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The Inadequacy of Underspecification

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Introduction

All arguments for underspecification follow a similar course: they show that a segment either does not undergo and/or does not trigger some phonological process, which, in either case the superficial properties of the segment suggest it should undergo or trigger. For example, Pulleyblank (1988) accounts for the inertness of Yoruba /i/ to a number of phonological processes by arguing that it is unspecified for any of the vocalic features that those processes refer to at the point in the derivation when they apply. In radically underspecified underlying representations (Archangeli 1984, Pulleyblank 1988) segments possess no more than the minimum feature specification necessary to distinguish all contrasting segments; all other specification is acquired through the application of a set of redundancy rules. If these redundancy rules are universal, then a much more restrictive theory of underspecification is possible, since then it should be possible to predict universally which segments will be underspecified and what features they will be underspecified for. In this paper, we will show, on the contrary, that the redundancy rules which fill in apparently noncontrastive laryngeal feature specifications for consonants in Southeast Asian languages must instead be language-specific. If the redundancy rules are language-specific rather than universal, then the underspecified segments and features can no longer be automatically identified and less impoverished underlying representations must be used instead.

In the tone splits induced by syllable-initial consonants in Southeast Asian languages, two clear cross-linguistic differences emerge in which reflex of the split is determined by which laryngeal articulation in the consonants. First, in some languages, lower tones appear after voiced obstruents and sonorants, while higher tones appear after consonants with other articulations, but in others, the tonal developments are reversed, with higher tones after the voiced consonants than after the others. Second, in languages with three way

splits, some languages exhibit higher reflexes after glottalized obstruents and sonorants than after aspirated obstruents and voiceless fricatives and sonorants, while other languages exhibit the reverse. This variability requires that consonants be specified both for distinctive and redundant laryngeal features (if the two can be told apart) at the stage when the tone splits occur; that these features represent the consonants' effect on the pitch of following vowels directly, in terms of tonal features; and that if redundancy rules are responsible for any of the laryngeal specification of consonants, they are language-specific rather than universal in nature. The substantially more impoverished representations prescribed by radical underspecification are simply inadequate to predict the variability of these tone splits. Furthermore, there are substantial phonetic reasons to believe that consonants do have the richer specifications that we will argue for, though such data only argue for their plausibility and do not by themselves rule out maximal underspecification.

Tone splitting in Southeast Asian Languages

2.1 Introduction

The splitting of tones under the influence of preceding consonants is an exceeding common sound change in the languages of the Southeast Asian linguistic area (Brown 1965, Haudricourt 1972, Li 1965, 1966, 1977, Matisoff 1970, 1972, 1979, Chang 1972, 1975, 1976, Mazaudon 1976, Hombert, Ohala, & Ewan 1979, Yip 1980). In tone splits in the languages we have examined, which include members of the Sinitic, Tibeto-Burman (Lolo-Burmese and Karen), Kam-Sui, Tai, Miao-Yao, and Viet-Muong families, the consonants are partitioned into classes with respect to their laryngeal articulations; after one class of consonants one series of tonal reflexes evolves, while after the other(s), distinct tonal reflexes appear. So long as the original contrasts in laryngeal articulations or manner are retained in the consonants, these new tonal reflexes remain predictable/allotonic, but typically the consonantal contrasts collapse (partially or completely) after the split and differences between the tonal reflexes become tonemic as a consequence.

Following Haudricourt (1972), we can distinguish between two and three way splits; in the former, the proto tones are split into high and low reflexes, while in the latter, mid as well as high and low reflexes develop. In two way splits, the partition of the consonants is to a very large extent the same across languages: the voiced obstruents and sonorants (henceforth [+ voice]) induce one set of tonal reflexes and consonants with other laryngeal articulations another. Splits where the tonal reflexes after the voiced consonants are lower than those after other consonants are what would be expected on phonetic grounds, considering that voiced obstruents are known to depress the fundamental frequency of following vowels (Hombert, Ohala, &

