CHAPTER 5

POSITIONAL AUGMENTATION AND POSITIONAL NEUTRALIZATION

5.1 Introduction

The idea that constraints can be relativized to strong or weak positions, as with the **M/str** constraints discussed here, has previously been applied quite extensively in the OT literature to address positional neutralization phenomena.[1] Three kinds of position-sensitive constraints have been introduced to account for positional neutralization: **F/str** constraints (positional faithfulness constraints; Selkirk 1994; McCarthy & Prince 1995; Alderete 1995, 1999ab; Beckman 1995, 1997, 1998; Casali 1996, 1997; Lombardi 1999; Steriade 1999ab), **M-*Feat*/wk** constraints (positional feature-markedness constraints; Steriade 1997, among others), and COINCIDE constraints (alignment-type constraints for marked structure and strong positions; Zoll 1996, 1997a, 1998).

This chapter examines the relationship between positional neutralization and the positional augmentation phenomena that have been the focus of the preceding chapters. §5.2 considers whether any of the three competing approaches to positional neutralization can be extended to account for positional augmentation effects, replacing the **M/str** constraints that have been proposed here with either **F/str** constraints (§5.2.1), **M-*Feat*/wk** constraints (§5.2.2), or COINCIDE constraints (§5.2.3) and thereby simplifying the inventory of necessary constraint types. The discussion in §5.2 shows that none of these three approaches can in fact account for positional augmentation phenomena. Even COINCIDE constraints, which have sometimes been described as a constraint type that handles both positional neutralization and positional augmentation effects, cannot account for positional augmentation without theoretical extensions of the very kind proposed in the model of **M/str** constraints developed above — constraints specifically requiring prominent properties to hold of strong positions, and filters like the Prominence Condition and the Segmental Contrast Condition to prevent the generation of pathological feature-neutralization constraints for strong positions. Thus, it is necessary to admit positional augmentation constraints into the universal constraint set as a distinct constraint type.

However, as discussed in §5.3, it is not surprising that fundamentally different types of constraints are responsible for positional neutralization and positional augmentation, because the two classes of phenomena are themselves qualitatively distinct — involving the avoidance of typologically marked features on the one hand and the enhancement of perceptual prominence on the other. Moreover, only attested patterns are predicted by a factorial typology that includes

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[1]As noted in Chapter 1, the term 'positional neutralization' (Trubetzkoy 1939; Steriade 1993, 1995) is used here to refer specifically to the class of phenomena in which a phonological contrast is licensed in strong positions but neutralized in weak positions. A familiar example of this kind of pattern is a language, such as Russian, that permits contrastive mid vowels in stressed syllables but not in unstressed syllables.

M/str constraints and **F/str** constraints (§5.3.1) or by one that includes **M/str** constraints and either COINCIDE or **M-*Feat*/wk** constraints (§5.3.2).

5.2 Positional neutralization in Optimality Theory

As noted in Chapter 1, the phonologically relevant distinction between strong and weak positions first became apparent in studies of positional neutralization — the neutralization of phonological contrasts to the typologically unmarked value — where strong positions are able to resist processes of featural neutralization that affect weak positions (e.g., Trubetzkoy 1939; Steriade 1993, 1995). This section reviews three approaches that have been developed within the OT framework to account for the special ability of strong positions to resist neutralization: positional faithfulness (**F/str**) constraints (§5.2.1), positional featural-markedness (**M-*Feat*/wk**) constraints (§5.2.2), and COINCIDE constraints (§5.2.3). After each proposal is summarized, it is shown to be unable to account for positional augmentation. That is, no matter what approach is taken toward cases in which strong positions *resist* markedness requirements, a separate (though complementary) theory is needed to account for cases where strong positions are specifically *affected by* markedness requirements.

5.2.1 Positional neutralization with positional faithfulness constraints

One way to account for the special ability of strong positions to resist positional neutralization is to propose that there are faithfulness constraints that are relativized to strong positions (**F/str** constraints). The positional faithfulness approach emerged in work by Selkirk (1994), Alderete (1995), and McCarthy & Prince (1995) and has been developed most fully by Beckman (1995, 1997, 1998) and Casali (1996, 1997). This section reviews the theory of positional faithfulness and shows that, although it is able to account for the positional neutralization effects that it was designed for, it does not account for positional augmentation (see also Zoll 1998).

Whether a particular phonological contrast is present in a particular language is determined by the relative ranking in that language of the markedness constraints that would ban the contrast and the faithfulness constraints that would require its preservation. For example, there are languages that have contrastive mid vowels (and allow them in all positions in the word), such as Japanese. There are also languages that lack contrastive mid vowels (again in all positions), such as Quechua. In languages like Japanese, a faithfulness constraint requiring input vowel-height features to be preserved, IDENT[Vht], outranks the markedness constraint that bans mid vowels, *MIDV. Therefore, when an input contains a mid vowel, the output contains a mid vowel as well. But in languages like Quechua, the ranking of these two constraints is reversed; since *MIDV is ranked higher than IDENT[Vht], even if an input were to contain a mid vowel, it would surface as something else (perhaps a high vowel, but the exact outcome might be affected by other markedness or faithfulness constraints as well, depending on their ranking).[2]

There is also a third type of language: one in which a particular element that is typologically marked (i.e., in that its inclusion in an inventory implies the inclusion of some other element and not vice-versa), such as the set of mid vowels, is phonologically contrastive in some strong position, but not in other positions. This is the pattern referred to as positional neutralization. A positional-neutralization counterpart to the Japanese and Quechua examples given above would be Russian, which has contrastive mid vowels only in the strong position stressed syllable. In other syllables, that contrast is neutralized.[3]

The positional faithfulness approach to positional neutralization holds that there are faithfulness constraints relativized to strong positions. For example, the constraint IDENT[Vht]/σ́ requires output vowels that appear in stressed syllables to have the same specification for vowel height as their input counterparts. The addition of this constraint to the system allows for the ranking IDENT[Vht]/σ́ >> *MIDV >> IDENT[Vht], under which mid vowels surface in stressed syllables, but not in unstressed syllables — the pattern found in Russian-type languages.

