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1. Introduction

Recent cross-linguistic research on voicing (Mascaró 1987, Cho 1990, Lombardi 1991) has reduced many of the voicing effects found across languages to two simple rules. The first is the mechanism which accounts for final devoicing in languages like German; the second is the rule which accounts for the voicing agreement commonly found in consonant clusters, known as voicing assimilation. These authors do not agree on the formulation of the first mechanism but, as it turns out, either of the three formulations will be sufficient for the present purposes. My main concern here will be the nature of the second rule, voicing assimilation. Mascaró, Cho and Lombardi agree that the simple context free rule "spread [voice]" is the optimal formulation of this process, a point I agree with as well.

The ways in which these authors implement this rule differ, however. Mascaró assumes that [voice] is a binary feature; in particular, he crucially relies on a phonologically active feature [-voice] to block feature-filling voicing assimilation in certain cases. Lombardi, on the other hand, argues persuasively that [voice] is a privative feature (Trubetzkoy 1958, Mester & Itô 1989); that is, there is no phonologically active feature [-voice]. Problematically, for several cases in which it looks like [-voice] is needed, she is forced to add an *ad hoc* stipulation to the simple rule "spread [voice]" which will block its

application in the correct environments. In some cases this extra stipulation duplicates information already encoded in the mechanism for final devoicing, a suspect redundancy. Cho also argues for privative voicing and her analysis shares many similarities to Lombardi's, but as far as I know she does not discuss the cases which are difficult for Lombardi.

However, even though assuming binary [voice] can handle the problem cases, Lombardi argues that there is good reason to believe that [voice] is a privative feature. The kinds of arguments raised, which I will discuss in greater detail below, have to do with laryngeal neutralization, rule blocking and coocurrence restrictions. Mascaró's theory, which uses both [+voice] and [-voice] in the phonology, while being empirically adequate, is at odds with the arguments in favor of the theory of privative voicing. I will argue here that the theory of privative voicing can be maintained along with the context-free rule "spread [voice]"; the problem then becomes how to account for, in a non-*ad hoc* fashion, the problem cases for Lombardi's theory.

A closer examination of these cases reveals a certain character they all share; the *ad hoc* complication to the rule "spread [voice]" always involves prosodic information. Specifically, the voicing assimilation rule must be stipulated to apply only **across** a certain prosodic boundary, e.g. syllable boundary, word boundary. Looking at the problem in a slightly different way we could say that the stipulation in these cases is actually that "spread [voice]" cannot apply **within** a certain prosodic domain. Now, as we know from the work on prosodic phonology of Selkirk (1978, 1980, 1986) and Nespor & Vogel (1982, 1986), prosodic domains can be domains for rule application; that is, some phonological rules are limited to applying only within a specific prosodic domain (e.g. the phonological word) and cannot continue to apply in higher domains (e.g. phonological phrase, intonational phrase, utterance). This is analogous to morphological domains as domains for rule application in lexical phonology (Kiparsky 1982), where certain phonological rules are limited to applying within specific morphological domains (e.g. Level 1) and cannot continue to apply in higher domains (e.g. Level 2, morphological word level).

My claim is that the analogy between prosodic domains and morphological domains goes further than that. It has been known for some time that lexical phonological rules appear to obey the Strict Cycle Condition (Mascaró 1976, Kiparsky 1982, 1985); that is, after applying within a given domain, they are not allowed to reapply to the same domain at a later time unless triggered by "new information" previously not visible to the rule. I will argue that the same holds for cyclic rule application within prosodic domains. After a rule applies within a certain prosodic domain, it cannot reapply within that domain unless it is triggered by some new information that it did not have access to on the lower domain. This extension of the Strict Cycle Condition, the Prosodic

Cycle, will account for the cases that were problematic to Lombardi's theory. Those cases were characterized above as allowing voicing assimilation only across certain prosodic boundaries; the rule was blocked from applying within a specific prosodic domain. I will argue that these are strict cycle effects.

The result of this line of research will be that languages displaying voicing effects of the sort discussed here will differ not in the formulation of the rule of voicing assimilation, but rather in the prosodic "level" at which default feature fill-in occurs; this is because, as in the lexical phonology, various redundant features are absent earlier in the derivation but are present later. Thus, features that get filled in later will have no effect on rules which apply earlier. In other words, if a feature is not present as a rule applies to a given domain, but is present at a higher domain, that feature will not be affected by the rule.

Section 2 outlines Lombardi's (1991) theory, which is a sort of spring-board for the present account. In §3 I discuss in detail four cases of voicing assimilation which are problematic for Lombardi's account; in that section, I argue that voicing assimilation is cyclic and propose the Prosodic Cycle, a constraint on cyclic rule application in prosodic phonology. I show how it greatly simplifies the analysis of Lombardi's problem cases and makes the correct predictions with respect to the asymmetry between sonorants and obstruents in voicing assimilation. Section 4 offers independent motivation for the Prosodic Cycle by showing it is a necessary constraint on other cyclic rules in prosodic phonology, namely place assimilation and syncope. The analogy between cyclic lexical phonology and cyclic prosodic phonology is made throughout the paper and in §5 is pushed to its limits: the conclusion is that the Prosodic Cycle is simply the Strict Cycle Condition understood as a constraint on cyclic rule application rather than a constraint on lexical rules. Finally, §6 addresses the conclusions of the paper.

2. Lombardi's Theory

As mentioned above, both Lombardi (1991) and Mascaró (1987) have a mechanism which results in final devoicing in a language like German. Mascaró posits a rule of rime reduction which delinks the [±voice] feature from a consonant in the rime of a syllable. Lombardi argues that delinking of [voice] follows from its not being licensed in rime position; she posits a constraint, the Voice Constraint, on exactly where [voice] is licensed, which is generally the onset position. Cho (1990) also has several rules which have the result of delinking [voice] from obstruents. In many ways, the theories are equivalent;[2] however, since much of what I discuss below is in reaction to Lombardi's analysis I will detail only her account here.

The part of Lombardi's theory which concerns us here is made up of four assumptions:

(1) a. [Voice] is privative.
b. Some languages have the Voice Constraint, which licenses voice only in certain syllable positions.
c. Some languages have voicing assimilation, which is the rule "spread [voice]".
d. A rule of default voice fill-in can feed or counterfeed voicing assimilation; i.e. default voice can fill in [voice] which can then spread, or it can fill in [voice] after spreading has ceased.

In what follows, I briefly justify these assumptions and illustrate their interaction by giving Lombardi's analysis of Dutch.

2.1 Privative Voicing

Lombardi argues that [voice] is a privative feature. That is, there is no feature [-voice]. For this to be true, the following must be proven (p. 35):

(2) a. Segments are not underlyingly marked [-voice].
b. [-voice] is never active in the phonology.

If ((2)a) is correct, then for one thing, there can be no underlyingly voiceless sonorants; this means that no language can have sonorants which contrast for voice. Lombardi argues persuasively that this is correct. The apparent counterexamples can all be analyzed as a contrast in aspiration, not [voice] (Mester & Itô 1989, Lombardi 1991, chap. 4). A second consequence of ((2)a) is that there should be no cooccurrence restrictions on [-voice] segments underlyingly. While such cooccurrence restrictions are known for [voice], there appear not to be any on [-voice]. Mester & Itô (1989) discuss the interaction of Lyman's Law and Rendaku in Japanese. The result of the discussion is that obstruents can be underlyingly marked [voice] but are never marked [-voice]; they suggest that [voice] is privative in Japanese and all languages.

For ((2)b) to be correct, there should be no phonological processes which crucially refer to [-voice]. There are two possible counterexamples to this claim, which Lombardi discusses. The first is Dahl's Law in Bantu which involves apparent dissimilation of [-voice]; Lombardi discusses this rare case in some detail (pp. 85-96) and concludes that it is not really dissimilation, and as such, is not really a counterexample to the theory of privative voicing. The second possible counterexample is the well known cases of [-voice] assimilation. Lombardi, following Mester & Itô (1989), argues that such apparent assimilation is, in fact, neutralization followed by assimilation of

[voice]. The interaction of neutralization and assimilation is the crux of the theory Lombardi proposes, so inasmuch as her theory holds, apparent assimilation of [-voice] is not a problem.

An argument that ((2)b) is correct is discussed in Cho (1990, p. 146). Sanskrit has voicing agreement in obstruent clusters. This can be analyzed along the lines discussed in the preceding paragraph: as neutralization followed by spreading of [voice] (see below, §3.5). This assimilation results in a representation having a linked structure (two consonants linked to the same [voice] feature). The privative theory predicts that the unvoiced cluster will not be linked. If assimilation were spreading of both [+voice] and [-voice], then voiced as well as unvoiced clusters would have linked structures. As it turns out, the theory of privative voicing makes the correct predictions with respect to linking.

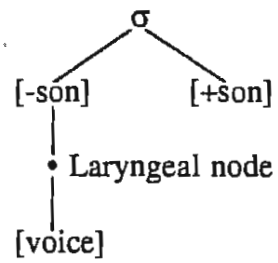
As is well-known, linked structures often behave differently from non-linked structures; this is known as geminate integrity (Hayes 1986, Schein & Steriade 1986). Sanskrit has another rule that neutralizes word-final voiced and voiceless fricatives into the visarga [h]; this rule is blocked only when the word-final fricative has undergone place assimilation, resulting in doubly-linked [place], or when it has undergone voice assimilation, resulting in doubly-linked [voice]. Thus, the rule is sensitive to linked structure (Steriade 1982). However, crucially, this rule is not blocked by a voiceless consonant cluster. This is predicted under the privative voicing account because the voiceless cluster is not linked. The binary voicing account cannot explain these facts since voiceless clusters would be linked and the lack of blocking effects would remain mysterious.

Another type of argument in favor of privative voicing is a theoretical one. Clements (1985) argues that laryngeal features like [voice] and [aspiration] should be grouped under a single laryngeal node. This is because laryngeal neutralization neutralizes all laryngeal distinctions, which he analyzes as simple delinking of the laryngeal node. The crucial assumption, as Lombardi notes, is that a segment with no laryngeal node is understood as voiceless unaspirated. This makes little sense under the binary view of voice. Why would it be that a segment with no laryngeal node would end up marked as [-voice]? If we assume privative voicing, then an unvoiced segment is simply a segment without a [voice] feature.

