*Aff-STEM-ix: On discontinuous morphology

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Introduction

This paper is a discussion of the predictions of the theory of Prosodic Morphology and its consequences. In particular, it is about two predicted patterns within the theory of Prosodic Morphology, the alternation between an exfix (prefix or suffix) and a disjoint affix, and alternation between a prefix and a suffix (side switching affixation), which are unattested in natural languages.

I propose that the unattested patterns are excluded from evaluation by not even becoming candidates. To exclude the two unattested cases I argue that there exists a universal constraint on the generator of candidates entering evaluation. This constraint filters the candidates and excludes, among others, disjoint and side switching affixes. The presence of such constraints is intuitive. It has been argued that a number of inviolable generalizations are best (or maybe even have to be) treated as non-participating in the evaluation (e.g. locality in feature spreading proposed by Ní Chiosáin & Padgett (1997)). The main claim here is that processing reasons on perception and production demand a constraint on GEN, which prevents candidates with disjoined or side switching affixes from entering into the evaluation.

The first section discusses the predictions and typology of prosodic morphology. Section 2 gives the proposal and its justification. Section 3 shows how possible alternatives fail. Section 4 is the conclusion.

1. Predictions and Typology of Prosodic Morphology

1.1 Terminological remarks

I use the term *disjoint affix* to refer to a special kind of a discontinuous affix. A disjoint affix is underlyingly a single contiguous string of segments and crucially participates in the alternation in (1), which shows its underlying structure. The disjoint affix in (1b) alternates with an exfix (a suffix or a prefix) in (1a). Throughout this paper affixes in the hypothetical cases are given in bold and italic.

(1) a) napa-***ka*** – b) ***k***-atod-***a***

These disjoint affixes are significantly different from circumfixes. Circumfixation is usually described as simultaneous suffixation and prefixation (Beard 1998, Spencer 1991, Anderson 1992, Sproat 1992). In other words, a circumfix consists of two affixes, each with its own alignment constraint positioning it within a prosodic word. Perhaps the most well-known example of a circumfix is the German past participle affix *ge…en* as in (2a). Such composed circumfixes are quite common, occurring in Dutch (2b), Tondano (2c), Tagalog (2d), and many other languages (examples from Lieber 1992).

(2) a) *ge*trunk*en* 'drunk'
*ge*sung*en* 'sang'
b) *ge*berg*te* 'mountains'
*ge*been*te* 'bones'
c) *p*əluntəŋ*an* 'hard of hearing'
d) *ma*bilis*an* 'required speed'

Both parts of the Tagalog example given in (2d) *ma-…-an* (which is also a verbal object focus circumfix: *ma-limut-an* "forget", *ma-tanda-an* "remember") are separate morphemes (or are at least similar in form to separate morphemes). Both are derivational affixes used to form adjectives from nouns: e.g. *ma-bigat* "heavy" from *bigat* "weight", and *putik-an* "virtually covered with mud" from *putik* "mud". (All Tagalog examples are from Schachter & Otanes 1983.) The Tagalog case shows the peculiar property of circumfixes. Although the two parts exist individually they do not individually participate in a

morphological operation with the same stem. The meaning of a circumfix is non-compositional. The two parts are used as separate morphemes with different meaning and with different set of words. Compare for example, the case of the Dutch collective morpheme *ge-…-te* of which no part can be used alone with nouns: *vogel* "bird" → ***ge-vogel-te*** "birds", but ****ge-vogel*** or ****vogel-te***.

Although their non-compositionality suggests they are one single morpheme, the crucial fact is that these affixes do not participate in any of the alternations given in (1). They appear to be solely two affixes with two separate alignment constraints, and not examples of disjoint affixes.[1]

1.2 Prosodic morphology

Infixation of the Tagalog verbal morpheme *um* is the subject of many analyses. Within the theory of Prosodic Morphology (McCarthy & Prince 1993a, 1993b) developed within Optimality Theory (Prince and Smolensky 1993) it was analyzed as a case of a prefix moving internally to the stem in order to avoid violation of phonological markedness constraints[2]. Affix displacement is allowed, because the prosodic markedness constraint (P) crucially dominates all relevant morphological constraints (M), resulting in the typical Prosodic Morphology ranking P >> M. Relevant data are given in (3). In (3a) vowel initial verbs take *um* as a prefix, while consonant initial stems in (3b) place *um* between the onset and the nucleus of the first root syllable.

(3) a)	*alis*	*um-alis*	"leave"	
	ibig	*um-ibig*	"love"	
b)	*tawag*	*t-um-awag*	"call"	
	sulat	*s-um-ulat*	"write to"	(Schachter and Otanes 1972)

This infixation is claimed to occur in order to avoid a violation of the markedness constraint against codas, NOCODA (4). NOCODA must be ranked higher than the two morphological constraints ALIGN$_{(um,L)}$ (5) and CONTIGUITY (6) in order for the affix to be allowed to move inside the verb.

(4) NOCODA: No syllable should have a coda.

(5) ALIGN$_{(um,L)}$: Affix edge aligns with the left PrWd edge (McCarthy & Prince 1993a)[3].