Ewan 1979). However, there is a substantial minority of languages in this area where higher reflexes have evolved after distinctively voiced consonants than consonants of other types. Splits where [+ voice] consonants induce lower tonal reflexes than other consonants will be referred to as "voiced-low," (VL) those where the [+ voice] reflexes are higher, as "voiced-high" (VH). Three way splits in general exhibit much more considerable crosslinguistic variability than two way splits. Aside from voicing contrasts, the obstruents and sonorants in languages of this area may be glottalized, i.e. [+ constricted], and aspirated stops and voiceless fricatives and sonorants, i.e. [+ spread] consonants, are also common. In two way splits, [+ spread] and [+ constricted] consonants typically pattern together in contrast to [+ voice] consonants, but in three way splits some languages show higher reflexes after [+ spread] than [+ constricted] consonants (these will be referred to a "spread-high" (SH)) while others reverse this difference (these are "constricted-high" (CH)). Furthermore in three way splits, [+ spread] and [+ constricted] consonants never induce the same tonal reflexes and, with just one exception in the very large number of languages that we have examined, obstruents and sonorants with the same laryngeal articulation always induce the same tonal reflexes.

2.2 Two way splits: VL vs. VH

A typical two way split is exemplified by the three Hmongic (Miao) languages below (from Chang 1972):[1]

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1. The symbols for bilabial consonants will be used throughout this paper as a shorthand for the various possible phonation contrasts in consonants. Proto tones in the Southeast and East Asian language are designated here by the letters A, B, C, and D, the last referring to checked syllables, i.e. those ending in a stop. The tones a language currently has will be named and described using Chao's (1930) numbering scheme. In representing consonantal developments in charts of tone splits, the formula $x > y$, e.g. $b > p$, means the original consonant has changed in the indicated way, otherwise simply listing the consonant, e.g. p, indicates it hasn't changed its proto value.

(1) The progress of a two way tone split in Shui wei, Shih men k'an, and Chi wei

1. **Shui wei**	**A**	**B**	**C**	**D**
Unsplit	31	55	35	31
2. **Shih men k'an**	**A**	**B**	**C**	**D**
High: *(m)p, (m)ph, hm, ?m*	55	55	33	11
Low: *b > b/b̥h, v > v/v̥h, mb, m*	35	33/13	53/31	31
3. **Chi wei**	**A**	**B**	**C**	**D**
High: *(m)p, (m)ph, hm, ?m > m*	35	44	53	44
Low: *b > p/p̥h, mb > m/h̥m, m > m/h̥m*	21	22	42	22

Shu wei is a conservative Hmongic language which has not undergone a split. Shih men k'an exhibits the first stage of a split, when distinct tonal reflexes have evolved after voiced and voiceless consonants, but because the consonants still contrast for voicing, these reflexes are only allotones.[2] Finally, in Chi wei, the reflexes of the split have become partially tonemic as a result of the merger of phonation types in the consonants, i.e. **b > p* and **?m > m*. Since in Chi wei original voiced stops simply devoice just in words with proto tone A but acquire a breathy voiced aspiration in words with proto tones B, C, and D, only the reflexes of proto tone A are tonemic after voiceless unaspirated stops. Prenasalized voiced stops have merged with simple nasals in Chi wei and exhibit the same distribution of breathy voicing as the reflexes of the voiced stops. Thus, even though **?m* has lost its glottalization in all four proto tones, the reflexes derived from the split are still only tonemic in proto tone A. Otherwise, the occurrence of higher reflexes remains entirely predictable after voiceless aspirated stops and voiceless fricatives and sonorants in this language. Chi wei exemplifies the VL majority in our sample. Examples of VH languages are the Tai language Shan (Haudricourt 1972), with a two way split, and the Hmongic language Szu ta chai (Chang 1972, Li, Ch'en, & Ch'en 1972 [1959]), with a three way split:

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2. Voiced obstruents become breathy voiced in Shih men k'an before reflexes of proto tones A and D, but retain plain voicing before B and C. The higher variant of the low reflex of tones B and C is found in nouns, the lower in verbs.

(2) Voiced-high splits in Shan and Szu ta chai

1. **Shan**	**A**	**B**	**C**
High: *p, hm > m, ?b > m/w*	334	11	22
Low: *b > p, m*	55	22	44

2. **Szu ta chai**	**A**	**B**	**C**	**D**
High: *(m)p, ?m > m*	33	44	13	31
Mid: *ph, mph > mp̂h, s > zh,* *hm > ĥm*	13	34	11	11
Low: *b > p, m*	35	33	44	53

The tonal reflex after the original voiced consonants is higher in every proto tone than that after consonants which had different phonation types in Shan and in all but the B tone in Szu ta chai. This inversion of expectation suggests that what effect a consonant of a given phonation type has on the pitch of following vowels cannot be predicted across languages. The variability in the behavior of [+ constricted] and [+ spread] consonants in three way splits immediately renders this possibility a virtual certainty.

