**On the role of prosodic and morphological categories in vowel harmony and disharmony.
A correspondence approach**

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Abstract

In this paper, I will show that consonants in coda position may influence vocalic feature interaction and I will argue that it follows from this that the mora is a relevant category for vowel harmony and disharmony. Furthermore, I will illustrate that morphological categories such as the root and the stem are domains of vocalic feature interaction. The data cause fundamental problems to an alignment approach to vowel harmony (Kirchner 1993, Pulleyblank 1996 and others). An alternative will be presented in which harmony is explained as a type of correspondence relation between surface elements.

1. Introduction

The languages examined here show complete harmony, which is sometimes referred to as 'vowel-copy'. Since both Yucatec Maya and Ainu display a five vowel system, which can be described without redundancy with three distinctive features, I assume that only these features harmonise. A further hint that this is an instance of harmony and not copying, is that both languages also show a principled disharmonic pattern which affects only backness within high vowels. Furthermore all these phenomena – vowel harmony, blocking of harmony, and disharmony – are morpheme-specific. This means that they occur only with particular morphemes and not with others. The facts support Inkelas' (1994) and Inkelas, Orgun & Zoll's (1997) theory of underspecification in which it is assumed that only predictably alternating structure is underspecified underlyingly while everything else is fully specified.

In most recent literature, vowel harmony is explained by the postulation of featural alignment constraints, which are an extension of the Generalised Alignment schema (McCarthy & Prince 1993). A formulation of this type of alignment is given in (1), cited from NíChiosáin & Padgett (1997).

(1) Align L/R (F, Pwd): Every feature F is associated with the leftmost/rightmost segment of the prosodic word.

In Optimality Theory (Prince & Smolensky 1993), such constraints are violable, and they interact with other constraints, for example, constraints on markedness. This means that in a given language a surface form violates some constraints in order to satisfy other higher ranked constraints. The analysis in this paper will work within this framework, more particularly the subtheory of Correspondence Theory (McCarthy & Prince 1995).

The paper is organised as follows. In section 2 I will introduce the type of harmony under examination and the phenomenon of blocking in Yucatec Maya which makes it necessary to incorporate the category of the mora into a theory of vowel harmony. For these data, a solution terms of feature alignment will be proposed. In section 3, harmony and disharmony in Ainu will be shown. These data pose a serious problem for the alignment approach. Section 4, then, provides an alternative analysis for both languages. This is necessary since both languages exhibit very similar patterns of harmony and disharmony, and the choice showing harmony and blocking in Yucatec and disharmony in Ainu is made because the respective points can be illustrated more transparently in the respective language.[1] Section 5 concludes.

2. Yucatec Maya
2.1. Harmony and blocking

Yucatec Maya is spoken in southeastern Mexico, Belize and northern Guatemala. It has five vowels, which can further be distinguished by length and tone. Some Yucatec affixes contain vowels that surface always as a complete copy of the last vowel of the preceding root. This is illustrated in (2).

(2)	a. Imperfective[2]		b. Subjunctive	
	ʔah-al	wake.up	*ʔah-ak*	
	ʔok-ol	enter	*ʔok-ok*	
	lub'-ul	fall	*lub'-uk*	
	wen-el	sleep	*wen-ek*	
	kíim-il	die	*kíim-ik*	

The language also displays disharmonic affixes in the sense that the vowels of these morphemes always surface with the same quality, as shown in (3).

(3)	a. *yil-ik*	see-IMPF	b. *yil-ah*	see.PERF
	tsol-ik	explain-IMPF	*putʃ-ah*	hit-PERF

This leads to the insight that some segments in some morphemes in Yucatec Maya must be regarded as being underspecified (e.g. those in (2)) while others bear underlying full feature specifications (e.g. those in (3)). The alternative would be to assume a morpheme-specific harmony grammar for just these affixes. This possibility must be rejected for reasons of economy.

In some cases, the underspecified vowel surfaces as *a* ignoring the quality of the preceding vowel. See (4).

(4)	*tùukul-n-**a**k*	think-N-SUBJ	* *túukulnuk*
	*hèek'-n-**a**k*	break-N-SUBJ	* *hèek'n**e**k*
	*ts'íib'-n-**a**k*	write-N-SUBJ	* *ts'íib'n**i**k*

Usually, Yucatec avoids consonant clusters. In the rare roots containing final consonant clusters, harmony is blocked. The most intuitive explanation for this interruption of a featural interaction is that features do not link from segment to segment (as proposed by Ní Choisáin & Padgett 1997) or from featural nodes

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[1] For a more detailed analysis of both languages as well as a broader theoretical discussion and an application of the proposed theory to harmony and disharmony in Turkish, the reader may be referred to Krämer (1998).