(6) CONTIGUITY: The portion of S_1 standing in correspondence forms a contiguous string, as does the correspondent portion of S_2 (McCarthy & Prince 1993a, Kenstowicz 1994).

As shown in tableaux (7) and (8), whenever the verb stem begins with a consonant, the affix consonant becomes a coda if the affix is placed at the leftmost edge (8a). In order to avoid this newly created coda, the affix has a choice of moving internal to the verb, between the onset and the nucleus of the first syllable, assuring no new codas are created.

(7)

um + ibig	NOCODA	ALIGN$_{(um,L)}$	CONTIGUITY
☞ a) .***u.m***i.big	*		
b) .i.***um***.big	**!	i,	*
c) .i.b***u.m***ig	*	ib!	*!
d) .i.bi.***um***g	**!	ibi,	*

[1] If they are underlyingly a single string of segments split in the output because of the nature of their alignment constraints, the alignment constraints have to refer to affix internal parts. But alignment constraints cannot refer to affix internal subconstituents (McCarthy & Prince 1993b).

[2] Lately it has been claimed that *um* is never an infix (Halle 2002), since the process involves Onset metathesis, and that it is never a prefix (Yu 2002), since it always follows the initial glottal stop. Although both suggest there is no alternation in the case of Tagalog infixation, this is not so important for the present discussion. Halle (2002) observes true alternation in Toba Batak, and following Klein (2002) there are also other languages with uncontroversial cases of alternation.

[3] McCarthy & Prince (1993b) give actually a more technical definition of Alignment.

(8)

um + sulat	NOCODA	ALIGN$_{(um,L)}$	CONTIGUITY
a) .***um***.su.lat	**!		
☞ b) .s***u***.***m***u.lat	*	s,	*
c) .su.***um***.lat	**!	su,	*
d) .su.l***u***.***m***at	*	sul!,	*

Important for our discussion is the constraint CONTIGUITY, preventing the splitting of adjacent strings, which must be crucially dominated in Tagalog[4]. CONTIGUITY was proposed to apply to morphemes by Kenstowicz (1994) and Landman (1999). Their definition is given in (9).

(9) CONTIGUITY$_{MORPHEME}$: The portion of S_1 standing in correspondence forms a contiguous string, as does the correspondent portion of S_2, where S_1 and S_2 is the same morpheme in either input or output. (Landman 1999)

1.3 Factorial typology

The central idea of Optimality Theory (Prince and Smolensky 1993) is that all languages use the set of universal violable constraints. Those are in turn ranked differently in different languages. With a set of constraints we can make a typology of all possible rankings. Each of those rankings should (or could) represent a possible human language. Failure to find a language with a predicted ranking is not really a counter-argument to the theory. The claim is that all languages should be covered in such a typology, but there is no guarantee that we find all possible rankings. It is still highly desirable to attest all typological predictions with existing natural languages, especially if the predicted patterns follow from more than just one ranking.

Using the three constraints in the tableaux above for Tagalog infixation, we get six different rankings/grammars. They involve three distinct classes of rankings: CONTIGUITY and ALIGN$_{(AFF-R)}$ are both morphological constraints, while NOCODA is a prosodic markedness constraint. There are two rankings of MARKEDNESS >> MORPH, two of MORPH >> MARKEDNESS >> MORPH, and two of MORPH >> MARKEDNESS. MARKEDNESS dominates one of the two morphological constraints in four rankings altogether. In all those cases the markedness constraint enforces violation of morphological constraints depending on the constraint dominated by it.

I show that the theory predicts unattested patterns. These predictions are explained in more detail in the following sections. The typology used for presentation takes ONSET (10) as the markedness constraint only for reasons of simplicity. ONSET is, like NOCODA, a markedness constraint present in OT from its inception.

(10) ONSET: Every syllable should have an onset.

1.3.1 Fixed position affixes

The most common type of affixation in the natural languages is a nonalternating type, where the affixes are either non-alternating prefixes or suffixes. In this case markedness constraints are dominated by the two morphological constraints, so that they do not have any influence on the way affixation is realized. The two rankings are given in (11).

(11)

Affixes always align with the edge of the PrWd, and are always contiguous, regardless of ONSET violations.	CONTIGUITY	ALIGN$_{(AFF-L)}$	ONSET
	ALIGN$_{(AFF-L)}$	CONTIGUITY	ONSET

[4] The original Tagalog analyses by McCarthy and Prince (1993) and Prince and Smolensky (1993) do not make use of CONTIGUITY. But since this constraint was proposed (McCarthy & Prince 1993, Kenstowicz 1994), and since constraints are universal, it should be considered in constraint rankings.

An example of this type is provided by English. A common English prefix, *un-* meaning 'the opposite' (negative) in adjectives (and verbs), is given in (12).

