Furthermore, let us examine the wrong candidate **bekurum*[13] from /bakar-um/. This form is compared with the optimal form *bőkurum* by constructing a tableau corresponding to the tableau (28) which does not rely on the pair theory:

(31) Tableau for /bakar-um/

/bakar-um/	*[-stress, -high, -low]	*u*-UMLAUT INDIFFERENT	IDENT$_{IO}$ (-high)	IDENT$_{IO}$ (+back, +low, -round)
a. (?) bökurum			*	**(+back) **(+low) **(-round)
b. bekurum			*	**(+back) **(+low) * (-round)

Unfortunately, the wrong candidate (b) must be evaluated as optimal, since it has a proper subset of the violations of the actual output form (a). This form is thus compared over again with the optimal form in the tableau constructed in conformity with the pair theory:

(32) Tableau in Terms of the Pair Theory

/ba$_1$ka$_2$r-um/	*[-stress, -high, -low],π_1	H-π_1	*u*-UMLAUT INPUT,π_j	H-π_1	*u*-UMLAUT OUTPUT π_k	H-π_k	IDENT$_{IO}$ (-high), π_1	IDENT$_{IO}$-V$_2$ (+back, +low, -round), π_1	IDENT$_{IO}$-V$_1$ (+back, +low, -round), π_k
a bö$_1$ku$_2$rum							*	*	*(+back) *(+low) *(-round)
b. be$_1$ku$_2$rum						?	*	*	*(+back) *(+low) √(-round)

How to construe this tableau is problematic, since here again the wrong candidate (b) must be evaluated as optimal in terms of the number of asterisks. But note that the vowel *e* in form (b) does not arise as a consequence of satisfying the process pair *u*-UMLAUT$_{OUTPUT}$,π_k >> IDENT$_{IO}$-V$_1$(+back, +low, -round),π_k, since the faithfulness constraint is not fully

[13] The vowel *e* is permitted in stressed syllables in Icelandic (Anderson 1972.19)

violated. Hence, the question mark in the tableau above is replaced by asterisk, which makes the actual output form optimal in the strictest sense of the term.[14]

Finally, let us consider the forms in (25b) where the INPUT part of *u*-UMLAUT$_{\text{INDIFFERENT}}$ is concerned. The following tableau demonstrates that the INPUT *u*-UMLAUT is not sufficient to provide us with the expected output forms. (The satisfaction of vowel deletion is assumed.)

(33) Tableau for /bagg-ul-e/

/bagg-ul-e/	*u*-UMLAUT$_{\text{INPUT}}$	IDENT$_{\text{IO}}$ (+back, +low, -round)
(?) böggli		*
baggli		

The wrong candidate **baggli* is evaluated as optimal. Hence, in this case, too, the pair theory is to be crucially relied upon for the survival of the level condition INPUT:

(34) Tableau in Terms of the Pair Theory

/bagg-ul-e/	*u*-UMLAUT$_{\text{INPUT}}$,π_i	H-π_i	IDENT$_{\text{IO}}$ (+back, +low, -round),π_i
☞ böggli			*
baggli		*!	

The incorrect candidate is ruled out because it violates H-π_i, the head of the process pair *u*-UMLAUT$_{\text{INPUT}}$,π_i >> IDENT$_{\text{IO}}$ (+back, +low, -round),π_i. It is thus proven that the pair theory plays a decisive part in rescuing the level condition INPUT from falling into disuse.

In a brief summary, it has been shown that to give a satisfactory account of Icelandic *u*-Umlaut phenomenon the process-specific constraint FAITH-to-INPUT (*u*-UMLAUT$_{\text{INDIFFERENT}}$), an instantiation of the general schema FAITH-to-INPUT, is necessary. Moreover, it has also been demonstrated that it is essential to mobilize other novel devices, namely, the level condition INDIFFERENT and the pair theory.

4. Yawelmani

In this section, I will first investigate the data from the Yawelmani dialect of Yokuts, an American Indian language of California, in search of the instantiations of the general schema FAITH-to-INPUT. And I will later take up the problem of vowel harmony in the

[14] Worse still, the vowel *e* in form (b) is not the product of any other constraint. Thus, this form, having the unidentifiable *e*, is also discarded by the constraint NRC (67) which will be introduced in section 5

Wikchamni dialect of Yokuts in relation to Yawelmani vowel harmony. The interaction of vowel lowering and vowel epenthesis with the phenomenon of vowel harmony will be shown to result in two instantiations of FAITH-to-INPUT to constrain one and the same constraint in charge of vowel harmony. In Yawelmani, a vowel becomes back and rounded after a back rounded vowel of the same height within a word by vowel harmony. The data and discussion are chiefly based on Kenstowicz & Kisseberth (1977, 1979; for the discussion by other writers, see Kuroda 1967, Kisseberth 1969, Archangeli 1985, Cole & Kisseberth 1995; all these writers rely on Newman 1944). Let us begin by considering the following data:

(35) a.

