

CHAPTER 6

CONCLUSIONS, IMPLICATIONS, AND FUTURE DIRECTIONS

Phonologically "strong" positions are traditionally distinguished by their special ability to resist featural neutralization phenomena that affect other positions (Trubetzkoy 1939; Steriade 1993, 1995; Beckman 1995, 1997, 1998; Casali 1996, 1997). However, there are certain phonological requirements that sometimes hold of strong positions specifically, including requirements that stressed syllables be heavy, that long vowels be high in sonority, that initial syllables have onsets, or that roots bear stress. This dissertation has presented a theory of strong position-specific requirements that accounts for those that exist while excluding those that do not. Specifically, it is proposed that certain substantive considerations determine when a markedness constraint can be relativized to a strong position, and that the substantive considerations in question are implemented as constraint filters that use extra-phonological information to screen formally possible constraints and determine which of them are to be included in CON.

Thus, in the model developed here, phonological requirements for strong positions are imposed by **M/str** constraints. However, **M/str** constraints are legitimate constraints only if they call for strong positions to have perceptually prominent properties, a restriction enforced by the constraint filter known as the Prominence Condition. **M/str** constraints on psycholinguistically strong positions are further restricted by another filter, the Segmental Contrast Condition, which reflects the importance that these positions have in early-stage word recognition; not even the addition of perceptually prominent properties to these positions is advantageous if doing so would neutralize psycholinguistically useful segmental contrasts without facilitating left-edge demarcation.

Several topics closely related to the core empirical phenomena examined in the preceding chapters will be interesting to investigate further in light of the findings assembled here. One such topic is the status of tone-related augmentation constraints. First, as noted in §4.3.4.2, the psycholinguistic evidence to date concerning the relationship of tonal contrasts to early-stage word recognition has not yet converged on a firm conclusion. If it is in fact the case that tone, like stress, is less important in early-stage word recognition than segmental contrasts are, at least in some languages, then this model predicts that there should be tone-related augmentation effects in psycholinguistically strong positions, in addition to those already identified in phonetically strong positions. Another question concerning tone is the extent to which augmentation constraints exist that refer to tones other than H; for example, attraction of L tones to strong positions has been discussed by, e.g., Kang (1997) and Yip (2000).

Another goal to be pursued in future work is a deeper understanding of the nature of the set of strong positions and the role of these positions in phonology generally (i.e., in positional neutralization as well as in positional augmentation). In addition to the five positions investigated here — stressed syllable, long vowel, onset/released consonant, initial syllable, and

root — what other strong positions are there, and what kinds of positional augmentation do they undergo? As observed in §1.3.2, heads of prosodic constituents both larger and smaller than the PrWd, in particular secondary-stress syllables (foot heads) and phrasal heads, are probably also included in the set of strong positions, and the lexical category noun is probably included as well. Also, there may be justification for recognizing root-initial syllable and MWd-initial syllable as distinct strong positions (§4.4.2). But are there other strong positions beyond even these? For example, the final syllable is sometimes identified as a position that is able to resist positional neutralization (Trubetzkoy 1939; Steriade 1993; Hyman 1998). Is this position actually a strong position, and if so, which kind? Steriade (1993) observes that final lengthening is a common phenomenon and suggests that phonetic length accounts for the resistance of final position to featural neutralization. On the other hand, Brown & McNeill (1969) and Nootboom (1981) suggest that word-final material appears to be more useful than word-medial material in word recognition, so this position may have some degree of psycholinguistic importance.