(1) Positional faithfulness and the positional neutralization of mid vowels (hypothetical input)

/tépo/	IDENT[Vht]/σ́	*MIDV	IDENT[Vht]
a. tépo		**!	
☞ b. tépu		*	*
c. típu	*!		**

Because *MIDV dominates the general faithfulness constraint IDENT[Vht], mid vowels are banned from most positions in the language (as they are banned entirely in Quechua-type

[2]Recall that according to the principle of richness of the base (Prince & Smolensky 1993), there are no language-particular restrictions on input forms (see §1.3.2, especially footnote 12). If a language has no mid vowels, we cannot simply assume that inputs never contain mid vowels, because there is no way to limit inputs in such a manner. We must instead propose a grammar for the language that would weed out surface mid vowels *even if* mid vowels were to appear in input forms.

[3]In Russian, the basic neutralization pattern is that underlying /e/ surfaces as [i] when unstressed, whereas underlying /o/ surfaces as [a] when unstressed. The fact that the two mid vowels are handled differently by the system is separate from the fact that mid vowels are banned in unstressed syllables.

languages). However, the stressed syllable-specific faithfulness constraint IDENT[Vht]/σ́ dominates *MIDV, which means that in stressed syllables, maintenance of an input mid vowel has the highest priority (stressed syllables in this language are thus analogous to Japanese-type languages).

Languages like Japanese and Quechua, which do not have position-sensitive neutralization (as far as mid vowels are concerned), can still be accounted for even with the inclusion of positional faithfulness constraints like IDENT[Vht]/σ́ in the system. As long as *MIDV outranks both IDENT[Vht]/σ́ and general IDENT[Vht], a language will ban mid vowels completely (as in Quechua). And as long as general IDENT[Vht] outranks *MIDV (no matter how IDENT[Vht]/σ́ is ranked), a language will permit mid vowels in all positions (as in Japanese). Crucially, as (2) shows, no ranking of these three constraints[4] can ever produce a language in which mid vowels are tolerated in unstressed syllables, but banned in stressed syllables. This is a desired result, since the positional neutralization of typologically marked phonological structure (such as mid vowels) is never confined to strong positions only.

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[4]Some versions of positional faithfulness (e.g., McCarthy & Prince 1995 for $\mathbf{F/_{Root}}$ and $\mathbf{F/_{Affix}}$) assume that faithfulness constraints are relativized to both strong and weak positions, i.e., IDENT[Vht]/σ́ and IDENT[Vht]/σ̆. In order to account for the fact that neutralization never affects strong positions only, the positional constraints must be in a fixed universal ranking **F/str** >> **F/wk**, allowing for three different markedness rankings: **M** >> **F/str** >> **F/wk** for neutralization in all positions; **F/str** >> **F/wk** >> **M** for contrast in all positions; and **F/str** >> **M** >> **F/wk** for neutralization in weak positions only.

However, there are two reasons for preferring the Beckman/Casali implementation, which assumes only **F/str** and general **F**. First, this version eliminates the need for a universally fixed ranking. Although Beckman and Casali both explicitly assume that the ranking **F/str** >> **F** is universally fixed, even the ranking permutations of these constraint types that allow **F** >> **F/str** correspond to attested neutralization patterns, as shown in (2). Moreover, Struijke (1998, 2000) and Keer (1999) argue for a crucial **F** >> **F/str** ranking in certain languages. It is true that languages without positive evidence to the contrary will have **F/str** >> **F**, since this ranking must be enforced by a "persistent bias" in order to avoid a subset problem in grammar learning (Hayes 1999b; Prince & Tesar 1999; Smith 2000a). But this is not the same as requiring the ranking **F/str** >> **F** to be universally fixed in adult grammars.

Second, as discussed in §1.3.2, the "weak position" counterpart to a given strong position is not always an independently identifiable class. For example, "non-initial syllables" can only be identified indirectly, as the complement of the set of initial syllables. This problem is avoided in a system that assumes only **F/str** and general **F**.

(2) Grammars produced by a positional-faithfulness system

	Ranking	*Characteristic*	*Result*
(a)	**M** >> **F/str** >> **F** **M** >> **F** >> **F/str**	(**M** highest ranked)	Neutralization in all positions (Quechua)
(b)	**F/str** >> **F** >> **M** **F** >> **F/str** >> **M** **F** >> **M** >> **F/str**	(**F** >> **M**)	Contrast in all positions (Japanese)
(c)	**F/str** >> **M** >> **F**		Neutralization in weak positions only (Russian)

Thus, the fundamental characteristics of the Beckman/Casali theory of positional faithfulness can be summarized as follows. There is a set of strong positions, identifiable because they have a special phonetic or psycholinguistic salience. Faithfulness constraints have **F/str** counterparts. This system allows for one of three possibilities for a given contrast: it can be neutralized throughout a language, it can be maintained throughout a language, or it can be neutralized in weak positions but maintained in strong positions.