2.2 Voice Constraint

To account for the phenomenon of "final devoicing", Lombardi posits a constraint which positively licenses the feature [voice]:[3]

(3)



The Voice Constraint (VC) states that the feature [voice] is licensed in an obstruent only if it stands before a tautosyllabic [+son] segment. The result is that an obstruent which is underlyingly marked for [voice] can maintain its voicing only if it precedes a sonorant in the same syllable. If the obstruent is in the rime of a syllable, [voice] is unlicensed and will delink and delete. VC is to be thought of as an extension of "prosodic licensing" (Itô 1986, Goldsmith 1990) which requires phonological material to belong to higher prosodic structure.

2.3 Voicing Assimilation

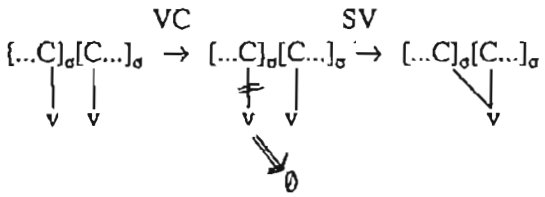
As mentioned in §1 Lombardi assumes that some languages have a rule of voicing assimilation. This is formulated as the simple context free rule:

(4) Spread [voice]

In the simplest case direction need not be specified; segments marked [voice] attempt to spread this feature, in a feature-filling manner, to adjacent segments. I assume that structure preservation blocks [voice] from spreading to sonorants, which are underlyingly unmarked for [voice] universally;[4] a later default fill-in rule supplies them with their lexically redundant [voice] specification (see below for discussion). Segments that are underlyingly unmarked for [voice] but for which filling in [voice] does not violate structure preservation, as is often the case with obstruents, are then the appropriate targets for Spread Voice. In languages which clearly require, for example, progressive but not regressive assimilation, the appropriate direction ("left" or "right") is added to the rule in (4).

If a language has both VC and SV, the effect is that some rime consonants that were "devoiced" due to VC will "revoice" by SV and parasitic licensing as illustrated below:

(5)



It is languages of this type which will concern us most in the discussion that follows.

2.4 Default Voice

Lombardi argues that sonorants are never marked for voice underlyingly because such a marking would be redundant since, as she argues, sonorants do not contrast for voice in any language. Therefore, at a later stage in a derivation there is a rule of default voice fill-in (henceforth, "default"). This rule simply inserts the feature [voice] on all sonorants. Since SV is formulated in such a way as not to specify trigger or target, there is no way of ensuring that only obstruents (or only sonorants) are the triggers of SV. As is well-known it is quite common for obstruents to trigger SV, and both sonorants and obstruents to trigger it, but quite rare (or possibly completely unattested) for only sonorants to trigger SV. This follows from Lombardi's account; SV simply spreads whatever [voice] is around. If SV applies only before default then only obstruents will trigger it; if it applies after default then both sonorants and obstruents will trigger it. However, there is no point in the derivation when only sonorants are marked [voice]; thus, there is no way that only sonorants could trigger SV. It is by allowing a choice for when SV applies, or stops applying, that Lombardi accounts for a large part of the individual language variation found.

2.5 An Example: Dutch

From Lombardi (1991, p. 42):

(6)

a.	hui[z]en	'houses'
b.	hui[s]	'house'
c.	hui[sk]ammer	'livingroom'
d.	hui[zb]aas	'landlord'
e.	kra[b]en	'to scratch'
f.	kra[p]	'scratch'
g.	kra[ps]el	'scratchings'
h.	zi[db]ad	'hipbath'
i.	zi[tt]en	'sit'

Dutch has both the Voice Constraint and Spread Voice: underlyingly voiced obstruents (a, e) surface as voiceless in absolute final position (b, f) or in

agreement with adjacent onset consonants (c, d, g, h, i). This can be illustrated by the following derivations:

(7)	UR:	hui[z k]ammer	hui[z b]aas	hui[z]	hui[z]en
	VC:	hui[s k]ammer	hui[s b]aas	hui[s]	
	SV:		hui[z b]aas		
	Surface:	hui[s k]ammer	hui[z b]aas	hui[s]	hui[z]en

Not illustrated by the examples above is that SV applies before default voice fills in [voice] on sonorants. This results in assimilation triggered by obstruents only. Also, SV must stop applying at the word level; SV does not apply across word boundaries[5].

3. Problem Cases

As we have seen in §2, Lombardi's Voice Constraint combined with the rule Spread Voice is able to derive a wide variety of the voicing effects found in the world's languages, while still maintaining the theory of privative voicing. In this section I will discuss a number of cases that are problematic for Lombardi's analysis; at first glance these cases appear to suggest that the feature [-voice] is needed in the phonology as it would serve to block SV in the appropriate environment. Abandoning privative voicing is not the tack that Lombardi takes however. Instead she complicates the rule of Spread Voice in such a way as to block its application in the appropriate environments. Interestingly, the ways in which SV must be complicated for the various cases to be discussed below all share a certain character: SV must be rewritten to include reference to prosodic boundaries. I will argue below that this generalization should not be encoded into each assimilation rule separately but should rather be understood as a general constraint on rule application: the Prosodic Cycle.

3.1 Catalan

3.1.1 The Facts. Catalan has the Voice Constraint: underlyingly voiced obstruents (b) surface as voiceless in absolute final position (a) (data from Wheeler 1979, Mascaró 1976, 1983, 1987):

(8)	a.		b.	
	bul[p]	'bulb'	bul[β]os	'bulbous'
	nebo[t]	'nephew'	nebo[ð]a	'niece'
	val[k]	'I am worth'	val[ɣ]i	'you(sg) are worth'

Catalan has Spread Voice triggered by obstruents:

(9)	a.		b.	
	ca[b z]ona	'no zone'	ca[p]	'no'
	liqui[d b]lanc	'white liquid'	liqui[t]	'liquid'
	llar[g d]e camas	'long legs'	llar[k]	'long'

SV is also triggered by sonorant consonants:

(10)	a.		b.	
	ca[b n]ubitat	'no change'	ka[p]	'no'
	sè[d m]ans	'seven hands'	sè[t]	'seven'
	val[g m]es	'I'm worth more'	val[k]	'I am worth'
	escu[b l]u	'spit it!'	escu[p]	'spit'

Word-medial consonant clusters—obstruent-obstruent (a), obstruent-sonorant (b)--also agree in voicing:

(11)	a.		b.	
	ca[bd]ell	'(wool) ball'	a[bn]egasio	'abnegation'
	do[dz]e	'dozen'	è[dn]ik	'ethnic'
	e[gz]emple	'example'	a[dl]ètic	'athletic'
	ane[gd]ote	'anecdote'		
	perce[ps]io	'perception'		

The analysis of Catalan that Lombardi discusses in the text (p. 55) is that Catalan has VC and SV; although she does not discuss the whole range of facts in (8) - (11) (except briefly in fn. 2, p. 97), since SV is triggered by both obstruents and sonorants and applies across word boundaries, her analysis would presumably have to be that SV applies (at least) after default voice is filled-in on sonorants.

3.1.2 The Problem. The analysis laid out above predicts that any sonorant in general should Spread Voice to any consonant. This prediction turns out to be incorrect:

(12)	a.		b.
	[pl]ac	'I please'	*[bl]ac
	a[pl]audir	'to applaude'	*a[bl]audir
	[kl]ima	'climate'	*[gl]ima
	a[kl]arir	'to clear'	*a[kl]arir

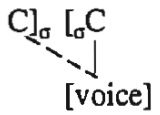
The problem here is that SV is sensitive to syllable structure. In all of the examples where SV applies, the trigger and the target of SV are heterosyllabic.

The examples in (12) do not undergo SV because both the trigger and the target are in the same syllable. The following minimal pair illustrates this contrast well:

(13)	a.	Spread Voice blocked	a/pl/audir	$a]_{\sigma}[_{\sigma}plau]dir$
	b.	Spread Voice applies	a/tl/eta	$ad]_{\sigma}[_{\sigma}le]ta$

In Catalan, [pl] is an acceptable onset cluster, while [tl] is not. This example clearly illustrates that SV applies only across a syllable boundary. It appears that the only way to capture these facts while maintaining the current assumptions is to complicate the rule of voicing assimilation. The rule was simply "spread [voice]". In order to account for the facts in (12), it could be reformulated as a context sensitive rule taking syllable-structure into account:

(14) Spread Voice (Catalan)



This version of SV, which is Catalan-specific, stipulates that SV applies only across a syllable boundary, not within a syllable.

There are two problems with this move, both theoretical. First, the information in Catalan's SV duplicates information in the Voice Constraint. VC was what forced delinking of the syllable-final voice feature in the first place; this delinking created the environment for SV. The fact that the environment needs to be stipulated again in the rule of SV is suspicious. Preferably, syllable structure should be mentioned in one rule or the other but not both.

The second problem is that cross-linguistically much of the voicing effects observed can be accounted for as Lombardi does: some sort of σ-final delinking of [voice] followed by simple context free "spread [voice]". The better theory would not stipulate that in a small number of cases things are actually more complicated and SV is not context free, but rather that the heterosyllabic property of SV in Catalan should follow from something else particular to Catalan.

I should note here that Mascaró (1987) can account for these facts with different assumptions. On his account [voice] is a binary feature. This means that voiceless consonants are marked [-voice] by a complement rule, a type of default rule which fills in underlyingly underspecified features. This marking

has the effect of blocking spreading in certain cases. The way he accounts for (12) is the following:

(15)	*a*]$_{\omega}$[$_{\omega}$p*lau*]*dir*	*at*]$_{\omega}$[$_{\omega}$*le*]*ta*
Complement [voice]	-v	-v
Reduction	-v	∅
Default	-v+v	∅ +v
Spreading	-v+v	+v +v
Surface	a[pl]audir	a[dl]eta

Complement [voice] applies, marking underlyingly unmarked obstruents [-voice]; this marks [p] and [t] as [-voice]. Reduction, Mascaró's version of final devoicing, applies, delinking and deleting all rime voice features; [t] loses its voice feature because it is in the rime of its syllable, but [p] is unaffected because it is in the onset. Default applies, marking sonorants [+voice]; this marks both [l]'s. Spreading applies; both [l]'s are possible triggers for spreading because they both have a [voice] feature to spread. However, only in *atleta* is there an appropriate target for feature-filling spreading, the [t] which has no voicing feature. In *aplaudir* the [p] is marked [-voice]. It is this marking which blocks spreading on Mascaró's analysis.