(12)

intentional	***un**-intentional*
expected	***un**-expected*
focused	***un**-focused*
dominated	***un**-dominated*

As seen from the examples given, markedness constraints on syllable shape do not force any alternations of the position of this affix. ONSET is crucially dominated by constraints on the position and shape of the affix. The relative ranking between CONTIGUITY and $\text{ALIGN}_{(\text{AFF-L})}$ on the other hand is hard to determine, since none of the two get ever violated in this case. Unless we have some other constraint ruling out the optimal candidate, their relative ranking doesn't have any influence. In (13-14) we can see that the optimal candidate satisfies both undominated constraints, and that no other candidate performs as well. (13-14) can be compared to the Tagalog case in (7-8) where the markedness constraint dominates the other two.

(13)

un + intentional	CONTIGUITY	$\text{ALIGN}_{(\text{AFF-L})}$	ONSET
☞ a) ***u.n***in.ten.tio.nal			*
b) in.t***u.n***en.tio.nal	*!	*!	*
c) ***u.***in.ten.tio.nal***n***	*!		*
d) in.ten.tio.na.l***un***		*!	*

(14)

un + dominated	CONTIGUITY	$\text{ALIGN}_{(\text{AFF-L})}$	ONSET
☞ a) ***un***.do.mi.na.ted			*
b) d***u.n***o.mi.na.ted	*!	*!	
c) ***u***.do.mi.na.ted***n***	*!		*
d) do.mi.na.te.d***un***		*!	

1.3.2 Prefix - suffix alternation

With CONTIGUITY undominated and the prosodic constraint dominating ALIGNMENT as in (15), the theory predicts the existence of side switching affixes. Such affixes are predicted to exist also with a slightly different ranking, where a prosodic markedness constraint is undominated, but CONTIGUITY ranks higher than ALIGNMENT.

(15)

CONTIGUITY always satisfied. In order to save ONSET affixes violate the alignment constraint. If that cannot satisfy ONSET, than nothing changes.	CONTIGUITY	ONSET	$\text{ALIGN}_{(\text{AFF-R})}$

(16)

ONSET is always satisfied. Since CONTIGUITY is higher than the constraint governing the positioning of affixes, affixes will change position if that would contribute to the satisfaction of ONSET. Dependent on the violations of input of the stem and the affix.	ONSET	CONTIGUITY	$\text{ALIGN}_{(\text{AFF-R})}$

Such cases are proposed to exist in Afar and Huave, but as I show, the analyses proposing this are not correct. Neither Afar nor Huave exhibit this kind of affixation. I argue that such cases of side switching affixation are not attested.

1.3.2.1 Afar

Fulmer (1991) analyzed the alternation observed in Afar (a Cushitic (Afro-Asiatic) language spoken in Ethiopia and Djibuti) verbal morphology as a case of side switching affixation, but as I will show, the alternation in Afar is not of the relevant kind.

Afar verb stems are divided into two classes, the prefixing and the suffixing class (Bliese 1981). When affixes are added to the verb, they are either prefixes or suffixes, depending on the stem they are attached to. One of these migrating affixes is the person affix, others are mood, focus and tense affixes (Bliese 1981, Fulmer 1991). (17) gives examples with the second person affix *-t* and first person plural affix *-n*. As can be seen, the person affix is a prefix to vowel initial roots and a suffix to consonant initial verb roots. The perfective suffix is invariably *-é*.

(17) (Bliese 1981)

t-okm-é	*you-eat-perf*	suk-***t***-é	*had-you-perf*
t-eexeg-é	*you-know-perf*	bah-***t***-é	*bring-you-perf*
n-irgic-é	*we-see-perf*	dagi-***n***-é	*be small-we-pref*

From the nature of the alternation it seems plausible to assume that the markedness constraint involved in the alternation is ONSET. According to de Lacy (1999), the need to satisfy ONSET drags the affix from its default suffix position to the beginning of the word.

The monoconsonantal suffix therefore satisfies the ONSET constraint violated by the verb alone by becoming its prefix. With an undominated contiguity and the two alignment constraints given in (18) and (19), the ranking is shown to work in tableau (20):

(18) $\text{ALIGN}_{\text{PERF, R}}$: Align perfective affix to the R edge of PrWd

(19) $\text{ALIGN}_{\text{PERSON, R}}$: Align person affix to the R edge of PrWd(both are gradient)

(20)

eexeg + ***t*** + é	ONSET	$\text{ALIGN}_{\text{PERF, R}}$	$\text{ALIGN}_{\text{PERSON, R}}$
☞ a) ***t***-ee.xe.g-é			$*_{\text{eexeg}}, *_{\text{e}}$
b) ee.xeg.-***t***-é	*!		$*_{\text{e}}$
c) ee.xe.g-é-***t***	*!	*	

With a consonant initial root, ONSET is not violated and the affix can occur at the right edge of the root. Since $\text{ALIGN}_{\text{PERF,R}}$ is ranked higher than $\text{ALIGN}_{\text{PERSON,R}}$ the perfective affix is located at the outer edge in the winner (21b).

(21)

suk + ***t*** + é	ONSET	$\text{ALIGN}_{\text{PERF, R}}$	$\text{ALIGN}_{\text{PERSON, R}}$
a) ***t***-su.k-é			$*_{\text{suk}}!, *_{\text{e}}$
☞ b) suk.-***t***-é			$*_{\text{e}}$
c) su.k-é-***t***		*!	