[2] The Yucatec data are taken from Ayres & Pfeiler (1997) and from Bricker & Yah (1981).

(e.g. Clements & Hume 1995), but from mora to mora. A consonant in coda position projects a mora in Yucatec, and furthermore it is not a good place for a vowel feature to associate to, since it is consonantal. Due to a general locality requirement, which says that all phonological phenomena apply locally, i.e. that each adjacent feature node, segment or mora should be affected by an assimilation pattern, and cannot be skipped, such an inappropriate mora blocks assimilation. Thus, harmony or feature spreading is stopped when a consonantal mora intervenes between two vowels. Consonants in onset position do never bear a mora and never have any impact on harmony.[3] The structure in (5) shows that whenever a mora is occupied by a consonant, this mora cannot interact with the adjacent moras as far as vocalic features are concerned.

(5) Yucatec: *tuukulnak* 'think' (subjunctive form)

[	***tu***		***u***		***ku***		***l***		***na***		***k***	]$_{\text{word}}$
	|		|		|		|		|		|	
	μ	↔	μ	↔	μ	↮	μ	↮	μ	↮	μ	
		[±F]		[±F]		[±F]		[±F]		[±F]		

These findings can be translated straightforwardly into an alignment analysis, as will be shown in the following section.

2.2. A solution in terms of alignment

A formulation of the alignment scheme incorporating the notion of the mora is given in (6). For an alternative view, basing on strict locality see Ní Chiosáin & Padgett (1997).

(6) Moraic Alignment: μ-ALIGN R/L (feature, Pwd): Feature F is associated with the leftmost/rightmost *mora* of a prosodic word.

A further ingredient to the analysis is a prohibition against the articulation (or association) of vocalic features on consonants, given in (7).

(7) *COPRODUCE: Do not associate vowel features with consonants.

Finally, it must be avoided that harmony simply skips a mora for a better satisfaction of featural alignment. This is provided by a general locality constraint, as formulated below.

(8) LOCALITY: Featural Spreading does not skip targets.
(compare Pulleyblank's (1996) NOGAP constraint)

Even a less specific principle of Locality may probably prove to be undominated in all languages, since all phonological phenomena appear to be local in a certain sense. *COPRODUCE must be ranked above the alignment constraint in order to account for the case of blocking in Yucatec Maya. This blocking grammar is illustrated in the tableau below.

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3 For palatality this probably does not hold in all instances. For example in Turkish, an interaction between some consonants and the following vowel with regard to backness/palatality can be observed (see Clements & Sezer 1982). And usually it is observed that onset consonants palatalise in accordance with the following vowel (e.g. Russian, Irish and many other languages).

In (9a), the features [+high] and [+back] are associated to all moras. Since two of these moras are linked to consonants, *COPRODUCE is violated two times. In (9b), the consonantal mora (*l*) is skipped and the last mora (*k*) is not associated with the vocalic features either, in satisfaction of *COPRODUCE. The former (skipping the mora of *l*) constitutes a violation of LOCALITY. In (9c), the mora above *l* blocks harmony in order not to violate *COPRODUCE and LOCALITY, but in violation of ALIGNMENT. Now the ranking of *COPRODUCE, LOCALITY >> ALIGNMENT comes to play. Violating alignment is obviously less expensive than violating the other two constraints.

(9) Yucatec harmony and blocking as alignment

*/tuukul+n+**V**k/* [4]	LOCALITY	*COPRODUCE	μ-ALIGN R (f, Pwd)
a. [+hi,+bck] *mm mm mm* *tuu.ku l.nu k*		*!*	
b. [+hi,+bck] *mm mm mm* *tuu.ku l.nu k*	*!		*
☞ c. [+hi,+bck] *mm mm mm* *tuu.ku l.na k*			***

In the cases where no coda consonant is found, vowels surface harmonically in satisfaction of featural alignment. In order not to let harmony apply throughout it must be assumed that featural Identity constraints (McCarthy & Prince 1995) rank above the given alignment constraint. This assures that harmony affects only underspecified vowels.