While this analysis can account for Lombardi's problem case, it is at odds with the arguments for the theory of privative voicing. As discussed in §2.1 there are a number of good reasons to assume that [-voice] cannot be a phonologically active feature. It is then worth looking for an alternative analysis which can maintain privative voicing but also account for the problem case discussed above. In the next section I will outline such an analysis.

3.2 The Prosodic Cycle

In this section I will first lay out my general hypothesis and then show how it accounts for the Catalan facts.

3.2.1 The Strict Cycle. The hypothesis that I would like to explore here is that the syllable-related asymmetries found in Catalan might best be explained as the effects of a modified strict cycle, the Prosodic Cycle. The pieces of this hypothesis include the idea that some phonological rules apply on prosodic domains (Selkirk 1978, 1986; Nespor & Vogel 1982, 1986) and that cyclic rules that apply on these domains obey the strict cycle. Selkirk and Nespor & Vogel argue that some phonological rules are limited to applying within a given **prosodic** domain (e.g. the phonological word (ω)); that is, these rules cannot continue to apply on a larger prosodic domain (e.g. the phonological phrase (Φ), the intonational phrase (I), etc.). This is analogous to domains of rule application in the lexical phonology (Kiparsky 1982); some rules are limited to applying on a given **morphological** domain (e.g. Level 1) which

means that they cannot continue applying on higher morphological domains (e.g. Level 2, the morphological word, etc.).

My claim is that the analogy between lexical phonology and prosodic phonology goes further than that. Cyclic lexical rules obey the strict cycle; this means that these rules can apply only in a "derived" environment, an environment in which new information is available. I claim that the same holds for cyclic rules in prosodic phonology. This can be illustrated as follows, assuming a modified Strict Cycle Condition, which I will call the Prosodic Cycle:

(16) *Prosodic Cycle* (PC):
- a. Cyclic rules apply only to derived representations.
- b. Def.: A representation γ is *derived* w.r.t. rule R in cycle j iff γ meets the structural analysis of R by virtue of information introduced on j not available on cycle j-1.

(17) Rule R: $A \rightarrow B / \_\_ C$

a. Cycle 1, apply R: $[_{\gamma}[_{\alpha}...A_1C_1...A_2][_{\beta}C_2...]]$

b. Cycle 2, apply R: $[_{\gamma}...A_1C_1...BC_2...]$

Let R be cyclic and cycle 1 be the first cycle on the string. On cycle 1 (a), R applies on domain α and domain β. In β the environment for R is not met. In α the environment is met but the application of R would violate the PC because the juxtaposition of A_1 and C_1 is not new information on α, i.e. α is not a derived environment. Note that A_2 and C_2 are not visible to each other on this cycle. Thus, on cycle 1, R fails to apply. On cycle 2 (b), R now applies to γ. Again A_1 and C_1 still meet the structural analysis of R but this is not by virtue of new information; thus, R fails to apply to A_1. However, on γ A_2 and C_2 satisfy the structural analysis of R **in that cycle** so R applies, changing C_2 to B.

The basic intuition is that while a rule is applying to a domain α it cannot see information in an adjacent domain β. When the rule is applying to a higher domain γ, it can now see into both domains α and β simultaneously; the new environment created is eligible for the rule to apply to. However, it cannot go back into α and β to apply affecting either of them alone.

α, β and γ have traditionally been thought of as morphological domains (e.g. stem, affix and morphological word). My proposal is that α, β and γ may also be prosodic domains (e.g. syllable, prosodic word, etc.). Thus, a rule applying on a prosodic domain α will not be able to "see" information in an

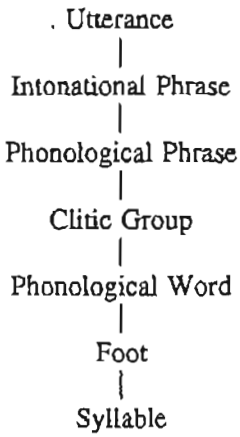
adjacent domain β. On a higher domain γ, however, all the information in α and β becomes visible to the rule and it can again apply; it must obey the PC which blocks it from reapplying on either α or β alone.

3.2.2 Prosodic Phonology. Before showing how the PC can account for the Catalan facts, I will briefly lay out some of the assumptions of prosodic phonology. Selkirk (1978, 1980, 1986) and Nespor & Vogel (1982, 1986) argue that there are a number of phonological rules, both segmental and metrical, whose proper formulation cannot be stated in morphological or syntactic terms. These rules require prosodic information.

These prosodic rules are of three types: (1) domain span rules, which are stipulated to apply within a specific prosodic domain; (2) domain juncture rules, which only apply across a specific type of prosodic boundary; and (3) domain limit rules, which always apply at the edges of prosodic domains. The prosodic domains themselves are the syllable, the foot, the phonological word, the clitic group, the phonological phrase, the intonational phrase and the phonological utterance. It is not clear if every language uses each domain in its phonology and it has been somewhat controversial exactly which domains are relevant for prosodic phonology.

A crucial assumption in this theory is the Prosodic Hierarchy or the Strict Layer Hypothesis: prosodic constituents are arranged hierarchically and each is exhaustively included within a superordinate constituent:

(18)



This means that every syllable is incorporated into a foot and that every foot is incorporated into a phonological word, etc. The reverse is meant to hold as well; every utterance is made up only of intonational phrases and every intonational phrase is made up only of phonological phrases, etc. In this paper

I will concern myself mostly with the syllable (σ), the phonological word (ω), the phonological phrase (Φ) and the intonational phrase (I). These are the constituents that there is the most evidence for in what follows.

3.2.3 Catalan Voicing Assimilation and the Prosodic Cycle. Recall that on Lombardi's account Catalan has the Voice Constraint and Spread Voice. Both obstruents and sonorants trigger SV, within and across words. The problem was that SV was restricted to applying only across syllable boundaries; or put another way, it was blocked from applying within a syllable. This is illustrated by the minimal pair *a[pl]audir* and *a[dl]eta* (*a*[$_{\sigma}$p*lau*]*dir*, [$_{\sigma}$*a*d][$_{\sigma}$*l*e]*ta*).

These facts follow immediately on the analysis I am proposing. Assuming, along with both Lombardi and Mascaró, that sonorants are underlyingly unmarked for voice, if SV is a rule that applies cyclically on prosodic domains and default voice gets filled in after the syllable level then the problematic contrast follows:

(19)

Syllabify:	SV on σ:	Default:	SV on ω:
[$_{\sigma}$*a*t][$_{\sigma}$*l*e]*ta*	→ [$_{\sigma}$*a*t][$_{\sigma}$*l*e]*ta*	→ [$_{\omega}$[$_{\sigma}$*a*t][$_{\sigma}$*l*e]*ta*]	→ [$_{\omega}$[$_{\sigma}$*a*d][$_{\sigma}$*l*e]*ta*]
		v	v
a[$_{\sigma}$p*lau*]*dir*	→ *a*[$_{\sigma}$p*lau*]*dir*	→ [$_{\omega}$*a*[$_{\sigma}$p*lau*]*dir*]	→ [$_{\omega}$*a*[$_{\sigma}$p*lau*]*dir*]
		v	v

First syllabification takes place; at this point VC applies, but in this example it plays no role so it is not represented. SV, which is a cyclic rule, first applies on the syllable level; no change takes place in either form because there is no [voice] to spread since default has not yet applied. Next, default applies, filling in [voice] on sonorants; for clarity, I represent [voice] on [l] only, not vowels. Finally, SV applies on the phonological word level; what this means is that at this point SV can see information in all the lower syllable domains. The [l] in *a[tl]eta* spreads its voice feature to the [t] forming *a[dl]eta*. This is possible because the [t] and the [l] are "seeing each other" for the first time. In *a[pl]audir* this is not possible. The reason is the Prosodic Cycle. SV has already cycled out of the syllable *[plau]* and cannot reapply solely within that syllable.

For the present account of voicing assimilation in Catalan to work, the only new assumption needed is that SV is a cyclic rule which applies on prosodic domains and, as such, obeys the Prosodic Cycle. The assumption that

default voice applies at the level of the phonological word carries over from the previous account. This account however had to stipulate the heterosyllabic condition on SV. Thus, in the present account, the condition of heterosyllabicity is taken out of the rule itself and imposed on the theory of cyclic rule application as the Prosodic Cycle.

Now, if the Prosodic Cycle were invoked solely to capture the Catalan facts, there would be very little support for such a device. However, as we will see below, such a condition on rule application is necessary to account for prosodic asymmetries in voicing assimilation application in other languages as well. By stipulating the prosodic requirement in each and every rule that shows such strict cycle effects, we would be missing an important parallelism which can be explained independently. The parallelism is the fact that the rules involved apply cyclically and as cyclic rules are constrained by the strict cycle (in this case the PC).

The account I have proposed rests on the following claims: (i) cyclic rules of the prosodic phonology, here Spread Voice, obey the Prosodic Cycle; and (ii) default rules apply at a stipulated level, here ω. Claim (i) is original but (ii) is assumed by Mascaró (1987) and Lombardi (1991), among others. I have also implicitly assumed the Strong Domain Hypothesis, although not crucially, which allows the grammar to state when a rule "turns off" but not when it "turns on". As we will see below, the level at which a rule turns off will crucially interact with the level at which default rules apply, allowing for variation among different languages having the same rules.

We will see that from the claims in (i) and (ii) follow the appropriate strict cycle effects. If default voice, or any default rule, applies on the *n+1* cycle, the output of the default rule, say a new [voice] feature, cannot affect a domain which has already been cycled through, e.g. *n*. However, the new [voice] feature can affect the current domain, i.e. *n+1*. This is illustrated by the Catalan case. Default voice applies on ω (*n+1*); although there is an appropriate target for spreading, the [p] in *aplaudir*, Spread Voice is blocked because the σ level (*n*) has already been cycled through and reapplication of SV on σ would violate the PC since the [voice] feature was not introduced on the σ cycle.