I claim that this alternation is actually not phonologically conditioned. I provide several arguments to show that stems are specified as being either suffixal or prefixal in the lexicon.

Firstly, as both Bliese and Fulmer report, prefixes attach only to non-low vowel initial stems, while both consonant initial stems and /a/ initial stems take suffixes as shown in (22). A simple ONSET analysis is therefore not sufficient since it wrongly predicts prefixes on /a/ initial stems. This is however

not an insuperable problem. /a/ vowel initial stems might have an underlying glottal stop (suggested by Bliese 1981), or one could think of a vowel specific ONSET constraint.

(22) (Bliese 1981) ab-***t***-é *do-she-perf*[5]

But more importantly, it is not even the case that all non-low vowel initial verbs belong to the prefixing class. E.g. *in-'t-e* 'say-you-perfective' and *iman-s-it-t-aa-'na* 'believe-causative-benefactive-you-imperfect-plural' should belong to the prefixing class according to our generalization and proposed grammar. The only generalization that can be made is: all consonant initial stems and all /a/ vowel initial stems belong to the suffixing class, but not all non-low vowel initial stems belong to the prefixing class. To avoid this problem, one could again posit underlying glottal stops on the exceptional stems, but there is a problem with such an analysis. When the negative prefix *ma-* is added (23), there is no reflex of the initial glottal stop, although Bliese does not report any glottal stop deletion process in intervocalic context.

(23) maabin'na *neg-do-perf* 'he hasn't done x'

The prefixing class of verbs is, according to Bliese, a small class, while the suffixing class is much bigger, and productive. In addition, in derived forms, most prefixing verbs are in the process of leveling with the larger suffixing class, losing their prefixing property. So for example, prefixing verbs take causative, passive and benefactive prefixes, but the trend (as reported by Bliese) is to use only suffixes in these forms. The causative of *ik're* (*I read*) is *i-**s**-ki're* (*I caused to read*). This form in Aussa dialect is either *ikri-'**y**-e* or *ikriy-**sii's**-e*.

As mentioned, the monoconsonantal person affix is not the only affix with alternating alignment. Other affixes are added to the verb stems in the same distribution. What is important here is that these affixes are not monoconsonantal and therefore do not necessarily save the stem from violation of ONSET. For example, the benefactive affix has the prefixal form *Vtt-* where V represents a copy of the stem initial vowel: *t-ott-o(o)b'be* "you-benef-heard", *t-ott-oogor're* "you-benef-hit". This kind of a prefix cannot and does not save any violations of ONSET, so there is no (markedness) motivation to make this affix a prefix. These other affixes, although having the same distribution, are not governed by the same prosodic constraints, which seems to be strange. Since the conditions of the alternations of the different affixes are the same, we expect that the alternations are also governed by the same markedness constraint, yet this is not what we find. One could say that these affixes are actually aligned with the person affix and that therefore they do not violate any alignment, but simply migrate to the beginning of the word together with the person affix, but they do so also in the first person singular form, where there is no person affix (or the person affix is *ʔ-*), e.g. *ott-oogor're* 'I benef-hit', *ott-okom'me* "I benef-ate".

What is most suggestive that the two classes of verbs are actually distinguished in the lexicon is that they differ also in several other morphological phenomena that are not related to the assumed phonologically conditioned alternation.

The prefixing verbs change their stem vowels to /a/ when they are followed by a certain kind of suffix: i.e. mood, *-inn*, infinitive *-i* and *-u*, the verbal nouns with *-a*, *-'a*, and *-iyya*. This results in *ubul* (see) – *a'bal-i* (to see); *ubkun* (plant) – *tab'kan-ay* (let her plant); *edder* (to keep many cattle), *adda'r-iyya* (ranching) etc. No such vowel changes occur in the suffixing class of verbs: *ged-i* (to go); *soo'l-iyya* (standing).

In the prefixing class of verbs, mid internal stem vowels become high (/i/ and /u/) in the imperative (24). No such vowel quality change is observed in the suffixing class verbs:

(24) a) *exey* 'give' *a'xuy ('hay)* "give-imperative"
okom 'eat' *a'kum ('hay)* "eat-imperative"
b) *sol* 'stand' *'sol ('hay)* "stand-imperative"
gey 'get' *'gey ('hay)* "get-imperative"

[5] Neither Fulmer (1991) nor Bliese (1981) give more clear examples of *a-* initial verbs, although they both claim that the generalization holds for a whole class of them. One other possible case is: *am-t-é* 'you come'.

Verbs of the prefixing class add an initial nasal to the roots with CC or VV sequences: *endeb'be* (return) *e-y-deb'be* (cause to return)*; cf. inki'le* (to copulate) *iyniki'le* (cause to copulate).

Verbal nouns are formed from prefixal verbs with the prefix *m-*, and from suffixal verbs with a suffix *-o*. In addition to the prefix, prefixal verbs also change all of their vowels to /a/ (25); no vowels change when *-o* is added to the suffixal verbs:.