However (as Zoll (1998) points out), the positional faithfulness system outlined above is fundamentally unable to account for positional augmentation phenomena of the sort discussed in the preceding chapters. As demonstrated in (2), no ranking of **F**, **M**, and **F/str** constraints can produce a language that enforces a requirement (that is, neutralizes a contrast) in strong positions and not in weak positions. But in a language with positional augmentation, that is precisely what happens: stressed syllables are forced to be heavy while unstressed syllables can be heavy or light, for example, or initial syllables are forced to have low-sonority onsets while other syllables may have any kind of onset.[5]

5.2.2 Positional neutralization with positional featural markedness constraints

A number of OT analyses have taken an alternative approach to positional neutralization phenomena, using featural markedness constraints that make reference to weak positions (**M-*Feat*/wk**). One common example is the constraint CODACOND. This constraint, an OT translation of Itô's (1986, 1989) Coda Condition, is designed to account for the fact that

[5]To be precise, a positional augmentation language is any language that enforces a requirement on strong positions that it does not enforce on weak positions. It is not always the case that the weak positions in a language with positional augmentation show a greater number of contrasts than the strong positions do — sometimes, there is a type of complementary-distribution effect, with one member of an opposition occurring exclusively in the strong position and the other member in the weak position. See §5.3.2 for discussion.

consonant place features are often neutralized specifically in coda position. CODACOND is often formulated as in (3a) (see, e.g., Lombardi 2001), after Itô's original filter; this conception of CODACOND can also be stated as in (3b), to emphasize the **M-*Feat*/wk** structure of this constraint.

(3) The Coda Condition

(a) CODACOND $\begin{array}{c} *\ \mathrm{C}\ ]_{\sigma} \\ | \\ [\mathrm{Place}] \end{array}$

(b) CODACOND *[Place]/$_{\mathrm{Coda}}$

In general, constraints of the **M-*Feat*/wk** type have been introduced individually, when needed for analyses of particular phonological phenomena, and not many attempts have been made to develop an explicit, typologically constrained theory of positional **M-*Feat*** constraints as a general account of positional neutralization.[6] But given the empirical observation that languages that permit typologically marked elements only in certain positions will always limit them to strong positions rather than to weak positions, a constrained **M-*Feat*** theory of positional neutralization must include the restriction that **M-*Feat*** constraints can be relativized to weak positions, but not to strong positions.[7] With this restriction in place, the following factorial typology, which produces only the empirically attested patterns of neutralization of marked features, is produced.

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[6]A notable exception to the lack of explicit theories of **M-*Feat*/wk** constraints is the markedness-constraint implementation of the theory of Licensing by Cue presented in Steriade (1997). Under this proposal, for every phonological feature $Feat_i$ there exists a hierarchy of auditory cues to the recovery of the contrast involving that feature, ranked from best/most perceptible cues to worst/least perceptible. This hierarchy then projects a hierarchy of markedness constraints that can be schematically represented as *$Feat_i$/[worst cues] >> ... >> *$Feat_i$/[medium cues] >> ...>> *$Feat_i$[best cues]. If the predicate "has cues of degree of goodness *G*" is viewed as a way of defining positions, then Steriade's hierarchy is analogous to a hierarchy of positional constraints, **M-**$Feat_i$**/weakest** >> ... >> **M-**$Feat_i$**/weak** >> ... >> **M-**$Feat_i$**/strong**.

See also Wilson (2001) for formal extensions of Licensing by Cue. Steriade (1999ab) develops a faithfulness-based implementation. Additional discussion of Licensing by Cue is given in §2.4.2.3 above.

[7]This consequence is in fact a good reason to avoid the **M-*Feat*/wk** approach as a general theory of positional neutralization effects, since it brings up the problem of referring to weak positions — some of which, as noted in §1.3.2 and elsewhere in the current chapter, are not necessarily identifiable except as the complement of the corresponding strong position.

(4) Grammars produced by a positional featural markedness system

	Ranking	*Characteristic*	*Result*
(a)	**M** >> **F** >>**M-*Feat*/wk** **M** >>**M-*Feat*/wk** >> **F** **M-*Feat*/wk** >> **M** >> **F**	(**M** >> **F**)	Neutralization in all positions (Quechua)
(b)	**F** >> **M** >> **M-*Feat*/wk** **F** >>**M-*Feat*/wk** >> **M**	(**F** highest ranked)	Contrast in all positions (Japanese)
(c)	**M-*Feat*/wk** >> **F** >> **M**		Neutralization in weak positions only (Russian)

But once again, the three classes of grammars in (4) do not include any grammar in which a phonological requirement (and thus, the neutralization of a contrast) can hold of strong positions but not of weak positions. Therefore, using only the three constraint types **M-*Feat*/wk**, **F**, and **M**, it is impossible to account for positional augmentation.

There is a sense in which the **F/str** and the **M/*Feat*-wk** approaches to positional neutralization are similar. Both use position-specific versions of constraints in order to ensure that a different ranking between faithfulness and markedness constraints holds in strong and weak positions. For strong positions, where the contrast is maintained, the ranking of relevant constraints is **F** >> **M** (i.e., **F/str** >> **M** under positional faithfulness, or **F** >> general **M-*Feat*** under positional featural markedness). But for weak positions, where the contrast is neutralized, the relevant ranking is **M** >> **F** (**M** >> general **F** under positional faithfulness, or **M-*Feat*/wk** >> **F** under positional featural markedness).

