Footnotes

1.While it is true that high and mid vowels never contrast, there are some words that do not contain uvulars and yet appear to be lexicalized with mid vowels, for instance, Vi Hilbert's Lushootseed name, [taq^{w}ɣəblo]. A strict phonemicization would require that underlying /e/ and /o/ be set up on this evidence, as this is not free variation, per se; however, the very clear generalization is that the mid vowels are, with the exception of ə, conditioned variants of the high vowels. It should also be mentioned that for some speakers, not only uvulars but also glottal stops condition lowering. This does not effect the substance of my argument.

2. Lushootseed has voiceless uvular and labio-uvular stops (q,q^{w}), and their glottal ejective counterparts (q̓,q̓^{w}), as well as uvular and labio-uvular voiceless fricatives (X, X^{w}).

3. It is, admittedly, conceptually odd to think of these vowels as being lowered twice, one degree in each direction the subrules apply, since what is happening is really a simple height assimilation. But one presumes that Anderson's theoretical construct is not meant to mirror production but only to model it.

4. Given the rudimentary state of research on the phonology of Lushootseed, I have not attempted to distinguish between those mid vowels which actually alternate with high vowels in the same morpheme and those which are present due to some static constraint on distribution. However, this last example quite clearly consists of a transitivizing suffix /-id/, which appears as [ed] when affixed to a stem ending in a uvular. Thus rule (2) does describe dynamic alternations (allomorphy).

References

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Phonological Traits of Shuswap Dialects[1]

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1. The Shuswap dialects fall into a Western and an Eastern group (henceforth abbreviated WSh and ESh). The dividing line runs N-S between the Reserves of Kamloops and Chase. This division is based on the treatment of the unstressed syllabic resonants m and n. In WSh these are preserved as such. In ESh they are to a greater or lesser extent replaced by other syllabic resonants (m by w, and n by y) or by the vowel a. The conditions for these shifts are not the same in all ESh dialects. In this paper, we concentrate on the dialect of Canim Lake and Alkali Lake as representative of WSh, and on that of Enderby for ESh. As the special features of ESh are obvious innovations, we discuss the main phonological features of WSh first.

2. The WSh phonemes are presented in the chart below (1. labials, 2. dentals and laterals, 3. palatals, 4. plain velars, 5. plain uvulars, 6. laryngeals, 7. labialized velars and w ẇ, 8. labialized uvulars):

Conss.	1	2	3	4	5	6	7	8
Plos.	p	t	c	k	q		k^{w}	q^{w}
	p̓	t̓	c̓	k̓	q̓		k̓^{w}	q̓^{w}
Fric.		ɬ	s	x	χ		x^{w}	χ^{w}
Res.	m	n l	y	ɣ	ʕ	h	w	ʕ^{w}
	m̓	n̓ l̓	y̓	ɣ̓	[ʕ̓]	ʔ	ẇ	ʕ̓^{w}

Vowels		
a	ạ	
ə	(ʌ)	
i		u ụ

3.1 Phonetically, t̓ is [k̓] in the speech of the older, [t̓] in that of the younger generation. -- c c̓ s are [č č̓/c̓ š], the pronunciation [c̓] being the more common one in most WSh dialects other than that of Canim Lake. -- ɣ is similar to a voiced velar fricative, but with a wider aperture. The vowels a i u are [æ/ɛ i/e u/o]; the retracted vowels ạ ụ are [ɑ ɔ].

(as do Chomsky and Halle), and assuming also with them that the neutral position of the tongue is at the height of a mid lax vowel, then full assimilation to a uvular is achieved only when the focus vowel has determinants on both sides. Otherwise, a compromise between the underlying height of the vowel and of the uvular is reached. The distinctive feature system would allow us to rewrite rule (2) using the feature [±tense] to describe the lower mid allophones, but that would miss the natural assimilation, as uvulars are not [-tense]. The correct formulation should remain as in (2), with the full 'numerical' realization of [-hi,-lo] corresponding to a tongue height involving no muscle gesture. Once again, we see that a possible formulation of the rule in terms of categorial features ([±tense]) is irrelevant to its conjunctivity; it is its function in achieving partial or complete height assimilation that bears on its mode of application.

