Microvariations in Harmony and Value-Relativized Parametrization
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Abstract: This paper explores a parametric delimitation of the space of possible harmony patterns with respect to the class of feature-values that are visible. Extending the framework of Calabrese (1995), the proposal is that alternating morphemes that are searching for a harmonic value may have access to *all-values*, only a *single-value*, or the *contrastive* values of the harmonic feature. Two cases of microvariation are explored: [ATR] vowel harmony in Standard Yoruba vs. Ifẹ Yoruba, which reduces to the setting of the relativization-value to *all* vs. *contrastive*, and vowel-consonant interactions mediated by [high] harmony in Sanjiazi Manchu vs. Sibe, which reduces to the parametric setting of *contrastive* vs. *single-value*.
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Generative grammar seeks to investigate to what extent the study of linguistic variation can shed some light on the broader issue of language particular vs language universal properties, language design and the hypothesis space of possible grammars that will be considered by the learner.

Microvariation between closely related languages can be modeled as the result of differences in the value of a single parameter, while the core formal principles remain constant. Parametric modeling of linguistic variation, particularly in the domain of phonology, leads to important insights into parametric ambiguity and the nature of unattested patterns. In this paper, I investigate two case studies: microvariation in the locality of [ATR] harmony in Yoruba dialects, and microvariation in the locality [high] assimilation in Modern Manchu dialects.

This paper may be seen as an outgrowth in the steps towards constraints on possible assimilation and dissimilation rules that can be traced in the literature: from the formal constraints on rules of Howard (1972); Jensen (1974); Battistella (1982); Yamada (1983) to the representationally-based constraints on rules of Clements (1985); Sagey (1986); Steriade (1987); Calabrese (1988); McCarthy (1988); Odden (1994); Archangeli and Pulleyblank (1994). The goal of this paper will be to show that "neutrality", or transparency, in harmony, follows a very restricted range of variation, due to the activity of a single three-valued parameter.

In previous work (Nevins, 2004), I have developed the motivation for the operation of VALUE-CLOSEST, through which a morpheme with a representation that allows alternation searches for a featural value to determine its form. The notion of *closest* is to be understood in terms of the *precedence* relation[1]:

(1) G is the closest goal to P if $\neg\exists$ H, H $\neq$ P, such that either:
   a. G precedes H and H precedes P
   b. P precedes H and H precedes G

However, the study of (dis)harmony systems reveals that, while an important foundation for the determination of a featural source, (1) is too restrictive. What is important is being the closest source of a *relevant* type:

(2) G is the relativized-closest goal to P if $\neg\exists$ H, H $\neq$ P, such that either:
   a. G precedes H and H precedes P
   b. P precedes H and H precedes G
   c. The domain of search includes both G and H

It is the last clause which is most important. This clause holds in situations in which the domain of search for a closest-valuator is restricted by the *value* of the feature.

The hypothesis of this paper is that there are three parametric settings of the visibility of features in harmony and dissimilation: all-value visibility, single-value visibility (where only a single value, + or -, of a feature [F] is visible in harmony), and contrastive-value harmony. This paper will attempt to demonstrate that one of the most important restrictions / relativizations of search is to values of the feature in question [F] that are *contrastive* on that segment.

The idea that contrastiveness should play a role in the restriction of search domains for subsegmental rules has many antecedents in the literature. What all authors agree on is that certain features on certain segments are "invisible" for the purposes of computing the locality of an assimilation relation.

In Kiparsky (1981) and Steriade (1987), for example, it is assumed that "predictable" or "redundant" features are simply *not present in the representation* at the point at which locality is computed. Steriade's formulation can be exemplified by the example of the value of [voice] in sonorants: the inventory allows for true statement of the implication: [+sonorant] $\rightarrow$ [+voice]. Hence, the value of [voice] is *predictable* on the basis of [sonorant]. Steriade's (1987) application of this concept to locality then dictates that, when the application of redundancy rules *follows* harmony, the redundant features will not be present during the harmony rule – hence their invisibility. Redundant values are, by hypothesis in this class of theories, absent throughout the derivation until very late.

There are two aspects of this solution that have been shown to be problematic: the consistency of a rule-ordering in which redundancy-filling rules are necessarily "late", and the notion of predictability itself, which runs into problems when there is *mutual* predictability among features.

The first problem, of transitivity paradoxes in rule ordering with underspecification, is addressed in detail in Steriade (1995) but can be briefly illustrated here by an example from Mohanan (1991) and McCarthy and Taub (1992): coronal assimilation in English across lexical boundaries (e.g. *hot cakes* $\rightarrow$ *hock cakes*, *sweet bread* $\rightarrow$ *sweep bread*) would lead one to assign the redundancy rule for coronal specification to the late lexical phonology, but at the same time, many rules of English phonology (e.g. onset structure constraints barring **tl*, *t*-palatalization in *presiden**t**ial*, the ban on coronals preceding stressed nuclei composed of *ju* in American English, and so forth) need to refer to coronal specification early in the phonology. Thus, late-ordering of specification

has no support from (and is often contradicted by) other behavior of the "invisible" feature. The problem of wholesale underspecification of a value [F] occurs when some process P refers to the presence of [F], and another process P' depends on [F] being absent. Since this state of affairs requires a featural specification to be both *there* and *not there* in the course of the phonological computation (in an apparent superposition of different states), we'll call this the *Schrödinger's Cat* problem for underspecification.

The second problem, indeterminate predictability of underspecification, is raised most incisively by Dresher (2003). Consider the following inventory, characterized by [± white] and [± triangular]:

(3)

	A	B	C
	◯	◁	◀
White	+	+	-
Triangular	-	+	+

Since, in the inventory above, A is the only [-triangular] item, one could say that this feature alone can characterize A, and is all that must be lexically specified; a later rule can fill in the predictable fact that all [-triangular] items are [+white]. Similarly, for C, it is the only [-white] item in the inventory; hence one might argue that its [triangular] feature is predictable once we know the value of [white]. If we get rid of all predictable specifications, then we can have the representations in (4) and the redundancy rules in (5):

(4)

	A	B	C
	◯	◁	◀
White		+	-
Triangular	-	+	

(5) Redundancy rule 1: [−triangular] → [+white]
Redundancy rule 2: [−white] → [+triangular]

The principle that allows this representation is *logical redundancy*, defined by Dresher (2003:243) as follows:

(6) If ϕ is the set of feature specifications of a member, M, then the feature specification [F] is *logically redundant* iff it is predictable from the other specifications in ϕ.

Thus, the slogan underlying representations such as that above for A, B, and C may be summarized as: "Don't specify any feature that is logically redundant." Indeed, this is the essence of Steriade's 1987 proposal, which is cast in terms of co-occurrence filters, rather than redundancy rules.

(7) Redundant-values with respect to F: the class of segments where a feature co-occurence constraint blocks a value of F (Steriade 1987: 341)

To see that the problem of underspecification based on the logic of redundant

values arises in either implicational (5) or co-occurence-constraint-based (7) implementations, consider the following inventory and its features, and consider the co-occurrence restrictions that represent generalizations over the inventory:

(8)

	A	B
	◀	◯
White	-	+
Triangular	+	-
Small	+	-

(9) Logical redudancy implications: [+triangular] → [−white], [−small] → [−triangular], [−white] → [+small]

(10) Feature co-occurence restrictions: *[+triangular,+white], *[-small, +triangular], *[-white, -small]

Based on the the definition of redundant values, [+triangular] is redundant, since a feature co-occurrence constraint blocks it, while [−triangular] is also redundant, since a feature co-occurrence constraint blocks it, too. Similarly, both [± white] and [± small] are redundant, given the inventory of A and B above. Thus, as **all values of all features** are redundant above; does that mean that the inventory has *no* specifications?

Dresher (2003), after demonstrating the logic of this problem[2], suggests that the solution is a *hierarchy* that determines which features are to have scope over which others in determining successive contrast. For example, in Manchu, which has the [-low] vowels *i*,*u*,ʊ, once the [back] distinction has cut up the space between {*i*} and {*u*,ʊ}, and once the [ATR] distinction has cut up the space between {*u*} and {ʊ}, then [round] is redundant for these latter segments, and can be predicted by the fact that they are [-low,+back]. Thus, the solution to the problem of *logical redundancy* outlined above is to assume that certain features have "priority" in the directionality of implicational statements. Thus, in the Manchu case, for [-low] vowels, the implication is [-back] → [+round], and not the other way around ([+round] → [-back]).

While Dresher's hierarchical/asymmetric approach to implicational redundancy statements may prove sufficient to achieve underspecification without overgeneration, it is worth asking why underspecification of segments in individual segments is a desideratum at all, because of the Schrödinger's Cat problem mentioned above. Throughought phonological theory, the primary use of *paradigmatic* underspecification is to achieve a simpler statement of the *syntagmatic* applicability of, e.g., an assimilation process. But then why not put the locus of "invisibility" within the syntagmatic rule itself? This is the path pursued here.

The most direct source of inspiration for the current work is Calabrese (1995), who argues that "underspecification of feature values becomes an idiosyncratic property of individual rules". Let us paraphrase this as follows, for the case of Finnish, in which vowels not contrastive for [back] are invisible in a search for harmonic values:

(11) Parametric Visibility: A given valuation rule *R* for the feature [F] may parametrize its search domain to only *contrastive* values for F.

The advantage of (11) is that it allows full specification for all features in segments; the motivation for leaving [back] out of [-low,-round] segments in Finnish (which accomplished the harmonic invisibility of neutral segments for Kiparsky, Steriade, etc.) disappears, once we state the valuation rule as limited to contrastive values of [back]. The definition of contrastiveness that will be adopted in this paper is provided below[3]:

(12) Let S = [M,αF] be a segment, where [M] is a feature bundle and [αF] a feature-value pair. S is *contrastive* for [$\pm$F] in position P if and only if the segment S′ = [M, $-\alpha$F] exists and may occur in position P.

A brief remark is in order regarding (11)-(12), and the notion of "there is another segment S′" and " may occur". The contrastiveness comparison is relativized to the position in which the segments in question occur. This is relevant for Karaim (Nevins & Vaux 2003), which exerts positional restrictions on where certain vowels can occur, with concomitant effects on harmony: vowels that aren't positionally contrastive for [back] (i.e. in non-initial syllables) are transparent for consonants to harmonize to across them. It is important to point out that (12) does not refer to the underlying inventory of the language, since non-underlying segments that are the output of allophonic rules can participate in harmony. In Ngore-Kiga, discussed by Hansson (2003), allophonic [s] derived from /ʃ/ can condition further sibilant harmony; similarly, in Canadian French, discussed by Poliquin (2005), allophonic high lax vowels [ɪ,ʊ], derived in closed-syllables from /i,u/, can condition further [ATR] harmony. Thus, allophonic outputs may be included in the computation of contrastiveness.

