent systems that use voicing as a cue to a two-term lexical contrast. This enterprise was organised into three broad parts, comprising chapters 1 to 3, chapters 5 through to 7, and chapter 8 respectively. The first of these was concerned with the theoretical underpinnings of a functionalist model of (laryngeal) phonology and phonetics, its basic architecture and predictions, as well as with a survey of the relevant phonetic and phonological data in the literature. The second part described three experiments designed to test the predictions of the model

concerning the phonetics of regressive voicing assimilation. The third part was devoted to a critique of formalist analyses of fortis-lenis systems.

Chapter 1 described the analytical framework for this study, which was inspired by Ohala's (1981, 1993) theory of language change and more recent work on what I have referred to as *diachronic* or *evolutionary* functionalism (de Boer 1999, 2001; Blevins to appear). This brand of functionalism is distinct from the *synchronic* functionalism of Boersma (1998), Kirchner (1998), Flemming (2001) and others in its hypothesis that speakers' grammars have no direct access to functional or 'ecological' principles such as articulatory effort minimisation or perceptual optimisation. It is distinct from formalist frameworks in its assumption that all phonological and phonetic constraints are ultimately derived from such principles. An additional difference with formalist models and some (early) models of the phonetics-phonology interface associated with work on laboratory phonology is that all constraints are stated in terms of continuously-valued auditory and articulatory features

The fundamental components of the model are rote learning, transmission noise, and various forms of feedback. The first of these embodies the assumption that language learners strive to approximate the (ambient) language produced by older generations as closely as they are able to. However, because the speech transmission chain is noisy in both directions, some errors are introduced in the copying process. These errors are likely to be non-random in being approximations of the categories of the ambient language, and can develop into linguistic innovations that are retained and transmitted to subsequent generations if they receive a sufficient amount of positive feedback. Because positive feedback to a phonetic form is a function of its utility (to speaker and addressees alike) innovations and will conform to functional constraints at the time they are adopted into the phonetic grammar. One of the advantages of diachronic functionalist models is that new forms become exempt from functional pressures afterwards: this means that such models can accommodate so-called crazy rules.

Chapter 2 motivated the terms fortis/tense and lenis/lax as convenient descriptive labels for the phonetic categories found in obstruent inventories bifurcated by a two-term contrast that is phonetically supported in terms of voicing distinctions, and attempted a review of the vast literature on the phonetics of such systems.

Chapter 3 provided the phonological counterpart to the phonetic investigations of chapter 2. It attempted to identify a number of generalisations about laryngeal neutralisation in fortis-lenis systems including the type of dynamic word-final neutralisation that can be found in Dutch and German. Its theoretical point of departure was the work of Steriade (1997) which tries to derive generalisations about the effects of flanking contexts on laryngeal neutralisation from the effects of those contexts on the perceptibility of distinctions between fortis

and lenis obstruents (and thus on the likelihood of such obstruents to be subject to copying errors in acquisition).

As it stands, Steriade's theory deals only with the effects of flanking contexts and not with neutralisation asymmetries between fricatives and plosives or the asymmetry between word-initial and word-final environments. Following suggestions by Balise & Diehl (1994) and the work of J. Beckman (1996, 1997) I argued that a perceptibility-driven account of laryngeal neutralisation can at least in principle be extended to incorporate positional and manner-based asymmetries. First, the well-documented phenomena of articulatory weakening and strengthening are likely to have an asymmetric effect on the perceptibility of word-initial and word-final contrasts which is consistent across flanking contexts. Second there is evidence that voicing distinctions inhibit the expression of place cues in fricative systems, which biases any functionalist model towards fricative inventories composed of only voiceless fricatives.

Chapter 3 is in many ways the most speculative of this study because several of its assumptions about perceptibility remain to be confirmed. However, I think it is important to emphasise yet again that perceptibility hierarchies represent propositions about the relative salience of specific phonetic features to speakers with specific native languages at particular times in history that can be tested in perception experiments. Thus a perceptibility-driven account of laryngeal neutralisation is empirically accountable.

Chapter 4 developed a preliminary typology of voicing assimilation phenomena, showing that there are important differences between assimilation in restricted morphological contexts and regressive assimilation across word boundaries. Whereas the former occurs regardless of the voicing categories employed by a language to cue the distinction between tense and lax obstruents, the latter is clearly dependent on the active (de)voicing of trigger obstruents. In addition, experimental studies indicate that regressive assimilation at word boundaries tends to be phonetically gradient whereas morphologically restricted assimilation (at least) seems to operate in a neutralising fashion.