Nonfuture	Nonfuture Passive	Precative	Dubitative	
xat-hin	xat-it	xat-xa	xat-al	'eat'
xil-hin	xil-it	xil-xa	xil-al	'tangle'
bok'-hin	bok'-it	bok'-xo	bok'-ol	'find'
dub-hun	dub-ut	dub-xa	dub-al	'lead by hand'

b. max-sit-hin 'procure'
ko?-sit-hin 'throw'
tul-sut-hun 'burn'

The output form *tulsuthun* from /tul-sIt-hIn/ 'burns for' in (b) above shows that the vowels of two suffixes (the indirect /sIt/ and nonfuture /hIn/) harmonize to the root vowel. In other words, it shows that vowel harmony is satisfied across the board within a word. The pattern of vowel harmony observed above can be accounted for nicely in relatively straightforward manner. However, verb roots containing long high vowels in underlying representations constitute a serious obstacle to the seemingly simple analysis of vowel harmony. For the underlying long high vowels *i:* and *u:* lower context-freely to mid vowels *e:* and *o:* respectively:

(36)

	Nonfuture	Nonfuture Passive	Precative	Dubitative	
a. /mi:k'/	mek'-hin	me:k'-it	mek'-xa	me:k'-al	'swallow'
b. /c'u:m/	c'om-hun	c'o:m-ut	c'om-xa	c'o:m-al	'destroy"
c. /do:s/	dos-hin	do:s-it	dos-xo	do:s-ol	'report'

The surface roots *c'om* and *c'o:m* in (b) behave exactly like a root with a high rounded vowel toward vowel harmony. Thus, the surface low vowels *o:* (or *o*) and *e:* (or *e*) which function as high vowels are derived from the abstract underlying vowels *u:* and *i:* respectively (Kisseberth 1969). (But note that *o* or *o:* in the forms in (c) is a non-high vowel in underlying representations.) The process pair responsible for lowering is: *[Vμμ, +high] (LOWERING) >> IDENT$_{IO}$ (+high).

Here, I will digress into the subject related to the constraints LOWERING and SHORTENING as a background for the discussion which will follow. On the assumption that syllable-final consonant is moraic, long vowels are shortened by the process pair *[μμμ]$_{\sigma}$ (SHORTENING) >> WT-IDENT$_{IO}$ (e.g., *doshin* from /do:s-hin/ in (36c) above). SHORTENING bleeds LOWERING, so the level condition INPUT is imposed on the latter, which outranks the former. But this is not all there is to the story, as is demonstrated in the following tableau:

(37) LOWERING$_{INPUT}$ >> SHORTENING

/c'u:m-xA/	LOWERING$_{INPUT}$	SHORTENING
(?) c'omxa		
c'umxa		
c'u:mxa	*!	*
c'o:mxa		*!

Even the mechanism of the level condition INPUT placed upon LOWERING and the ranking established do not guarantee the expected output form. Therefore, as in the case of Icelandic *u*-UMLAUT, we may have recourse to the pair theory. The tableau (37) above is now restructured in conformity with this theory:

(38) Tableau in Terms of Pair Theory

/c'u:m-xA/	LOWERING$_{INPUT}$, π_1	H-π_1	SHORTENING, π_1	H-π_1	IDENT$_{IO}$ (+high), π_1	WT-IDENT$_{IO}$, π_1
☞ c'omxa					*	*
c'umxa		*!				*
c'u:mxa	*!	*	*	*		
c'o:mxa			*!	*	*	

The effect of the pair theory is clearly exhibited in this tableau: the incorrect candidate **c'umxa* is discarded because it violates H-π_1, the head of the process pair LOWERING$_{INPUT,\pi_1}$ >> IDENT$_{IO}$ (+high),π_1.

To return, high vowel not specified with the features [back] and [round] is epenthesized in the environment C _____ C{C,#}:

(39)	Nonfuture	Dubitative	
a. /ʔilk/	ʔilik-hin	ʔilk-al	'sing'
b. /paʔṭ/	paʔiṭ-hin	paʔṭ-al	'fight'
c. /logw/	logiw-hin	logw-ol	'pulverize'
d. /ʔugn/	ʔugun-hun	ʔugn-al	'drink'

The output form *ʔugun-hun* in (d) shows that epenthetic high vowel is no different from underlying one with respect to vowel harmony.

With this much preliminary, we are now in a position to call in the alignment constraint (40) (for the formulation of alignment constraints, see McCarthy & Prince 1993, and for the formulation of the constraint responsible for the process of harmony, see Kirchner 1993, Smolensky 1993, Cole & Kisseberth 1995).