Returning to the discussion of Finnish *i,e* transparency in [back] harmony, and its relevance in the study of contrastiveness as a factor in harmonic (in)visibility, recall that since the inventory is such that there are no [+back,-low,-round] segments in Finnish, the value [back] is not contrastive for the [-low,-round] values. This fact alone has no effect on the phonology of Finnish, nor the representation of *i,e* – but where it does have effect is in the operation of valuation rules that restrict their domain of search to contrastive values. Thus, the learner does not need to induce a redundancy rule or posit a co-occurrence restriction, nor does s/he need to order it after the operation of harmony; rather, the learner must posit the valuation rule yielding assimilation or dissimilation, and set the value of that rule's visibility parameter accordingly.

The remainder of this paper explores the consequences of a small parametric space of visibility for harmonic features, in which only *all, a single-value, or the contrastive values* of harmony may be visible. Importantly, this parametric space disallows the harmonic pattern in which both contrastive values of a feature are invisible[4]. This is a strong and falsifiable prediction, not shared by a wide class of alternative theories of possible harmony systems. A specific case that is excluded would be one in which, say, [back] harmony affected {o,ö,a,ä}, but not {u,ü}; in other words, a system in which *both* members of a contrastive

pair would be invisible to harmony, neither valuing nor undergoing the process. Such a system would clearly be excluded under *all-value* visibility, since all values, including those in {u,ü} would be visible. Such a system would also be excluded in *single-value* harmony, since if only [-back] values were visible, then *ü* would still remain the visible member of this pair. Finally, such a system would be excluded under *contrastive-value* harmony, since both {u,ü}, being contrastive for back, would remain visible for harmony.

This is related to another aspect of the current account: given the three possible parametric settings of visibility, there will be no harmony system in which *only* the *non-contrastive* values of a feature are visible for harmony.

The three parametric options for visibility will be achieved in shorthand notations in structural descriptions with the notation: $V_{[\text{all: } \alpha\ F]}$, the notation $V_{[\text{contrastive: } \alpha\ F]}$, and, for the case of single-value harmony, either $V_{[+F]}$ or $V_{[-F]}$, where V is shorthand for Vowel, C for Consonant, and X for a segment that is either C or V.

1. All-Values Visible

The first parametric option will be demonstrated for Tangale.

1.1. Tangale

Tangale is a Chadic language, and in fact, the only Chadic language known to possess a vowel harmony system. It has a suffixing Advanced-Tongue Root (henceforth [ATR]) harmony, and the following 9-vowel inventory:

(13) Tangale Inventory (Kidda 1985:18)

i		u	[+high,+ATR, -low]
i̱		u̱	[+high, -ATR, -low]
e		o	[-high, +ATR, -low]
e̱		o̱	[-high, -ATR, -low]
	a		[-high, -ATR, +low]

As can be seen by inspection of the inventory, the feature [ATR] is contrastive for all vowels except /a/. Examples of stem-affix combinations yielding harmony may be observed in (14):

(14) Examples of Harmony (Kidda 1985:20)

a.	wudo-no	my tooth
b.	wu̱do̱-no̱	my farming
c.	sóórii-nì	his height
d.	sò̱r-nì̱	his age
e.	rii-go	multiplied
f.	rii̱-go̱	satisfied
g.	dù̱kà	salt
h.	kanj-wu̱	their deleb-palm

Importantly, /a/ values suffixes as [-ATR], as seen in, e.g. (14h). Thus, it may be said that Tangale has non-contrastive vowels that are visible within the search for valuation. More precisely, **all** values of [ATR] appear to be visible sources for valuation in Tangale.

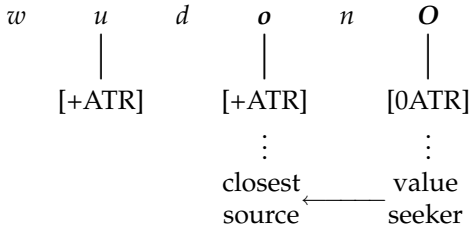
At this point I will provide background on the formal model of harmony that I am assuming. The basic assumption is that alternating affixes whose value depends on that of a nearby segment are lexically *value-less* for the harmonic feature. In other words, learners cannot infer an underlying value for the feature [ATR] of the vowel in the Tangale possessive suffix. When the syntax merges this suffix with a stem, the result must be phonetically interpretable. In order to converge at the interface with articulation, therefore, the possessive suffix of Tangale must find a value for the feature [ATR]. This *valuation* is conducted via a dynamic search for the *closest* source of valuation. The mechanics of this operation closely resemble the procedure outlined in minimalist syntax for the valuation of the phi-features of a Tense node. According to Chomsky (2001), the Tense node has no stored values for the features [person],[number], and [gender], but must bear values for these features in order to converge at the interfaces. Thus, according to Chomsky, the Tense node must seek values for these features by means of a search procedure — one which is governed by locality and conducted within a relativized domain. The operation of harmonic valuation assumed here is similar in many formal regards. Harmonically-alternating suffixes, such as the Tangale possessive suffix in (14a-d), must seek a local value for the feature [ATR]. and copy this value into their feature matrix.

This is schematized in terms of the following rule: the structural description specifies the value-seeker and the set of possible sources. The search procedure stops at the closest element within the domain of possible sources. The structural change is to copy the value of the harmonic feature onto the value-seeker.

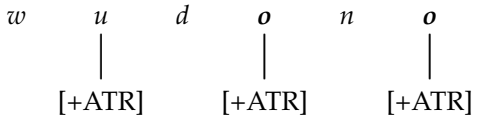
(15) Structural Description: $V_{[\alpha\ \text{ATR}]} \cdots V_{\text{target}}$
Structural Change: V_{target} becomes [α ATR]

This is exemplified for the affix *-nO* as it attaches to the stem *wudo* in search of valuation for its [ATR] feature (where the capital letter is a shorthand for a round mid vowel that is lexically value-less for [ATR] and requires a harmonic search).

(16) Search Procedure (All Values):



(17) Copying Procedure:



By hypothesis, the search procedure is always the same: once the domain of search is delimited by value-relativization, the closest element within that domain is chosen as the value-source. The structural description may be either to copy the value of the source onto the value-seeker, resulting in harmony, or to copy the opposite value of the source onto the value-seeker, resulting in dissimilation (sometimes thus called "disharmony"). Since the focus of this paper is on variation, we will largely focus our attention on the parameters of circumscribing the search domain, rather than the invariant principles of search.

Returning to Tangale, to verify that this is an *all-value* system of [ATR] harmony, we may further observe the harmonic behavior of /a/ (which is noncontrastive for [ATR]), noting that it is non-alternating when in suffixes (18) and that it is a visible local source that, when the closest vowel to a suffix, is the one whose value is copied in disharmonic roots (19).

(18) The vowel /a/ co-occurs with tense vowels if in an affix:

a.	peer-na	compelled
b.	pẹ̀d-na	untied
c.	ɗob-na	called
d.	la-pídò	small tree
e.	ana-wólò	singers
f.	ànà-wù̩tè̩n	workers

(19) The vowel /a/ intercepts [+ATR] harmony from the stem to an affix, providing instead its own [-ATR] value in valuation, because it is the *closest* and included in the domain of search.

a.	ped-nà-n-gò̩	untied me
b.	peer-ná-n-gò̩	compelled me
c.	ɗob-nà-g-gù̩	called you (pl.)
d.	ɗib-nà-m-gù̩	cooked for us
e.	wee-nà-m-gù̩	saw us

The analysis of Tangale is completely straightforward: the domain of search includes **all** values of [ATR] in a suffix's leftwards search, and the closest source is chosen.

2. Contrastiveness

A number examples of locality as determined by contrastive visibility can be found in the literature; a striking one is Chumash [anterior] harmony (Poser, 1982), which affects /s/ and /ʃ/ across intervening coronals. Only the [+strident] segments are contrastive for [anterior], so intervening [-strident] consonants are not considered in the computation of locality. The third person sub-

ject prefix illustrates this case: it assimilates [-anterior] from the nearest contrastive source:

(20) Chumash [anterior] assimilation (Poser 1982:132-133)

a.	s-aqunimak	'he hides '
b.	s-ixut	'it burns'
c.	ʃ-ilakʃ	'it is soft'
d.	s-kuti	'he sees'
e.	ʃ-kuti-waʃ	'he saw-past'

The instances intervening /k,t,w,x/ in (20) are not relevant to the computation of locality for [anterior] assimilation, because they are not contrastive for [anterior] by the definition in (12).

(21) Chumash sibilant harmony
Structural Description: $\text{Strident}_{\text{target}} \cdots \text{C}_{[\text{contrastive: } \alpha \text{ anterior}]}$
Structural Change: $\text{Strident}_{\text{target}}$ becomes [α anterior]

A simple exemplification of contrastive visibility within dissimilation/disharmony processes can be found in the familiar process of [lateral] dissimilation in Latin. The adjective-forming suffix is *-alis* (22a-d), but changes to *-aris* if the stem contains an /l/. This can be seen as a dissimilation of [+lateral] when preceded by another [+lateral][5] (22e-h). This dissimilation process can occur across intervening consonants and vowels, as long as they are not contrastive for [lateral]. However, an intervening /r/, which is contrastive for [lateral], will intervene, blocking application of the dissimilation rule[6].

(22) Latin Liquid Dissimilation (Gildersleeve and Lodge, 1895): Only contrastive [lateral] visible

a.	nav-alis	naval
b.	mort-alis	mortal
c.	ven-alis	venal
d.	caud-alis	caudal
e.	milit-aris	military
f.	lun-aris	lunar
g.	consul-aris	consular
h.	vulg-aris	common
i.	flor-alis	floral
j.	sepulchr-alis	funereal
k.	litor-alis	of the shore

Intervening consonants such as /t,n,g/ in (22e-h) do not block the [+lateral] dissimilation, since they are not contrastive for [lateral], but intervening /r/ in (22i-k) does, because it *is* contrastive for lateral, by the definition in (12).

The importance of contrastiveness in the computation of motor planning and comparison has been established in interesting ways elsewhere in the study

of human cognition. Sedivy et al. (1999) made use of the real-time eye-tracking paradigm in an experiment with spoken language and visual contexts. Given a scene with a pink comb, a yellow comb, and a yellow bowl, subjects were given instructions such as *Pick up the yellow comb*. Importantly, the use of an eye-tracker allowed Sedivy and her colleagues to measure where subjects looked in real-time, as they heard each incoming word. Sedivy *et. al* found that at the onset of the word *yellow*, subjects looked much faster and more frequently at the yellow **comb**, even before they had heard the head noun.

The only logical explanation is that subjects understood that, given spoken instructions, their interlocutor would be more inclined to use the predicate *yellow* when it was *contrastive* for the object to be manipulated. That is, even though the predicate *yellow* was true of both the comb and the bowl, the subjects preferred to interpret it in a contrastive use within 300 milliseconds, only looking to the object of which it was noncontrastively true much later (at 450 milliseconds). We take these results as supporting evidence to show that the preferred contrastive use of a predicate (over a set of more than one objects for which it is true) may be a guiding principle in human cognition. Nobody would say that the bowl was "underspecified" for *yellow*, and that is why subjects waited longer to look at it; rather, it seems that when performing a search for something with the relevant feature, contrastive uses of that feature may simply get priority in certain circumstances. The search for a determinant feature in assimilation and dissimilation are, by hypothesis, two such instances in the phonological computation, in which contrastiveness determines the search domain.