3.3 Krakow Polish

3.3.1 The facts and Lombardi's account. Krakow has the Voice Constraint: underlyingly voiced obstruents and clusters (a) surface as voiceless in absolute final position (b) (data from Lombardi 1991 who cites Gussmann 1992 and Bethin 1989):

(20)

a.		b.	
wo[d]a	'water'	wó[t]	gen.pl.
chel[b]a	'bread, gen.sg.'	chel[p]	nom.sg.
ka[ž]e	'he orders'	ka[š]	imper.
ró[zg]a	'rod'	ró[sk]	gen.pl.
wró[žb]a	'prophecy'	wró[šp]	gen.pl.
i[d]ē	'I go'	i[ć́tć́]	inf.
wio[d]ē	'I lead'	wie[ć́tć́]	inf.
kła[d]ē	'I put'	kla[ć́tć́]	inf.
gry[z]ē	'I scramble'	le[ć́tć́]	inf.

Krakow has Spread Voice triggered by obstruents, as the following alternations show:

(21)

a.		b.	
źa[b]a	'frog'	za[pk]a	'small frog'
ró[zg]a	'rod'	ró[štšk]a	'small rod'
wo[d]a	'water'	wó[tk]a	'vodka'
pro[ć́]ić	'request, vb.'	pro[źb]a	noun
li[tš]yć	'count'	li[džb]a	'numeral'
wies[štš]yć	'prophesy'	wie[ždžb]a	'prophecy'

In fact, all obstruent clusters agree in voicing (I discuss the possibility of obstruent-sonorant-obstruent clusters in the following section):

(22)

a.		b.	
[gd]y	'when'	o[dg]rodzić	'separate'
[db]ać	'take care'	gwia[zd]a	'star'
[bzd]ura	'nonsense'	o[dvz]ajemić	'reciprocate'
[dždž]ownica	'earthworm'		
[pt]ak	'bird'	ne[ptk]a	'twit, gen.sg.'
[kt]o	'who'	pa[štš]a	'gorge'
[pštš]oła	'bee'	gwia[stk]a	'star, dim.'
[pst]ry	'gaudy'	o[tst]raszyć	'scare'

SV is also triggered by sonorants, but only across a word-boundary:

(23)

brat rodzony	[bradrodzonɨ]	'own brother'
jak nidy	[jagńidɨ]	'as never'
wóz Andrzeja	[vuzandžeja]	'Andrew's car'

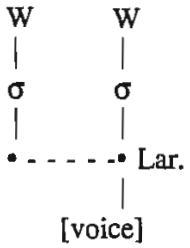
Within words, sonorants do not trigger SV:

(24)

a.		b.	
[zn]ak	'sign'	[sn]op	'sheaf'
[gr]ono	'cluster'	[kr]owa	'cow'
[zv]ój	'coil'	[sf]ój	'one's own'
o[gw]ada	'good manners'	o[kw]ada	'he covers'
pi[žm]o	'musk'	pi[sm]o	'writing'

Lombardi's analysis is that Krakow Polish has VC and SV; SV applies before default has filled in [voice] on sonorants. This accounts for the data in (20), (21), (22) and (24).[6] To account for the fact that sonorants do trigger SV, but only across word boundaries (23), Lombardi posits a second voicing assimilation rule:

(25)



This rule spreads voice only across a word boundary. On the assumption that default voice applies before (25), both obstruents and sonorants are available as triggers for this special voicing assimilation rule. Thus, combining VC and standard SV with (25), Lombardi accounts for the basic Krakow data presented above.

The problem here is, of course, that Krakow requires two separate voicing assimilation rules: SV, which applies early in the derivation, stops applying before default voice applies, and does not need to mention trigger or target, and (25), which applies after default voice and must stipulate both trigger and target. On this account, the fact that (25) is really simply SV with a stipulated trigger and target, is a mysterious accident. A more satisfying analysis of these facts would try to limit voicing assimilation to only one rule, SV, and derive the apparent target/trigger requirements encoded in (25) from something particular to Krakow Polish.

3.3.2 Krakow Polish and the Prosodic Cycle. If, as we did with Catalan, we assume that SV is a cyclic rule which applies on prosodic domains in Krakow Polish, and as such is constrained by the Prosodic Cycle, the effects found in (20) - (24) follow almost immediately. The only relevant difference between Catalan and Krakow, then, is the prosodic level at which default voice applies.

In Catalan, default applied at the ω-level; this accounted for strict cycle effects on the σ. In Krakow, default applies at the Φ-level; thus, strict cycle effects are on the ω.[7] This can be illustrated by the following derivation:

(26)	a.	b.
Syllabify:	[$_{\sigma}$*brat*] [$_{\sigma}$*ro*][$_{\sigma}$*dzo*][$_{\sigma}$*ny*]	[$_{\sigma}$sn*op*]
SV on σ and ω:	[$_{\omega}$[$_{\sigma}$*brat*]][$_{\omega}$[$_{\sigma}$*ro*][$_{\sigma}$*dzo*][$_{\sigma}$*ny*]]	[$_{\omega}$[$_{\sigma}$sn*op*]]
Default and SV on Φ:	[$_{\Phi}$[$_{\omega}$[$_{\sigma}$*brad*]][$_{\omega}$[$_{\sigma}$*ro*][$_{\sigma}$*dzo*][$_{\sigma}$*ny*]]] (v)	[$_{\Phi}$[$_{\omega}$[$_{\sigma}$sn*op*]]] (v)

First, the words are syllabified and VC applies. SV first applies on the σ, causing no effect in these examples. Second, SV applies on the ω; again, no effect. Default applies, voicing the sonorant [r] in (a), and [n] in (b). On the Φ-level, now [r] can see [t] for the first time, so SV applies spreading voice to [t]. In (b), when [n] finally has a [voice] feature to spread, such spreading would violate the PC; thus, SV is blocked in this example. In fact, on this account, all spreading from sonorants will be blocked from applying solely within a word. This is exactly the strict cycle effect that we want for Krakow.

For the present account of Krakow voicing assimilation to work, the only two assumptions needed were: (1) as in the case of Catalan, SV is a cyclic rule which applies on prosodic domains and, as such, obeys the Prosodic Cycle; and (2) SV "turns off" at a specific level. What emerges from this analysis is a different way of thinking about the way languages can differ: Catalan and Krakow differ, not in the formulation of the rule of voicing assimilation as Lombardi's analysis requires, but rather in the prosodic level at which default [voice] fill-in applies. Thus, the prosodic restrictions encoded in SV on Lombardi's account need not be stipulated as such in the rule itself, but are actually derivable from the prosodic level at which default applies. Is there independently any reason to believe that default rules like [voice] fill-in can vary in when they apply? I believe there is; Myers (1987) argues that some differences in the realization of tone in two Shona dialects must be attributed to default fill-in applying at different levels in the two dialects. While more needs to be done here, these results are at least suggestive.

3.4 Warsaw Polish

3.4.1 The facts and Lombardi's account. Warsaw Polish is identical to Krakow Polish in all relevant respects except for one which I will discuss in a moment. Recall from the previous section that Krakow Polish has VC and SV;

this is also true of Warsaw Polish. Thus, the examples (20), (21), and (22) are indentical for both dialects.

The difference between the two dialects is that in Warsaw, SV is never triggered by sonorants. However, word-initial sonorants appear to block SV across a word boundary, while word-final ones appear to be transparent. Consider the following examples:

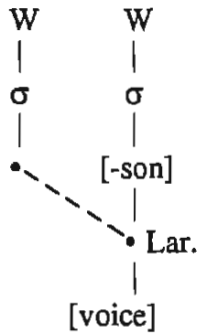
(27) a. jest mglisto 'it's foggy'
obwok mgwi 'fogbank'
odgwos rżiṅa 'sound of neighing'
zapax mdlonci 'nauseating smell'

b. lidr vutki 'liter of vodka'
spazm bulu 'spasm of pain'
żubr dźik'i 'wild aurochs'

In (a), the word-final obstruents remain unvoiced even when followed by a voiced consonant, a sonorant. This suggests that SV is not triggered by sonorants. Presumably, this is because default voice has not yet applied when SV applies. Note that in (a), the word-initial sonorants do not allow the voiced obstruents following them to spread voice "through" them. So, even though the [g] in *mglisto* is voiced, it cannot spread its [voice] feature to the word-final [t]. As we see in (b), however, a word-final sonorant does not block this spreading. The [v] in *vutki* spreads its [voice] feature to the [d] in *lidr* apparently spreading "through" the sonorant.

Lombardi, following Rubach & Booij (1990), assumes that the asymmetry between word-final and word-initial sonorants must be accounted for by differences in syllabification. These authors argue that final sonorants are unsyllabified until very late in the derivation; thus, at the relevant point when SV applies, the sonorants in (b) are not incorporated prosodically, and therefore do not break up the adjacency of the surrounding obstruents. SV appears to apply *through* them. Onset sonorants, on the other hand, are prosodically adjoined, not to σ, but to ω. Since they are prosodically incorporated they are visible and block the spreading of voice. Lombardi takes this blocking effect to suggest that default has applied and sonorants are voiced. This [voice] feature blocks spreading from obstruent to obstruent. In order to make this work, she posits a special voicing assimilation rule, similar to the one she needed for Krakow, which specifies trigger and target:

(28)



This rule spreads voice only from obstruents and only across a word boundary. The stipulation [-son] must be included because, on this account, sonorants are voiced when (28) applies, so they must not be allowed to spread this feature. Hence the stipulation that only obstruents can spread voice. Thus, combining VC with standard SV and (28), along with the extra assumptions about prosodically unattached sonorants, Lombardi accounts for the facts in (27) as well as those in (20), (21), and (22).

The same sorts of objections raised above against (25) can be raised against (28). Lombardi's account of Warsaw, like that of Krakow, suffers because it requires two separate voicing assimilation rules. SV, which applies early in the derivation and stops before default voice applies, is context-free; the second rule (28) applies after default and stipulates trigger and target. Again, what looks like one rule applying at two different stages and in two slightly different ways must be analyzed as two completely independent processes. As discussed above, the better theory would simplify the voicing assimilation rule and attempt to derive the differences in rule application from other properties of the language; for Krakow, that property turned out to be the fact that default voice applies at the Φ-level, creating a strict cycle effect on the ω-level.