2.3 Three way splits: CH vs. SH

For example, in most varieties of Kam, each of the three proto tones has been replaced by three reflexes, giving a modern system of nine tones in nonchecked syllables. We give here three varieties of Kam, which illustrate three distinct stages in the tone split; as was the case for the three Hmongic languages in (1), there is no actual temporal sequence here, rather these three languages differ in how far along the tone split has progressed. In all three, tones after original [+ constricted] consonants, as well as after voiceless unaspirated stops, are higher than after original [+ spread] consonants.

(3) The progress of a three way split in Shidong, Yungchiang and Renli Kam

1. **Shidong Kam**	**A**	**B**	**C**
High: *p, ?b > m, ?m > m*	35	33	55
Mid: *ph > p̂h, hm > ĥm*	11	13	453
Low: *b > p, m*	?	?	?
2. **Yungchiang Kam**	**A**	**B**	**C**
High: *p, ?b > m, ?m > m*	55	53	323
Mid: *ph, hm > m*	35	453	13
Low: *b > p, m*	212	33	31
3. **Renli Kam**	**A**	**B**	**C**
High: *p, ?b > m, ?m > m*	55	324	53
Mid: *ph > p, hm > m*	35	213	453
Low: *b > p, m*	11	21	31

(Our source (Yang (in press)) does not give the low tonal reflexes for Shidong Kam, but does make clear that this is a language with a three way split, in any case we are concerned here just with the high and mid reflexes). In the Shidong variety of Kam , the split has been caught very close to its beginning. While the glottalized sonorants have collapsed with the voiced ones and the voiced stops with the voiceless unaspirated ones, yielding a tonemic contrast between the high and low reflexes, neither the aspirated stops nor the voiceless sonorants have merged with consonants of another phonation type (both have acquired a breathy quality, however), so the mid reflexes remain predictable after [+ spread] consonants generally. At this earliest stage, only 6 tones actually contrast. At the next stage, in Yungchiang Kam (Haudricourt 1972), the merger of the sonorants has been completed through the voicing of the voiceless sonorants. Though all three series of reflexes now contrast after sonorants, the mid reflexes are still predictable after the aspirated stops. Thus, nine tones contrast after sonorants, but still only six after voiceless unaspirated stops. The tones which occur after the voiceless aspirates resemble the high reflexes, but with lowered onsets. Finally, in the Renli variety of Kam (Cheng & Yang (in press)), the aspirated stops have finally merged, with the unaspirates; and as a result, in Renli Kam nine tones contrast not only after sonorants but also after stops. In all three varieties of Kam, the [+ constricted] consonants, induce higher tones than the [+ spread] ones do. Aside from Kam, the Miao-Yao and Lolo-Burmese languages also exhibit higher reflexes after [+ constricted] than [+ spread] consonants, which shows that having [+ constricted] consonants induce higher tonal reflexes than [+ spread] ones do is not an idiosyncrasy of a single family of languages.

In the Karen and Tai languages, however, it is after the [+ spread] consonants that the higher reflexes develop in three way splits, as illustrated below in the Tai languages: Nakhorn Sithammarat Thai, T'ienchow Chuang (Northern Tai), and Chiangmai Thai (Haudricourt 1972):

(4) Three way splits in Tai

1. **Nakhorn Sithammarat**	**A**	**B**	**C**
High: *ph, hm > m*	53	53	55
Mid: *?b, p*	24	24	33
Low: *b > ph, m*	31	35	11
2. **T'ienchow Chuang**	**A**	**B**	**C**
High: *p, hm > m*	13	35	55
Mid: *?b*	13	35	53
Low: *b > p, m*	31	33	53
3. **Chiang Mai Thai**	**A**	**B**	**C**
High: *ph, p, hm > m*	35	11	221
Mid: *?b > b*	33	11	221
Low: *b > p, m*	33	31	443

Since in Nakhorn Sithammarat Thai, the glottalized stops in the mid series remain unmerged and the original voiced stops become aspirated rather than unaspirated, only the high and low reflexes are tonemic; the mid reflexes remain predictable. T'ienchow Chuang and Chiangmai Thai are similar; they also illustrate a typical secondary development of languages which have undergone three way splits: vertical[3] merger of mid reflexes with either the high or low reflexes depending on the proto tone. In fact, it is only because the vertical mergers are different in the various proto tones that we can even tell that a three way split has occurred in T'ienchow Chuang or Chiangmai Thai. In all three of these languages, because the mid series of consonants does not merge in phonation type with either the high or low series, the tonal reflexes induced by that series remain allotonic rather than tonemic. The Karen