4. Lushootseed also gives evidence of the two-foci type for the conjunctive application of rule (2). Both its subparts must apply to derive the following

(4)	yeqos	basket
	toqʷob	cough
	ʔoχʷel	get lost
	ʕoqʷelb	footrace
	ʕoqʷod	whittle
	heqed	push it[4]

since a single application from left to right or from right to left could not affect both foci. The conjunctive application of such allophonic mirror-image rules as are found in Breton and Lushootseed is to be contrasted with the disjunction observed by Anderson for such phenomena as Acoma accent loss, Oscan anaptyxis or Faroese glide insertion. In these cases, the application of the rule in one direction blocks its subsequent application in the other. Thus, for instance, the Oscan rule, which inserts a copied vowel between a sonorant and an obstruent, in either order, yields anafriss from /anfriss/, not *anafiriss. The reader can easily satisfy her/himself that all three disjunctive examples offerred by Anderson involve neutralization rules.

Lushootseed vowel height adjustment is clearly to be formulated as a conjunctively applied mirror-image rule. It is, to my knowledge, the only language thus far described to give both kinds of evidence for this conjunctivity. This is important, since it is inherent in Anderson's claim that if the right strings can be found, a language must not give conflicting results from the two-foci and the two-determinant tests. Also, much in the spirit of recent work in phonology, the Lushootseed rule demonstrates that the formal character of a rule is not sufficient to predict its mode of application.

that the Breton subrules apply conjunctively. The formal difference between the Breton and the Lushootseed cases is this: given the Chomsky and Halle system, a rule assigning three heights to mid vowels will always involve numeric (non-distinctive) features, whatever language such a rule may appear in. Its formalization is never in doubt, as it cannot be written using only binary values of features. Anderson's statement will have no difficulty applying to the rule. But a rule making a high vowel mid involves a potentially distinctive feature, [±hi], that may or may not be made use of in a given language, for a given pair of vowels. Thus if English (which, like Lushootseed, probably has (at least) three distinctive vowel heights) were to have a rule formally identical to the Lushootseed one, the English rule would perform a neutralization. This is, of course, because, in English, the feature [±hi] is distinctive for the front unrounded vowels and the back rounded ones, serving to distinguish i and u from e and o. I believe that the spirit of Anderson's claim must be that the English rule would have its subparts applied disjunctively. But in the Lushootseed case, the rule only distributes allophones, despite the probability that there are three distinctive vowel heights. It is not possible, then, to have an automatic way to decide how to formulate a rule that will

tell us which clause of Anderson's statement a mirror-image rule is to be subject to. Given the vowel system of Lushootseed, the innocent researcher would have formulated the rule (2), using the independently motivated feature [-hi] and capturing thereby the assimilation to the uvular consonants. It is necessary to know the segment inventory of the language, not merely its distinctive features,in order to know whether conjunction or disjunction should hold. We must know if the rule distributes allophones or performs a neutralization. I therefore propose (3) to replace Anderson's formulation.

(3) Neutralizing mirror-image rules apply disjunctively; allophonic mirror-image rules apply conjunctively.

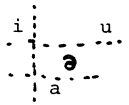
This makes the correct prediction for all of the examples raised by Anderson and for Lushootseed.

3. Consider again the data in (1b). Here Lushootseed exhibits the sort of 'additive' behavior described by Anderson for Chontal vowel laryngealization, Irish vowel raising, etc. A focus surrounded by determinants undergoes the rule to a greater phonetic extent that one with a determinant on only one side. In this case, if we assume that uvulars involve only a backward movemet of the tongue. without raising, lowering, or tensing,

(2)a. $\begin{bmatrix}+\text{syll}\\-\text{cns}\end{bmatrix} \dashrightarrow [-\text{hi}] / \begin{bmatrix}+\text{cns}\\-\text{hi}\\-\text{lo}\\+\text{bk}\end{bmatrix} \_\_\_$

b. $\begin{bmatrix}+\text{syll}\\-\text{cns}\end{bmatrix} \dashrightarrow [-\text{hi}] / \_\_\_ \begin{bmatrix}+\text{cns}\\-\text{hi}\\-\text{lo}\\+\text{bk}\end{bmatrix}$

Consider the phonemic vowel inventory of Lushootseed.