3.4.2 Warsaw Polish and the Prosodic Cycle. Given the similarities, and relationship, between Warsaw Polish and Krakow Polish, it is certainly worth investigating if some version of the prosodic analysis given above for Krakow can work for Warsaw. The answer, I believe, is that it can. Recall that the prosodic analysis for Krakow posited only one voicing assimilation rule, context-free SV; this rule applies cyclically on prosodic domains. The blocking effects encoded in Lombardi's special across-word voicing assimilation rule followed on my account from the Prosodic Cycle. The locus of variation turned out to be not in the formulation of SV but rather in the prosodic level at which default voice applies.

Since the basic analysis of Warsaw is that of Krakow, the problem cases are the examples in (27). Schematically, the following is what needs to be accounted for:

(29) From C_1 to C_2:
a. spreading blocked: $\ldots C_2]_\omega [_\omega$ son $C_1 \ldots$
b. spreading okay: $\ldots C_2$ son $]_\omega [_\omega C_1 \ldots$

In (29), the (a) example schematizes the (a) examples in (27), above (e.g., *obwok mgwi*) and (b) schematizes (b) from (27) (e.g., *lidr vutki*). Since we see that sonorants never trigger SV, we can assume that default voice must apply after SV has stopped applying (as in Dutch). We also know that SV applies across word-boundaries so it must still apply at the Φ-level. So, independently of the sonorant problem, we must posit that default voice applies later than the Φ-level, perhaps the I (intonational phrase) level.

What about the sonorant problem? Why is spreading apparently blocked in (a) and not in (b)? Let us consider first (a); it seems that there are two hypotheses to explore:

Hypothesis 1: sonorant and C_1 are tautosyllabic.
Hypothesis 2: sonorant and C_1 are heterosyllabic; sonorant is perhaps adjoined to ω.

Hypothesis 1 entails that the sonorant and C_1 are in the same cyclic domain while hypothesis 2 has them in separate cyclic domains. As it turns out, either hypothesis might be correct as far as my account is concerned. This is welcome since, given the complicated and controversial nature of Polish syllable structure, it would not be favorable for my analysis to crucially rely on a possibly wrong hypothesis.

Let us begin by assuming 1: the word-initial sonorant and the following consonant are both in the same syllable. SV is a cyclic rule, which means it first applies on the σ and then on the ω and Φ levels. I assume that SV applies iteratively; it applies to its neigboring segment then applies to the next closest one, etc. On the σ-level application, nothing happens because any application of SV would violate the Prosodic Cycle; no new information has been introduced on that cycle.

At the ω-level, again any application of SV would violate the PC since, again, no new information has been introduced. On the Φ level, C_2 comes into view. However, on the standard assumption that SV is a local spreading rule, for SV to apply from C_1 to C_2 its first application must be to the sonorant in between. However, this application of SV is impossible. It would violate the

PC because it would require SV to reapply in a cyclic domain which it has already cycled through. Thus, on hypothesis 1, spreading fails to take place from C_1 to C_2.

Let us now assume hypothesis 2, that the word-initial sonorant and C_1 are heterosyllabic. On the σ level application of SV, nothing occurs since there is no target for spreading (and the PC would block it anyway). On the ω level, the sonorant comes into view for the first time. The PC is silent on this, since the environment is derived. However, the question now becomes one of Structure Preservation. Recall that default voice has not yet applied. Structure Preservation mandates that there be no sonorants marked for [voice] at this point in the derivation.

Structure Preservation can be understood in several different ways. Kiparsky (1985) argues that it is a series of filters (e.g. *[+son,+voice]) which are "called off" at a certain point (for him, at the word level); thus, rules are blocked from creating such a representation; this can mean that a rule which would create a starred representation "skips" that particular segment and continues to apply to the next relevant segment. An example of this is neutral vowels in harmony systems. We know that some vowels cannot be targets of spreading because the output is not a phoneme of the language, yet they do not block continued spreading onto the next relevant target. Structure Preservation is assumed to be at work in not allowing the neutral vowel to harmonize; however, Structure Preservation does not block further spreading.

Myers (1991) argues that Structure Preservation should be viewed as a system of fix-up rules, what he calls "persistent rules". On this view, a rule is not blocked from creating a nonphoneme, but rather, a persistent rule immediately fixes the representation into something the language does allow phonemically. So, Myers' view would be that a rule is not blocked when it encounters a neutral segment but rather that it applies to the segment and a persistent rule fixes the representation, often by simply delinking the offending feature. It seems, then, that both Kiparsky and Myers would agree that Structure Preservation does not block a rule from continuing to apply when it reaches a neutral segment (see Padgett (1991) for discussion of the domain of Structure Preservation).

In the case we are looking at ((29)a) the fact that the sonorant to be spread to cannot be marked for [voice], because of Structure Preservation, does not mean that the spreading is blocked from skipping it. Thus, the sonorant in (a) is analogous to a neutral vowel in harmony systems. So SV is not blocked from applying, it just must skip the sonorant. But, since there is no further visible target, SV fails to apply on ω, as well.

At the Φ-level, C_1 again tries to spread [voice]; however, this time, the first step in spreading must be to the sonorant, which is within ω, a domain already cycled out of. This application of SV would be a violation of the Prosodic Cycle, and as such, is not allowed. SV, then, fails to apply in (a) altogether.

Here we see a sharp distinction between the natures of Structure Preservation and the Prosodic Cycle. The Prosodic Cycle blocks a rule from ever applying within a domain it has already cycled through. Thus, the PC is a constraint on rule application. Structure Preservation does not care about rule application but is concerned with the resulting representations and thus, is a constraint on representations. This distinction is seen above in the effects it has on a derivation.

The above discussion derived the correct results for ((29)a) on either hypothesis 1 or 2; the present account does not crucially rely on one particular view of Polish syllable structure.

In ((29)b), things are different. On the ω-level, nothing occurs since C_1 cannot yet "see" the material in the other ω. At the Φ-level, given the assumptions discussed above, that (i) SV applies iteratively and (ii) Structure Preservation does not block rule application, C_1 spreads voice iteratively, first to the sonorant (either skipping it à la Kiparsky or applying to it à la Myers) and then to the obstruent, C_2.

Summarizing, SV is a cyclic rule which applies iteratively. The PC constrains rule application while Structure Preservation constrains representations. The present account does not crucially depend on any crucial assumptions with respect to Polish syllable structure; recall that to account for the asymmetry between word-final and word-initial sonorants in (29), Lombardi had to assume that they were syllabified differently and that this difference accounted for their distinct behaviors. On my account this asymmetry follows from the differences between the Prosodic Cycle and Structure Preservation.

Independently of the schema in ((29)b), there is reason to believe that SV can apply across a sonorant and onto another obstruent in Polish. Polish, both Krakow and Warsaw, allows unusual word-internal consonant clusters as shown in the following examples:

(30)	a.		b.	
	[kr̥t]an	'larynx'	[grd]yka	'Adam's apple'
	mē[dr]ek	'wiseacre'	mē[tr̥k]owa	'wisecrack, vb.'

(30) illustrates complex clusters of the form obstruent-sonorant-obstruent; it also illustrates that the obstruents in clusters of this sort always agree in voicing as if the sonorant were not there. If the sonorant were interacting in some way with the voicing agreement, we would expect either that it would spread its [voice] causing one or both obstruents to be voiced (although, from the above discussion we know that it probably is not marked as such at this stage), or that it would block voicing agreement as in ((29)a), not allowing for the contrasts between (a) and (b) in (30). Neither of these effects is found, however.

What is important about (30) is that it is the obstruent closest to the vowel which determines the voicing of the whole cluster; this follows from Lombardi's VC. As I see it, there are two possible explanations. One is Lombardi's, that the complex clusters are actually all in the onset of their syllable. VC licenses [voice] on the innermost consonant because it is next to the vowel and the other one's [voice] is licensed because it is next to a sonorant (recall that VC licenses an obstruent if it precedes a tautosyllabic sonorant). If the innermost obstruent is not marked for voice underlyingly, then the other obstruent loses its voice feature because the resulting onset e.g. [grt] would violate a modified sonority hierarchy (Lombardi 1991, p. 42); if the outermost obstruent is not voiced underlyingly, then [voice] spreads from the innermost obstruent resulting in e.g. [grd] (see (b)). In this case, SV apparently can apply, effectively skipping over the intervening sonorant.

This view of SV would force us to assume that the syllable itself counts as a derived environment; this assumption may or may not be correct. Thus far, I have assumed that the syllable counts as the first cycle in the prosodic derivation and that the PC blocks any rule application on that cycle. However, nothing I have said so far hinges on that assumption. It is possible that the operation of syllable structure building should count as "derived" in the relevant sense for the PC. If that were the case then SV on the syllable level would not be blocked as Lombardi's account requires. Below in §4, though, I argue that the syllable level cycle should count as the first cycle and not as a derived environment. If this turns out to be correct, then the above account of the examples in (30) is not available.[8]

Another possibility is to deny that such complex clusters as e.g. [grd] (in (30)) actually form an onset constituent. For one thing, it is unlikely that a word-internal cluster like [...VCCCV...] would be syllabified as [...V][CCCV...], but rather as either [...VC][CCV...] or [...VCC][CV...]. As for the word-initial

clusters, it was already suggested (by Lombardi as well as Rubach & Booij 1990) that some initial consonants do not syllabify at all, but rather adjoin to ω.[9] If this were the case with complex clusters like [grd], then we would have an example completely parallel to the cases in ((29)b), above (repeated here as ((31)b):

(31) C_1 spreads to C_2:

a. . . . $[_{\omega}$ C_2 son $[_{\sigma}$ C_1 . . .
b. . . . C_2 son $]_{\omega}$ $[_{\omega}$ C_1 . . .

What this configuration gives us is a prosodically derived environment in which SV is free to apply. In neither case does the PC play a role. So if C_1 is voiced, it SV can apply first to the sonorant and then continue immediately on to C_2. Recall from above that Structure Preservation does not block rule application like the PC would. The only difference between ((31)a) and (b) is the type of prosodic boundary crossed; in (a) the boundary is a syllable boundary and in (b) a word boundary. The case in ((29)a) differed because the prosodically derived environment arose too late; at that point, for C_1 to undergo SV it would have to violate the PC by reapplying in an environment out of which it had already cycled.