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3. The terms "vertical" and "horizontal" refer to the orientation of tones which take place after a split with respect to the proto tones. Vertical mergers collapse reflexes of high, mid, or low series, within a proto tone, as in T'ienchow Chuang and Chiangmai Thai. Horizontal mergers collapse tone contrasts across the proto tones, within the high, mid, or low series, as in Nakhorn Sithammarat.

language, Palaychi, (Mazaudon 1976) exhibits a similar three way split (the *?* in some of the tone reflexes indicates a creaky quality in the tone):

(5) Three way split in Palaychi, without vertical merger of all mid series

Palaychi	**A**	**B**	**C**
High: *ph, hm* > *m*	22?	55?	22?
Mid: *p, ?b, ?m* > *m*	22?	22?	22?
Low: *b* > *p, m*	45	21	45

Unlike the Tai languages, Palaychi (and Karen languages generally) also originally had a series of glottalized sonorants. Both the glottalized and voiceless sonorants have become plain voiced, and as a result the mid as well as the high and low tonal reflexes of at least proto tone B[4] are now tonemic after voiced sonorants. Regardless of the contrastive status of the tones, it is still clear that both in the Tai and Karen languages, higher tonal reflexes evolve after [+ spread] consonants than after [+ constricted] ones, developments opposite to those exhibited by the three way splits in Kam, Miao-Yao, and Lolo-Burmese languages.

2.4 Summary

Two kinds of variability have been identified in how consonants split tones. [+ voice] consonants may induce lower (VL) or higher (VH) reflexes than other consonants, and families of languages differ in whether [+ constricted] induce higher tones than [+ spread] consonants (CH) or vice versa (SH) in three way splits. VL and VH languages are found within the same family and co-occur freely with both CH and SH developments. The problem for which this paper seeks a solution, then, is how to account for the two kinds of differences in how consonants split tones. Both difficulties can be resolved by representing consonants for tone as well as nontonal laryngeal features, but the tonal representation of consonants obviously cannot be obtained from universal redundancy rules.

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4. Vertical mergers have reduced the number of tone contrasts in proto tones A and C, which have furthermore undergone a subsequent horizontal merger of all tones.

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Tonal and nontonal laryngeal features of consonants

We will use the tonal laryngeal features [stiff] and [slack] to refer to the amount of tension applied to the vocal folds in consonants (cf. Halle & Stevens 1971). Either [stiff] or [slack] alone is enough for two way splits, and since two way splits always distinguish [+ voice] consonants from everything else, the tonal feature can be predicted reliably from the specification for the feature [voice]; for VL languages: [a voice] --> [a slack] (or [-a stiff]), but for VH languages: [a voice] --> [-a slack] (or [a stiff]). Both features are needed, however, for three way splits. The assignment of values for [stiff] in the nonslack consonants must also be language-specific rather than universal since in CH languages, [+ constricted] consonants induce a higher tone than [+ spread] consonants, while in SH languages, this difference is reversed. The specification for nontonal laryngeal features for a large consonant inventory of the Southeast Asian type is given below (with the likely redundant values parenthesized):

(6) Nontonal laryngeal features

	b	*m*	*p*	*ph*	*hm*	*?b*	*?m*
voice	+	(+)	(-)	(-)	(-)	(+)	(+)
spread	(-)	(-)	(-)	+	+	(-)	(-)
constricted	(-)	(-)	(-)	(-)	(-)	+	+

Voiceless unaspirated stops and voiced sonorants are entirely unspecified in underlying forms for these nontonal laryngeal features. Tonal features of consonants are predicted here from the distinctive nontonal laryngeal features, across the board; however, the choice of redundancy rules is generally language specific for the features [spread] and [constricted], and occasionally also for the feature [voice]:

(7) Redundancy rules for tonal features of consonants

a. [+ voice]	-->	[+ slack]	VL languages
b. [+ voice]	-->	[+ stiff]	VH languages
c. [+ constricted]	-->	[+ stiff]	CH, VL languages
d. [+ spread]	-->	[+ stiff]	SH, VL languages
e. [+ constricted]	-->	[+ slack]	SH, VH languages
f. [+ spread]	-->	[+ slack]	CH, VH languages