Contrastiveness, however, is not a property that can be observed by looking at a spectogram or a power spectrum or even an electromyographic or ultrasound movie of the articulators in action. Contrastiveness is an extremely abstract property of the speech sound; one that cannot exist anywhere but in an intelligent mind. However, so is "the color red". Discretization is an essential property of all perception: without it, there is no possibility of perceiving or using a finite set of categories.

Importantly, the notion of contrastiveness as a *parameter* is taken seriously; we should expect to find languages that are closely related (or nearly identical in form) that differ only in the value of this parameter, retaining all other aspects of the structural description of a harmony rule. That is, if the concept of a parameter, as formulated by Chomsky (1981), is to play and essential and explanatory role in understanding the range of variation, we expect to characterize some cases of microvariation in terms of single parameters. In what follows, we will examine two such cases. The first is a microparametric difference in [ATR] harmony between Standard Yoruba and Ifẹ Yoruba. The second is a microparametric difference in long-distance uvularization between two Tungusic languages of China, Sibe and Sanjiazi Manchu.

3. Ifẹ vs. Standard Yoruba: All vs. Contrastive Visibility

In this section, we explore the [ATR] systems of Standard Yoruba and Ifẹ Yoruba, a central Yoruba dialect, spoken in Ile-Ifẹ, and described by Ọlanikẹ Ọla Orie (2001). The two languages make for very good comparison, because they have identical vowel inventories, and show the same basic harmonic behavior: Right-to-Left [ATR] harmony. Nonetheless, they show a fundamental difference in the transparency of noncontrastive vowels, which we will characterize in terms of relativization of the search domain.

3.1. Standard Yoruba

Among the oral vowels[7], Standard Yoruba (henceforth SY) has the 7-vowel system in (23).

(23) Oral Vowel Inventory

i		u	[+high,+ATR, -low]
e		o	[-high, +ATR, -low]
ẹ (ɛ)		ọ (ɔ)	[-high, -ATR, -low]
	a		[-high, -ATR, +low]

Thus, the feature [ATR] is contrastive in the [-high,-low] vowels, but not in /i,u,a/. Regarding the morphological status of harmony in Yoruba, Adetugbo (1967), Fresco (1970), and Bakovic (2000) suggest that, as the harmony is right-to-left, final vowels should always be treated as (the only) root vowels, "despite the apparent paucity of independent synchronic evidence for such morphological structure in some cases" (Bakovic 2000: 129). We take this as the basis for the hypothesis that non-final mid vowels in Standard Yoruba are value-less for [ATR] and require a search-based harmonic valuation.

The operation of harmony may be first observed in disyllabic forms, which come from two sources: monomorphemic nouns of the form VCV, or deverbal nouns of the form V-CV. Before proceeding, we must note that Standard Yoruba exhibits a positional restriction: nasal vowels and the vowel [u] are systematically absent from the initial syllable. (Thus, the final syllable hosts a wider range of contrasts than the initial syllable.)

Disharmony within disyllabic words is possible in the following cases:

(24)
a. [a] may precede [+ATR] vowels (as it cannot alternate, lacking a [-ATR] counterpart
b. [i] may precede [-ATR] vowel (as it cannot alternate, lacking a [-ATR] counterpart)
c. There are a limited number of disharmonic stems in which a [-ATR] mid vowel precedes a final high vowel. These are treated as limited in productivity, and stored with a diacritic that indicates the value to be copied from them as harmonic sources. (Such stems thus bear a representation similar to that of exceptional Hungarian stems such as *hid* that take [+back] suffixes.)

Co-occurring combinations of vowels in disyllabic words may be observed in the following examples (as compiled by Bakovic 2000)

(25)

a.	èwé	'lip'
b.	olè	'thief'
c.	éró	'crowd'
d.	ód͡ʒó	'rain'
e.	égé	'cassava'
f.	ɔsɛ	'soap'
g.	èfɔ́	'vegetable'
h.	ɔwɔ́	'hand'
i.	ɛja	'fish'
j.	ɔ̀dá	'drought'
k.	ajé	'world'
l.	abo	'female'
m.	alɛ́	'night'
n.	akɔ	'male'
o.	ilé	'house'
p.	ig͡bó	'forest'
q.	idɛ	'brass'
r.	ikɔ́	'cough'
s.	ebi	'hunger'
t.	órí	'shea-butter'
u.	eku	'rat'
v.	ówú	'cotton'
w.	èbi	'guilt'
x.	ɔtí	'heaven'
y.	ɛtu	'deer'
z.	órũ	'heaven'
za.	ilá	'okra'
zb.	àfi	'except'
zc.	atú	'type of dress'
zd.	igi	'tree'
ze.	ikú	'death'
zf.	aja	'dog'

A preliminary formulation of harmony may be characterized as follows (where *mid* abbreviates [-high,-low]):

(26) Standard Yoruba [ATR] Harmony
Structural Description: $V_{\text{mid}_{\text{target}}} \ldots V_{[\alpha\ \text{ATR}]}$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [α ATR]

Thus, all values of [ATR] will be visible in the search, yielding èwé, olè, 'eró, ód͡ʒó, égɛ́, ɔsɛ, èfɔ́, ɔwɔ́, ɛja,ɔ̀dá, ebi, órí, eku, ówú. At this point, SY largely resembles the analysis of Tangale, except for the fact that only mid vowels alternate.

As noted above, there are disharmonic forms with a [-ATR] mid vowel, such as ɛ̀bi, which are limited in number, but of interest to our study here. Archangeli and Pulleyblank (1994) adduce additional examples of such roots (p.149):

(27) a. ɛ̀kú 'a costume worn by the Egúngún'
b. ɛ̀rí 'evidence'
c. ɛwù 'a pleasurable feeling'

In addition, Bakovic notes minimal pairs in the following set of deverbal nouns:

(28) a. rú 'to disrupt' **takes [+ATR] prefixes**
b. rú 'to haft' **takes [-ATR] prefixes** (cf. A& P 1989:fn 18)

(29) a. ò-kú 'corpse' (root: die); e-rú 'dishonesty'
b. ɔ̀-mu 'drink-er' ; ɛ̀-rí 'evidence'

The representation of the (b) forms is that they bear a diacritic on the high vowel that indicates the value to be copied is [-ATR][8]. Thus, speakers of Yoruba must record the representation of the final vowel in case such as ɛ̀bi as [-ATR][9]. A rightward search for valuation thus yields [-ATR] [ɛ].

In the forms thus far, we have not encountered any instances of transparency (or opacity), as at least three syllables are required to diagnose this property. We immediately turn to trisyllabic forms.

(30)

a.	akisa	'rag'
b.	ìk͡parí	'end'
c.	òg̀èdè	'incantation'
d.	ɔ̀g̀èdè	'plantain'
e.	ɛmɛ́wá	'chief's messenger'
f.	ɛbɔra	'type of egungun'
g.	àjèré	'name of a Yoruba town'
h.	abɛ́rɛ́	'needle'
i.	ìjèrè	'a kind of seed'
j.	ìjɛ́rɛ́	'name of a Yoruba town'
k.	oʃòdì	'name of a ward in Lagos'
l.	ɔ́g͡bèrì	'uninitiated'
m.	ɛrák͡pó	'type of plant'
n.	ìgàkè	'tickling'
o.	ík͡parí	'end'
p.	àkùrɔ̀	'dry-season marshy-farm'

As may be observed, both medial and initial mid vowels are consistent with our initial formulation of [ATR] harmony: both seek valuation from the closest source within the set of all [ATR] values. Finally, the set of forms below represent one of the most important points about Standard Yoruba [ATR] harmony: *all mid vowels that precede medial high vowels are* [+ATR]. Thus, high vowels, even though they are not contrastive for [ATR], are not transparent, and provide a local source of valuation to preceding vowels. Thus consider the forms (31a-f),

where the final vowel is a mid [-ATR] vowel, but the initial vowel is a mid [+ATR] vowel. Clearly this is the result of the medial high vowels *i,u* being visible (and *closer*) in the initial vowels' harmonic search.

(31)
a. òkígbɛ 'magical drug'
b. èdʒìká 'shoulder'
c. òjìbó 'any European'
d. orúkpò 'mudbench serving as a bed'
e. èsúró 'Redflanked Duiker'
f. èlùbó 'yam flour'

The fact that medial (i.e. in the second syllable in a trisyllabic word) high vowels participate in harmony, despite being non-contrastive, confirms the parameter setting suggested above for Standard Yoruba: :

(32) Structural Description: $V_{\text{mid}_{\text{target}}} \ldots V_{[\alpha \text{ ATR}]}$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [α ATR]

There are also a handful of disharmonic trisyllabic forms. Bakovic (2000) analyzes these all as the result of hiatal vowel deletion (on which see, for example, Oyelaran (1971)). Usually in hiatus, the **second** vowel is deleted[10]:

(33) ɔ̀mutí 'drunkard' = ɔ̀mu + ɔtí; first member of compound is known to be disharmonic; second hiatal vowel deletes.

However, the purely compound-based analysis loses a bit of explanatory merit when disharmonic forms with the instrumental prefix o-/ɔ- before [a] (examples from A&P 1989, based on R.C. Abraham's (1958) dictionary):

(34)
a. odár'o 'dyer' (from d'ar'o 'to dye')
b. órayé 'fool' (from ra + (ní) iyɛ́ 'render stupid'

These forms are not amenable to a compound analysis, and hence, it cannot be that all disharmonic trisyllabic forms are attributed to compounding-plus-hiatus. On the current analysis, these forms, limited in number, also must be analyzed in terms of a diacritic [+ATR] copy-value on the medial low vowel.

A few aspects of the harmony phenomena in Standard Yoruba deserve attention here. [ATR] harmony does not apply across clitic boundaries (Bamgboṣe, 1967):

(35)
a. mo lɔ 'I went'
b. mo jó 'I danced'
c. o fɛ̀ 'you (sg.) want'
d. o dé 'you (sg.) arrived'
e. ó wá 'he came'
f. ó kú 'he died'

However, in the dialects of Oyo and Egbado (Bamgboṣe, 1967; Fresco, 1970) assimilation does occur for these clitics. Archangeli and Pulleyblank (1994) situate the variation in terms of postlexical linking of [-ATR] to high vowels. However, Bamgbose notes that 2nd person plural /ɛ/ does not harmonize, even in these dialects. In the present analysis, the variation is characterized simply in terms of the lexical specification of these clitics. If a learner observes alternation, then s/he will store the alternating clitics as requiring valuation (i.e, unspecified for [ATR]), and apply the general harmony rule proposed earlier.

At this point, a remark is in order on the status of morpheme-structure-constraints as opposed to harmony rules as I have developed them here. One might suppose that all of Yoruba [ATR] harmony may be characterized in terms of surface constraints on intra- and inter-morphemic vowel sequences. However, this analysis would face difficulties with certain classes of forms that exhibit derivational opacity. In Standard Yoruba, there is a rule of consonant deletion, which is then followed by what is described as left-to-right vowel assimilation (Pulleyblank, 1988).