On this account, the difference between Krakow Polish and Warsaw Polish is at what level default voice applies. For Krakow, default applies at the Φ-level; for Warsaw, it applies at the I-level. Again, the differences between the voicing effects in the two dialects does not need to be stipulated in the formulations of the rule of voicing assimilation; it follows from the fact that SV is a cyclic rule which applies on prosodic domains and that default feature values are assigned at different prosodic levels.

3.5 Sanskrit

Selkirk (1980) argues that Sanskrit has a rule of final devoicing/deaspiration which accounts for the following facts (p. 119):

(32)

agnimath	>	agnimat
tristubh	>	tristup
labh - sye	>	lap-sye
vīrudh	>	vīrut
tad	>	tat
suhrd	>	suhrt

Sanskrit has a rule of voicing assimilation triggered by obstruents, within (a) and across (b) words (p. 114):

(33) a. ad + si > atsi
ad + thas > atthas
ap - jah > ab-jah
dik - gadah > dig-gadah

b. jyok jīva > jyog jīva
parivrāt gacchati > parivrād gacchati

Sanskrit also has voicing assimilation triggered by sonorants, but only between words; compare ((34)a) with ((34)b) (p. 115):

(34) a. tat namas > tad namas
sat - aha > sad-aha
samyak uktam > samyag uktam
parivrat ayam > parivrad ayam

b. prāñc + aḥ > prāñcaḥ
vac + ya > vacya
marut + i > maruti

Selkirk argues that there are two separate voicing assimilation rules to account for the above facts. One rule accounts for the assimilation triggered by obstruents, as in (33); this rule applies word-internally as well as across word boundaries. She formulates it as follows:

(35) $[\text{-son}] \rightarrow [\alpha\text{voice}] \,/\, {}_{U}(\ldots \underline{\quad} \,|\, \begin{matrix}\text{-son} \\ \alpha\text{voice}\end{matrix}|\, \ldots)_{U}$

(35) is a "domain span" rule, which means that it applies everywhere it can within a stipulated domain, here the phonological utterance (U). Her second rule accounts for the voicing assimilation triggered by sonorants, as in (34):

(36) $[\text{-son}] \rightarrow [\text{+voice}] \,/\, {}_{U}(\ldots {}_{W}(\ldots \underline{\quad})_{W}\ {}_{W}([\text{+voice}]\ldots)_{W}\ldots)_{U}$

(36) is a "domain juncture" rule, which means that it is the type of rule which only applies across certain domain boundaries, here the word-boundary. At this point the reader might have noticed the similarity between the two rules needed here for Sanskrit and the two rules needed by Lombardi (1991) to account for the Krakow and Warsaw Polish facts. They are, indeed, quite similar, and I suggest, can be reanalyzed along the same lines.

What the facts in (32) - (34) suggest is that Sanskrit has the Voice Constraint and Spread Voice. VC is motivated on the grounds that Sanskrit has final devoicing (32); SV is the voicing assimilation illustrated in (33) -

(34). The contrast between the behavior of obstruents and sonorants as triggers of SV is the result of default voice applying at the phrase level. This creates a strict cycle effect on the word.[10]

SV applies cyclically on the syllable and word levels; at these levels in the derivation the only [voice] features available are those on obstruents. Thus, word-internally, only obstruents trigger voicing assimilation ((33)a). At the Φ level default voice applies, voicing sonorants. Now sonorants are triggers of SV. This accounts for the interword voicing assimilation in (34). The sonorants within the words are also now marked for [voice]; however, SV has already cycled out of the ω domain so they do not trigger spreading.

Selkirk (1980) entertains the idea of collapsing her two voicing assimilation rules into one but rejects it on the grounds that it is impossible given her formalism and assumptions. On my somewhat different assumptions, that [voice] is privative and voicing assimilation can apply cyclically, the two rules collapse naturally into one: Spread Voice. The internal versus external differences follow from the Prosodic Cycle and the ordering of default voice at the Φ-level.

3.6 A Concluding Remark

The striking generalization across the four languages discussed in this section is that sonorants behave differently from obstruents as triggers of voicing assimilation. Rather than build the special status of sonorants directly into the assimilation rules, and thus require special rules for sonorants in language after language, it is worth trying to derive their special behavior independently of the rules they participate in. This is what I have attempted to do here. By assuming that sonorants are underlyingly unmarked for [voice], an assumption shared by others (Mascaró 1987, Mester & Itô 1989, Lombardi 1991 and others), and by assuming that they are assigned a voice feature at some point during in the derivation, another assumption well-supported, we have already made progress towards understanding the different behavior of sonorants as opposed to obstruents. The next step is what I have taken in this paper. I treat SV as a cyclic rule applying on prosodic domains. As such, it is constrained by the Prosodic Cycle. Combining that idea with the assumptions above about sonorants, the effects found in Sanskrit as well as Catalan and the dialects of Polish follow quite straightforwardly.

4. Independent Evidence for the Prosodic Cycle

If the Prosodic Cycle is a condition on cyclic rule application in prosodic phonology, then we expect to find its effects in cases other than voicing assimilation. I believe that there are such cases and will discuss two here.

4.1 Nasal Assimilation in Spanish

Nespor & Vogel (1986) argue that nasal assimilation in Spanish is a rule of the prosodic phonology confined to the Intonational Phrase (I).[11] What this means is that it applies everywhere except across an I boundary. This is exemplified in (37), where an underscore represents assimilated nasals and italics represent unassimilated nasals:

(37) a. [$_{I}$Tenían diez canguros en un parque muy cerca de aquí]$_{I}$
'(They) used to have ten kangaroos in a park very near here.'

b. [$_{I}$Las plumas de faisán cuestan tantísimo hoy día]$_{I}$
'Pheasant feathers are very expensive nowadays.'

c. [$_{I}$Un gran balcó*n*][$_{I}$como sabe*n*]$_{I}$[$_{I}$puede ofrecer mucho placer]$_{I}$
'A large balcony, as (they) know, can offer much pleasure.'

d. [$_{I}$Carme*n*]$_{I}$[$_{I}$cántanos una nueva canció*n*]$_{I}$[$_{I}$por favor]$_{I}$
'Carmen, sing us a new song, please.'

As we can see from (37), nasal assimilation applies everywhere it can, within a word (e.g. *cangaros*) and across words (e.g. *un parque*), but it fails to apply across an I boundary. In the terms of Nespor & Vogel, nasal assimilation is limited to applying within an Intonational Phrase. Since they do not see this as a cyclic operation, they assume that it applies once and its domain is I. In the terms of this paper, if nasal assimilation is a cyclic rule of the prosodic phonology (an assumption yet to be justified), then it is a rule which stops applying before the I-phrase. This means that it applies repeatedly to prosodic constituent after constituent but does not apply after above the I-phrase.

Is there reason to think that nasal assimilation is a cyclic rule of the prosodic phonology? Yes, because it shows strict cycle effects analogous to voicing assimilation effects discussed in §3.

4.2 Spanish Nasal Assimilation and the Prosodic Cycle

If we assume the Strong Domain Hypothesis, that is, that rules can be stipulated to turn off at some point but not to turn on, then if nasal assimilation is a cyclic rule it will begin as soon as its environment is first met. We have already seen in (37) that it must turn off before the I-level. This makes the prediction that, as a cyclic rule, nasal assimilation will be blocked from applying in a non-derived environment. This appears to be the case. The first cycle for nasal assimilation will be the syllable-level. If this counts as a non-derived environment then we would expect the rule not to apply within that domain. As it turns out nasal assimilation is blocked syllable-internally as shown by the following minimal pairs (Hooper 1976):[12]

(38)	a.	nuevo	[nweβo]	(*[ŋweβo])	'new'
	b.	un huevo	[uŋweβo]		'an egg'
(39)	a.	nieto	[njeto]	(*[ñjeto])	'grandson'
	b.	un hielo	[uñjelo]		'an ice'

We see here that nasal assimilation is blocked in the (a) examples syllable-internally (e.g. [$_{\sigma}$nwe...) but is allowed in the (b) examples across a word boundary (e.g. ...ŋ]$_{\omega}$[$_{\omega}$we...). It should be noted that nasal assimilation is allowed across a syllable boundary as well (e.g. ((37)a) ...kaŋ]$_{\sigma}$[$_{\sigma}$gu...). Thus the only place nasal assimilation is blocked is within a syllable.

These facts are explained on the account proposed here. Nasal assimilation is a cyclic rule of the prosodic phonology and as such is constrained by the Prosodic Cycle. This means that it is allowed to apply in derived environments only. If we assume that the first cycle is the syllable-level and as such is not a derived environment, then the fact that assimilation is blocked in just those cases follows.[13]

4.3 Cairo Arabic Syncope

Welden (1977) discusses syncope in Cairo Arabic. This is a rule which deletes an unstressed high vowel in a doubly-open syllable (VC_CV). According to Welden, syncope behaves differently depending on whether it applies at the word level or the phrase level.

(40) a. Word level: only [i] deletes

fihim+it	→	fihmit	'she understood'
šaayif+u	→	šayfu	'he sees him'
kutub+i	→	*kutbi	'my books'

b. Phrase level: both [i] and [u] delete

9andaha kitaab	→	9andaha ktaab	'she has a book'
fi kutub+ha	→	fi ktubha	'in her books'

As illustrated in (a), word level syncope deletes only [i]. In (b) we see that phrase level syncope affects both [i] and [u] (see Welden 1977, p. 165). To account for these differences, Welden assumes there are two different rules applying at different levels: one rule applying at the word level and deleting only [i] and a second rule at the phrase level which deletes both [i] and [u]. Crucially, her formulation of phrase level syncope must include word boundaries to block it from *re*applying solely within the domain of the word level rule. In other words, she writes the strict cycle effects directly into the phrase level rule, analogously to Lombardi's formulations of voicing assimilation.