3. Ainu
3.1. Harmony and disharmony

A similar pattern can be observed in Ainu which is spoken on the island of Hokkaido (Japan), Sachalin and on the Kurile Islands (Russia). Ainu has five vowels, *i,e,a,o,u*. On some verbal stems, the transitivising suffix completely echoes the root vowel; see (10).

(10) Harmony in Ainu:

mak-a	'to open'	*tas-a*	'to cross'	
ker-e	'to touch'	*per-e*	'to tear'	
pis-i	'to ask'	*nik-i*	'to fold'	
pop-o	'to boil'	*tom-o*	'to concentrate'	
tus-u	'to shake'	*yup-u*	'to tighten'	[Itô 1984:506]

On some stems, the same suffix always surfaces as [+high] and with a backness specification that is the opposite of that of the vowel in the stem.

4 Underspecified vowels are indicated by capital V. All other vowels are assumed to be fully specified underlyingly.

(11) Backness disharmony in Ainu:

a.	*hum-i* 'to chop up'	*mus-i*	'to choke'		
	pok-i 'to lower'	*hop-i*	'to leave'		
b.	*pir-u* 'to wipe'	*kir-u*	'to alter'		
	ket-u 'to rub'	*rek-u*	'to ring'		[Itô 1984:506]
c.	*an-i* 'to have'	*car-i*	'to rotate'		
	ram-u 'to think'	*rap-u*	'to flutter'		
	pat-u 'spray'	*yak-u*	'destroy'		[Dettmer 1989:479f.]

Itô (1984) analysed the transitivising suffix as a completely underspecified vowel, or as merely [+syllabic]. Furthermore she proposes that, in the disharmonic cases, a floating autosegment [+high], i.e. a feature which is not associated with any segment, may belong to the stem. The autosegment gets associated to the empty suffix, and triggers a Melodic Dissimilation Rule (MDR), which forces the vowel in the suffix to have the opposite backness specification to that of the stem vowel.

A more plausible reason, why feature dissimilation applies instead of vowel harmony in these cases can be found if we assume that when the floating feature of the root is realised on the suffix, this suffix is interpreted as belonging to that root, because it contains material from the root. Within roots dissimilation is required, while between roots and affixes assimilation is the dominant requirement.

3.2. A problem for alignment

Itô solved the problem via rule ordering, a device which is not available within OT. In this section it will be shown that even with the generalisation that disharmony holds within roots and harmony holds within words, an alignment account does not suffice to explain the Ainu data. Below I list the constraints which should be essential to an analysis of Ainu.

(12) Harmony Alignment: See (6).

(13) FAITH S/F: A segment / feature in the input has a correspondent in the output and vice versa. (i.e. MAX and DEP, see McCarthy & Prince 1995)

(14) Root Alignment: ALIGN (Root,R, Root Feature, R):
The right edge of every root coincides with the right edge of its rightmost feature.
('Integrate your theme vowel into the root.')

(15) Obligatory Contour Principle[5] (restricted on roots)/ Local conjunction:
$*S_{1[\alpha F]}S_{2[\alpha F]}$, Local Domain = root
Adjacent identical specifications of feature F are prohibited.

The vocalic features at the end of a verb root must be regarded as thematic vowels. Constraint (14) is intended to assure that such thematic vowels are integrated into the root. From this it follows that also their host (in this case the underspecified affix) is analysed as belonging to the root while it would otherwise count as part of the stem. The following tableau shows that harmony

5 For definitions of the OCP see Leben (1973), McCarthy (1986) and others.

can be accounted for with or without ranking the proposed constraints. The disharmonic data, however, pose a problem to the analysis because no matter how we rank the constraints, the correct candidate will never be the winner.

(16)

i. /tus+V/	FAITH-F	ALIGN R (ROOT,F)	ALIGN R (F,WD)	OCP_{root}
☞a. [+high,+back] t u s u				
b. [+hi,+bk] [+hi,+bk] t u s u	**		* *	**
c. [+hi,+bk] [+hi,-bk] t u s i	*		* *	*

ii. /hum[+high]+V/	FAITH F	ALIGN R (ROOT,F)	ALIGN R (F,WD)	OCP_{root}
a. [+hi,+bk] [+hi,+bk] h u m u]	*		**	**
☠ b. [+hi] [+bk] [+hi] h u m u]			*	*
c. [+bk] [+hi] [+bk] h u m u]	*		*	*
☹ d. [+hi,+bk] [+hi,-bk] h u m i]			**!	*
☠ e. [+hi] [+bk] [+hi] h u $m]_{root}$ u		*	*	