(36)
a. oódɛ (from odídɛ) 'Grey Parrot'
b. eèpè (from erùpè) 'earth'
c. yoòbá (from yorùbá) 'Yoruba'

Recall that medial high vowels participate in harmony, despite being noncontrastive. When they are deleted, however, there is opacity on the surface. Importantly, the results of this process, however characterized, are surface forms that are disharmonic. Thus, a Standard Yoruba speaker will hear the varying outputs [odídɛ], which is fully consistent with surface morpheme structure constraints, and [oódɛ], which violates surface morpheme structure constraints. Thus, the statement of [ATR] distribution in terms of purely surface MSCs must face counterexamples (or violability).

These data, however, require no modification to the existing harmony rule developed in (32). The essence of the proposal is that [ATR] valuation is ordered prior to consonant-deletion. The initial mid vowel seeks rightward valuation and finds the closest source, a high [+ATR] vowel. By hypothesis, valuation of a harmonic feature must occur immediately upon affixation. Now consider the implementation of the fast-speech rule of consonant deletion above. Suppose that instead of characterizing this as consonant deletion, followed by vowel assimilation of the vowel in the second syllable to that of the first syllable, there is instead a single process: syllable-deletion of the second syllable. This is followed by compensatory lengthening, which occurs in order to preserve the tone on the medial vowel: e.rù.pè, to which harmony becomes e.`∅.pè, which lengthens the initial vowel to eè.pè.

(37) Yoruba medial syllable deletion:
Structural description: σ_1, σ_2, where precedes(σ_1, σ_2) & $\neg\exists\sigma_0$, such that precedes(σ_0, σ_1)
Structural Change: Delete Onset(σ_1) and Nucleus (σ_1)

Importantly, harmonic valuation may thus be understood as an operation that applies in an early stage of the phonological derivation. Once this valuation is accomplished, and followed by medial-syllable-deletion. the result may be a surface violation of what seem to be otherwise regular generalizations about [ATR] sequences. Importantly, we may understand this result as following from the steps of sequenced computation developed here. Thus, the failure of the final [-ATR] to "spread" leftwards in eè.pɛ̀ shows that harmony precedes consonant-deletion. A purely surface AGREE constraint (of the type that says "adjacent mid vowels must agree in [ATR] on the surface") will founder on data such as óodɛ.

A final remark is necessary on the harmony system of Standard Yoruba, before we turn to the Ifẹ dialect. Although I have stated that harmony includes all [ATR] vowels, there is reason to think that the participation of /a/ may be due to an additional principle, operative irrespective of the harmony setting. Briefly, it is a crosslinguistic tendency observed in Wolof, Hungarian, Manchu, and Finnish, that vowels of greater sonority (i.e. lower height) may participate in harmony, above and beyond the visibility setting imposed by relativization. Nevins (2004: Ch.3) analyzes these cases as the result of an additional *Sonority-Controlled-Harmony* parameter, which restricts the parametric space of possible harmony patterns as follows: no language may have two neutral vowels, ϕ and ψ, where ϕ is of lesser sonority than ψ and is opaque while ψ is transparent. The effect of Sonority-Controlled-Harmony is to turn on low vowels as designated participants in harmony; thus /a/ participates in [ATR] harmony in Yoruba (and in Wolof) irrespective of its status as a contrastive value. We will assume here that Sonority-Controlled-Harmony is operative in all dialects of Yoruba, and exemplify this in the next section. Importantly, however, since our focus here is on *variation* between the dialects, and not what stays constant, we cannot justify Sonority-Controlled Harmony here with the space it deserves.

We conclude by summarizing the central point of this section: *all* values of [ATR], even noncontrastive ones, are visible in the search for featural valuation in Standard Yoruba (yielding a harmony policy quite similar to that of the 9-vowel system of Tangale). In the next section, we turn to Ifẹ Yoruba, in which noncontrastive values of [ATR] are transparent, or, more properly, *excluded from the domain of search*.

3.2. Ifẹ Yoruba

Ifẹ Yoruba (IY) has the same vowel inventory as Standard Yoruba (SY). According to Ọlanikẹ Ọla Orie (2001), high vowels are transparent in Ifẹ. We verify this difference with Standard Yoruba in the following table. Transparent medial vowels are shown on the left, and the corresponding harmonic medial vowel behavior in SY is shown on the right.

(38)

	Ifẹ	SY	
a.	ɔrúkɔ	orúko	'name'
b.	ɛ̀lùbɔ́	èlùbɔ́	'yam flour'
c.	ɛúrɛ́	ewúrɛ́	'goat'
d.	ɔ̀sùpá	òṣùpá	'moon'
e.	ɔ̀ruka	òrùka	'ring'
f.	ɔ̀rì̀sà	òrì̀ʃà	'primordial deity'
g.	ɔ̀kuta	òkuta	'stone

Thus, learners that encounter ɛ̀lùbɔ́ will not formulate the harmony rule as in (32), but rather, as follows[11]:

(39) Ifẹ [ATR] Valuation (preliminary):
Structural Description: $V_{\text{mid}_{\text{target}}} \dots V_{[\text{contrastive: } \alpha \text{ ATR}]}$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [α ATR]

Let us consider the consequences of this formulation for an input such as /ɛ̀lùbɔ́/. Valuation for the initial vowel will perform a rightward search for the closest contrastive value of [ATR]. The consonants and the high vowel /u/ will be skipped, as these are not contrastive for [ATR]. Search encounters ɔ, which is contrastively [-ATR], and this value is copied to the initial vowel, yielding ɛ̀lùbɔ́.

As mentioned above, both Ifẹ Yoruba and Standard Yoruba are subject to an additional condition on harmony: sonority-controlled harmony, which states that all vowels which are [+low] participate in harmony, regardless of what the harmonic feature is[12], and regardless of their contrastive status in the language. Thus, /a/ participates in [ATR] harmony in Standard and Ifẹ Yoruba, regardless of the relativization of the visibility parameter.

(40) Ifẹ[ATR] Valuation (preliminary):

a. Structural Description: $V_{\text{mid}_{\text{target}}} \dots V_{[\text{contrastive: } \alpha \text{ ATR}]}$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [α ATR]

b. Structural Description: $V_{\text{mid}_{\text{target}}} \dots V_{[+\text{low}, \alpha \text{ ATR}]}$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [α ATR]

Sonority-controlled harmony can be understood in the context of a broad class of prominence-based asymmetries: sonority-controlled nucleus syllabification (Spanish, (Harris, 1983); Berber, (Dell and Elmedlaoui, 1985), (Prince and Smolensky, 1993): *P/i,u >> *P/e,o >> *P/a); Tahitian, (Bickmore, 1995)); sonority-controlled stress (Kobon; Kenstowicz (1997): cf. mó.u, sií.og, alágo, ki.á, ái.ud), and sonority-controlled hiatus-persistence (Casali, 1998).

As both Ifẹ and Standard Yoruba, by hypothesis, exhibit Sonority-controlled harmony, they differ only in whether the visibility parameter is set to *all-values*

or *contrastive values*. There is an additional consequence to having the contrastive-value setting to consider: what happens when the root/harmony-source contains only non-contrastive vowels?

We have not yet considered disyllabic forms in which the final vowel is a noncontrastive high vowel, such as the following:

(41) a. etí 'ear'
b. eku 'rat'
c. èrígì 'molar'
d. ògiri 'wall'

The forms in (41) clearly cannot be assimilated under the rubric of a search procedure in which the noncontrastive high vowels are invisible. This case recalls "default agreement" in syntax: when no source of values is to be found, a last resort operation supplies a value in the absence of a source. The value supplied by default may vary crosslinguistically (cf. default agreement in Russian is neuter but is masculine in Hindi). Ifẹ learners must add a context-free rule supplying the value [+ATR] as a last resort (an "advancement of tongue root" rule) to their grammars:

(42) Ifẹ context-free advancement:
Structural Description: $V_{\text{mid}_{\text{target}}} \ldots V$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [+ ATR]

This rule will clearly be superseded by the contrastive ATR harmony rule, due to the Elsewhere condition: the structural description of context-free advancement is fully contained within the structural description of contrastive valuation . Noncontrastive high vowels do not participate in harmony in Ifẹ, as can be seen by their transparency in medial position. The rule in (42) only yields the appearance of participating in harmony in disyllabic forms. There is an immediate positive consequence of framing the analysis in this way. In Standard Yoruba, *all* values of [ATR] were visible in the search for valuation, including values of [-ATR] that were diacritically-based on high vowels. Given the formulation of searching for *contrastive* values only, however, these diacritics, should they exist, will never be encountered in a relativized search.

This prediction is upheld: according to Ọla Orie (2003), those disyllabic forms that were disharmonic in SY[13] are "harmonic" in Ifẹ:

(43) a. èbi 'guilt' (cf. SY ɛ̀bi)
b. ewírì 'bellows' (cf. SY ɛwìrì)
c. ebi 'hunger' (cf. SY ebi)
d. ékuru 'food made of beans' (cf. SY èkuru)
e. etu 'antelope' (cf. SY ɛtu

We may understand (43) if Ifẹ has an automatic consequence of a harmony policy that includes the following two rules (disjunctively ordered by the Else-

where condition):

(44) Ifẹ[ATR] Valuation:
Structural Description: $V_{\text{mid}_{\text{target}}} \dots V_{[\text{contrastive: } \alpha \text{ ATR}]}$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [α ATR]

(45) Ifẹ context-free advancement:
Structural Description: $V_{\text{mid}_{\text{target}}} \dots V$
Structural Change: $V_{\text{mid}_{\text{target}}}$ becomes [+ ATR]

Given an input such as /Ebi/, or even $/\text{Ebi}_{[\text{copy value: -ATR}]}/$, the output of the harmony policy will be [ebi], as context-free advancement is the only rule that may apply. As we will see, Ifẹ demonstrates a harmony policy that is thus formally identical to Finnish, in which all neutral [-back] roots take [-back] suffixes: non-contrastive vowels are fully transparent in medial positions, but when they are the only vowel in the word, a context-free valuation rule may apply, that happens to yield the same harmonic value as that of the neutral vowel. Importantly, this "same" valuation is not universal, it only "happens to" be the same. In Uyghur (Lindblad, 1990), the neutral vowel is *i*, and the result of context-free valuation for suffixes attached to all-neutral stems is [+back] valuation, the opposite value (cf. e.g., *til-lar*). Thus, the formulation of the Ifẹ subgrammar developed here places no premium on the harmonic value of non-contrastive vowels: they are full invisible to the system.

Finally, we may briefly consider the dialect of Ekiti Yoruba, as described by Ọlanikẹ Ọla Orie (2003). Ekiti has a 9-vowel system: in addition to the 7 vowels of Standard Yoruba, Ekiti allows [-ATR] contrast among the high vowels as the result of harmony. Ekiti can be understood as having a harmony rule identical to that of Standard Yoruba, except that **both** mid and high vowels seek valuation from *all-values* of [ATR].