Moreover, since the strong positions themselves are granted their special status on the basis of substantive factors related to phonetic salience and psycholinguistic importance, are these positions in fact supplied as primitive universal phonological building blocks, as assumed in §2.2? Or alternatively, are even the strong positions identified through the action of constraint filters? In such an approach, the relativization of any constraint to any position would be formally possible, but positional constraints relativized to any non-salient positions would be rejected by a substantively based filter. The identification of strong positions by means of a constraint filter is an attractive idea in some respects, because it links the substantive basis for strong-position status more directly to the substantive grounding of particular constraints: both are achieved through filters. However, it is not entirely clear that this alternative approach to strong positions is feasible. It does not seem reasonable to expect that any arbitrary position ("fifth syllable", "second element of a cluster"...) can be made available to a relativized constraint (see also §1.3.2). It may be necessary to recognize the set of strong positions as part of the universal inventory of basic phonological elements simply to allow constraints to refer to these positions at all. In any case, a characterization of the means by which the set of strong positions becomes available to the formal grammar is an interesting and important point to pursue.

The most fundamental question related to the topics investigated in the preceding chapters is this: what is the relationship between formal and substantive aspects of phonological theory? In other words, how direct a contribution do substantive pressures make to phonological patterning, and to what extent is an abstract formal system necessary? A number of the phenomena that have been discussed here have implications for this question, supporting the approach to interactions between formal and substantive considerations that is taken in the Schema/Filter model.

Optimality Theory, which seeks to explain phonological phenomena on the basis of interactions among ranked and violable constraints, provides a way for substantive concerns to play a more direct role in the grammar than was possible in rule-based theories. For example, a particular markedness constraint such as *VOICEDOBSTRUENT can be seen to codify the

articulatory and/or perceptual difficulty inherent in a particular phonological structure (in this case, voiced obstruents). In rule-based theories of phonology, rules were sometimes said to exist or apply because of some kind of "functional pressure", but there was no way of encoding that kind of pressure in the formulation of the rule itself. In OT, on the other hand, (many of) the constraints themselves literally represent individual functional pressures.

Following this line of reasoning to its ultimate conclusion, one might even ask whether there is any need for a system of formal entities in the constraint set at all. Perhaps all constraints arise directly from substantive pressures. In a sense, such a system can be seen as a null hypothesis: no abstract structure intervenes between the substantive pressures and the system of constraints, because the constraints *are* the substantive pressures.

Nevertheless, a number of the results discussed in this dissertation show that the phonology does indeed deal with constraints and phonological structures that are more abstract than substantive pressures or concrete properties of the speech stream. For example, while the constraint ONSET and the sonority-sensitive *ONSET/X subhierarchy perform a related function — ensuring that syllables have well-formed onsets — the specific formulations of ONSET and *ONSET/X are distinct, and as a result, the phonological structures that satisfy the two are different (§2.3.2.3.3, §3.2.2.3, §4.2.1.2.4). First, ONSET is satisfied by the presence of any pre-peak segment, regardless of its sonority or its precise position in prosodic structure (true onset versus nuclear onglide), but the *ONSET/X constraints are sensitive both to sonority and to syllabic position. Furthermore, ONSET can be variably ranked with respect to the constraints in the *ONSET/X subhierarchy, so it must not itself be a member of that subhierarchy. Therefore, ONSET and *ONSET/X, while related to, and perhaps existing in response to, the same kinds of functional pressure, are formally distinct in the phonological system.

Another result examined here that necessitates recognizing abstract, formal elements is the relationship of phonetically strong positions (e.g., stressed syllable, onset/released consonant, and long vowel) to positional augmentation processes. The Licensing-by-Cue approach (Steriade 1993, 1995, 1997, 1999ab) proposes that phonetically strong positions have a special ability to license phonological contrasts, and thereby avoid positional neutralization, because they possess salient cues to the recovery of particular phonological contrasts. This claim is well supported by the empirical facts of positional *neutralization* cases. However, the null hypothesis — that the only thing special about phonetically strong position *P* is its salient cues *x* and *y*, and that it is these cues themselves that have a special ability to license contrast, so that there is nothing intrinsically special about position *P* at all — cannot be maintained when the patterns of positional *augmentation* in these positions are considered. Crucially, phonetically strong positions are eligible for any kind of augmentation process, even one that is unrelated to the special cues possessed by the position in question. For example, the position stressed syllable is a phonetically strong position by virtue of its salient cues for vowel feature contrasts, and so resistance to positional neutralization by stressed syllables typically involves vowel features (or suprasegmentals like tone or length that are realized on vowels), just as the Licensing-by-Cue approach would predict. But positional augmentation constraints that target stressed syllables