For reasons of space I will skip the discussion of tableau (16i) and concentrate on tableau (16ii), which is crucial for the current argument. In (16ii), the floating feature of the stem is indicated by the superscript [+high]. Candidates (a) and (d) incurr one more violation of ALIGN R (F,Wd) than the undesired winners (b) and (e) because of epenthesised features at the right edge of the word instead of linking the underlying features to both vowels. Even a ranking of the constraints {i.e. FAITH F >> ALIGN R (root, F) >> ALIGN R (F, Wd) >> OCPstem} would not yield the right result since the favored candidate (d) would then lose against (b) because it has one more violation of Align R (F, Wd). Ranking OCP higher than ALIGN R (F, Wd) does not lead to the desired result either, since the OCP constraint under the given (standard) definition is not violated when a feature is linked to two vowels, because in this case no two adjacent identical specifications of feature F (here [back]) occur but only one feature [+back] which is realised on two segments/moras.

My proposal in the next section will be to dispense entirely with the notion of double feature linking at all and regard harmony as a featural identity relation between moras. From the responsible identity constraint, a markedness constraint can be derived which is responsible for dissimilation without the shortcomings demonstrated above.

4. Surface correspondence

The surface correspondence constraints, which I am about to introduce here, belong to the family of Identity constraints proposed by McCarthy & Prince (1995:264), cited in (17).

(17) The IDENT(F) Constraint Family
General Schema
IDENT(F)
Let α be a segment in S_1 and β be any correspondent of α in S_2.
If α is [γF] then β is [γF].
(Correspondent segments are identical in feature F.)

The given identity relation is restricted to elements standing in an input-output correspondence. Correspondence has been extended to base-reduplicant and base-output relations in the literature. In (18), I have given a definition where a featural correspondence between distinct elements within one output string is involved.

(18) SURFACE-IDENTITY(F) (S-IDENT, general schema):
Let α be a vowel in *syllable/mora* 1 and β be any correspondent of α in *syllable/mora* 2.
If α is [γF] then β is [γF].
('A vowel has to have the same value for a feature F as the vowel in the adjacent syllable or mora.')

For Ainu and Yucatec Maya, the relevant categories or elements which correspond in feature specifications must be the mora, as outlined in section 2.

(19) Moraic SURFACE-IDENTITY (S-IDENT$_{\mu[b,h,l]}$):
Let α be a vowel in *mora* 1 and β be any correspondent of α in *mora* 2.
If α is [γback], [δhigh], [εlow] then β is [γback], [δhigh], [εlow].

Since both languages display a five vowel system, only three features are needed to describe this system and to describe complete harmony. All other features (like roundness, ATR etc.) salient in surface representations emerge in satisfaction of feature cooccurrence constraints.[6]

Further ingredients to a proper analysis are MAX(IO) which militates against skipping (underspecified) segments and a reformulated DEPendency constraint. In the definition in (21) the restriction to input-output pairs is skipped. Thus, a feature which is only licensed by a surface correspondence relation is better than one that does not have a correspondent at all (none in the input either).

(20) MAX(IO): Any segment in the input has a correspondent in the output.

(21) DEP-X: Every x in the output has to be licensed by a correspondence relation.

(22) LOCALITY: Categories, referred to in correspondence relations, are adjacent.

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[6] Without the assumption of feature cooccurrence constraints like *[-back, +round] it cannot be explained why five-vowel-systems never exhibit inventories like y, ɯ, ø, ɤ, a for example.

With these theoretical assumptions and the analytical inventory proposed so far I will proceed now to a more convenient analysis of the discussed data.

4.1. Yucatec Maya Analysis

The Yucatec data discussed here did not pose a challenge to previous accounts. They only served to demonstrate that the mora is the crucial category for vowel harmony. They are quite easily translated into the new approach. Tableaux (23i&ii) illustrate how S-IDENTITY rules out all nonharmonic candidates when an underspecified affix is attached to a root (23i) and how the ranking IDENT(F) >> S-IDENT assures that specified suffixes prefer their underlying specifications to those of their neighbours.