(25)	*m-ab'l-a*	*'seeing'*	from base *t-**ub'l**-e* – 'she-see-perf'
	m-ak'm-o	*'eating'*	from base *t-**ok'm**e* – 'she-eat-perf'
	a'b-o	*'doing'*	from base ***ab**-'t-e* – 'do-you-perf'
	gey-'t-o	*'finding'*	from base ***gey**-'t-e* – 'find-you-perf'

Afar roots show vowel harmony in their vocalic composition of roots. Except for /a/, the vowels inside a root are usually identical. The low vowel /a/ is neutral in this respect and is found in roots with any vowels: E.g. *duddub* (to swell), *soloolox* (to tumble down), *usxub* (to think), *deben* (to beard), *xeemaa'ki* (measles), *xi'saab* (worry), *gum'cata* (Friday), *dooba'caytu* (black head scarf). The perfective morpheme is *-e* for both classes of verbs, but the imperfective differs. Suffixal verbs use *-a* to mark imperfective. Verbs of the prefixing class, on the other hand, change the initial stem vowel to /a/ and raise the mid vowels /e/ and /o/ to /i/ and /u/ for other (noninitial) stem vowels. When negation is added, the imperfective affix for the prefix class is the suffix -aa. E.g. *'ma-t-aagu'r-a* (base = *ogoor*) 'neg-you-hit-impf'. Notice that the person affix is still a prefix, suggesting that the presence of the negative morpheme alone should not have much influence. The difference between the two classes in the realization of imperfective cannot be attributed to vowel harmony, since /a/ does not participate in vowel harmony in Afar.

These facts strongly suggest that the alternation between the prefix and the affix in Afar is not conditioned by any prosodic markedness constraint, but is rather a learned property of the stems. How such a system developed is a question I do not plan to answer.

1.3.2.2 Huave

Noyer (1993) proposed that certain verbal affixes in Huave (a language isolate from Oaxaca, Mexico) switch sides to satisfy prosodic markedness constraints. I claim his analysis is not correct. Side switching affixes remain unattested.

In Huave the theme vowel attaches either to the left or to the right of the root. The alternation is not phonologically conditioned since it actually carries meaning. According to Noyer, location of the vowel serves as a partial index of argument structure. Verbs with suffixal themes are reflexives, middles or statives, while their corresponding prefixed verb is either transitive or causative. Examples in (26) are from Noyer (1993). Quality of the theme vowel depends on the vowels in the stem. Huave has a left-to-right vowel harmony, so that the underspecified theme vowel is the default vowel [a] when it is a prefix, and matches the stem vowel when it is suffixed (Noyer 1993:70).

(26)	transitive/causative	reflexive/middle/stative
a)	*a-wants*	*wants-a-*
	'drill' (lit. 'make turn around')	'turn [self] around'
b)	*a-ts'ey*	*ts'ey-e-*
	'swallow' (lit. 'make go down')	'get [self] down'
c)	*a-wit'*	*wit'-i-*
	'raise'	'rise'
d)	*a-ṛond*	*ṛond-o-m*
	'(s)he hangs [sth.]'	'(s)he is hanging' (nonpast)

Together with the theme vowel there are also some other affixes that switch positions. Such affixes are the past tense affix *t-* ~ *-t*, the nonpast tense affix *m-* ~ *-m*, and the 1st person affix *n-* ~ *-n*. Noyer analyzes the positioning of these affixes as a phonological alternation. He claims that the affix is specified as a

prefix in the input, and that it becomes a suffix to satisfy the markedness constraint FINAL-C (all native verbs end with a consonant in Huave). When the theme vowel is a suffix, the alignment of the affix is violated. But Alignment is not a constraint Noyer uses; affixes come to the generator already specified as either prefixes or suffixes.

Assuming that affixes are specified as prefixes or suffixes by alignment constraints, and given that movable affixes are always attached to the theme vowel, their alignment to the theme vowel is not really violated. The other problem is that, as shown in (27), the past tense affix (27a) or the 1st person affix are not always the outermost affix of the word. They can be followed by other affixes which satisfy the proposed prosodic markedness constraint FINAL-C.

(27) a) *wit'-i-**t**-as-on*
raise-TH-past-1-aug 'we (incl.) rose'
b) *sa-wit'-i-**n**-on*
(1)fut-raise-TH-1-aug 'we (excl.) will rise'

Noyer claims this is not a problem, since candidates are evaluated with respect to phonological constraints after every cycle in the derivation. I am assuming a monostratal OT (McCarthy and Prince 1993a, 1995b) and therefore consider the data in (27) a problem for Noyer's analysis. I claim the three mobile affixes are aligned to the theme vowel as can be seen from (28), where they are not even the leftmost prefix. Since they are aligned to the theme vowel, they move with it to the other side of the word. They switch between being the prefix and the suffix position only because of the theme vowel.

(28) a) *sa-n-a-kõts'-in*
(1)fut-1-TH-cut-aug 'we (excl.)will cut'
b) *ap-m-a-lik'-iaw*
fut-nonpast-TH-scold-3pl 'they will scold'

The theme vowel is actually two different affixes, each with its own alignment constraint. The prefixing theme vowel is called THEME-T(ransitive) and the suffixing THEME-M(iddle). Can there be only one constraint aligning the past tense affix? The past tense affix is aligned with two different morphemes; therefore it should also be aligned with two different alignment constraints. The alternation is therefore not phonological. The theme affix does not violate its alignment constraint.