(5) Different relevant rankings for strong and weak positions

(a) Positional faithfulness

F/str >> **M** >> **F**

Strong positions: **F** >> **M**
Weak positions: **M** >> **F**

(b) Positional featural markedness

M-*Feat*/wk >> **F** >> **M**

Strong positions: **F** >> **M**
Weak positions: **M** >> **F**

Because these two approaches are similar in character, they face the same problem in accounting for positional augmentation. They must not produce rankings that allow positional neutralization-type phenomena (the neutralization of typologically marked features) to affect strong positions alone. To ensure this result, the position-specific constraints are limited as to the class of positions that they can target, to **F/str** or to **M-*Feat*/wk** respectively. As seen in (2) and (4) above, this restriction gives the correct result with respect to positional neutralization, but it also ensures that the **F/str-M-F** system and the **M-*Feat*/wk-F-M** system are both incapable, without further elaboration, of generating languages with positional augmentation phenomena.

The further elaboration that is needed is a way of distinguishing between the neutralization of typologically marked features, as in positional neutralization, and the enhancement of perceptual prominence, as in positional augmentation, so that constraints can be permitted that enforce the latter, but not the former, in strong positions. The proposal developed in the preceding chapters is of course a way of doing just that. Thus, either of these two approaches to positional faithfulness can be combined with the positional augmentation (**M/str**) constraints introduced here. As long as the **M/str** constraints are themselves appropriately restricted, as by the Prominence Condition and the Segmental Contrast Condition, they will interact with the positional neutralization constraints only in ways that lead to classes of grammars that are attested (see §5.3). However, the point that has been demonstrated here is that both of these approaches to positional neutralization — the positional faithfulness approach and the positional featural markedness approach — are unable, on their own, to account for positional augmentation without being rendered incapable of accounting for the restricted typology of positional neutralization.

5.2.3 Positional neutralization and augmentation with COINCIDE constraints

Another account of position-sensitive phonological phenomena that has been proposed is the theory of positional licensing through COINCIDE constraints (Zoll 1996, 1997a, 1998). While the positional faithfulness and positional featural markedness theories of positional neutralization simply relativize independently attested constraint types to strong or weak positions and then derive positional effects indirectly through constraint interaction, COINCIDE constraints are a distinct constraint type that directly relates phonological properties and strong positions.[8]

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[8]In Zoll (1996), COINCIDE constraints are introduced as a distinct constraint type, formulated as in (6) below. In later work, Zoll (1998) proposes that COINCIDE constraints can be derived through the local conjunction (Smolensky 1995, 1997) of a feature-markedness constraint with a constraint penalizing the presence of a particular weak position. Thus, in the revised system, the coda-condition constraint "COINCIDE([CPlace], Onset)" is to be derived from the local conjunction *[CPlace] $\&_{\text{Segment}}$ NOCODA.

However, it does not seem that the the local-conjunction approach can be successfully generalized to all instances of COINCIDE constraints. For this approach to be uniformly successful, there would have to be constraints analogous to NOCODA that ban all of the different types of weak positions. As noted above, not all weak "positions" are independently identifiable. Furthermore, it is not immediately clear to what extent there is empirical support for the existence of NOCODA-type constraints banning weak positions such as affixes or non-initial

Nevertheless, this section shows that, just as was the case for the positional faithfulness and positional featural markedness approaches, the COINCIDE constraints that are used to account for positional neutralization cannot be directly extended to account for positional augmentation without modifications along the lines of the proposal developed in this dissertation.

COINCIDE constraints are similar to alignment constraints (McCarthy & Prince 1993a) in that they quantify over two categories, one universally and one existentially, and require the two categories to be associated in output forms. They differ from alignment constraints in two ways: first, they require not edge-matching but 'coincidence,' defined as a relationship of either identity or domination, and second, they are categorically rather than gradiently violable. As formulated in Zoll (1996), COINCIDE constraints quantify universally over instances of marked phonological structure, and existentially over strong positions (COINCIDE constraints of this form are abbreviated below as COINCIDE(α,**str**), where α stands for some marked phonological property). Thus, they are able to account for positional neutralization effects by requiring that a given marked structure, if it is to appear in the output at all, must appear in some strong position.

(6) General schema for COINCIDE(α,**str**) constraints (Zoll 1996:143)

COINCIDE (marked structure, strong constituent)

(i) $\forall x$ (x is marked $\rightarrow \exists y$ (y=strong constituent $\wedge$ *Coincide* (x,y))
• *Coincide* (x,y) will be true if $y=x$, y dominates x, or x dominates y

(ii) Assess one mark for each value of x for which (i) is false.

For example, a system with a COINCIDE(α,**str**) constraint in the appropriate ranking can account for the positional neutralization of mid vowels in languages like Russian, where mid vowels appear only in stressed syllables. The constraint COINCIDE(MidV, σ́) penalizes any mid vowel that is not in a stressed syllable. If this constraint dominates IDENT[Vht], it will cause any unstressed mid vowel to surface unfaithfully. However, this constraint will not be violated by stressed mid vowels, so they will surface faithfully (as long as IDENT[Vht] dominates *MIDV, a markedness constraint that would otherwise ban *all* mid vowels).

syllables. Thus, it seems preferable to maintain the Zoll (1996) formulation of COINCIDE, which has the advantage of referring only to strong positions. (See also Fukazawa & Lombardi 2000 on problems that arise in deriving CODACOND-type constraints through local conjunction.)

(7) COINCIDE(α,**str**) constraints and positional neutralization

/tépo/	COINCIDE(MidV, σ́)	IDENT[Vht]	*MIDV
a. tépo	*!		**
☞ b. tépu		*	*
c. típu		**!	