(23) (Under-)specification and harmony in Yucatec:

i. /*lub'-Vl*/	IDENT(F)	S-IDENT$_{\mu[F]}$	MAX
a. *lub'al*		*!	
b. *lub'el*		*!	
c. *lub'ol*		*!	
d. *lub'il*		*!	
e. *lub'l*			*!
☞ f. *lub'ul*			

ii. /*tsol-ik*/	IDENT(F)	S-IDENT$_{\mu[F]}$	MAX
a. *tsolok*	*!		
☞ b. *tsolik*		*	
c. *tsolak*	*!	*	

Also instances of blocking are accounted for quite easily as demonstrated in tableau (24). It is not quite clear whether Locality should be regarded as a defining property of all correspondence relations and thus be incorporated into their definition or whether it should be regarded as a single, unviolated constraint. However, the harmonic candidate (c) does not violate S-IDENTITY as such. Since in this approach consonants do not bear vocalic features (due to high *COPRODUCE or any property of GEN), S-IDENT is vacuous with regard to them, because it compares only feature specifications. Where there is no feature, there is no specification to compare. In the cases where there are vowel features to compare, they all have the same specification. The problem is only that the moras with equal feature specifications are not adjacent. This gives the critical violation mark. Since LOCALITY rules out any feature licensing by correspondence relations, the choice of the surface feature specifications of the underspecified vowel is governed by the ranking of DEP(F) constraints. In Yucatec, these constraints must be ranked as in the tableau below in order to let [a] turn out as the epenthetic vowel (quality).[7]

[7] The constraint DEP[mid] should not be regarded as referring to a primitive feature but rather as a local conjunction of DEP[-high] & DEP[-low]. (See Krämer 1998 for a discussion of the necessity of this move and Smolensky (1993, 1995) for local conjunction.)

(24) Evaluating vowel harmony when there is none in Yucatec:

	/*tu:kul+n+**V**k*/	ID (F)	LOCAL, S-IDENT$_{\mu[F]}$	MAX	DEP [+bck]	DEP [+hi]	DEP [mid]	DEP [+lo]
a.	*tu:kuln**o**k*				*!		*	
b.	*tu:ku$_1$ln**u**$_2$k*				*!	*		
c.	*mm m m m m* *tu:ku$_1$ln**u**$_1$k*		*! (Locality)					
d.	*tu:kulnk*			*!				
e.	*tu:kuln**i**k*					*!		
f.	*tu:kuln**e**k*						*!	
☞ g.	*tu:kuln**a**k*							*

In the following subsection, I will account for the facts that provided difficulties for the alignment/OCP approach.

4.2. Ainu Analysis

There are two possibilities to violate Surface Identity. First, if an underlyingly specified feature surfaces with its underlying specification instead of the one required by S-IDENT (I would call this 'accidental' violation) and, second, if the feature surfaces with the opposite value (i.e. always α instead of β). The intuitively most straightforward one is the latter option, i.e. to let features not agree. This yields disharmonic patterns. The feature in question is 'copied' with the opposite value. *S-IDENT has to be formulated as in (25). The relevant specification which can be observed active in Ainu is given in (26).

(25) *S-IDENTITY (general schema):
Let α be a vowel in *mora/syllable* 1 and β be any correspondent of α in *mora/syllable* 2. If α is [γF] then β is ***not*** [γF].
Domain: G-Cat.

Where G-Cat is any grammatical category, like root, stem, or morphological / phonological word.

(26) *S-IDENTITY (with surface reflexes in Ainu):
Let α be a vowel in ***mora*** 1 and β be any correspondent of α in ***mora*** 2.
If α is [γback] then β is ***not*** [γback].
Domain: **root**.

Note that the constraints S-IDENT and *S-IDENT must be restricted to local domains which furthermore must be of different size if both show surface effects.[8] The scope of the constraint responsible for disharmony (i.e. *S-IDENT$_{root}$) in Ainu is smaller than the scope of the one which demands harmony (i.e. S-IDENT). The former constraint holds over roots, while the latter is restricted to the domain of the whole word. Thus, *S-IDENT must rank higher in the Ainu hierarchy than S-IDENT, else it would have no surface effect. Since harmony is not a widespread phenomenon in Ainu either, input-output featural identity constraints must rank above those requiring (dis)harmony.

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[8] There is no human language documented in which vowel harmony applies beyond morphological or phonological word boundaries, in contrast to voicing assimilation or tonal spreading, which commonly cross word boundaries. However, there seem to be cases attested where vowel harmony holds over domains which are smaller than that of the morphological or phonological word (see e.g. Pulleyblank 1996). Thus, S-IDENT constraints on vocalic features must be restricted locally with the word as their maximal scope.