Past tense is not the only affix that can be realized as either a prefix or an affix. Person affixes show the same kind of alternating alignment. The difference is that the person affixes do not have the same shape in the two positions. (29) gives the atemporal paradigm for the transitive verbs, where the person affixes and the theme vowel are prefixes (Stairs and Scharfe (1981) call this form the indicative). Numbers in the first column represent persons, '1,2' means dual and inclusive plural. *-an* is the plural marker and is not as important in (29), but becomes more relevant in the examples to follow. The paradigms are taken from Stairs and Scharfe (1981). They do not separate the theme vowel from the person affix, which is why all prefixes are either V- or CV- and all suffixes -VC.

(29)

	singular/dual	plural
1	sa-	sa-…-an
2	i-	i-…-an
1,2	a-	a-…-an
3	a-	a-…-an

(30) gives the atemporal paradigm for the reflexive verbs, where the person affixes and the theme vowel are suffixes. As we can see, none of the person affixes for reflexive verbs matches the corresponding person affix in the indicative verbs. Whereas in (29) the non-first person prefixes are all just vowels (no consonant), their suffix correspondents are all at least -VC.

(30)

	singular/dual	plural
1	-an	-anon
2	-ar	-aron

1,2	-amor	-amoots
3	-am	-amoj

(31) and (32) give the paradigm for the future and the continuous (imperfective) for indicative and reflexive verb forms respectively. In this case the first person affix and the third person affix show the correspondence, with the same consonant on the different side of the theme vowel. The same correspondence is not observed for other affixes.

(31)

	singular/dual	plural
1	na-	na-…-an
2	me-	me-…-an
1,2	ma-	ma-…-aats
3	ma-	ma-…-üw

(32)

	singular/dual	plural
1	-an	-anon
2	-amear	-amearon
1,2	-amor	-amoots
3	-am	-amoj

We would expect all side switching affixes in Huave to behave similarly. So since the person affixes were shown not to involve side switching of the same morpheme, we can predict that other affixes exhibiting similar behavior can be analyzed in a similar way. I claim that not only do these affixes have separate alignment constraints for the two positions where they are found, but that they are also two different morphemes.

I leave the question of proper analysis of these verbal affixes open. What is important in this case is that Huave does not exhibit the predicted side switching pattern. Only one other possible case of side switching affixes is reported in the literature. This is the negation in Alabama (Montler and Hardy 1991), but Alabama has a different kind of alternation as is shown in the next section.

1.3.3 Exfix – Infix alternation

Up to this point four out of six possible rankings described in 1.3 were attested, while one pattern (side switching) derived from two different rankings appears to have no representative among natural languages. Exfix-infix alternation, to which I turn next, was already shown to exist in Tagalog. The two rankings given in (33) and (34) also predict the existence of other alternations, to which we will turn later. An alternation that combines infixation with side switching is claimed to exist in Alabama (Muskogean Native American language) (Montler & Hardy 1991, de Lacy 1999).

(33)

ONSET is always satisfied. Since Contiguity is higher than the constraint governing the positioning of affixes, affixes will change position if that would contribute to the satisfaction of ONSET, dependent on the violations of input of the stem and the affix.	ONSET	CONTIGUITY	RIGHTMOST

(34)

ONSET is always satisfied. Infixation is preferred over switching the edge of alignment. If infixation cannot satisfy ONSET, affixes switch sides of the word (if that helps).	ONSET	RIGHTMOST	CONTIGUITY

The alternation found in Alabama negation is triple. It is a variant of the alternation observed in Tagalog. The Alabama verbal negation is composed of two affixes, a nonalternating suffix *-o* and an affix that

alternates between a prefix, three infixes and a suffix: *ik-*, *-ki-*, *-kii-*, *-ik-, -ki* (and *-ikko*). This kind of alternation is predicted to exist by the ranking MARKEDNESS >> EDGEMOST >> CONTIGUITY.

Montler & Hardy claim that this alternation is phonologically conditioned. According to them, the shape of the affix can be determined from the phonological shape of the stem with the assumption that underlying form {/k/, /i/} is unspecified for linear order, and with a general constraint on Alabama verbs such that last two syllables form a heavy-light frame.

Since alternation between an exfix and an infix is quite common I will not go through it in detail. The more interesting alternation is side switching. I claim that Alabama does not exhibit side switching of the relevant kind.

Data in (35) show the three realizations of the infix. In all three cases the afirmative verb ends with an uneven trochee. When the onset of the last syllable is *k*, the negative infix is *ik*, creating a geminate (35a). When the penultimate syllable of the affirmative form is a CVC sequence, the infix is *ki* as in (35b) and when the penultimate syllable has a long vowel, the second mora of the long vowel is taken over to the negative infix – *kii*.