(40) ALIGN-R ([+round], PRWD)

The right edge of every [+round] coincides with the right edge of some prosodic word.

This constraint is sufficient to take care of the simplistic case of the vowel harmony phenomenon observable in the data given in (35).

Nevertheless, this constraint falls short of preventing, for example, the derivation of **c'o:mol* from /c'u:m-Al/, as is demonstrated in the following tableau:

(41) $\text{LOWERING}_{\text{INPUT}}$ >> ALIGN-R

/c'u:m-Al/	$\text{LOWERING}_{\text{INPUT}}$	ALIGN-R
(?) c'o:mal		*!
c'o:mol		

Furthermore, the wrong candidate **c'umal* from the same underlying representation in which high long vowel is shortened does not violate $\text{LOWERING}_{\text{INPUT}}$. But this is an instance exactly parallel to the derivation **c'umxa* from /c'u:m-xA/ discussed above. Hence, here again, the pair theory is in readiness to filter it out:

(42) Tableau in Terms of the Pair Theory

/c'u:m-Al/	LOWERING$_{INPUT}$, π_1	H-π_1	IDENT$_{IO}$ (+high), π_1	ALIGN-R
(?) c'o:mal			*	*!
c'o:mol			*	
c'umal		*!		*

The incorrect candidate **c'umal* is ruled out since it violates the higher-ranked H-π_1, the head of the process pair LOWERING$_{INPUT}$, π_1 >> IDENT$_{IO}$ (+high), π_1. Still, the problem remains to be solved of how to discard the wrong candidate *c'o:mol*.

Only such forms as these taken into account, it might be sufficient simply to impose the level condition INPUT on ALIGN-R, but the fact that epenthetic high vowel harmonizes to the root vowel at the output level might also force us to impose the level condition OUTPUT on it. Thus, it might be that the level condition INDIFFERENT is imposed on ALIGN-R. This scheme, however, is thwarted, since the OUTPUT part of ALIGN-R$_{INDIFFERENT}$ would be helpless in preventing the derivation of **c'o:mol*. Consequently, for the prevention of the occurrence of *o* from underlying /A/ harmonizing to the lowered *o:* or *o* of the underlying *u:* of the root, we have the following FAITH-to-INPUT (ALIGN-R)$_1$ to fall back on, which is an instantiation of the general schema FAITH-to-INPUT:

(43) FAITH-to-INPUT (ALIGN-R)$_1$

The only non-epenthetic vowel or the sequence of non-epenthetic vowels in the satisfied domain of the constraint ALIGN-R has a correspondent with monotonic [αhigh] in input.[15]

This constraint also guarantees the occurrence of *u* after the lowered vowel *o:* or *o* of the underlying /u:/. Now, with this constraint in hand, we are enabled to construct the following summary tableau. (The satisfaction of the constraints LOWERING$_{INPUT}$ and SHORTENING is assumed.)

[15] It is assumed that the structural elements in correspondence may include sequence of segments

(44) FAITH-to-INPUT (ALIGN-R)$_1$ >> ALIGN-R

		FAITH-to-INPUT (ALIGN-R)$_1$	ALIGN-R
a. /c'u:m-Al/	☞ c'o:mal		*
	c'o:mol	*!	
b. /sudu:k-hIn/ 'remove'	☞ sudokhun		
	sudokhin		*!

The fact in (a) indicates very decidedly that FAITH-to-INPUT (ALIGN-R)$_1$ must dominate ALIGN-R. This affords another empirical proof of the claim put forward in section 2 that the process-specific constraint dominates the conditioned constraint if the former is to be effective.

Proceeding to the forms with epenthetic high vowel, let us consider the following tableau:

(45) FAITH-to-INPUT (ALIGN-R)$_1$ >> ALIGN-R

		FAITH-to-INPUT (ALIGN-R)$_1$	ALIGN-R
a. /logw-ʔAs/	(?) logiwʔas		**
	loguwʔos		
	loguwʔas		*
b. /ʔugn-hIn/	☞ ʔugunhun		
	ʔugunhin		*!
	ʔuginhin		*!*

As shown in (a), FAITH-to-INPUT (ALIGN-R)$_1$ is not sufficient to supply us with the correct output form. The reason is that the constraint as stated in (43) has nothing to do with epenthetic vowel. Hence, we need another instantiation of the general schema FAITH-to-INPUT to take care of the forms with epenthetic vowels:

(46) FAITH-to-INPUT (ALIGN-R)$_2$

The feature [+high] of epenthetic vowel in the satisfied domain of the constraint ALIGN-R has a correspondent in root in input.[16]

[16] This constraint is formulated in terms of featural correspondence

This additional constraint to condition ALIGN-R makes it possible to have the following reconstructed tableau:

(47) FAITH-to-INPUT (ALIGN-R)$_1$, FAITH-to-INPUT (ALIGN-R)$_2$ >> ALIGN-R

		FAITH-to-INPUT (ALIGN-R)$_1$	FAITH-to-INPUT (ALIGN-R)$_2$	ALIGN-R
/logw-ʔAs/	☞ logiwʔas			**
	loguwʔos		*!	
	loguwʔas		*!	*
/ʔugn-hIn/	☞ ʔugunhun			
	ʔugunhin			*!
	ʔuginhin			*!*

The incorrect candidates **loguwʔos* and **loguwʔas* are ruled out due to their epenthetic vowel being in violation of FAITH-to-INPUT (ALIGN-R)$_2$, though their non-epenthetic rounded vowels are in conformity with FAITH-to-INPUT (ALIGN-R)$_1$.

Finally, we have the problem of how to prevent the choice of the incorrect candidate **logiwʔos* rather than the expected form *logiwʔas* from /logw-ʔAs/. To settle this problem, let us consider the following tableau:

(48) FAITH-to-INPUT (ALIGN-R)$_1$, FAITH-to-INPUT (ALIGN-R)$_2$ >> ALIGN-R

/logw-ʔAs/	FAITH-to-INPUT (ALIGN-R)$_1$	FAITH-to-INPUT (ALIGN-R)$_2$	ALIGN-R
a. (?) logiwʔas			**
b. logiwʔos			**

The sequence of non-epenthetic vowels in form (b) obeys FAITH-to-INPUT (ALIGN-R)$_1$, since its input correspondent sequence *o* and *A* has monotonic [-high]. But note that the [+round] span is broken in the middle of the word. We may therefore rely on the high-ranking constraint NOGAP (+round) (Kiparsky 1981, Levergood 1989, Archangeli & Pulleyblank 1994) to filter out this form, as is illustrated in the following tableau:

(49) NOGAP (+round) >> FAITH-to-INPUT (ALIGN-R)$_1$, FAITH-to-INPUT (ALIGN-R)$_2$ >> ALIGN-R

/logw-ʔAs/	NOGAP (+round)	FAITH-to-INPUT (ALIGN-R)$_1$	FAITH-to-INPUT (ALIGN-R)$_2$	ALIGN-R
☞ logiwʔas				**
logiwʔos	*!			**
loguwʔos			*!	
loguwʔas			*!	*

Certainly, the wrong candidate **logiwʔos* is ruled out owing to the high-ranking constraint NOGAP (+round).[17]

The Wikchamni dialect of Yokuts has two front rounded vowels *ü* and *ö*, which Yawelmani lacks.[18] Accordingly, the segmental markedness constraint *[-back, +round] is high-ranked in Yawelmani, while low-ranked in Wikchamni. Taking into consideration the phenomenon of Wikchamni vowel harmony, which differs from Yawelmani vowel harmony only in that it yields two front rounded vowels, ALIGN-R (40) must be revised as stated in (51) after the constraint (50) formulated by Archangeli & Suzuki (1997). This is because ALIGN-R (40) cannot ensure the different occurrences of *u* and *ü* of the respective suffixal vowels of *hutšu* from /hut-šI/ 'knew' and *tüʔüšsü* from /tüʔüs-šI/ 'made', namely, the different occurrences from the same underlying /I/.[19]

(50) ALIGNCOLOR: ALIGN (Color (= [round], [back]), Right, Wd, Right)
The right edge of every Color (= [round], [back]) is aligned with the right edge of some word.

(51) ALIGN-R ([αback, +round], PRWD)
The right edge of every [αback, +round] coincides with the right edge of some prosodic word.

Archangeli & Suzuki formulate the following constraint, which may supplant the two instantiations of FAITH-to-INPUT established above:

[17] Alternatively to NOGAP (+round), we may have the high-ranking DEP_{IO} (+round) or the high-ranking self-conjoined constraint $*[+round]^2_{PRWD}$ which prohibits two occurrences of [+round] within a prosodic word.

[18] The data and discussion concerning Wikchamni are solely based on Archangeli & Suzuki (1997)

[19] This remark holds true even if we assume the fully-specified suffixal vowel /i/ in input.

(52) {ROUND, αHIGH^{IE}} (RD/αHI^{IE})[20]

Every path including [round$_i$] includes [αhigh] in the input or, lacking an input, in the output. (Each token of [round] must be linked to vowels of the same height in the input or, lacking an input, in the output.)