(46) Structural Description: $V_{[\text{-low}]_{\text{target}}} \dots V_{[\alpha \text{ ATR}]}$
Structural Change: $V_{[\text{-low}]_{\text{target}}}$ becomes [α ATR]

A comparison table of correspondences may be found in (47). What it shows is that in Standard Yoruba, medial high vowels are "blockers", in Ifẹ Yoruba, they are "transparent", and in Ekiti, they are "undergoers". However, *none of these terms are primitives in the theory of harmony developed here*. The classifications are the phenomenological result of 1) the structure of the segmental inventory and 2) parametrization of valuation to all *vs.* contrastive visibility.

(47)

	SY: Blockers	Ife: Transparent	Ekiti: Undergoers	
a.	èbúté	èb'ute	èbúte	harbor
b.	ewúro	eúro	eúro	bitter-leaf
c.	orúkɔ	ɔrúkɔ	ɔrúkɔ	name
d.	odídɛ	ɔdídɛ	ɔdídɛ	parrot
e.	ewúré	ɛ́ŕé	ɛúré	goat
f.	èlùbɔ́	èlùbɔ	èlʊ̀bɔ	yam flour
g.	òsùpá	ɔ̀sùpá	ɔ̀sʊ̀pá	moon
h.	ewùrà	ɛùrà	ɛʊ̀rà	water-yam

Having demonstrated the powerful changes that a single parametric change in a valuation rule can yield in describing microvariation in dialects of Yoruba, we turn to another case of microvariation: that of the visibility of [low] in VC harmony in Tungusic languages.

4. Sibe vs. Sanjiazi Manchu: Marked vs. Contrastive Visibility

In this section, we will explore a further parametric option for the relativization of a search: to an asymmetric set of values for the harmonic feature. This "single-value" harmony is a case in which any segment in the word bearing, [+F], say, is sufficient to trigger harmony. For example, in the operation of some dialects of Dahl's Law in Kikuyu (Davy and Nurse, 1982), a [-voiced] segment anywhere in the word is sufficient to trigger dissimilative voicing in the prefix.

(48) k→ɣ dissimilative voicing occurs before the voiceless segments *s,t,k*:

a. ɣo-siara 'GERUND-giving birth'
b. ɣo-tɛɣa 'GERUND-trapping'
c. ɣo-kama 'GERUND-milking'
d. ko-niina 'GERUND-finishing'
e. ko-ruɣa 'GERUND-cooking'

(49) Dahl's Law [Voice] Dissimilation:
Structural Description: $\text{Velar}_{\text{target}} \cdots \text{C}_{[\text{- voice}]}$
Structural Change: $\text{C}_{[\text{target}]}$ becomes [+voice]

Learners may posit that an affixal segment, seeking valuation, only searches for a given value {+,-} of the value of interest, and does so at unbounded distance. This option *asymmetric-value harmony* is limited in natural language. When it does occur, it is usually for the *marked* value of the feature, as we will argue for Sibe; however, there are clear cases in which the singly-visible value is not the marked value, as in Dahl's Law above, in which the single-value of [voice] that is visible to the search procedure is [-voice]. We turn to Sibe, where the single-value relativization is to [-high], the marked value of that feature, and compare this case with the microvariation in Sanjiazi Manchu, a closely related Manchu descendant, which has set the visibility parameter to *contrastive* values of [high].

4.1. An Overview of Sibe Segmental Phonology

The crucial data to be discussed come from Sibe (southwest Tungusic), as described by Li (1996). Sibe (also written Xibe or Xibo) is a modern Manchu dialect in the Tungusic family.

Like all Tungusic languages, Sibe is purely suffixing, with no prefixation or infixation. In the vowel system, Sibe has only Rounding Harmony, and no other vowel harmony (e.g. backness). The primary stress is mostly on the initial syllable in Sibe. One of the most important features to note at the outset is that, unlike Classical Manchu, Sibe has no active contrast for the feature retracted tongue root (RTR). As Li notes, "in the disintegrated RTR system of Sibe, [RTR] is systematically absent in the UR." (Li 1996: 286)

The following table illustrates the consonantal inventory. Importantly, along the velar-uvular distinction, the language opposes k and q, g and ɢ, x and χ, and ɣ and ʁ. By hypothesis, these segments are all specified as [Dorsal], but differ in their specification of [± high]. The [+high] segments /k g x ɣ/ will be referred to as *velar*, while the [-high] segments /q ɢ χ ʁ/ will be referred to as *uvular*.

(50) Sibe Consonant Inventory:

	LAB	COR	DORS	nas.	cont.	liq.	later.	distrib.	anter.	high	voi.	cons.	son.
p	+	-	-	-	-	-	-	-	-	+	-	+	-
b	+	-	-	-	-	-	-	-	-	+	+	+	-
m	+	-	-	+	-	-	-	-	+	-	+	+	+
f	+	-	-	-	+	-	-	-	-	+	-	+	-
v	+	-	-	-	+	-	-	-	-	+	+	+	-
t	-	+	-	-	-	-	-	-	+	+	-	+	-
d	-	+	-	-	-	-	-	-	+	+	+	+	-
s	-	+	-	-	+	-	-	-	+	+	-	+	-
z	-	+	-	-	+	-	-	-	+	+	+	+	-
n	-	+	-	+	-	-	-	-	+	+	+	+	+
l	-	+	-	-	+	+	+	-	+	+	+	+	+
r	-	+	-	-	+	+	-	-	+	+	+	+	+
tɕ	-	+	-	-	-	-	-	+	-	+	-	+	-
ɕ	-	+	-	-	+	-	-	+	-	+	-	+	-
dʑ	-	+	-	-	-	-	-	+	-	-	+	+	-
ʑ	-	+	-	-	+	-	-	+	-	+	+	+	-
tʂ	-	+	-	-	-	-	-	-	-	+	-	+	-
ʂ	-	+	-	-	+	-	-	-	-	+	-	+	-
dʐ	-	+	-	-	-	-	-	-	-	+	+	+	-
ʐ	-	+	-	-	+	-	-	-	-	+	+	+	-
k	-	-	+	-	-	-	-	-	-	+		+	-
g	-	-	+	-	-	-	-	-	-	+	+	+	-
x	-	-	+	-	+	-	-	-	-	+	-	+	-
ɣ	-	-	+	-	+	-	-	-	-	+	+	+	-
q	-	-	+	-	-	-	-	-	-	-	-	+	-
ɢ	-	-	+	-	-	-	-	-	-	-	+	+	-
χ	-	-	+	-	+	-	-	-	-	-	-	+	-
ʁ	-	-	+	-	+	-	-	-	-	-	+	+	-
ŋ	-	-	+	+	-	-	-	-	-	+	+	+	+
j	-	-	+	-	+	-	-	-	-	+	+	+	+

The vowel inventory is composed of three binary distinctions: [± back], [± round], and [± high], resulting in eight vowels. There is ample evidence that there is only one phonologically active height distinction, as will be extensively discussed.

(51) Sibe Vowel Inventory:

	LAB	COR	DORS	nasal	voiced	consonantal	sonorant	round	back	high
i	-	-	+	-	+	-	+	-	-	+
ü	-	-	+	-	+	-	+	+	-	+
ɨ	-	-	+	-	+	-	+	-	+	+
u	-	-	+	-	+	-	+	+	+	+
ɛ	-	-	+	-	+	-	+	-	-	-
ö	-	-	+	-	+	-	+	+	-	-
a	-	-	+	-	+	-	+	-	+	-
ɔ	-	-	+	-	+	-	+	+	+	-

In the next subsection, the distinct behavior of [+high] and [-high] vowels in Sibe rounding harmony will provide evidence that i, ü, ɨ, u and ɛ,ö,a,ɔ constitute distinct natural classes, and that neither can be treated as "underspecified" for [high].

4.2. Height-Conditioned Rounding Harmony in Sibe

Sibe has Left-to-Right rounding harmony. Like many languages with rounding harmony (see Kaun (2004) for an overview), Sibe imposes restrictions on [round] agreement between vowels of different heights. Cross-height harmony is only tolerated when there is a [+high] target. Thus, [+high] vowels may undergo rounding harmony triggered by vowels of either height. Nonhigh vowels, on the other hand, may undergo rounding harmony only as long as the trigger is also [-high][14]. This is exemplified for root-internal harmony in (52). In (a), the target is high, and the trigger is high, so rounding agreement takes place. In (b), the target is high, and the trigger is non-high, but rounding agreement can take place. In (c-d), the target is nonhigh, and the trigger is non-high, so rounding harmony may obtain. However, in (e), rounding harmony fails to apply, because it cannot spread from a [+high] to a [-high] target.

(52)
a.	fulxu	root
b.	ɕögu	vegetable
c.	ɔmɔl	grandson
d.	ölχɔ	cowardly
e.	uva	flour

The patterning of [-high] vowels as a natural class with respect to rounding harmony can be further verified by examining co-occurrence restrictions on round vowels when a root contains two [-high] vowels. As (53d-h) illustrate, after a [-high, -round] vowel, any of the [+high] vowels may follow, while only [-high] vowels which are [-round] may follow. Similarly, after a [-high, +round] vowel, any of the [+high] vowels may follow, but only [-high] vowels which

are [+round] may follow. This exemplifies the essential pattern of "labial attraction" among low vowels in Tungusic languages, and confirms the height specifications assumed in (51).

(53) Roots with /a/ in the initial syllable: no /ö,ɔ/ follow:
- a. aχa rain
- b. mamɨ grandmother
- c. narχun thin, slim
- d. ani year
- e. maχal cap, hat
- f. sarχɨn wife
- g. dzʲalu full
- h. madzʲigʲ little, slightly

(54) Roots with /ɛ/ in the initial syllable: no /ö,ɔ/ follow:
- a. χɛrχa pine tree
- b. tɛxa hunting dog
- c. vɛqu askew, slant
- d. ɛtχun wild boar
- e. ɛlin mountain
- f. ɛdki neighbor
- g. χɛtɨ to fasten
- h. tɛvɨlχun a kind of willow

(55) Roots with /ɔ/ in initial syllable: no /a,ɛ/ follow:
- a. bɔdɔmin plan
- b. ɔlχun dry
- c. odzʲi to kiss
- d. ɔmɔl grandson
- e. ɔrχu grass
- f. χonin sheep

(56) Roots with /ö/ in initial syllable: no /a,ɛ/ follow[15]:
- a. ölχɔ cowardly
- b. döcʲü to enter
- c. tcʲöki to peck
- d. ömi to drink
- e. ötüvu to be greedy
- f. tcʲöru the day after
- g. tömχɔ nipple

Returning to the theoretical question posed by forms such as uva (52)[e], it becomes clear that there is a condition blocking the spread of [round] from [+high] to [-high] vowels. This is schematically illustrated in (57):

(57) Round Harmony Patterns:

Low → Low	OK
High → Low	BLOCKED
High → High	OK
Low → High	OK

The state of affairs in (57) cannot be modeled by assuming that high vowels are underspecified for [high]; if so, there would be no way to state the blocking of rounding harmony from high vowels to non-high vowels[16]. However, full specification of vowels for [high], as in (51), allows for a simple formalization of the conditions on rounding harmony:

(58) Spread [Round] rightwards except:
(i) from [+high] to [-high]
(ii) from [+back] to [-back]

The important conclusion of this subsection, then, is that the behavior of the two vowel heights in Rounding harmony provides independent syntagmatic evidence for a natural class of [+high] and [-high] vowels.