The alignment constraint on roots and features (as given in (14)) was a constraint on surface representations. In case of an alignment analysis, where harmony is understood as the alignment of a feature (of a stem) with a boundary (e.g. the word boundary), the root would be extended to the whole domain of harmony, what cannot be intended for empiric reasons. We gain a more appropriate formulation in adopting the anchoring constraint scheme (McCarthy & Prince 1995) for this purpose, which includes an input-output relation. With this device, it can be formulated that a root ends, where its last underlying feature ends, as stated in (27).

(27) Root Anchoring: ANCHOR (Root,R, Root Feature, R):
The right edge of every root coincides with the right edge of its rightmost underlying feature.
('Integrate your theme vowel into the root.')

In satisfaction of ANCHOR, the underspecified transitivising suffix gets incorporated into the root domain if a floating feature is present. There, any output candidate violates either S-IDENT or *S-IDENT. A possibility to escape from this dilemma would be to skip the affix and the floating feature. The fact that this does not happen proves that some sort of constraint like MAXIO or a morphological requirement which demands surface reflexes of grammatical features must rank above the (dis)harmony constraints. This completes the ranking argument for Ainu.

Tableau (28) illustrates the evaluation of the surface form of a root with floating [+high] plus transitivising affix. Candidate (a), in which the root boundary is set in front of the affix, is out because the last feature of the root, the floating [+high] is realised on the suffix vowel, and thus outside the root domain, in violation of ANCHOR. Candidates (b-e) are ruled out for not realising the floating vowel feature of the root. Candidate (f) has anchored its root at the right place and realises all underlying features, but in obedience of S-IDENT it violates *S-IDENT, because in this candidate the affix is contained in the root domain and thus subject to dissimilation. The only survivor is candidate (g), satisfying *S-IDENT by dissimilating the two vowels of the word in backness. Height is excluded as dissimilating feature because IDENT(F)/MAX(F) ranks above *S-IDENT and there are two underlying features [+high] that would like to appear in the surface representation. Prespecification of [±high] excludes also [±low] as a good feature for dissimilation. A segment or mora containing [+high, +low] must be considered as ruled out by a universally undominated feature cooccurrence constraint against that combination. So backness disharmony is the only possibility. Candidate (f) violates only low ranking S-IDENT.[9]

[9] Additionally, the winning candidate in (28) has to violate a morphological requirement like ALIGN (affix, L, root, R) in order to satisfy the given phonological requirements. But such morphophonological considerations are of no relevance here.

(28) /*hum*$^{[+high]}$+*V*/	ANCHOR	MAX^{IO}	MAX/ IDENT [high]	*S-IDENT$_{root}$	S-IDENT$_{\mu[F]}$
a. *hum]$_{root}$u*	*!				
b. *hum*		*!			
c. *huma*			*!	*	*
d. *hume*			*!		*
e. *humo*			*!	*	*
f. *humu]*				*!	
☞ g. *humi]*					*

Tableau (29) illustrates the same phenomenon, this time with a verb root containing a nonhigh front vowel.

(29) /*ket*$^{[+high]}$+*V*/	MAX	IDENT[high]	*S-IDENT$_{root}$	S-IDENT$_{\mu[F]}$
a. *ket*	*!			
b. *keta*		*!	(*)	*
c. *kete*		*!	*	
d. *keto*		*!		*
e. *keti*			*!	*
☞ f. *ketu*				*

Finally I will discuss what happens when the affix is added to a root without a floating feature (30). In this case, *S-IDENT is vacuous, because the second vowel of the resulting candidates is not within the scope of this constraint. But both vowels are within the scope of S-IDENT. Since there are no prespecified features on the last vowel this time, its features are all licensed by the correspondence relation of S-IDENT. A hypothetical candidate *tome]* in which the root boundary is set after the affix and in which both vowels disagree is ruled out by high ranking ANCHOR. Here it is crucial that the root boundary setting is subject to anchoring instead of alignment. As already mentioned Alignment is a requirement on surface representations as is S-IDENT, while Anchoring includes an input output correspondence, anchoring the right root edge at the right edge of the rightmost underlying feature. In case of harmony, surface features correspond, and no underlying ones, thus, the root edge must not be set after the harmonic vowel.