The first question we may ask regarding this constraint is whether there are forms in which epenthetic high vowel harmonizes to the lowered trigger *o:* (e.g., *...o:Cu̲CC...* from /...u:CCC.../). Indeed, there are such forms:

(53)[21]

Dubitative		Gerund		Imperative		
wowlal	/wu:wl-Al/	wo:wu̲ltaw	/wu:wl-tAw/	wo:wu̲lka	/wu:wl-kA/	'stand up'

And the second question we may ask concerning RD/αHI^{IE} is whether there are forms in which epenthetic high vowel occurs after the raised high vowel in Wikchamni. (Roughly, short /o/ is raised to *u* when followed by *i* (underlying or epenthetic) in Wikchamni.) In that event, it is possible for the raised high vowel to affect the epenthetic high vowel in compliance with vowel harmony (e.g., **...uCu̲CC...* from /...oCCC.../), bringing about the wrong winners. Here again, we find such forms:

(54)

t'uyi̲xši (*t'uyu̲xši, *t'uyu̲xšu)	/t'oyx-šI/	'doctored'
puṭi̲k'ši (*puṭu̲k' ši, *puṭu̲k' šu)	/poṭk'-šI/	'soured'
ʔuṭ'i̲what (*ʔu ṭ'u̲what)	/ʔo ṭ'w-hAt/	'hairs'
tuʔi̲t'hat (*tuʔu̲ ṭ'hat)	/toʔṭ'-hAt/	'heads'

On the one hand, RD/αHI^{IE} cannot guarantee the expected output forms *wo:wu̲ltaw* and *wo:wu̲lka* in (53), because they violate its second clause. On the other, it cannot penalize the wrong candidates given in (54), because they are in perfect conformity with its second clause.

In contrast, these recalcitrant forms are taken care of by taking advantage of the two instantiations of FAITH-to-INPUT established above, which take the place of RD/αHI^{IE}. (In the following tableau, the satisfaction of LOWERING$_{INPUT}$ and vowel raising is assumed.)

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[20] This constraint is claimed to be an instantiation of the following schema.

(ii) Input-Else (IE)
In cases where there is a discrepancy between input and output structures, input structure takes precedence over output structure, otherwise, output structure is opted for.

[21] These data are cited from Clements & Halle (1983).

(55) FAITH-to-INPUT (ALIGN-R)$_1$, FAITH-to-INPUT (ALIGN-R)$_2$ >> ALIGN-R

		FAITH-to-INPUT (ALIGN-R)$_1$	FAITH-to-INPUT (ALIGN-R)$_2$	ALIGN-R
/wu:wl-tAw/	☞ wo:wultaw			*
	wo:wiltaw			**!
/t'oyx-šI/	☞ t'uyixši			**
	t'uyuxši		*!	*
	t'uyuxšu	*!	*!	

Finally, I have the following remarks to add. If not for forms like *puk'e:na* from /pok'-I:na/ 'will find' in Wikchamni, and thus if the Wikchamni dialect of Yokuts were left out of consideration, the single constraint FAITH-to-INPUT (ALIGN-R) (56) would be sufficient to constrain ALIGN-R without recourse to the two instantiations of the schema FAITH-to-INPUT established above:

(56) FAITH-to-INPUT (ALIGN-R)[22]

The feature [αhigh] of every vowel in the satisfied domain of the constraint ALIGN-R has a correspondent in root in input.

This constraint is not sufficient to rule out the wrong winner **puk'o:no* from /pok'-I:na/, the product of LOWERING$_{\text{INPUT}}$, vowel raising[23] and ALIGN-R, as is illustrated in the following tableau. (It is assumed that LOWERING$_{\text{INPUT}}$ and vowel raising are satisfied.)

(57) FAITH-to-INPUT (ALIGN-R (54)) >> ALIGN-R

/pok'-I:na/	FAITH-to-INPUT (ALIGN-R (54))	ALIGN-R
a. (?) puk'e:na	*	**
b. puk'o:no	*	
c. puk'o:na	*	*

22 This constraint is based on featural correspondence (see footnote 16).

23 In view of both this form and the fact that epenthesized *i* triggers vowel raising, the level condition INDIFFERENT is to be placed upon the constraint in charge of this phenomenon. Archangeli & Suzuki (1997), however, propose the following constraint, which is claimed to be another instantiation of the schema given in footnote 20.

(iii) [-HI]. [+HI]^{IE}

If a vowel is [-high], then it must not be followed by a vowel that is [+high] *in the input or, lacking an input, in the output.*

The high vowel *u* in all the candidates violates FAITH-to-INPUT (ALIGN-R) (56), but the vowels *o:* and *o* in the candidate (b) satisfy it, since their [-high] has a correspondent in root.