4.3. Velar/Uvular Alternations in Sibe Suffixes

The data of central interest are exemplified below. The diminutive suffix for adjectives has four variants in Sibe (Li 1996:201). Whether or not there is a round or unround vowel in the suffix is determined by the roundness of the closest root vowel. Since the suffix vowel is a high vowel, its full participation in rounding harmony will follow predictably, as discussed in the previous subsection. Hence, (59a-h) exhibit an unround high, back vowel when the closet vowel to the left is [-round], while (59i-p) exhibit a round, high back vowel when the closest vowel to the left is [+round].

(59)	a.	ɨldɨ(n)-kɨn	bright
	b.	ʂümi(n)-kɨn	deep
	c.	muxuli(n)-kɨn	round
	d.	udʐi(n)-kɨn	heavy
	e.	ʂa(n)-qɨn	good
	f.	sula-qɨn	loose
	g.	ɢɔlmi(n)-qɨn	long
	h.	adʐi(g)-qɨn	small
	i.	untuxu(n)-kun	empty
	j.	ulu-kun	soft
	k.	gɨltu(xun)-kun	severe
	l.	ɨrsu(n)-kun	ugly
	m.	tɔndɔ-qun	honest
	n.	χɔdu(n)-qun	quick
	o.	dʐalu-qun	full
	p.	farχu(n)-qun	dark

The alternation between a velar ([+high]) and uvular ([-high]) consonant in the suffix, on the other hand, is determined by whether there is a [-high] vowel preceding *anywhere in the word*. In (60a-d) and (60i-l), no [-high] vowel precedes the suffix, and hence its initial consonant surfaces as [k]. In (60e-f) and (60m), when the stem vowel that is closest to the suffix is [-high], the suffix surfaces with [q]. The most surprising and compelling cases are those in (60g-h) and (60n-p), in which the suffix surfaces with [q], even though the determining [-high] vowel is two syllables away, and a [+high] vowel intervenes.

This behavior is not limited to this particular suffix. Identical factors govern the alternation of the comparative suffix, which has the variants -kɨndi / -qɨndi / -kundi / -qundi (Li 1996: 201). In fact, velar/uvular alternations are not limited to the [-continuant] series of Dorsal consonants. The suffix of the non-self-perceived immediate past tense shows an alternation between the voiceless velar fricative /x/ and the voiceless uvular fricative /χ/ (Li 1996: 202).

(60)

a.	dzi̯-xɨ	to come
b.	tɨ-xɨ	to sit
c.	iɕi-xɨ	to be enough
d.	gɨnɨ-xɨ	to go
e.	tɨsu-xu	to satisfy
f.	türü-xu	to rent
g.	utu-xu	to dress
h.	xinu-xu	to hate
i.	tükɛ-χɨ	to watch
j.	sav-χɨ	to see
k.	fɔndzi̯-χɨ	to ask
l.	ömi-χɨ	to drink
m.	tɔ-χu	to curse
n.	gö-χu	to hit (the target)
o.	bɔdu-χu	to consider
p.	lavdu-χu	to become more

As can be seen in (60a-d) and (60i-l), a [-round] rightmost stem vowel yields a [-round] vowel in the suffix, while in (60e-h) and (60m-p), a [+round] rightmost stem vowel yields a [+round] vowel in the suffix. The velar/uvular alternations are conditioned by the same factor as those in (59): whether a [-high] vowel precedes anywhere in the word. Hence, (60i-p) exhibit the uvular suffix, even when the conditioning [-high] vowel is non-local to the suffix, as in (60k-l) and (60o-p).

Finally, the velar/uvular alternation shows long-distance effects even across intervening suffixes. Hence, when the reciprocal suffix /-ndu/ precedes the past tense suffix, the uvular variant of the past tense suffix can be conditioned by a [-high] vowel three syllables away (61a). When there are no [-high] vowels preceding in the word, the suffix is realized as a velar (61b).

(61)

a.	qarɨ-ndu-χu	to protect-reciprocal-past

b. nikɨ-ndu-xu to rely on-reciprocal-past

The generalization about Sibe suffixes, then, is that a [-high] vowel is sufficient to trigger an alternation from velar to uvular within the Dorsal consonants (the analysis here follows the analysis of Sibe in Halle et al. (2000) in this regard). The data involving velar/uvular suffixes are of special interest to theories of the locality of phonological processes. In particular, the fact that a [-high] vowel can induce a [-high] alternation across an intervening [+high] vowel exemplifies a case in which contrastive segments are transparent to an assimilation process. Before proceeding with a theoretical account, however, it is worth considering uvularization processes induced by [-high] vowels in other languages. Similar alternations in Turkana and Yakut will illustrate that a causal relationship between [-high] vowels and uvular consonants is well-attested cross-linguistically.

There has been a good deal of attention to the fact that uvular consonants may differ in their featural composition (see Trigo (1991) for a thorough discussion). In Sibe, as we have seen, [-high] seems to be a necessary component of uvulars. In Chomsky and Halle (1968), it was suggested that uvulars are [+back, -high]. While there has been a recent tendency to treat the uvulars of certain languages as [-ATR] (see Shahin (2002) for a proposal on Palestinian Arabic), it is not always the case that [-ATR] vowels are necessary for inducing uvularization[17]. In fact, in Turkana, one finds quite the opposite.

Turkana has a nine-vowel system, with a contrast between [+ATR] and [-ATR] in all vowels except /a/:

(62) Turkana vowel inventory:

	i	ɪ	e	ɛ	a	ɔ	o	u	ʊ
high	+	+	-	-	-	-	-	+	+
low	-	-	-	-	+	-	-	-	-
back	-	-	-	-	+	+	+	+	+
ATR	+	-	+	-	-	-	**+**	+	-

Dimmendaal (1983, p.9) describes uvularization in Turkana as follows: "The voiceless velar obstruent /k/ obligatorily becomes a uvular obstruent when surrounded by /o/'s, /ɔ/'s, or /a/'s, on the condition that such a vowel belongs to the same phonetic syllable as the velar obstruent. If /k/ is preceded and followed by back vowels, it further changes to [χ],[ɣ], or [ʁ]." In other words, the context is [-high,+back], and the advancement or retraction of the tongue root is, in fact, irrelevant, particularly because both /o/ and /ɔ/ can induce uvularization (63).

(63) Turkana uvularization:

	UR	SR	gloss
a.	a-bokok	a.bo.ɣoq	turtle
b.	na-bɔkɔbɔk	na.bɔɣɔbɔq	elephant shrew
c.	a-kamu	a.ɣɑ.mu	dry season
d.	a-kɔɔkɪ-aan-ʊt	a.ɣoo.kyaa.nut	loneliness

In short, there is cross-linguistic support that [-ATR] is not a necessary feature for uvularization in a given language. Trigo (1991) provides independent arguments that "pharyngeality remains orthogonal to uvularization" in Akha, where low vowels from both the "head" (-RTR) and "chest" (+RTR) register trigger lowering of [x] to [χ].

Recall that the proposed generalization about Sibe is that [-high] is sufficient to induce uvular alternations in the suffix. While Turkana uvularization illustrates a case in which uvularization can proceed without the feature [-ATR] on a triggering vowel, it remains to be shown that, in addition, [-back] is not a necessary feature. Yakut, as described by Krueger (1962), illustrates such a case.

Yakut has an eight vowel system[18], as shown in (64). There is active [back] and [round] harmony in the language.

(64) Yakut vowel inventory:

	-back, +rd	-back, -rd	back, -rd	back, +rd
high	ü	i	ɨ	u
low	ö	e	a	o

Among the Dorsal consonants, Yakut has velar /k g/ and uvular /q χ ʁ/ , which occur in the following contexts (Krueger 1962: 55):

(65) a. q after a o e ö ɨa uo ie üö; k **elsewhere**
b. χ after a o e ö ɨa uo ie üö; g **elsewhere**

Yakut Dorsal consonants, therefore, also require [-high] as a necessary feature for uvularization. Importantly, since both /ö/ and /e/ can trigger uvularization, it can be observed that [+back] is not always necessary for uvularization. Consonantal alternations of this sort in suffixes can be illustrated with the 2nd.pl /-gɪt/ (Krueger 1962: 89). In (66), both [+back] (66c-d) and [-back] (66e-f) harmonic vowels may trigger uvularization, as long as they are [-high].

(66) Yakut velar/uvular alternations:

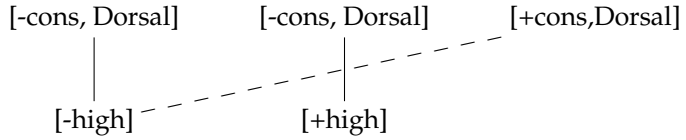
a.	tɨ:-gɨt	your-pl. boat
b.	kel-li-git	you-pl. came
c.	sa:-ʁɨt	your-pl. gun
d.	oʁo-ʁut	your-pl. child
e.	kinige-ʁit	your-pl. book
f.	öŋö-ʁüt	your-pl. service

On the basis of Yakut, it is possible to conclude that [-high] alone is sufficient to induce uvularization, supporting the generalization that either [-back] or [+back] vowels can trigger the alternation[19]. Taken together, the importance of Turkana and Yakut is that they demonstrate that the interaction between [-high] vowels and uvular consonants is a well-attested cross-linguistic phenomenon.

4.4. Towards an Analysis of Non-Locality in Sibe Uvularization

In the initial presentation of the phenomenon above, the generalization over the data proposed was that the feature [-high], copied from root vowels to the initial consonant of the suffix, induces uvularization. Importantly, however, in forms such as (59)[g-h,n-p] and (60)[k-l,o-p], the assimilation of [-high] from the stem vowel to the initial consonant of the suffix occurs across an intervening [+high] vowel. The formal representation of forms like lavdu-χu in traditional autosegmental phonology poses an apparent violation of the No Crossing Constraint (Goldsmith 1976, and much subsequent work).

(67) lavdu-χu: a violation of the No Crossing Constraint?



It was demonstrated earlier, based on asymmetric nature of rounding harmony, that underspecification is not a viable analysis of the Sibe vowel system. That is, any attempt to circumvent the No Crossing violation in (67) by means of positing that high vowels are not specified for [high] will lead to an incomplete analysis of the language[20], as the behavior of vowels in height-stratified rounding harmony requires specification of [high] for all vowels in the language.

4.5. Intervener-Based Locality: Relativized to Marked [-high] in Sibe

The theory of locality that will ultimately account best for the Sibe data is one that emphasizes the potential role of intervening segments. In an intervener-based theory of locality, a featural relation (such as assimilation) may take place between any two segments within the word domain, as long as no segment *of the relevant type* intervenes.