(30) /*tom*+*V*/	MAX	IDENT F	*S-IDENT$_{root}$	S-IDENT$_{\mu[F]}$
a. *tom]*	*!			
b. *tom]a*				*!
c. *tom]e*				*!
☞ d. *tom]o*				
e. *tom]i*				*!
f. *tom]u*				*!

This completes my argumentation for a different treatment of harmony and disharmony. For the sake of completeness it should be noted that in Yucatec Maya too a disharmonic pattern exists. This is triggered by a stem-forming suffix containing a vowel, which is specified for height and disagrees in backness. Since in this language disharmony is triggered by a stem formant, it must be concluded that in Yucatec the domain of *S-IDENT is the stem, not the root.

4.3. Further evidence

The aforementioned disharmonic pattern from Yucatec Maya in deadjectival verb-stem formation is exemplified in (31).

(31) Yucatec: *-kV:*$^{[+high]}$*n-*

a. ***u****ts-k****ii****n-t-ik* 'enhance/repair sthg.'
good-D-TR-IMPF

b. *h****a****w-k****uu****n-t-ah* 'lay sthg. down face up'
lie.down.face.up-D-TR-PERF

c. *sáas****i****l-k****uu****n-s le k'oʔob'en-oʔ!* 'Light up the/that kitchen!'
light.up-D-CAUS DET kitchen-DEM

As can be seen from these data, disharmony is not blocked by consonantal moras. Thus, it must be assumed that also the prosodic domain of the syllable is a potential domain for vocalic feature interaction. The additional assumptions necessary for the analysis of Yucatec Maya harmony are incorporated into the definition of a *S-IDENT constraint in (32).

(32) *S-IDENTITY (with surface reflexes in Yucatec):
Let α be a vowel in ***syllable*** 1 and β be any correspondent of α in ***syllable*** 2. If α is [γback] then β is ***not*** [γback].
Domain: **stem**.

Tableau (33) illustrates how the analysis works.

(33) Evaluation of vowel disharmony for Yucatec /*kV:*$^{[+high]}$*n*/:

	/*uts+kV:*$^{[+high]}$*n+t*/	IDENT [back]	IDENT [high]	S-IDENT$_{\mu F\ Wd}$	*S-IDENT$_{\sigma F\ stem}$
a.	***i****tsk****u:****nt]*$_{stem}$	*!			
b.	***i****tsk****i:****nt]*$_{stem}$	*!			*
c.	*utsk****a:****nt]*$_{stem}$		*!		
d.	*utsk****e:****nt]*$_{stem}$		*!		
e.	*utsk****u:****nt]*$_{stem}$				*!
☞ f.	*utsk****i:****nt]*$_{stem}$				

In (33), it is indicated that S-IDENT ranks above *S-IDENT in Yucatec Maya even though the scope of the latter is more narrow. The surface effect of *S-IDENT appears when consonantal moras block harmony and an affix with an underspecified vowel is analysed as belonging to the stem.[10] This ranking is furthermore motivated by the fact that Yucatec has long and short vowels, but no diphthongs at all.

(34) Yucatec vowel system (Tozzer 1921)

i, i:				u, u:
	e, e:		o, (o:)	
		a, a:		

Furthermore, it is noteworthy that Ainu, in contrast, has no long vowels, but diphthongs, which, in most cases, disagree in backness. These diphthongs are found within roots. I have found no affixes containing a diphthong.

[10] The notion of stem as used here is defined as including roots and stem-forming, i.e. derivational affixes. Inflectional affixes, like the tense/mood/aspect affixes in Yucatec, are not considered as part of the stem.

(35) Ainu vowel system (Dettmer 1989)

i. simple vowels			ii. diphthongs				
i		u	iu/iw				ui/uy
e		o		eu/ew		oi/oy; ou/ow	
	a				ai/ay, au/aw		

These data must be regarded as additional evidence for the analysis proposed here. The ranking *S-Ident >> S-Ident in Ainu and the respective domains and scopes of these constraints suggest exactly this outcome, diphthongs in roots but not in affixes.

5. Conclusion

In this paper, I have argued that several linguistic categories, namely consonants, the mora, the syllable, root and stem are determining factors for the interaction of vocalic features. As the findings posed problems for current treatments of vowel harmony and disharmony, an alternative proposal was made. With the new proposal, harmony and disharmony can be described analogously, which was impossible before. Furthermore I suggested that principled underspecification of alternating structure is a convenient way of analysing morpheme-specific phenomena, following in this point Inkelas (1994) and Inkelas, Orgun & Zoll (1997).

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