We will now see whether the analysis of Yawelmani vowel harmony within the framework of Optimal Domains Theory (ODT) proposed by Cole & Kisseberth (1995) is tenable. For this purpose, let us examine their tableau given in (59); the constraints employed in this tableau are stated in the following:

(58) a. MAX-H[24]: Every H of the input has a correspondent in the output.
b. LOWERING (LOWER): $V_{\mu\mu} \rightarrow$ [Low]
c. UNIFORMITY (UNIF): The harmony domain must be monotonic: High or Low. **Faithful (High / Low).**
d. EXPRESSION (EXPR): The feature [F] must be expressed on every element in an F-domain.
e. WIDESCOPE ALIGNMENT (WSA): Align (Rd-domain, R; PrWd, R)

(59) (= their tableau (27)) Evaluation of *ʔo:ṭ'ut* from /ʔu:ṭ'-It/ 'steal'

Notation: { } = Low domain, ( ) = High domain, [ ] = Round domain

input	u:...I	MAX-H	LOWER	UNIF	EXPR-H	WSA-RT
a.	[(u:)...(u)]		*!			
b.	[({u:})...(u)]		*!			
☞ c.	[({o:})...(u)]				*	
d.	[{o:}...(u)]	*(!)		*(!)		

In this tableau, the notations { } (low domain) and ( ) (high domain) play a crucial role in making lowered vowels behave in dual character. In (c) above, the lowered ({o:}) functions as [+high] with respect to the constraints MAX-H and UNIF by virtue of the presence of the high domain ( ), but it also functions as [+low] with respect to the constraints LOWER and EXPR-H by virtue of the presence of the low domain { }. In addition, despite the same phonetic realization *o:*, the lowered vowels ({o:}) in (c) and {o:} in (d) behave contrary to each other toward the constraints MAX-H, UNIF and EXPR-H merely because the former has two domains ( ) and { }, while the latter has only one domain { }. Consequently, it appears that without a more plausible and justifiable explanation of the dual behavior of the vowels enclosed with both ( ) and { }, the ODT

[24] This constraint is also based on featural correspondence (see footnotes 16 and 22).

analysis of Yawelmani vowel harmony which crucially depends upon those notations cannot be insisted upon.

Moreover, Archangeli & Suzuki (1997) remark that

> Cole and Kisseberth (1995) propose a UNIFORMITY constraint which restricts the height requirement to either an input value or, lacking one, an output value (p. 17).

If we take this interpretation of the constraint UNIFORMITY (UNIF) (58c) at its face value, UNIF is proven to be insufficient to cope with those recalcitrant forms discussed above in relation to the constraint RD/αHI^{IE}, as has been done the latter constraint, which is modeled after the interpretation of UNIF above.

In this section, I have argued that it is necessary to call in two instantiations of the schema FAITH-to-INPUT for an adequate description of vowel harmony in the Yawelmani and Wikchamni dialects of Yokuts. Also, it has been demonstrated that the level condition INPUT and the pair theory must be exploited in dealing with the interaction between vowel lowering and vowel shortening. In addition, two other OT analyses have been shown to be inadequate to account for the phenomena of vowel harmony in the Yokuts dialects.

5. Diola Fogny

In the West African language Diola Fogny, we find the fourth case where an instantiation of the general schema FAITH-to-INPUT is necessary. This process-specific constraint is involved in working out a problem encountered in the interaction of nasal assimilation (NA) with consonant deletion. The following data and discussion mainly rely on Kiparsky (1973b), supplemented with the data from Kenstowicz (1994) (the data are due originally to Sapir 1965).

(60) a. Morpheme-Internal NA

bunt	/bunt/	'lie'
jensu	/jensu/	'undershirt'
ekumbay	/ekumbay/	'pig'
famb	/famb/	'annoy'
mba	/mba/	'or'
ndaw	/ndaw/	'man's name'

b. NA Before Nasal or Obstruent

niŋaŋŋan	/ni-ŋan-RED/	'I cried'

na-mi:mmi:n	/na-mi:n-RED/	'he cut (with a knife)'
nigaŋgam	/ni-gam-RED/	'I judge'
paɲjimaɲj	/pan-ji-maɲj/	'you (pl.) will know'
kubɔmbɔɲ	/ku-bɔɲ-RED/	'they sent'
nati:nti:ŋ	/na-ti:ŋ-RED/	'he cut (it) through'
napuŋkuɲilak	/napum#kuɲilak/	'he pushed back the children'
najuntɔ	/najum#tɔ/	'he stopped there'

c. Nasal Deletion Before Non-Nasal Sonorant Consonant

nalalaɲ	/na-laɲ-RED/	'he returned'
nayɔkɛyɔkɛn	/na-yɔkɛn-RED/	'he tires'
na-waɲa:waɲ	/na-waɲ-a:m-RED/	'he cultivated for me'

d. Consonant Deletion Before Obstruent

ajabuŋar	/a-jaw-bu-ŋar/	'voyager'
lɛkujaw	/lɛt-ku-jaw/	'they won't go'
ujuja	/ujuk-ja/	'if you see'
kɔkɔbɛn	/kɔb-RED-ɛn/	'yearn for'
kutɛsinaŋas	/kutɛb#sinaŋas/	'they carried the food'
ɛkɛbɔ	/ɛkɛt#bɔ/	'death there'

e. Iterative Consonant Deletion

ɛrɛrɛnt	/ɛ-rɛnt-RED/	'it is light'
namamaɲj (*namammaɲj)	/na-maɲj-RED/	'he knows'

f. Miscellaneous

takumbi…	/takun-mbi…/	'he must not ...'
baɲa (*baɲɲa)	/ban#ɲa/	'finish now'