(8) Default redundancy rules for tonal features of consonants

a. [ ] --> [- stiff]
b. [ ] --> [- slack]

One of the redundancy rules for tonal specification in association with [+ voice] (7a,b) is selected per language; if a language is VL (7a) and furthermore exhibits a three way split, then it selects one of (7c,d), otherwise, if it is VH with a three way split, one of (7e,f). Rules (7d,e) would be employed for SH languages, while (7c,f) would be employed for those which are CH. The default rules in (8) supply the negative values for the two tonal features and can be presumed to apply, universally, after the application of whatever subset of (7) apply. As indicated below, four types of three way splits can occur: if (7a) applies, i.e. the language is VL, then either (7c) (CH) or (7d) (SH) apply, but if (7b) applies, i.e. the language is VH, then either (7e) (SH) or (7f) (CH) applies:

1. [+ voice, + slack], [+ constricted, + stiff], [+ spread, - stiff]: VL, CH (7a,c; 8a)

2. [+ voice, + slack], [+ constricted, - stiff], [+ spread, + stiff]: VL, SH (7a,d; 8a)

3. [+ voice, + stiff], [+ constricted, + slack], [+ spread, - slack]: VH, SH (7b,e; 8b)

4. [+ voice, + stiff], [+ constricted, - slack], [+ spread, + slack]: VH, CH (7b,f; 8b)

The redundancy rules which fill in missing values for nontonal laryngeal features are given in (9); these provide default values for each of the three nontonal laryngeal features.

(9) Redundancy rules for nontonal laryngeal features

a. [+ constricted] --> [+ voice]
b. [a sonorant] --> [a voice]

c. [ ] --> [- spread]
d. [ ] --> [- constricted]

In this account, the mechanism of the tone split is simple: the tonal features of the consonant spread to the following vowel, creating higher and lower allotones. The subsequent merger of phonation types that renders the tone split tonemic can be accomplished through the loss of a consonant's tonal and

nontonal laryngeal feature specification; what were originally the consonant's tonal features remain linked to the following vowel and the split becomes tonemic.[5] The last three of these redundancy rules for nontonal laryngeal features (9a-d) in most cases also provide the correct feature specification **after** the merger. Ordering the redundancy rules for nontonal laryngeal features last considerably simplifies both the specification of tonal features for consonants and the rules collapsing laryngeal contrasts after spreading.

The default redundancy rules in (8) above assign minus values for both [stiff] and [slack] to voiceless unaspirated stops and to voiced sonorants, since these two segment classes are unspecified for all nontonal laryngeal features in underlying forms. One would expect both kinds of consonants to therefore pattern as mid series consonants in three way splits, but they instead tend to pattern differently from one another. In VL languages, unaspirated stops vary between [+] and [- stiff], while voiced sonorants are typically [+] or [- slack]; in VH languages, this pattern of variation is reversed, i.e. voiced sonorants are [+/- stiff] and voiceless unaspirated stops [+/- slack].

Discussion

The essential observation on which the argument in this paper is based is pervasive crosslinguistic differences in which laryngeal articulations induce higher reflexes in tone splits and which induce lower reflexes. The essential innovations that we argue for in our account of this observation are that consonants are specified for tonal, as well as nontonal, laryngeal features, by language-specific redundancy rules. There is, however, an alternative to language-specific redundancy rules: post-split inversion. In such an account, all consonants with the same laryngeal articulation, as specified by the features [voice], [constricted], and [spread], would have the same tonal specification in all languages, perhaps:

(10) Universal tonal specification for consonants

High:	[+ spread, + stiff]
Mid:	[+ constricted, - stiff, - slack]
Low:	[+ voice, + slack]

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5. In terms of segment geometry, both the tonal and nontonal features of a consonant could be linked to its laryngeal node. The allotonic stage of the split is represented by linkage of the tonal features both to the consonant and, via spreading, to the following vowel, while in the tonemic stage, the consonant's entire laryngeal node delinks and it loses both its tonal and nontonal laryngeal features. Because they were linked to the following vowel, the tonal features do not disappear after delinking.