Zoll (1996, 1998) proposes that COINCIDE constraints can be used to account for certain cases of positional augmentation as well as for positional neutralization. However, this section shows that if positional augmentation is to be accounted for by means of coincidence, there must be a second, formally distinct class of COINCIDE constraints. COINCIDE(α,**str**) constraints (6), the kind used to account for positional neutralization (7), cannot serve as an adequate account of positional augmentation effects, for the following two reasons.

First, (as has been argued throughout this dissertation), in positional augmentation phenomena, it is not *marked structure* per se that strong positions are required to have; it is one of a number of properties that enhance perceptual prominence.

Second, in positional augmentation, it is the strong position over which some requirement holds, not the phonological feature or contrast that has a positional distribution. In the terminology introduced by Crowhurst & Hewitt (1997), the position, not the phonological property, must be the focus of the constraint (the element associated with the universal quantifier).

This means that two classes of COINCIDE constraints, with formally distinct constraint schemas or generalized formulations, would have to be recognized. COINCIDE(α,**str**) constraints, as in (6) above, universally quantify over a certain marked phonological structure and require it to coincide with some strong position, thus accounting for positional neutralization. The new type, to account for positional augmentation, would universally quantify over a certain strong position and require it to coincide with some perceptually prominent property, as shown in (8); this type of COINCIDE constraint will be abbreviated as COINCIDE(**str**,π) (where π is mnemonic for 'prominent property').

(8) General formulation for COINCIDE(**str**,π) constraints

COINCIDE (strong position, prominent property)

(i) $\forall x$ (x is a strong position → $\exists y$ (y=prominent property ∧ *Coincide* (x,y))
• *Coincide* (x,y) will be true if y=x, y dominates x, or x dominates y

(ii) Assess one mark for each value of x for which (i) is false.

Universal quantification over the strong position rather than over the phonological property is essential in accounting for positional augmentation effects. If COINCIDE constraints intended to account for positional augmentation were set up in the same form as COINCIDE(α,**str**) constraints — universally quantifying over the prominent property and only existentially quantifying over the strong position — then they would be unable to enforce any property to hold of a strong position if that property was not present somewhere in the form.

For example, in a number of languages including Mongolian, the onset of a word-initial syllable can never be a liquid (§4.2.1.2). An attempt to account for this pattern based on COINCIDE constraints with universal quantification over phonological properties would presumably invoke a constraint like the following, which states that every instance of an onset with sonority lower than that of a liquid (the perceptually prominent property) must coincide with some initial syllable (the strong position).

(9) COINCIDE (|Onset|<LIQ,σ_1) $\forall x$ (x is an onset with sonority < LIQ $\rightarrow$ $\exists y$ (y=$\sigma_1 \wedge$ *Coincide* (x,y)))

Crucially, a COINCIDE constraint of this form cannot be used to account for a language like Mongolian in which liquid onsets are absolutely prohibited. Since is it the phonological structure that is associated with the universal quantifier, if an input contains no non-liquid consonants, then the COINCIDE constraint in (9) is (vacuously) satisfied even with an initial liquid onset.

(10) Vacuous satisfaction with putative "COINCIDE(π,**str**)" constraints

/lala/	COINCIDE (|Onset|<LIQ,σ_1)	FAITH
☞ a. lala		
b. tala		*!
c. ala		*!

But words *never* begin with liquids in Mongolian-type languages. The actual constraint at work must therefore be one that prefers some unfaithful candidate, such as (10b) or (10c), over (10a), even when there is no non-liquid consonant in the input.

The problem of vacuous satisfaction shown in (10) is the reason why a distinct class of COINCIDE(**str**,π) constraints, which universally quantify over strong positions rather than over phonological properties, must be added to the system if COINCIDE constraints are to be used in the analysis of positional augmentation.

Moreover, a theory of just what kinds of things can coincide with each other in a COINCIDE(**str**,π) constraint would also be needed. It would be crucial to ensure that the π variable could only be filled by arguments that qualify as perceptually prominent properties — that is, a counterpart of the Prominence Condition would still be required. Likewise, to prevent segmentally neutralizing augmentation phenomena from affecting psycholinguistically strong positions, a version of the Segmental Contrast Condition would also be needed.

In general, there seems to be no difference in the degree to which a theory designed to handle positional neutralization must be extended if it is to account for positional augmentation as well. A new constraint schema must be introduced, either **M/str** or COINCIDE(**str**,π), that is different from the constraint schema adopted for positional neutralization, be it **F/str**, **M-*Feat*/wk**, or COINCIDE(α,**str**). Constraint filters analogous to the Prominence Condition and the Segmental Contrast Condition are also needed, whether it is **M/str** or COINCIDE(**str**,π) constraints that are used in analyzing positional augmentation. In no case does an account of positional augmentation come for free.

Thus, contra Zoll (1996, 1997a, 1998), there is no advantage to choosing COINCIDE constraints over **F/str** (or **M-*Feat*/wk**) constraints in the analysis of positional neutralization based on the simplicity of an extension of the approach to positional augmentation cases.[9] Further investigation is needed to determine whether it is empirically possible to distinguish between the **M/str** and the COINCIDE(**str**,π) approaches to positional augmentation. Even if COINCIDE(**str**,π) constraints ultimately prevail, the fundamental claims made in this dissertation are unchanged: substantively grounded constraint filters are an indispensable part of the theory of positional augmentation constraints.