In Diola Fogny, the constraint CODA-COND limits consonant clusters to homorganic nasal plus consonant, geminate nasals and liquid followed by coronal *t* (e.g., *salte* 'be dirty'). Just for the sake of argument, Kiparsky (1973b) states the rule of nasal assimilation equivalent to that given in (61), which is bound to be simplified by taking advantage of Elsewhere Condition (for this condition, see Kiparsky 1973b, 1982).

(61) Nasal Assimilation

[C, +nas] → [α place] / _____ {[C, +nas, α place], (#) [-son, α place]}

In OT, the constraint responsible for the nasal assimilation may be stated as in the following:

(62) Constraint Responsible for Nasal Assimilation (NA)

*[C, +nas, α place] {[C, +nas, -α place], (#) [-son, -α place]}

The constraint CODA-COND practically amounts to deleting the first consonant of the consonant clusters which are not produced (vacuously or non-vacuously) by the process of nasal assimilation, leaving unscathed the first consonant of the cluster liquid plus coronal *t*. That is, it deletes their first consonant morpheme-internally,[25] across morpheme boundary or across a single word bounday (#).

With the exception of the derivation of *namamaɲj* from /na-maɲj-RED/, the constraints CODA-COND and NA guarantee the expected surface forms. However, it would seem quite natural that **na.mam.maɲj* from /na-maɲj-RED/ is evaluated as the optimal form, since it perfectly obeys CODA-COND and NA as does *nimammaŋ* from /ni-maŋ-RED/. A comparison is made between these two forms in the following tableau:

(63) CODA-COND, NA >> MAX_{IO}

		CODA-COND	NA	MAX_{IO}
a. /na-maɲj-RED/	(?) na.ma.maɲj			**
	na.mam.maɲj			*
	na.maɲ.maɲj	*!	*!	*
	na.maɲj.maɲj	*!		
b. /ni-maŋ-RED/	☞ ni.mam.maŋ			
	ni.ma.maŋ			*!
	ni.maŋ.maŋ	*!	*!	

Note that *ɲ* in the intermediate form *namaɲmaɲj* from /na-maɲj-RED/ in (a) must be deleted, subsequent to the disobedience to NA. It is due to the fact that the nasal *ɲ* (i.e., the

[25] Their first consonant may be deleted "morpheme-internally" in case input is structured in accordance with the principle of Richness of the Base (for Richness of the Base, see Prince & Smolensky 1993, Smolensky 1996a,b).

potential target of NA) which comes to be located immediately before the first segment *m* of the reduplicant (i.e., the potential trigger of NA) as a result of the deletion of *j*, is not in the root-final position in input, as is the case with the target of NA in all the other optimal output forms. This provides the clue for solving the problem: that the potential target *ɲ* of NA in the intermediate form is not the root-final segment in input is enough to make us invoke an instantiation of the general schema FAITH-to-INPUT:

(64) FAITH-to-INPUT (NA)

The target in the satisfied domain of the constraint NA in intermorphemic environment has a correspondent in the final segment of the root in input.[26]

We may conceive of an alternative to this constraint. It might be to fall back on the level condition INPUT to be placed on the constraint NA. This alternative, however, fails since the trigger of NA is not present in the morpheme RED in input. Even if the morpheme RED is assumed to be prefixed, the alternative also fails, since the target of NA is not present in RED in input, either. With the constraint FAITH-to-INPUT (NA) in hand, we may now have the following tableau:

(65) CODA-COND, FAITH-to-INPUT (NA) >> MAX$_{IO}$; FAITH-to-INPUT (NA) >> NA

		CODA-COND	FAITH-to-INPUT (NA)	NA	MAX$_{IO}$
/na-ma$_1$ɲ$_2$j$_3$-RED/	☞ na.ma$_1$.maɲj				**
	na.ma$_1$m$_2$.maɲj		*!		*
	na.ma$_1$ɲ$_2$.maɲj	*!		*!	*
	na.ma$_1$ɲ$_2$j$_3$.maɲj	*!			
/ni-ma$_1$ŋ$_2$-RED/	☞ ni.ma$_1$m$_2$.maŋ				
	ni.ma$_1$.maŋ				*!
	ni.ma$_1$ŋ$_2$.maŋ	*!		*!	