(35) a)	afaaka	afa**ík**ko	'laugh'[6]
	naałiika	nałi**ík**ko	'talk'
	liska	lis**ík**ko	'beat'[7]
b)	bassi	ba**kí**sso	'poor'
	lokba	lo**kí**kbo	'hot'
c)	pakaama	paka**kíi**mo	'tame'
	ooti	o**kíi**to	'kindle'

All negated verbs end with the right aligned uneven trochee – a (H, L) foot. This holds for all different realizations of the affix. The constraint aligning the uneven trochee to the right of the stem is also the dominating prosodic constraint that forces morphological alternations (36).

(36) $\text{ALIGN}_{\text{NEG}}$-Trochee-R: Align an uneven trochee with the right edge of PrWd of a negated verb.

In both (35b-c) the negative affix is aligned with the left edge of the R-aligned foot, which is without exception an uneven trochee. Such alignment is allowed under both Generalized Alignment (McCarthy and Prince 1993b).

(37) $\text{ALIGN}_{(\text{Aff,L,Ft})}$: Align left edge of the affix to the left edge of the foot.

This alignment constraint explains how we get the prefixes in (38). When the verb root is monosyllabic, $\text{ALIGN}_{(\text{Aff,L,Ft})}$ puts *ki* in the word initial position. Roots of the form CV are negated with *ik-* prefixed as – *ik*-CV:

(38)	pa	**ík**po	'eat'
	mo	**ík**mo	'pick'

In addition to the fact that this is only a case of an infix being exposed to the edge because of lack of root segments, Montler and Hardy claim that the prefix "is limited to the very small set of words with the rare CV root shape" (1991:5). No prosodic constraint forces the negative affix to the prefix position. In (38) *ik* is aligned to the left edge of the foot, it just happens so that the boundary of the foot corresponds to the boundary of the prosodic word.

[6] Montler and Hardy (1991) do not provide stress for the affirmative form. As can be seen, the gloss is only given for the affirmative form.

[7] The form *lis**ík**ko* exists in variation with *li**kí**sko*.

The negative morpheme is realized as a suffix when the verb root ends with a consonant or long vowel followed by the affirmative suffix *–li*[8] (39a) or when the verb ends with two light syllables as in (39b). The negation affix deletes the affirmative suffix *-li*.

(39)	a)	bit-li	bít**k**o	'hit'
		alkomoo-li	alkomóó**k**o	'hug'
	b)	isi	ís**k**o	'take'
		hocifa	hocíf**k**o	'name'
		hap-li-ci	hap**kíí**co	'bathe someone'

Alabama also has periphrastic negation, which will not be discussed here. Verbs that require periphrastic *-tikko* also require periphrastic agreement in the affirmative. The choice of verbs does not seem to follow from their phonological properties. The sequence /tikko/ is historically polymorphemic, but synchronically unanalyzable as such.

(40)	ootoba	ootoba-tíkko	'dream'
	ola	ola-tíkko	'ring, sound'
	owwatta	owwatta-tíkko	'hunt'
	oolamiita	oolamiita-tíkko	'speak many languages'

A complete analysis is given in Appendix 2. Here I will only answer one more question. As can be seen from the list of all possible environments where the negative affix gets a different shape given in (41), the negative verbs always ends with *-o*.

(41)	a)	CV	prefix	/**ik**/	[CV]	→ [***ik***Co]
	b)	(C)VVCV	infix	/**kii**/	…VVCV]	→ …V***kii***Co]
	c)	(C)VCCV	infix	/**ki**/	…VCCV]	→ …V***ki***CCo]
	d)	(C)VCkV	infix	/**ik**/	…CkV]	→ …C***ik***ko]
	e)	(C)VVkV	infix	/**ik**/	…VkV]	→ …V***ik***ko]
	f)	(C)VCV	suffix	/**ki**/	…(C)VCV]	→ …(C)VC***k***o]
	g)	(C)VV	suffix	/**ki**/	…(C)VV]	→ …(C)VV***k***o]
	h)	(C)VC	suffix	/**ki**/	…(C)VC]	→ …(C)VC***k***o]

So, what is the final *-o*? It seems reasonable to assume that it is one of the two affixes giving the negative meaning. This leads us to the question whether *-o* and *-ki-* are really two different affixes or just one single one – is *-o* the suffix part of the disjoint negative affix or a separate morpheme?

In (42) the causative *-ci* lengthens the preceding vowel. This case, according to Montler and Hardy, proves that the negative is really *-ik-* and not *-ko-* since the *-o* is realized on the causative *-ci*. But they do not specify what exactly (42) means. Negation and causative can influence each other's meaning, and information about their relative scope is important. If the causative has scope over negation, and the meaning is "cause to not bathe someone", then it seems reasonable to say that *-ci* is the outermost affix and that the negation affix really is *-ki*. But in case the meaning is "not cause to bathe someone", which is what we would expect to find next to its positive version, then the case isn't so clear.

(42)	hap-li-ci	hap**kíí**co	'bathe someone'

[8] The *-li* suffix to the affirmative verb in (39) is just a verb expansion morpheme. It is added to the verb in completely predictable cases – whenever the verb root ends in a heavy syllable (VC, CVC, CVV). *-li* is added to the verb, to create a structure that conforms to the Alabama verb frame.