include those demanding onsets or low-sonority onsets (§3.2.2). That is, from the point of view of the phonological system, the element *stressed syllable* does have a special phonological status that can be referred to abstractly, as by augmentation constraints, and is not tied directly to its salient perceptual cues. Instead, the presence of those cues gives the position its abstract, formal status as a strong position. Filters on positional faithfulness constraints (§2.4.2.3) ensure that any feature-licensing abilities of the phonetically strong position stressed syllable are indeed related to its special salient cues. But because there are no filters that specifically restrict the formal possibilities for augmentation constraints on phonetically strong positions (beyond the Prominence Condition, which ensures that *all* positional markedness constraints are augmentation constraints), the stressed syllable is eligible for all manner of positional augmentation constraints. If there were no abstract level at which this position qualified as a strong position, irrespective of its particular phonetic attributes, then there would be no way in which augmentation constraints unrelated to those phonetic attributes could identify it as a strong position.

Finally, it is necessary to draw a formal distinction between the constraint filters and EVAL, the component of the grammar that chooses the optimal output candidate for each input. This is because the substantive pressures that are instantiated in the constraint filters *have no direct effect on the selection of optimal output forms*. For example, the Prominence Condition is a constraint filter that prevents non-prominence-enhancing constraints from having **M/str** counterparts. However, it is not the case that strong positions are never affected by markedness constraints that happen not to enhance perceptual prominence. If a general markedness constraint such as *MIDV, which is not an augmentation constraint (§2.3.1), dominates all vowel-height faithfulness constraints in the language, it will ban contrast in *all* positions, including strong positions such as stressed syllables, long vowels, initial syllables, and roots. The Prominence Condition does not prevent this; in fact, languages without any mid vowels are attested (and likewise for other feature-markedness constraints). Similarly, the Segmental Contrast Condition is a constraint filter that bans positional augmentation constraints whose satisfaction would require the neutralization of (non-edge-demarcating) segmental contrasts in psycholinguistically strong positions. However, this does not mean that such a neutralization might not come about indirectly, as a consequence of constraint ranking. For example, the [*PEAK/X] σ_1 subhierarchy is banned by the Segmental Contrast Condition. But in a language where stress always falls on the initial syllable, and low-sonority nuclei are banned by [*PEAK/HIGHV]/ \acute{o} , the initial syllable — because it is also the stressed syllable — will support no contrast between high and mid vowels. The Segmental Contrast Condition has no power to prevent this kind of pattern. Crucially, then, it is not "non-prominence-enhancing neutralization in strong positions" and "contrast neutralization in psycholinguistically strong positions" that are blocked by the Prominence Condition and the Segmental Contrast Condition respectively. Instead, it is *constraints designed to achieve such ends directly* that the constraint filters block.

These considerations show that the substantive pressures represented by the Prominence Condition and the Segmental Contrast Condition are not general forces that can have an effect on any aspect of phonology. Rather, these substantive pressures have a specific point of interaction

with the phonological system: they prevent the inclusion of certain constraints, whose satisfaction would directly oppose the substantive pressures behind these filters, in CON.

Thus, the Schemas & Filters model of CON developed in this dissertation serves as an explicit framework for a theory of **M/str** constraints, and more broadly, it is a way of modeling the complexity of the relationship between the abstract, formal behavior of the phonological system and the substantive pressures that underlie many of the constraints in the system. Crucially, while incorporating substantive pressures into the system (in the filters), this model maintains the view of phonology as a formal system. Such a model is supported by the evidence for formal, abstract patterning in phonology that has emerged over the course of this investigation of phonological augmentation in prominent positions.