With FAITH- to-INPUT (NA) dominating MAX$_{IO}$, we can rule out the incorrect candidate **namammaɲj*. CODA-COND outranks MAX$_{IO}$ because it is natural that the markedness constraint outranks the faithfulness constraint in a process pair if the former is to be effective. No ranking obtains between CODA-COND and FAITH-to-INPUT (NA), and NA is indifferent to the former and MAX$_{IO}$.

[26]Even if the morpheme RED is assumed to be prefixed, this constraint fully serves its purpose

By way of summary, let us consider the following summary tableau where diverse forms are evaluated:

(66) Summary Tableau for Consonant Deletion in Diola Fogny

		CODA-COND	FAITH-to-INPUT (NA)	NA	MAX_{IO}
a. /ni-gam-RED/	☞ nigaŋgam				
	nigamgam	*!		*!	
	nigagam				*!
b. /na-laɲ-RED/	☞ nalalaɲ				*
	nalaɲlaɲ	*!			
c. /lɛt-ku-jaw/	☞ lɛkujaw				*
	lɛtkujaw	*!			
d. /ɛ-rɛnt-RED/	☞ ɛrɛrɛnt				**
	ɛrɛntrɛnt	*!			
	ɛrɛnrɛnt	*!			*
e. /ban#ɲa/	(?) ba#ɲa				*
	baɲ#ɲa				

The constraints employed in this tableau are not sufficient to allow the choice of the expected *baɲa*, as is seen in (e). But there is a proper step to take. In Lee (1996, 1997), the following constraint is proposed:

(67) No Restructuring Constraint (NRC)

F_{IO} may be violated only by the satisfaction of a markedness constraint in non-intramorphemic environment.

It is obvious that the sequence *ɲ#ɲ* in **baɲ#ɲa* is not the product of NA as stated in (62); put differently, the change of the root-final *n* to *ɲ* is not accomplished by the satisfaction of any constraint whatsoever. Hence, the root-final occurrence of *ɲ* in the wrong candidate violates the high-ranking NRC.[27]

To conclude, Diola Fogny supplies the fourth case of invoking an instantiation of the schema FAITH-to-INPUT. That is, the interaction of nasal assimilation with consonant deletion in Diola Fogny well evidences the vital necessity of placing reliance upon it.

[27] Instead of having recourse to NRC, it might be possible to complicate the statement of CODA-COND to meet this situation.

6. Klamath

Lastly, I will examine the problems of vowel gradation and vowel shortening in Klamath, an American Indian language of Oregon. They bear upon the process-specific constraint schema FAITH-to-INPUT. The self-interaction of vowel gradation ultimately leads to invoking an instantiation of this schema; besides, the interaction of vowel gradation with vowel shortening also leads to the same result. The subsequent data and discussion are chiefly founded on Clements & Keyser (1983:115-181; see also Barker 1963, 1964, Kean 1973, Kisseberth 1973a, 1973b, Thomas 1974; for a fuller treatment of these problems and the accompanying issues in the phonology of Klamath, see Lee In prep.).

First, I will clarify the phenomena of vowel gradation which comprises vowel truncation, vowel reduction and vowel deletion. In the first place, the forms in (a) below illustrate that the short initial vowel of a prefix or root is truncated provided it is preceded by at least one syllable in a word. Secondly, the forms in (b) show that the short first vowel of a prefix or root is reduced to schwa provided it is preceded by at least one syllable and followed by C{C,#} in a word. Finally, the forms in (c) demonstrate that the short first vowel of a prefix or root is deleted provided it is preceded by at least one syllable and followed by CV in a word.

(68) a. Vowel Truncation

ʔiwa	/ʔi-ew-a/	'puts plural objects into water'
hiwwa	/hiw-ew-a/	'spreads out a blanket in water'
n'iqwa	/n'iq-ew-a/	'puts a hand into water'
cf. wewa	/w-ew-a/	'strikes a long instrument in the water'
sgeʔəmbli[28]	/sgeʔn-ebli/	'buys back'
tweqa	/twe-eqn-a/[29]	'bore through'
teto:qa	/DIST-twe-eqn-a/[30]	'bore through' (distr.)

b. Vowel Reduction

sisəpca	/DIST-sipc-a/	'put out a fire' (distr.)
cf. sipca	/sipc-a/	'puts out a fire'
GaGəttk'a	/DIST-Gatdk'-a/	'are cold' (distr.)

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[28] Schwa is epenthesized when the stem-final sonorant consonant preceded by a consonant is word-final or followed by a consonant.

[29] The consonant *n* is deleted by the constraint *Cna#

[30] Distributive prefix is formed by reduplicating the sequence of the initial C_1 plus the short version of the base (see McCarthy & Prince 1995, Alderete et al 1996 for the treatment of reduplication within the framework of OT)