These observations suggest that voicing assimilation occurs in two forms: as a phonological rule that operates on the feature [tense] or its formal equivalent(s), and as a purely articulation-based process driven by the mechanisms underlying the production of voicing contrast. I hypothesised that the former type of process is the one typically found in morphological paradigms and that the latter is responsible for regressive assimilation across word boundaries. Coarticulation-based approaches to voicing assimilation rules have been proposed before, e.g., by Slis (1985) and Ernestus (2000), but such proposals rarely spell out the phonetic typology of articulation-driven assimilation rules. Three principal features of this typology are (1) that only actively (de)voiced obstruents are able to trigger coarticulatory voicing assimilation; (2) that the only correlates

of [tense] affected by assimilation obstruent voicing and phonetic features mechanically dependent on voicing; (3) that assimilation is always gradient.

The experiments reported in chapters 5 and 6 were designed to test whether regressive assimilation at word boundaries is always of the coarticulation-driven type, as suggested by chapter 4. Experiment 1 investigated patterns of assimilation in British English obstruent clusters whilst experiment 2 was an attempt to apply the same design to regressive voicing assimilation in Hungarian. In many respects the results of these experiments are in accordance with the predictions of the phonetic theory, and in some respects surprisingly so in the light of descriptions in the literature. The hypothesis that receives almost completely unequivocal support from these experiments as well as from experiment 3 is the one that states that only actively (de)voiced obstruents can trigger regressive voicing assimilation.

However, whereas the results of experiment 1 match the predictions of the phonetic theory more generally, the behaviour of vowel duration before Hungarian velar stop + obstruent sequences represents the most notable problem since it cannot be attributed to the coarticulation of voicing targets. In 6.4 I suggested that this might be interpreted as evidence for the idea that Hungarian RVA is a part-phonologised process, and a process that was perhaps sparked by the effects of phonetic RVA on the perceptibility of [±tense] in word-final plosives.

It is perhaps important to emphasise that whilst the data reported in chapter 6 contradict a purely phonetic analysis of Hungarian RVA, it does not vindicate recent generative analyses of the phenomenon. Such analyses describe Hungarian RVA as categorical, non-manner specific, and imply that the length of vowels preceding obstruent clusters should cue the laryngeal specification of the final obstruent in such clusters. All these claims are contradicted by the results of experiment 2

Chapter 7 investigated regressive assimilation of voicing in Dutch three-term clusters with a medial fricative. Part of the descriptive literature has it that assimilation does not apply in such clusters. Given that Dutch devoices word initial lenis fricatives that are preceded by an obstruents it is difficult to see this description as completely unconnected to phonological analysis. It is an inaccurate description in any case, because regressive assimilation clearly does apply in three-term clusters with a medial fricative, exactly as predicted by the phonetic theory. However, there is some evidence that the effect of assimilation is weaker in the clusters investigated in chapter 7 than in the corresponding singleton obstruents examined by Slis (1986), and this may well have given rise to the perception that assimilation does not apply at all.

The observation that Dutch RVA is [tense]-symmetric is probably the more exciting conclusion of the work reported in chapter 7: the observation that /ps/ clusters have less voicing before a fortis plosive than before a sonorant /m/ un-

dermines one of the most pervasive and unquestioned assumptions about RVA in Dutch. It is entirely consistent with the phonetic theory of RVA (because Dutch fortis obstruents are arguably actively devoiced) and with Ernestus' (2000) hypothesis that Dutch word-final neutralisation leads to the phonetic underspecification of [tense].

Chapter 8 finally, tried to dispel the notion that formalist phonological theory has a role to play as a source of metaconstraints on functionalist analyses or at least as a source of complimentary constraints that cannot be derived otherwise. This chapter went into considerable detail in fleshing out the predictions of current generative models of laryngeal phonology. I believe this detail was essential for pinning down the predictions of the models in question and exposing the inconsistencies introduced by patches designed to make these predictions to fit the data. The final section of this chapter brought the overall argument of this study full circle by showing how autosegmental models that improve on lexical feature analyses by incorporating phonetic detail need to be constrained by external principles and thus dissolve into the type of framework set out in chapter 1.