However, if syncope is a cyclic rule which applies on prosodic domains, then with one other assumption, the correct effects are derived and the analysis greatly simplified. Syncope deletes [+high] vowels. We assume that underlying [i] is [+high] but that underlying [u] is *not* marked [+high] underlyingly, perhaps distinctively marked as [+round]. Then only [i] is elegible for syncope on the word cycle. [u], since it has no [+high] feature at that level, is invisible to syncope. Later, [u] has its height filled in by default and phrase level syncope affects both [i] and [u], that is, all [+high] vowels. Crucially, after [u] is assigned the feature [+high], it cannot then undergo "word-level" syncope. That is, syncope on the phrase level obeys the Prosodic Cycle by not applying to domains it has already affected.

The conclusion, after looking at Spanish nasal-place assimilation and Cairo Arabic syncope, is that the Prosodic Cycle is independently needed for phonological rules other than voicing assimilation. This provides crucial independent evidence for the account of voicing assimilation proposed in this paper.

5. Cyclic Phonology

Throughout this paper I have argued that rules in prosodic phonology can apply cyclically. Further, I argued that, as cyclic rules, they obey the Prosodic Cycle. In this way prosodic phonology bears some resemblance to lexical phonology. In this section I will discuss just how far I think the analogy between lexical phonology and prosodic phonology can be pushed.[14] I will conclude that what the two subcomponents have in common is their inherently cyclic phonology and that the only relevant differences stem from differences between the subcomponents in which each functions: lexical phonology is constrained by Structure Preservation, a constraint on the **lexicon**, while prosodic phonology has no such constraint. What emerges is further support for the Prosodic Cycle, which turns out simply to be the Strict Cycle Condition understood as a constraint on rule application, not as a constraint on lexical rules per se. At the end of the section I speculate on the relationship between lexical/postlexical phonology on the one hand and prosodic phonology on the other and suggest that postlexical phonology is just a type of prosodic phonology.

5.1 Lexical Phonology

Kiparsky (1985), which further develops the theory of lexical phonology of Kiparsky (1982), Mohanan (1982) and others, argues that the specific constraints of lexical phonology involve the following three properties (p. 87):

(42) a. cyclic application
b. restriction to 'derived environments'
c. Structure Preservation

Cyclic application (a), Kiparsky argues, follows from the fact that the rules of lexical phonology are "sandwiched" between successive morphological operations. Their restriction to derived environments (b) is to be understood as a disjunctive relation between lexical entries. Structure Preservation (c) is basically the stipulation that a non-distinctive feature in a language may not be specificied in its lexicon.

Setting aside for the moment (a) and (c), I will focus on (b) for I think it requires further comment. Kiparsky argues, and I think rightly so, that some version of the SCC is required for cyclic phonology. This quote sums it up:

> It must however be said with all possible emphasis that the SCC is essential to *any* cyclic phonology [...] in order to permit counterfeeding order among cyclic rules. Suppose that A, B are cyclic rules, where B could feed A but in fact does not. We can block feeding on the same cycle by ordering A before B, but only the SCC can prevent the output of B from undergoing A on the *next* cycle (Kiparsky 1985, p. 88).

In very general terms he acknowledges that cyclic rule application must be constrained by the SCC. However, the version of the SCC he formulates is specifically worded to be relevant only in the lexicon; it cannot be understood as a general condition on cyclic rule application, only a constraint on lexical rule application:

(43) *Strict Cycle Condition* (Kiparsky 1985, p. 89)
If W is derived from a **lexical entry** W', where W' is nondistinct from XPAQY and distinct from XPBQY, then a rule A → B/XP__QY cannot apply to W until the word level (emphasis mine).

What this says is that, before the word level, a rule is blocked from applying to an item already listed in the lexicon. This works on the crucial assumption that lexical derivations always result in a new lexical item. The English examples he discusses (p. 87) are *paint*, *pint* and *mount* which do not undergo Vowel Shortening, as opposed to *meant*, which does. The reason is that Vowel Shortening is blocked from applying to the former items because they themselves are listed in the lexicon with long vowels. The latter, which is listed in the lexicon as /mēn/ and /-t/, combines as /mēn+t/. The morphologically derived /mēn+t/ is not listed in the lexicon and thus, can

undergo Vowel Shortening. The output of Vowel Shortening, /mĕnt/, is now listed in the lexicon.

The formulation of the SCC in (41) sneaks in a requirement that it only constrain **lexical** rule application. That is because it blocks rules from applying only to items listed in the lexicon. The point is that it is not a constraint on **cyclic** rule application per se. If the only cyclic phonology is that found in the lexicon, then (41) is adequate to constrain it. However, if my proposal is correct and there is cyclic phonology in a subcomponent other than the lexicon (specifically prosodic phonology), then the formulation of the SCC in (41) cannot be correct unless the similarity between it and the Prosodic Cycle is to be treated as mere coincidence. I believe that there is just one such constraint and it can correctly constrain cyclic rule application in both lexical and prosodic phonology.

If this is correct then the question becomes whether it is possible to formulate the SCC in such a way as not to overtly mention the lexicon as (41) does. As far as I can tell the stipulation that the SCC is a constraint on lexical rules follows from the theory of lexical phonology, without having to explicitly say so in the formulation. This follows from the fact that lexical phonological rules are inherently cyclic because of being sandwiched in between morphological operations. The SCC constrains cyclic rules; lexical rules are cyclic rules; therefore, the SCC constrains lexical rules. This being the case, it is clear that there are other formulations of the SCC which capture the intuition expressed in Kiparsky's quote above but do not inherently refer to the lexicon. Such a formulation is the one I called the Prosodic Cycle, introduced above in §3.2.1:

(44) *Strict Cycle Condition* (SCC):
  a. Cyclic rules apply only to derived representations.
  b. Def.: A representation γ is *derived* w.r.t. rule R in cycle j iff γ meets the structural analysis of R by virtue of information introduced on j not available on cycle j-1.

(42) is a constraint on the application of **cyclic** rules. They can apply only to derived representations. The definition of 'derived' here covers the lexical cases that (41) does. The basic constraint is that a rule cannot apply to a representation which does not contain new information introduced on that cycle, e.g. *paint*, no new information vs. *mean+t*, the new information is the past tense suffix. Crucially, (42) is silent on lexical vs. non-lexical rule application.

I now return to points (a) and (c) in (40). I will not have much to say about Structure Preservation (c) with respect to lexical phonology. Kiparsky

argues that it is a "result of constraints formulated over the entire lexicon." (p. 87) The important point is that it is, by definition, restricted to the lexicon.

Point (a) is sort of the crux of lexical phonology. As mentioned above, cyclic rule application in lexical phonology follows from the way in which the phonology and the morphology interact. Chunks of phonological rules apply after every morphological operation. Since morphological operations occur in the lexicon, it follows that the phonology of the lexicon will then be cyclic.

What I will argue below is that prosodic structure building rules can be understood to be the prosodic counterparts to the morphological structure building rules in the lexicon. It is this basis that forms the cyclic nature of rules of prosodic phonology.

5.2 Prosodic Cyclicity

Throughout this paper I have argued that prosodic domains like the syllable, the phonological word, etc., can be domains for cyclic rule application. The cyclic rules which apply on them must obey the Prosodic Cycle, the SCC of (16)/(42). Thus far I have suggested an analogy between cyclic rules of the prosodic phonology and of the lexical phonology. The most obvious similarity is that both types of rules obey the SCC. How much further does the analogy go? Here I will argue that the only relevant difference between the two follows from the fact that Structure Preservation is a constraint on the lexicon, and as such is inherently related to lexical phonology, while it is only indirectly related to the prosodic phonology.

As we saw above lexical phonology involves three central properties. Cyclic rule application, which derives from the nature of the morphology/phonology interaction; the restriction to derived environments, which follows from the SCC (either (41) or (42)); and Structure Preservation, which is a series of constraints on the lexicon itself.

Starting with the restriction to derived environments, we have already seen many examples of this property at work in the cyclic phonology in both the prosodic domains and the lexical phonology. Kiparsky's (1985) formulation of the SCC (41) cannot account for the similarity of rule applications in these two separate systems. That is because it is formulated specifically to constrain lexical rules only. My reformulation (42), which does not mention the lexicon, is a constraint on cyclic rules themselves. Thus, if we assume (42), the fact that rules are constrained in the same manner in both components follows from the fact that the rules in both components are cyclic.

What about cyclicity? One of the main tenets of lexical phonology is that morphological rules and lexical phonological rules are interspersed, each

feeding the other; this derives the inherent cyclicity of lexical phonology. I would like to suggest that the same holds for prosodic phonology. The idea for lexical phonology is that after each morphological structure building operation there is a chunk of phonological rules, followed by more structure building, followed by more rules, etc.

If prosodic structure building occurs in the same way, then the cyclicity of prosodic phonological rules follows. First some prosodic structure building takes place, say, syllable structure assignment to a string; this operation divides the string up into syllables such that a segment in syllable A is not visible to a segment in syllable B (A ≠ B). Then some phonological rules apply within those syllables, governed by the Prosodic Cycle. Next, further prosodic structure is built; this time it is the phonological word.[15] This operation has the effect of dividing the syllables up into words; as in the lexical phonology, cycling on this "higher" domain allows the rule to see segments in adjacent subdomains that were not visible simultaneously on those lower domains. Another cycle of phonological rules applies, and so on. This can be illustrated as follows:

(45) Rule R: $A \rightarrow B / \_\_ C$

a.	given string:	$...A_1C_1...A_2C_2...$
b.	build syllables:	$[_\sigma...A_1C_1...A_2][_\sigma C_2...]$
c.	apply R:	blocked by SCC
d.	build words/ bracket erasure:	$[_\omega...A_1C_1...A_2C_2...]$
e.	apply R:	$[_\omega...A_1C_1...BC_2...]$

Given the cyclic rule R and the string in (a), the first step is the prosodic structure building operation of building syllables (b); then cyclic rules apply, here R (c) but are blocked by the SCC since A_1 and C_1 have not come together by any operation. Note that A_2 and C_2 are not visible to one another because of the syllable boundary. The next step is another structure building operation, building phonological words from the syllables; then apply cyclic rule R which this time has a derived environment on which to apply: A_2 and C_2 are now visible simultaneously and R can apply changing C_2 to B.

If this view of prosodic structure building proves to be workable then the cyclicity of the rules applying between the building operations follows as in the lexical phonology.