Since there is full specification of feature values for all segments, the notion of intervention in this approach depends not only on the presence of a feature, but its values as well. The leading idea is that each assimilation or dissimilation process may parametrically vary in its sensitivity to the values of intervening segments.

We can now formulate the locality conditions for Sibe uvularization: the suffixes in question seek the asymmetric value [-high] anywhere in the word[21]; thus only the marked value of [high] (– in Sibe) visible

Under the formulation of (67), the spreading of [-high] from the low vowel to the dorsal consonant of the suffix in lavdu-χu may occur because, as will be discussed below, minus is the "chosen" asymmetric value of [high] in Sibe. Given a *single-value*-only parametrization of visibility, the intervening [+high] vowels will not be relevant interveners, and will not interfere with the locality of long-distance [-high] assimilation.

Although the parametric space delimited here allows "single-value" harmony as an option, the "chosen" feature may sometimes be the marked value of the feature, and sometimes the unmarked value. We can demonstrate that [-high] turns out to be the marked value in Sibe from some independent sources of evidence. There are three sources of distributional evidence, independent from the uvularization process, that [-high] is the marked value for [high] in Sibe. The first comes from co-occurrence restrictions. Li (1996), based on observations over the Sibe lexicon (though without explicit quantification), states that "Sibe has a restriction on low vowel co-occurrence within the domain of a phonological word." (p.203). Li's observation is that, by and large, the language disfavors too many low vowels in a word, and this is one often-used diagnostic for markedness of a particular feature, in this case, [-high]. A second source of evidence comes from the distribution of vowels with suffixes. Most suffixes in Sibe contain a single high vowel. In addition to the alternating inflectional suffixes discussed earlier, all of which contain a high vowel, Sibe contains the following suffixes.

(68) Alternating derivational suffixes: -lu/lɨ -nu/nɨ -ru/rɨ -du/dɨ (Li 1996:199-200)
Nonalternating derivational suffixes: -ɕi -rtan -nɔfi (Li 1996: 201)
Nonalternating inflectional suffixes: -kin -tɕi -maq -mɛtɕi -ma -ndu -tɕivi -tɨs (Li 1996: 203)

The relative distributional bias towards [+high] vowels in suffixes suggests that this is the unmarked value for [high] in Sibe, especially in the light of the recent body of research suggesting that affixes tend to draw from the unmarked pool of segments within a given language. For example, English inflectional affixes only draw from the coronal consonants, Lushootseed has glottalized consonants only in roots and lexical suffixes (Urbanczyk, 1995), and Cuzco Quechua does not have aspirated stops in suffixes (Beckman, 1998). These cases illustrate that affixal inventories tend to be reduced in favor of the unmarked values of segmental constrast, and support the view that the relative dearth of [-high] vowels in Sibe suffixes is due to their marked status.

The next indication that [-high] is the marked value comes from the fact that vocalic epenthesis in Sibe is always a [+high] vowel (either the high back rounded [u] or high back unrounded [ɨ], due to harmony from the value of [round] in the immediately preceding vowel). Examples are shown in (69) and (70).

(69) Epenthesis with accusative ending /-v/:

a.	ɛχ-ɨ-v	large.bead-acc.
b.	tasχ-ɨ-v	tiger-acc.
c.	döv-u-v	fox-acc.
d.	mul-u-v	beam-acc.

(70) Epenthesis between causative /-v/ and present-future tense /-m/:

a.	ömi-v-i-m	to drink
b.	va-v-i-m	to kill
c.	ɕöndʑü-v-u-m	to elect
d.	bu-v-u-m	to give

Finally, there is some diachronic evidence that low vowels are marked in Sibe. Zhang (1996) provides a comparison of Sibe and its predecessor, Written Manchu. Written Manchu had stress on the final syllable, while Sibe has moved stress to the initial syllable, probably under the influence of Mandarin Chinese (Zhang 1996:151). Importantly, Sibe has raised what was Manchu /a/ to ɨ, and has raised what was Manchu /o/ to /u/. Examples of the correspondences are shown in (71) (note that some forms, such as (71c), show an additional apocope process affecting the original final vowel).

(71) Sibe has raised the original non-initial Manchu back [-high] vowels to [+high] (Zhang 1996:129):

	Written Manchu	Sibe	gloss
a.	ama	amɨ	father
b.	ana	anɨ	push
c.	darama	darɨm	mosquito
d.	mama	mamɨ	grandmother
e.	tata	tatɨ	draw
f.	talman	talmɨn	fog
g.	jafa	dʑavɨ	seize
h.	bodo	bodu	think
i.	songgo	soŋu	cry
j.	onggo	oŋu	forget
k.	holto	χoltu	deceive
l.	sokto	soχtu	be drunk

The raising of [-high] vowels under loss of stress can be straightforwardly attributed to the markedness of [-high] in vowels. Stem vowels that were no longer protected by positional prominence lost their marked [-high] feature in Sibe[22]. This particular featural change must be due to the markedness of [-high], since not every language raises vowels under reduction: Belarussian (Crosswhite, 2004) *lowers* the mid vowels when unstressed, as does Makonde (Liphola, 1999). Thus, the diachronic raising of unstressed vowels supports the claim that [-high] is marked in Sibe.

Once the Sibe learner has concluded that velar/uvular alternations are based on relativization to the *single-value* of [-high], the locality properties of the harmony process will follow. The following subgrammar governs the alternation of velar and uvular consonants within suffixes, with disjunctive/Elsewhere application of the valuation rule over the context-free rule: since the latter's structural description is fully contained within the former, the valuation rule will always take precedence over the default rule when its structural description is met.

(72) Sibe: Copy the closest value of [-high] to the alternating suffixes KI,XI,KINDI.

a. Asymmetric [-high] valuation
Structural Description: $X_{\text{[-high]}} \ldots C_{\text{target}}$
Structural Change: C_{target} becomes [-high]

b. Context-free Raising
Structural Description: X $\ldots$ C_{target}
Structural Change: C_{target} becomes [+high]

This formulation of the locality conditions on Sibe uvularization as in (72) avoids the pitfalls of an underspecification account that were discussed earlier, as all segments are fully specified for [high], and it is simply their *values* that matter for a given process. The visibility of intervening segments in a syntagmatic process such as assimilation is determined by the paradigmatic properties of contrastiveness and markedness.

As Michael Kenstowicz (personal communication, March 2004) points out, if the parametrization of visibility in terms of contrastive values vs. single value is correct, the prediction is that there should be a related language, completely analogous to Sibe, except with access to contrastive specifications of [high] determining the locality conditions of V-C uvularization. In fact, such a language exists, as we see in the next section.

4.6. Sanjiazi Manchu: Contrastive Visibility for [high]

As another descendent of Classical Manchu, Sanjiazi Manchu is one of the closest languages to Sibe. The representative of modern Manchu investigated in Li's (1996) book is the dialect spoken in Sanjiazi, near the Nenjiang river in the west part of Heilongjiang province. Sanjiazi Manchu has an identical consonant inventory to Sibe, an almost identical vowel inventory, and also no trace of RTR harmony[23]. The vowel inventory is in (73).

(73) Sanjiazi Manchu vowel inventory:

	[-back, -rd]	[-back, +rd]	[+back, -rd]	[+back, +rd]
[+high]	i	ü	ɨ	u
[-high]	æ		a	ɔ

The vowels /a/ and /æ/ pattern together in taking the low vowel /a/ in suffixes (as can be seen in the examples below), providing supporting evidence that these two vowels form a natural class in their specification as [-high] (and [-round]).

Like Sibe, Sanjiazi Manchu shows velar/uvular alternations in the Dorsal consonants of the past tense suffix -χa / -xɨ / -xu / -xɔ, with rounding harmony determining the quality of the suffix vowel. However, unlike Sibe, the visibility of intervening feature values in Sanjiazi Manchu is sensitive to all *contrastive* values for [high].

(74) Sanjiazi Manchu: Copy the closest contrastive value of [high] to the al-

ternating suffixes

a. Contrastive [high] valuation
   Structural Description: $X_{\text{contrastive: [}\alpha\text{high]}} \cdots C_{\text{target}}$
   Structural Change: C_{target} becomes [αhigh]
b. Context-free Raising
   Structural Description: X $\ldots$ C_{target}
   Structural Change: C_{target} becomes [+high]

Note that (74), like all harmony rules, applies only to alternating suffixes. (The inclusion of (74b) is for purposes of minimal comparison with Sibe. It may in fact be necessary for alternations after non-contrastive ü; see footnote 24). The results of (74) may be observed in (75).

(75) Sanjiazi Manchu alternations in the past tense (Li 1996:182):

a.	qa-χa	to obstruct
b.	mɨla-χa	to roar
c.	ʂudzi̯a-χa	to rely on
d.	sæ-χa	to bite
e.	ɔm-χɔ	to drink
f.	davɨ-xɨ	to stride
g.	ɨldɨ-xɨ	to shine
h.	dazi-xɨ	to repair
i.	tæri-xɨ	to plant
j.	sü-xu	to mix
k.	dɔndzi̯-xɨ	to listen
l.	matʃu-xu	to grow thinner

As (31a-e) show, when the nearest contrastive specification for [high] to the Dorsal consonant of the suffix is a [-high] vowel, the suffix surfaces with a [-high], uvular [χ], whereas when closest contrastive value is [+high], the suffix surfaces with [+high] velar [x]. Thus, no long-distance copying of [-high] across an intervening [+high] segment can occur in Sanjiazi Manchu, because the intervening values of [+high] are contrastive[24]. That it is indeed a rule sensitive to contrastive specifications of [high] can be verified by (31e), in which uvularization occurs across the intervening consonant [m], which is not contrastive for [high].

The distinct parametrization of intervener visibility of Sanjiazi Manchu and Sibe can be seen when comparing Sanjiazi Manchu [dɔndzi̯-xɨ], in which contrastive [+high] is visible and yields a velar alternant in the suffix, with near-minimal Sibe [fɔndzi̯-χɨ] (*'to ask'*), in which only marked [-high] is visible, yielding a uvular alternant. Sanjiazi Manchu uvularization is thus formally identical to Sibe, with the difference of the parametric visibility of the specified features resulting in different assimilation behavior[25].

It is at this point useful to provide a comparison of the analysis offered here, in terms of contrastive and marked values of [high], with a privative analysis. It is indeed imaginable to propose that [high] and [low] are simply different features on different tiers (though certainly not done in practice; see Goldsmith 1987). Their contrastive relation of opposition would be handled by some additional statements of the grammar, but they would formally be defined as two distinct features. With this assumption, one could propose that in Sibe, [low] spreads from low vowels to the Dorsal consonant. In long-distance cases, the spreading of [low] would be across a segment with no specification for [low], only one for [high], which would be on a different tier. Thus, dividing [low] and [high] on separate tiers would allow one to maintain the traditional Line-Crossing approach to locality for Sibe.

Such an analysis, whatever its merits in explaining the transparency of high vowels in Sibe, is to be dispreferred, because such an arrangement cannot be generalized to other for two-height languages. Indeed, having privative [high] and [low] would make the wrong prediction that Sanjiazi Manchu should also have transparent high vowels in uvularization, which we have just seen is false. Once the model allows [low] spreading across any segments not specified on the [low] tier, it becomes difficult, if not impossible, to derive the microparametric difference in locality between Sibe and Sanjiazi Manchu.