5.3 Implications of distinguishing positional augmentation and neutralization

The preceding section has shown that accounts of positional neutralization, when properly constrained so that they make the right typological predictions *for* positional neutralization, are intrinsically unable to account for positional augmentation effects. Conversely, it is also clear that the **M/str** constraints proposed here cannot, by themselves, account for positional neutralization. As has been demonstrated throughout the preceding chapters, **M/str** constraints demand that certain properties hold of strong positions. They do not make any demands of weak positions, and they are antagonistic to faithfulness in strong positions (in that, if a given instance of a strong position *str* lacks the perceptually prominent property called for by a constraint **M/str**, then the satisfaction of **M/str** entails a violation of faithfulness in *str*). Therefore, **M/str** constraints are unable to account for either aspect of the positional neutralization pattern, the loss of contrast in weak positions or the preservation of contrast in strong positions.

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[9]In fact, Walker (to appear) suggests that both **F/str**-type and COINCIDE-type constraints may be necessary to account for the privileged behavior of multiple strong positions seen in the feature-migration pattern of Esimbi.

In short, it is unavoidable that two separate classes of position-specific constraints be recognized: those that account for positional augmentation, namely, **M/str** constraints, and those that account for positional neutralization, namely, one of the three systems reviewed in §5.2 above. However, this result is not surprising. Positional augmentation phenomena are fundamentally different from positional neutralization phenomena in that they involve the enhancement of perceptual prominence rather than the mere neutralization of phonological contrasts to the typologically unmarked value. The two goals sometimes intersect; syllables with onsets are both perceptually prominent and typologically unmarked, for example. The two considerations can also be contradictory, however, as in the case of perceptually prominent, but typologically marked, mid vowels. Therefore, the fact that no single constraint type can account for both kinds of effects is not entirely unexpected.[10]

In an optimality theoretic analysis, the broader typological predictions made by any proposed constraint inventory must also be considered. In this case, it has been necessary to conclude that both positional augmentation constraints and positional neutralization constraints are present in the universal constraint inventory. What classes of languages are thereby predicted to exist? This section examines the factorial typology of a constraint inventory containing **M/str** constraints for positional augmentation[11] and one of the three kinds of constraints discussed in §5.2 for positional neutralization. A system that has **M**, **F**, **M/str**, and **F/str** constraints is considered in §5.3.1, and one that has **M**, **F**, **M/str**, and either COINCIDE or **M-*Feat*/wk** constraints is considered in §5.3.2; as it turns out, both systems predict the same five general classes of grammars. §5.3.3 then confirms that each of the five predicted grammar types does in

[10]Another proposal that attempts to unify positional neutralization and certain instances of what would under the present system be classified as positional augmentation is that of Dresher & van der Hulst (1998). Dresher and van der Hulst argue that elements that are heads of prosodic (or segmental) units tolerate, and in some cases require, more complexity than non-head (dependent) elements, leading to positional neutralization and positional augmentation effects respectively. However, it does not seem that the notion of head versus non-head can be extended to all pairs of strong and weak positions — for example, the root, a strong position by virtue of its role in speech perception, is generally not a (morphosyntactic) head in derived forms. Even more problematic for this approach is the fact that not all attested cases of positional augmentation do involve an increase in complexity. For example, one kind of positional augmentation effect is the preference for low-sonority consonants in the onsets of stressed or initial syllables. Theories that try to derive markedness from complexity of structure (e.g., Rice 1992) generally propose that obstruents, as the less marked consonants, have less structural complexity.

[11]The same factorial typologies would also be found if positional augmentation constraints of the form COINCIDE(**str**,π) were assumed in place of **M/str** constraints, since the two constraint types are both violated only if the strong position they refer to fails to have the prominent property they invoke.

fact occur. Thus, no incorrect typological predictions are made when both positional augmentation constraints and positional neutralization constraints are included in CON.

5.3.1 Factorial typology with M/str and F/str constraints

To investigate the typological implications of a constraint inventory that contains general **M**, general **F**, **M/str**, and **F/str** constraints, consider a representative constraint set containing one of each of these types of constraint. The crucial case is one in which as many of these constraints conflict with each other as possible. Such a case can be constructed as follows. Let **M** and **F** be conflicting constraints (such as **M**=*MIDV and **F**=IDENT[hi]); let **F/str** be a positional version of **F** (such as IDENT[hi]/σ́); and let **M/str** be an augmentation constraint that is relativized to the same position as **F/str** and conflicts with it (such as [*PEAK/HIGHV]/σ́).[12] A factorial typology of these four constraints includes 4! or 24 distinct rankings. Nevertheless, as shown in (11), only five basic language types are predicted to occur: languages with full contrast; languages with full neutralization; languages with positional neutralization; and two kinds of languages with positional augmentation, those with contrast maintained outside the strong position and those with complementary distribution in strong and weak positions.

[12]Note that **M/str** ([*PEAK/HIGHV]/σ́) conflicts with **M** (*MIDV) in this example (as long as IDENT[low] is ranked high enough to prevent an input high vowel from being realized as a low vowel). Whether or not a given **M/str** constraint will conflict with some general **M** constraint depends on the nature of the **M/str** constraint in question. This point is discussed further in §5.3.3 below.