The third property of lexical phonology is Structure Preservation. As I mentioned above, Structure Preservation is a series of constraints on the lexicon of a language. As we know from Kiparsky's work such a constraint appears to be operative in the lexical phonology. However, there is no inherent link between cyclic phonology and Structure Preservation in the system I am describing. Such a link appears to follow on Kiparsky's account since all cyclic phonology is lexical phonology; hence, all cyclic phonology obeys Structure Preservation. I would argue that not all cyclic phonology obeys Structure Preservation and it is precisely the cyclic phonology that does not obey Structure Preservation that turns out not to be lexical either. Structure Preservation is inherently part of lexical phonology but cyclic phonology is not.

The cases in point are those that I analyzed in §3. In each case, cyclic rules applied before and after Structure Preservation "turned off". For example, in Krakow Polish (§3.3), the syllable-level and word-level applications of Spread Voice applied before Structure Preservation turned off, i.e. before default rules applied. Cyclic application of SV continued on the phonological phrase-level. This created a SCC effect on the word. New voice features (on sonorants) were available at the Φ-level but SV was blocked from reapplying to the ω by the SCC. Since Structure Preservation is a constraint on the lexicon, and SV in Krakow Polish is a cyclic rule of the prosodic phonology, it follows that SV should not be constrained by Structure Preservation.

Thus, we see that Structure Preservation does interact with cyclic rule application in the prosodic phonology, by feeding it, but also that it is not a constraint on the cyclic rules themselves. I conclude, then, that Structure Preservation does not constrain prosodic phonology in the way it does lexical phonology.

5.3 Lexical Phonology, Postlexical Phonology and Prosodic Phonology

The standard theory of lexical phonology (Kiparsky 1982, 1985) assumes two different types of phonology: lexical and postlexical phonology. These two types have different characteristics. Lexical phonology is cyclic, obeys the SCC, obeys Structure Preservation and applies only word-internally. Postlexical phonology is not cyclic, that is it applies "across the board" as if all boundaries had been erased, does not obey Structure Preservation and can apply across word boundaries. The cyclic prosodic phonology I have discussed here simply does not fit into either of these categories since it shares features of both: it is cyclic and obeys the SCC like lexical phonology, yet it does not obey Structure Preservation and can apply across word boundaries like postlexical phonology.

It is tempting to say that the cyclic rules of prosodic phonology are simply postlexical rules which, for whatever reason, obey the SCC. This is doubtful

for two reasons: (1) while many rules of postlexical phonology can be analyzed as being part of prosodic phonology, as rules whose domains are the intonational phrase or the phonological utterance, there is no evidence that these types of rules are cyclic or should be constrainted by the SCC since they apply "across the board" regardless of morphological, syntactic or prosodic boundaries or structure; and (2) it is even more mysterious why a postlexical rule would be sensitive to syllable structure, a clearly word-internal property, such as voicing assimilation in Catalan is. Postlexical rules simply should not have access to such information.

On the other hand, looking at the problem the other way around might prove a bit more promising. That is, perhaps postlexical rules are really rules of the prosodic phonology. I have made the claim that some rules of prosodic phonology are cyclic; I have carefully avoided making the stronger claim that all rules of prosodic rules are cyclic. If it is the case that some rules of the prosodic phonology can be specified to apply at a stipulated level, as has been assumed by the originators of prosodic phonology (Selkirk and Nespor & Vogel), then it makes sense to assume that all postlexical rules are simply rules of prosodic phonology whose domains are the Intonational Phrase or the Phonological Utterance (see Rice 1990). This assumption would deny the Strong Domain Hypothesis, at least in its strongest form.

This discussion is just speculative and ignores recent work by Kaisse (1985, 1990) which attempts to divide up postlexical phonology into two independently motivated types.[16] I have concentrated on the model of lexical and postlexical phonology because of the predictions it makes, which are inherently inconsistent with the type of rules studied here, casting doubt on the classic bifurcation of rules into lexical vs. postlexical rules.

In this section I have discussed three central properties of lexical phonology: cyclic rule application, the restriction to apply in derived environments, and Structure Preservation. What we have seen is that the way structure building operations like morpheme concatenation and prosodic structure building interact with the phonological rules which apply between such operations derives the inherently cyclic nature of both lexical phonology and the prosodic phonology I have studied here. The restriction that cyclic rules apply in derived environments follows from the SCC (42). We have also seen that Structure Preservation, which is a constraint on the lexicon only, interacts with cyclic rules in the prosodic phonology but does not constrain them like it does the cyclic rules in lexical phonology. Thus, the only relevant difference between the two types of cyclic phonologies discussed here is their behavior with respect to Structure Preservation, which follows from the distinct subcomponent each operates in.

Further, I compared the lexical/postlexical phonology model with the one of prosodic phonology developed here and noted that the former as it stands cannot obviously incorporate the latter. I speculated that classic postlexical phonology was really a subcase of prosodic phonology and that perhaps the model of phonology should be divided into two subcomponents: lexical phonology and prosodic phonology.

6. Conclusions

At the start of this paper I argued that a variety of the voicing effects found in the world's languages should be accounted for by a theory of neutralization and spreading like that of Lombardi (1991). In this theory [voice] is a privative feature which is underlyingly absent on sonorants but can appear on obstruents in certain syllable positions (the Voice Constraint). A context free rule, Spread Voice, associates underlying [voice] features with underlyingly unmarked consonants. A default rule later assigns [voice] to sonorants which allows them to be triggers of SV as well.

I then discussed a number of cases in which SV failed to apply in the manner predicted by the theory. As it turned out, in every case, SV was constrained to apply only across certain prosodic boundaries, e.g. the syllable, the word. On Lombardi's theory this meant that SV was reformulated in a language particular fashion to stipulate precisely which boundary a given language needed SV to mention. What resulted was a large amount of redundancy since, in several cases, a second rule was needed because of complications due to sonorants. It was also suspicious that so many cases would require the same type of constraint.

Taking as a starting point, the theory of prosodic phonology, which assumes that phonological rules can apply in prosodically defined domains, I argued that SV was such a rule. However, I further argued that SV was a cyclic rule which applied on prosodic domains. Invoking a modified Strict Cycle Condition, the Prosodic Cycle, I was able to account for the formerly mysterious manner in which SV applied in the problem cases. This line of analysis led to the conclusion that the languages in question do not vary on their formulations of SV; SV remains a simple context free rule. Rather, these languages vary on a different dimension: the prosodic level at which default voice applies to sonorants. This variable, combined with the possibility of SV turning off at a given point, derives a wide variety of voicing effects and correctly predicts the asymmetrical behavior of obstruents and sonorants with respect to SV.

The remainder of the paper concentrated on the Prosodic Cycle and cyclic phonology itself. The Prosodic Cycle received independent support from a case of cyclic place assimilation which required the PC to constrain its application. I compared lexical phonology with cyclic prosodic phonology and concluded that, both being cyclic phonology, both are constrained by the Strict Cycle Condition, which I argued the Prosodic Cycle was simply a subcase of. It turns out that the inherent cyclicity of lexical phonology and prosodic phonology, if I am correct, follows from the nature of each subcomponent: structure building rules are interspersed with chunks of phonological rules. For lexical phonology, this is morphological structure building; for prosodic phonology, it is prosodic structure building. Given the inherently cyclic nature of each subcomponent, the fact that each is constrained by the SCC follows.

Notes

1. I would like to thank Jill Beckman, Juli Carter, Joan Mascaró, Lisa Selkirk, Suzanne Urbanczyk, Draga Zec and the members of 3rd Year Seminar for helpful discussion and/or support. Special thanks go to my advisor John McCarthy, who always made me try to look at things upside down; this work was supported by a NSF graduate fellowship. All errors are my own.

2. Lombardi's Voice Constraint is able to handle the complicated voicing facts in Polish a bit better than Mascaró's Final Delinking account. In effect, Mascaró must stipulate an extra delinking rule to account for complex onsets (see §3.3).

3. In her chapter 2 discussion of voicing effects, she argues for the Voice Constraint illustrated above. Later, she extends the Voice Constraint to include the licensing of all laryngeal features: the Laryngeal Constraint.

4. See Padgett (1991) for a view of structure preservation which blocks lexical rule application that violates universal vs. language-specific redundancies.

5. Dutch also has progressive voicing assimilation involving fricatives; I do not discuss this here but it is handled in Lombardi 1991.

6. Lombardi argues that *o[gw]ada*, *o[kw]ada*, *pi[žm]o*, and *pi[sm]o* are syllabified with the bracketed clusters as onsets.

7. Lombardi (p. 221-224) is aware of the strict cyclic nature of the Polish voicing assimilation and speculates on an account of it assuming the VC to apply at a level later in the phonology.

8. Another possibility along the same lines is that the delinking of [voice] due to the Voice Constraint, might be what creates the "derived" environment.

9. This account would lose the sonority heirarchy explanation for the lack of e.g. [grt] clusters; however, since [gr] would never be under a σ node, the [voice] on [g] would never be licensed by VC. It could only get voiced by SV; that, however, would require the input to be [grd], which is correct.

10. Cho (1990, p. 145) suggests that Sanskrit does not have syllable-final devoicing, but rather has "cluster devoicing". Cluster devoicing delinks the voice features of both Cs in a obstruent cluster. If she is correct, it does not affect the argument here since *how* segments end up without any voice specification is not important; what is important for me is the nature of SV.

11. In particular, their claims are meant to hold for the Porteño dialect (Buenos Aires).

12. I believe Hooper's claim is that this a general fact of Spanish.

13. Assuming the syllable to be a non-derived environment works in this case but might be problematic for Polish, as mentioned above, depending on syllable-structure. Recall that all word-internal obstruent clusters agree in voicing. If these complex clusters are tautosyllabic, then the voicing assimilation which causes them to agree in voicing must violate the PC, as it must apply on the first cycle. However, if these clusters are heterosyllabic, a possibility discussed in the text in §3.4.2, the syllable can count as non-derived.

14. Inkelas (1989) also pushes the analogy between lexical and prosodic phonology; her conclusions differ from those drawn here but also her focus is quite different.

15. I hesitate to include the phonological foot because it does not appear to be relevant in any of the rules I discuss (see Nespor & Vogel 1986).

16. I will note, however, that as I understand it, her model does not make the correct predictions with respect to SV in Catalan. This is because it shares properties with her P1 and P2 rules.

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