This particular configuration of features would yield a VL language, which if a three way split occurred would be of the SH type. After the split had taken place, in particular after the consonants' tonal features had spread to the following vowel and been delinked from the consonant, inversion would occur, to create either the VH languages, or the CH languages, through the introduction of flip-flop rules of the form:

(11) Post-split inversion

[a slack] --> [-a slack]	VL --> VH
[a stiff] --> [-a stiff]	SH --> CH

There are at least four kinds of objections to this account. First, flip-flop rules of the sort in (11), which are otherwise rather rare, would have to apply freely throughout this linguistic area.[6] Second, inversion as stated in (11), since it must apply to the tonal features of the vowel which originated in the consonant, would apply across the proto tones. Therefore the prior, pre-inverted stage of the language could never be observed, and no positive evidence that inversion has occurred in particular cases could be obtained. Third, if inversion takes place by some other mechanism, which allows it to apply individually to the proto tones, then it could be observed since there should be languages in which inversion has taken place within some of the proto tones but not others. However, such mixed languages are not observed (see Brown 1975, Kingston & Solnit 1988 for a fuller elaboration of this argument). Finally, and most importantly, it is possible to demonstrate that the difference between CH and SH languages at least exists before the split has become tonemic. In Shidong Kam (3a) and Yungchiang Kam (3b), the [+ spread] consonants have not yet merged with any other consonant series and a series of allotones lower than those after [+ constricted] consonants follow them. In Nakhorn Sithammarat Thai and T'ienchow Chuang, on the other hand, it is the [+ constricted] consonants which have not yet merged and which induce a series of allotones in following vowels which are lower than those after [+ spread] consonants. These facts show that the difference between SH and CH languages can arise before consonant mergers occur and therefore before the consonants lose control over the level of the tone of the following vowel. They are entirely unexpected in the inversion account of the SH:CH difference, which takes place only after the consonants' tonal features have been delinked.[7]

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6. A possible parallel can be found, however, in tonogenesis in Athabaskan where it appears that such inversion may have occurred (see Krauss 1979, Leer 1979, Kingston 1985).

7. With respect to the effect of [+ voice] on tone before any merger has taken place, we have only been able to find cases where lower allotones, i.e. the

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In closing, we will outline what we think the motivation is for the crosslinguistic differences we have observed. Elsewhere (Solnit & Kingston 1988), we have argued that the occurrence of laryngeal contrasts in sonorants as well as obstruents is probably responsible for these differences. The gist of the argument is that in a sonorant, unlike an obstruent, there is no phonetic reason to expect that the fundamental frequency of the following vowel will be either elevated or depressed by the sonorant's laryngeal articulation (cf. Maddieson 1984); instead the speaker may be free to choose either elevation or depression of fundamental frequency.[8] However, once speakers make this choice, i.e. once they decide on which tonal redundancy rules to apply in the case of sonorants, then pattern congruity requires that obstruents with the same laryngeal articulation employ the same tonal redundancy rules. As a result all [+ voice], [+ spread], and [+ constricted] consonants, regardless of whether they are obstruents or sonorants will affect the fundamental frequency of the following vowel in the same way and will ultimately behave alike in a tone split. For example, if the rule making [+ voice] segments [+ slack] (7a) is chosen for sonorants, it will also be chosen for [+ voice] obstruents, and a VL language will emerge. This is exactly what we observe in our data: when sonorants as well as obstruents contrasted for laryngeal articulations in the proto language, sonorants and obstruents with the same laryngeal articulation always behave alike in the level of the tonal reflex that they induce (there is only one exception to this generalization, a Tai language called T'ien Pao (Li 1966)). What we see here then is that in a class of segments where there is no basis for selecting one or the other of a set of redundancy rules the choice is essentially arbitrary, and this arbitrary choice can override a phonetically more plausible choice for other segments which form a natural class with the first. The necessary condition for the development of such crosslinguistic differences in redundancy rules is then simply that a subset of the membership of a natural class defined by features which contrast in underlying forms should allow arbitrary choice of redundancy rules. Since such natural classes are probably rather common, it is overly optimistic to hope that crosslinguistic differences in tone splitting are the only threat to radical underspecification's reliance on universal redundancy rules.

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precursor to VL developments, occur after voiced consonants. These are found in many of the Wu dialects of Chinese, for example.

8. That speakers actually control many of what were once thought to be automatic details of articulation, in order to manipulate the auditory distinctiveness of contrasting sounds, is now a fairly well supported position (see Kingston 1986, Diehl and Kluender 1989, and Kingston and Diehl (in preparation) for evidence and discussion).

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