(11) Factorial typology: **M/str** and **F/str** constraints

	Ranking characteristic	*# rankings*	*Result*
(a)	**F** highest ranked **F/str** >> **F** >> {**M**, **M/str**} **F/str** >> **M/str** >> **F** >> **M**	6 2 1	Full contrast between marked and unmarked values ([i]≠[e])
(b)	**M** highest ranked	6	Full neutralization to unmarked value ([i])
(c)	**F/str** >> **M** >> {**F**, **M/str**} **F/str** >> **M/str** >> **M** >> **F**	2 1	Positional neutralization: contrast in *str* ([i]≠[e]); unmarked value in *wk* ([i])
(d)	**M/str** >> **F/str** >> **F** >> **M** **M/str** >> **F** >> {**F/str**, **M**}	1 2	Simple positional augmentation: prominent value in *str* ([e]); contrast in *wk* ([i]≠[e])
(e)	**M/str** >> **M** >> { **F**, **F/str** } **M/str** >> **F/str** >> **M** >> **F**	2 1	Positional augmentation with complementary distribution: prominent value in *str* ([e]); unmarked value in *wk* ([i])

In the rankings shown in (11a), where no **M** constraint is active, the language has full contrast in all positions (note that full contrast is possible even if **M/str** dominates general **F**, as long as **F/str** dominates **M/str**, thereby protecting the contrast in the strong position). Another simple case is that of (11b): if general **M** is highest ranked, then the contrast is neutralized to the unmarked value in all positions regardless of the rankings among the other three constraints. Languages of these two general types are well attested in the literature.

More intricate interactions involving the positional constraints are seen in the three remaining grammar types. In (11c), what is crucial is that **F/str** dominates both markedness constraints, allowing the contrast to be maintained in the strong position, but general **M** dominates general **F**, leading to neutralization to the unmarked value outside the strong position — this is classical positional neutralization, another well-attested language type.

The rankings in (11d-e) all produce languages with positional augmentation effects (neutralization to the perceptually prominent value in the strong position), because in each of these cases, **M/str** is highest ranked, dominating all three of the constraints that conflict with it. The difference between (11d) and (11e) is in the relative ranking of general **F** and general **M**. In (11d), the ranking **F** >> **M** allows contrast outside of the strong position. In (11e) this ranking is reversed, leading to neutralization to the unmarked value outside the strong position. As discussed further in §5.3.3 below, these two language types are likewise empirically attested.

5.3.2 Factorial typology with M/str and COINCIDE or M-*Feat*/wk constraints

As shown in §5.2, other ways to model positional neutralization are systems that assume **M-*Feat*/wk** constraints or COINCIDE(α, *str*) constraints. This section examines the factorial typology of a constraint set including **M/str** constraints and one of these two types of positional-neutralization constraints. This factorial typology predicts the same five grammar types as the system with **F/str** constraints considered above.

Since analogous **M-*Feat*/wk** and COINCIDE constraints, such as *MIDV/σ̆ and COINCIDE(MidV,σ́), have the same pattern of constraint violation — each of the two is violated whenever there is a mid vowel in an unstressed syllable and satisfied otherwise — they can be conflated for the purposes of this discussion. Therefore, the abbreviation **M/wk** will be used to stand for either **M-*Feat*/wk** constraints or COINCIDE constraints in the factorial typology examined below.

As in §5.3.1, the most instructive case to consider is one in which the four constraints conflict among themselves as much as possible. Again, let **M** and **F** be the conflicting constraints **M**=*MIDV and **F**=IDENT[hi]; then let **M/wk** be a positional version of **M** (such as *MIDV/σ̆) or the analogous COINCIDE constraint (such as COINCIDE(MidV,σ́)); and let **M/str** be an augmentation constraint that is antagonistic to **F** and affects the strong position related to **M/wk** (such as [*PEAK/HIGHV]/σ́).

(12) Factorial typology: **M/str** and **M/wk** constraints

	Ranking characteristic	*# rankings*	*Result*
(a)	**F** highest ranked	6	Full contrast between marked and unmarked values ([i]≠[e])
(b)	**M** highest ranked	6	Full neutralization to unmarked value ([i])
	M/wk >> **M** >> {**F**, **M/str**}	2	
(c)	**M/wk** >> **F** >> {**M**, **M/str**}	2	Positional neutralization: contrast in *str* ([i]≠[e]); unmarked value in *wk* ([i])
(d)	**M/str** >> **F** >> {**M**, **M/wk**}	2	Simple positional augmentation: prominent value in *str* ([e]); contrast in *wk* ([i]≠[e])
(e)	{**M/wk**, **M/str**} >> {**F**, **M**}	4	Positional augmentation with complementary distribution: prominent value in *str* ([e]); unmarked value in *wk* ([i])
	M/str >> **M** >> {**F**, **M/wk**}	2	

The same five grammar types are predicted as in the typology considered in §5.3.1.[13] If **F** is highest ranked, there will be full contrast in all positions (12a). Whenever **M** dominates both of the conflicting constraints (**F** and **M/str**), there will be neutralization to the unmarked value in all positions (12b). If **M/wk** dominates **F**, but **F** dominates **M** and **M/str**, there will be neutralization to the unmarked value in the weak position, but contrast will be maintained in the strong position: positional neutralization (12c). Finally, there are again two kinds of positional

[13]A comparison of the *# rankings* columns in (11) and (12) shows that the two systems predict different numbers of rankings to fall under each of the five general grammar types. Some researchers have proposed that the number of distinct rankings that result in a particular pattern should correlate with the observed frequency of the pattern (see, e.g., Anttila 1997). If so, then this might provide a way to distinguish empirically between the **F/str** and **M/wk** approaches to positional faithfulness. However, work on the formal learnability of OT grammars (especially Smolensky 1996, Hayes 1999b, Prince & Tesar 1999, and Smith 2000a) has shown that certain types of rankings are chosen by the learner only when positive evidence for those rankings is encountered. Since the choice between two rankings that would produce the same language type is therefore not necessarily random, it may not be meaningful simply to relate the frequency of a particular phonological pattern to the raw number of constraint rankings that would be compatible with such a pattern.

augmentation languages (12d-e): any ranking in which **M/str** dominates **F** and **M** will result in neutralization to the perceptually prominent value in the strong position (positional augmentation). The difference between the two patterns lies in whether or not **F** dominates both of the markedness constraints that are relevant for the weak position, **M** and **M/wk**. In rankings where **F** dominates both of these constraints, then contrast is maintained in the weak position (12d). However, if either **M** or **M/wk** dominates **F**, then the weak position is neutralized to the typologically unmarked value (12e).