To conclude this section, we have seen that two closely related languages with [high] harmony and similar inventories differ only in the setting of the visibility parameter: it is *asymmetric-value* harmony in Sibe and *contrastive-value* harmony in Sanjiazi Manchu. We would thus not expect to find a related language in which, say, only the non-contrastive values of [high] are visible for harmony, since that option is not allowed by the parametric space delimited here.

5. Conclusion

We have considered microvariation in the [ATR] harmony of Standard Yoruba vs. Ifẹ Yoruba and in the [high] vowel-consonant harmony of Sibe vs. Sanjiazi Manchu, demonstrating that in each case, the pair of languages differ only in the relativization of the search domain, but that once this is delimited, both conduct a search involving the closest source within that domain. This paper has examined one set of conditions on harmony and dissimilation systems: the delimitation of the class of visible values. There are other conditions on harmony and disharmony: sonority, the distance between source and goal, and additional conditions imposed on the source (i.e. cases of "parasitic harmony" that require that the source bear a particular feature in addition to the harmonic feature). But as far as visibility of interveners is concerned, the three parameters shown here constitute a characterization of possible and impossible harmony rules in terms of specification of the domain of search of the rules themselves.

Before concluding, I should add that the term "impossible" as it applies

to harmony systems must be understood with some care, and perhaps qualification. Ideally speaking, Universal Grammar is a delimitation of the set of unlearnable languages. On this view, the function of what is called Universal Grammar, is not really to *provide* a grammar, but rather to provide a set of constraints on what can and can't be a possible grammar. Thus, the function of Universal Grammar in aiding the learner of harmony does not consist of giving him or her the answer magically from scratch (in fact, as we may observe from cases of optionality and intra-speaker variation, the learner may *never* learn a uniquely correct answer)[26]. What Universal Grammar can do is *prevent* the learner from ever considering a host of irrelevant answers. And I do mean prevent. On this view, the closest analog to Universal Grammar in another species would be in the songbirds. W.H. Thorpe's study of trying to teach chaffinches the songs of the tree pipit and seeing their failure to learn it (although it was sensorily perceptible and motorally executable) led him to conclude that "the chaffinch has the inborn blueprint conferring on it a tendency to learn to pay attention to certain kinds of sounds and certain types of phrase only" Thorpe (1958, p.84). Thorpe's quote, and indeed his views, emphasize that the defining feature of songbird learning is what they cannot and do not try to learn, because they simply exclude attention to certain kinds of sound patterns. This constitutes a strong view of the chaffinch's "blueprint", and Universal Grammar: the languages that it excludes are simply unlearnable; they are grammatical hypotheses that are excluded from the search. The parametric-based hypothesis of harmonic-value visibility takes a step towards understanding why microvariation is restricted in the variability it displays, but at the same time, why the learner's setting of a single parameter can yield apparently drastic output results in the locality of harmonic relations.

Endnotes

[1]See Raimy (2000) for an explication of the importance of precedence as a formal relation in phonology. Importantly, Raimy considers reduplication to be the result of multiple precedence. As harmony processes usually precede reduplication, we will ignore cases of multiprecedence here, though important issues remain to be worked out when the harmonic relationship with the reduplicant is not transparent/

[2]Dresher focuses on redundancy rules, and does not discuss that the same outcome arises using co-occurrence constraints, but it is very straightforward to extend the logic, as I have done here.

[3]The definition of contrastiveness here departs from that of Calabrese (1995), who makes crucial use of universal filters and deactivation statements.

[4]I thank Gunnar Hansson for pointing this prediction out.

[5]Long-distance lateral dissimilation is also attested in Kuman, Yidin^{y}, and Yimas; the reader is referred to Suzuki (1998) for discussion and references.

[6]Apparently, the form *fluvi-alis* is an exception to this rule.

[7]SY also has nasal /ĩ ũ ɔ̃/. These will be discussed where relevant.

[8]It is worth briefly considering alternatives to the diacritic analysis. Mohanan (1991) casts a condition on final high non-nasal vowels: that they are ex-

traprosodic (Calabrese (2003) adopts this suggestion as well.). Thus, by virtue of being extraprosodic, they are outside the domain of harmony. (Mohanan cites a personal communication from D. Pulleyblank to the effect that there are no disharmonic mid [-ATR] followed by final high vowels when the final high vowel is *nasal*. D. Pulleyblank (personal communication, May 2004) asserts that this was an unfortunate misquotation, and indeed, Ọla Orie (2003:7, fn.10) cites examples such as ɛn̄ı́ 'mat'.). Interestingly, Ọla Orie's proposal, based on tonal and distributional properties, is that final vowels in all Yoruba dialects are the prosodic head, which is clearly incompatible with Mohanan's suggestion. Another problematic fact is that neighboring dialects of Yoruba lack disharmonic roots like ɛ̀bi entirely, and it is perhaps a stretch of the imagination to suppose that these dialects differ on a radical property such as whether final high vowels are extraprosodic. On the other hand, a diacritic on certain lexical items, as assumed here, is more likely to be the kind of representational element subject to loss and variation.

[9]Krämer (2003) describes such cases as "Trojan vowels", recalling Odysseus' horse filled with a hidden group of Greek warriors. Readers who find this mnemonic useful are welcome to use it, as it characterizes the diacritic treatment of ɛ̀bi assumed here. Another logical possibility is absolute neutralization of an underlying abstract /ɪ/; see Hyman (1970); Vago (1973) for proposals along these lines. Arbitrating between the two approaches is best done through external evidence, perhaps via language games. As a brief example, consider the Spanish rhotic contrast between [ɾ] and [r], with the former found in codas and branching onsets, and the latter found in simplex onsets, and both allowed in intervocalic position. When names with initial trills undergo syllable-inversion games (e.g. *ga.to→to.ga*), the result is an intervocalic flap: *ro.sa → sa.ɾo*. The simplest analysis of the facts is that the word-initial rhotic is an underlying flap, absolutely neutralized in that position, except when language-games bring it to an intervocalic context.

[10]However, in some cases (usually adjudicated by sonority; cf. Casali (1998)), it may be the first vowel

[11]Readers curious about the behavior of [a] in harmony are asked to refer to Nevins (2004:Chapter 3), where the analysis of Wolof long vowels is entirely parallel to that of Ifẹ.

[12]Thus, the sonority-control parameter is not unique to [ATR] systems; viz. Hungarian, where the noncontrastive [+low] ɛ participates in [back] harmony due to this principle.

[13]Even though forms like ɛbi are, as we have discussed, quite common in SY, Adetugbo (1967) notes that there is only one dialectal occurence of /OCi/: ɔti, 'foreign wine'.

[14]In fact, the behavior of [round] harmony in Sibe is more complicated, in that while the language has front rounded vowels, only [+back] vowels alternate in rounding harmony. Sibe thus exhibits an additional [back] restriction on round harmony; see Kaun 2004 for discussion of this preference.

[15]Except for Uygur loanwords (Li 1996: 196): ɕöbɛ (*subsidiary*, Uyg. ʃöbɛr);

ɕögɛt (*oleander*, Uyg. ʃöget); kötar (*vegetable garden*, Uyg. kötatliq).

[16]A reviewer suggests, as an attempt to avoid reference to [+high], a context-free rule of [-round] insertion on [-high] vowels that is blocked by a rule of harmony when the trigger is also [-high], and which in turn blocks a second, more general rule of harmony without reference to height. To complete the analysis, [+high] specification would have to follow both this process and uvularization in Sibe, (but not Sanjiazi Manchu). Putting aside the fact that such an analysis requires two virtually identical rules of harmony, one which specifies [-high] vowels [α round] copying, and the other which specifies all vowels as undergoing [α round] copying, such a system is disallowed in any event, because context-free valuation rules are, by hypothesis, a last resort, and cannot serve to disjunctively block harmony rules.

[17]Throughout the discussion, [+ATR] will be used interchangeably with [-RTR], and [-ATR] will be used interchangeably with [+RTR].

[18]In addition, there are four dipthongs: ɨa, ie, uo, üö. The first half is always the determinant of [back] harmony (Krueger 1962:49).

[19]Interestingly, Colarusso (1975) notes that, in Kabardian, palatalized /qʼʲ/ transfers [-back] to a following vowel, demonstrating that uvulars themselves need not always be [+back].

[20]Further cases in which positing underspecification of certain segments as a solution to the transparency of spreading is at odds with other phenomena in the language may be found in Mohanan (1991) and Steriade (1995).

[21]The lowering rule does not apply root-internally (cf. ɛdki, *'neighbor'*; üχa, *'to itch'*). Thus, the rule must be more specific than a general Left-to-Right spreading from low vowels to Dorsal consonants, hence the formulation here in terms of alternating suffixes.

[22]The other two [-high] vowels in Sibe, /ɛ/ and /ö/ did not exist in Manchu, and were created in initial syllables in Sibe by an umlaut process, e.g. WM *omi* → Sibe *ömi* 'to drink' and WM *alin* → Sibe ɛ*lin* 'mountain'. Since these low vowels were in the initial, stressed syllable in Sibe, they were not subject to markedness reduction.

[23]For example, stems that took RTR suffixes in Classical Manchu may take suffixes with either u or ɨ in Sanjiazi (Li 1996:157).

[24]As the Sanjiazi Manchu inventory reveals, the front round high vowel /ü/ is not contrastive for [high], as it has no [-high] counterpart in the 7-vowel system. However, Li's (1996) book contains no examples of suffix alternations for a word in which /ü/ follows a [-high] vowel. In addition, Bing Li (personal communication, April 2004) reports that his field notes contains no such verb roots. The prediction here is that /ü/ should be transparent in such contexts since it is not contrastive for [high], and allow uvularization to pass through it by a preceding [-high] vowel.

[25]Like Sibe, Sanjiazi Manchu also shows local vowel harmony, with the same locality conditions: adjacent syllables. As this is straightforward and does not show variation in the two languages it is not of interest here. A reviewer suggests that Sanjiazi Manchu suffixal velar/uvular alternations might be understood as conditioned by the following vowel, which itself gets its value as the

result of harmony. For this to be the case, left-to-right [high] vowel harmony would have to skip the contrastive intervening velar consonant and then right-to-left [high] harmony would affect the previously skipped consonant. As has been discussed by Nevins & Vaux (2003, 2004) in considering [back] harmomy in the Turkic languages Karaim and Kyrghyz, separation of harmony processes into V-V and V-C harmony for the same feature in the same language fails to capture the locality conditions shared by both. In the case of Sanjiazi, V-V and V-C harmony should not be thought of as different, ordered processes: both are the result of a harmonic valuation based on the closest source that involves all contrastive targets, regardless of their value of [$\pm$ consonantal].

[26]See Ringen and Kontra (1989); Ringen and Heinämäki (1999); Davy and Nurse (1982) for a discussion of variable outputs in harmony, and an analysis of these cases as parametric ambiguity in Nevins (2004:Ch.4)

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