Though the historical source of /ə/ may be some other vowel or vowels, synchronically I see no way of avoiding a phonemic non-low back vowel, distinct from /a/, which differs from it only in height, and from /u/, which differs in height and in rounding. There are thus three distinctive vowel heights in Lushootseed, and the features [±hi] and [±lo] are both needed to describe vowels. So the crucial thing to notice about rule (2) is that the change effected on the input is most straightforwardly formulated in terms of a rule that 'alters the categorial value of a feature.' Underlying high vowels appear as such in all environments save next to a uvular, so there is little question of setting them up as anything other than underlyingly [+hi]. The output of the rule is clearly at the same phonetic height as ə̲, which is [-hi,-lo]. (This is what explains the lowering, since uvulars, in distinctive feature theory, are also [-hi,-lo]. Thus the structural change is most

reasonably written as a switch to [-hi]. One can imagine more baroque formulations in which a categorial switch from plus to minus was avoided, but I see no reason, save Anderson's wording of the conjunctivity prediction, to adopt any of them. Are we therefore to conclude that this is the sort of rule Anderson wishes to predict disjunctive application for? The data in (1b), and that which follows in the next section, show that this would be empirically incorrect. Moreover, the Lushootseed example is, in spirit, like those Anderson cites to demonstrate conjunctive application. We need to revise the letter of the constraint, however, in order to make our rule formally subject to conjunctive application of its subparts (2a) and (2b).

Let us consider a few of the 'numeric detail' rules given by Anderson. In Breton, the height of unstressed mid vowels can take on any of three values, depending on the height of a stressed mid vowel in an adjacent syllable. The Chomsky and Halle (1968) distinctive feature system allows for only two distinctive mid vowels (+tense,-hi,-lo or -tense,-hi,-lo), so clearly the Breton case cannot be described as a change in the categorial value of a distinctive feature. Instead, mid vowels, in phonetic detail, vary along a 'quasi-continuous' scale, and Anderson predicts, correctly,

it is surrounded by determinants than when the determinant is present on only one side; I shall refer to this as the 'two-determinant' type. In addition, he cites one language, Breton, where conjunction is inferrable because a single determinant causes changes in segments on either side, within a given string. This I will term the 'two-foci' case. (The meaning of these terms will become clearer when we reach the actual Lushootseed examples.) Lushootseed, gives both kinds of evidence. As is well known, a high vowel is lowered next to a uvular consonant in this language; I would like to suggest, in addition, that such a vowel is lowered even further when surrounded by uvulars. Furthermore, a uvular surrounded by high vowels causes lowering in both potential foci.

2. Lushootseed has four distinctive vowels: i. u, a, and ə. We will be concerned with the allophones of the two high vowels, i and u. In general[1], phonetic high vowels, [i], [u], appear in all environments except in the neighborhood of a uvular consonant.[2] (Hence the choice of the high allophone as the underlying representation of the phoneme.) Next to a uvular, the high vowels are lowered to what has thus far (Hess and Hilbert, 1976) been described as [e] and [o], as shown in the examples under (1a). Actually, as (1b) shows,

there are also lower allophones, [E] and [O], though I have as yet come across only one word exhibiting the latter. These lower mid vowels occur when the focus vowel is surrounded on both sides by uvular consonants, and they give evidence of the two-determinant type for conjunctive application.[3]

(1)a.

high vowel		mid vowel	
du?ayus	salmon roe	sqeg^{w}ac	deer
dəg^{w}i	you	čəlq^{w}obe?ac	blackcap
ci?il	that(f)	qelbid	vehicle
cick^{w}	very	soq^{w}a	sibling
stuləkʷ	river	heqab	alot
k^{w}i	a	XebXeb	hawk
x^{w}i?	no	Xek^{w}	ugly
k^{w}ag^{w}iǰəd	elk	s?ax^{w}o	clam
pišpiš^{y}	cat	taq^{w}o?	thirst
puyaləp	Puyallup	q^{w}ebid	fix
yubəč^{y}	king salmon	x^{w}olab	like
dił	it is	x^{w}obt	paddle
di?ucid	other side	x^{w}e	grape
d^{z}ix^{w}	first	d^{z}ex^{w}	break

b. lower mid vowel

XEXq	compete
XEq	scratch
qEqx^{w}u?	short
q^{w}Eq^{w}	strong
X^{w}Eq^{w}EX^{w}	dark blue
cisq^{w}OX^{w}ał	(proper name)

Since a uvular on either side of an underlying high vowel causes lowering, we write the mirror-image rule (2), which abbreviates rules (2a) and (2b):

$$(2)\quad \begin{bmatrix}+\text{syll}\\-\text{cns}\end{bmatrix} \dashrightarrow [-\text{hi}]\ \%\ \begin{bmatrix}+\text{cns}\\-\text{hi}\\-\text{lo}\\+\text{bk}\end{bmatrix} \_\_$$