5.3.3 Positional augmentation and complementary distribution

As the previous two subsections have shown, a constraint inventory that includes the constraints needed to derive both positional augmentation and positional neutralization phenomena will allow five types of grammars. Of these five, the existence of the first three types — contrast between members of a phonological opposition in all positions, neutralization to the unmarked value in all positions, and positional neutralization (neutralization to the unmarked value in weak positions but contrast in strong positions) — is well known.

The two remaining language types give rise to positional augmentation phenomena such as those that have been discussed in the preceding chapters. In both types, the strong position undergoes neutralization to the perceptually prominent member of a phonological opposition; this is the defining characteristic of a positional augmentation system. The crucial difference between the two types lies in whether the weak position maintains a phonological contrast (11d)/(12d), or whether it undergoes neutralization to the unmarked member of the contrast (11e)/(12e).

Many of the languages examined in chapters 3 and 4 are of the (11d)/(12d) type, which might be dubbed "simple positional augmentation". In these languages, the **M/str** constraint enforces neutralization of a contrast to the perceptually prominent value in the strong position, but contrast is maintained in the weak position. This can be seen for example in Arapaho (§4.2.1.1), in which initial syllables must have onsets, but other syllables may have onsets or lack them. Other examples are Chamicuro (§3.4), in which onset consonants must have a supralaryngeal Place specification, but other consonants may have or lack such a specification; Zabiče Slovene (§3.2.1.3), where stressed short-V syllables may not contain high vowels, but other short-V syllables may contain high, mid, or low vowels; and the languages in §4.2.1.2, where initial syllables may not contain high-sonority onsets, but other syllables may contain onsets of high or low sonority.

Examples of the (11e)/(12e) language type are also attested. This pattern involves neutralization in both strong and weak positions. In strong positions, the phonological contrast in question is neutralized to the perceptually prominent value. In weak positions, the contrast is neutralized to the typologically unmarked value. This pattern was labeled "positional augmentation with complementary distribution" in (11) and (12) above, because in cases where the perceptually prominent value is distinct from the typologically unmarked value, the two values will surface only in the strong position and only in the weak position respectively; hence, they will be in complementary distribution. This kind of pattern can be seen in Niuafo'ou loanwords (§3.2.2.3), where high vocoids in hiatus are syllabified as vowels when the following vowel is stressed (to satisfy the **M/str** constraint [*ONSET/GLI]/σ́) but as glides elsewhere (to satisfy ONSET). Thus, glides and high vowels are in complementary distribution, and the conditioning environment is the structural relationship of the high vocoids to the strong position stressed syllable. (See also de Lacy 2000, to appear for discussion of this point.) Other examples of this pattern are found in languages that have positional augmentation in stressed syllables that is related to vowel prominence, along with reduction of vowels outside of stressed syllables to typologically unmarked values — mid vs. high vowels (Chamorro; Chung 1983, Crosswhite 1999a); long vs. short vowels (Icelandic; Einarsson 1949; and Coatzospan Mixtec; Gerfen 1999:§3.6.1.1); and full vs. reduced vowels. Another plausible example would be a language that requires all onset consonants to have a supralaryngeal Place specification, like Chamicuro (§3.4; Parker 1994, 2000), while banning supralaryngeal Place in coda consonants, like Kelantan Malay (Teoh 1988; Lombardi 2001).

It should be emphasized that not all **M/str** constraints will participate in an observable complementary distribution pattern even when ranked as in (11e)/(12e). In cases where the perceptually prominent member of a phonological opposition is also the typologically unmarked value, then the "complementary distribution" ranking will produce a language that looks like the (11b)/(12b) case: neutralization to the unmarked value in all positions. This is because the "complementary distribution" ranking causes strong positions to be neutralized to the perceptually prominent value and weak positions to be neutralized to the typologically unmarked value, so in cases where the same member of the opposition is both perceptually prominent and typologically unmarked, the strong and weak positions will be neutralized to the same value. An example of an **M/str** constraint with this effect is ONSET/σ́, since syllables with onsets are both more perceptually prominent and less typologically marked than syllables without onsets.

5.4 Summary and conclusions

This chapter has explored the interaction of **M/str** constraints with other kinds of positional constraints. Since positional augmentation involves the enhancement of perceptual prominence in strong positions, whereas positional neutralization involves the elimination of typologically marked elements in weak positions, fundamentally distinct constraint types are involved in each case, and both must be included in the universal constraint set. The factorial typology predicted by such a constraint set is consistent with the kinds of languages that are empirically attested: languages with full contrast, full neutralization, positional neutralization, simple positional augmentation, and (for **M/str** constraints where the perceptually prominent value of a contrast is not the same as the typologically unmarked value) positional augmentation with complementary distribution.