A better argument for the claim that *-o* is a different affix comes from negative forms that do not have the *-o* morpheme (43a,b). For the examples in (43a) Lupardus (1982) claims that the final *-o* is not part of negation, but the perfective affix, since it is positioned after the aspect suffix *-ahi*. Lupardus gives no examples where the perfective *-o* and the negative *-o* co-occur, nor does she give any examples where the intentional affix *-ahi* follows the negative *-o*. (43b) shows that the perfective indeed follows the intentional affix. (In the examples (43) and (44) negative affixes are underlined.)

(43) a) balhíkaho[9] (< bal=ík=ka-ahi-o) 'They're not going to lie down'
b) cibataplilâo (< ci-batap=li-li-ahi-o) 'I am going to hit you'

The other set of examples given by Lupardus to show that the negative *-o* is not the same affix as *-ki-* are given in (44a). The final *-o* in (44) is part of the tense affix *-lo*. Tense affixes always comes after the negative *-o*, as shown in (44b).

(44) a) stałkíyalo (< ist-ał=kí=(i)ya-lo) 'He is not going ahead'
b) hokífnolo (< ho=kí=fna-o-lo) 'He will not smell it'

The third piece of evidence is provided by Swanton (1922), who reports that the final *-o* is not present in some negated verbs. His examples are given in (45).

(45)

tcopa	*to purchase*	tcokipa	*not to purchase*
notca	*to sleep*	iknotca, iknotco	*not to sleep sound*

Upon closer examination, what appeared to be a side switching alternation turned out to be just a case of exfixation of an infix because of the shortness of the stem. The other relevant observation was that the superficial disjoint affix involved two separate morphemes. The two patterns – side switching and disjoint affixation thus remain unattested.

1.3.4 Discontinuous affixation

I will now turn to cases involving discontinuous affixes. I will first go over the existing cases, then over patterns resembling existing cases, and conclude with the unattested ones. Discontinuous affixes can be derived in all three rankings when the prosodic constraint dominates CONTIGUITY.

1.3.4.1 Metathesized affixes

The first case I will look at is the alternation involving metathesis of the marginal segments of the stem and the affix presented in the hypothetical cases in (46) and (47). The two rankings that predict this kind of alternation both have a dominated CONTIGUITY, while the ranking between the prosodic constraint and $\text{ALIGN}_{(\text{AFF,R})}$ is irrelevant since it makes no difference with respect to this case. $\text{ALIGN}_{(\text{AFF,R})}$ used in (46) is slightly different from the one used in (7) and (8). In (46) and (47) it is taken to be non-gradient for simplicity reasons.

(46)

poro + ***tb***	ONSET	$\text{ALIGN}_{(\text{AFF,R})}$	CONTIGUITY
a) ***t***po.ro***b***			*!
☞ b) po.ro***tb***			
c) po***t***.ro***b***			**!
d) po***t***.***b***ro		*!	*!

[9] Lupardus (1982) calls *-o* the negative suffix and *-ki-* the negative agent auxiliary.

The stem in (46) does not violate ONSET. The affix ***cc*** cannot create any new violations of ONSET, nor does it have any violations to repair. The stem in (47), on the other hand, has an inherent violation of ONSET, which the affix can repair. The infix in (47d) is ruled out because it violates alignment.

(47)

kia + ***tb***	ONSET	ALIGN$_{(AFF,R)}$	CONTIGUITY
a) ***t***ki.a***b***	*!		*
b) ki.a***tb***	*!		
☞ c) ki.***t***a***b***			**
d) ki***t***.***b***a		*!	*

Such an alternation was described as metathesis by Hume (2002). Stemberger and Bernhardt (1999) call it interdigitation. It is observed in Kui (Dravidian, India) given in (48), Baasa (50), Dɛg (51), and some other languages, for which see Hume 2002. In the case of Kui the present participial suffix *-pi* is split when added to a word ending in *-k*. In this case, *p* and *k* switch positions.

(48) Kui (Hume 1997)

gas-	gas-***te***	(past)	gas-***pi***	(pres. part.)	gas-***pa***	(infinitive)	'to hang oneself'
mil-	mil-***te***	"	mil-***pi***	"	mil-***pa***	"	'to turn over'
bluk-	bluk-***te***	"	blu-***p***-k-***i***	"	blu-***p***-k-***a***	"	'to break down'
mlik-	mlik-***te***	"	mli-***p***-k-***i***	"	mli-***p***-k-***a***	"	'to turn over'

The true conditioning factor – the prosodic markedness constraint – is not entirely clear. Hume (2002) claims the order is switched for perceptual reasons, but does not provide an explicit analysis. Stemberger and Bernhardt (1999) analyze this metathesis with an undominated constraint preventing a velar from occurring before a labial – NOSEQENCE(DORSAL…LABIAL). Such a restriction is claimed to be quite common in natural languages. (49) gives the evaluation for the case with metathesis. The upper two constraints are left unranked, since there is no evidence as to which one is higher.

(49)

bluk + *pi*	NO(D…L)	ALIGN$_{(AFF,L,STEM)}$	CONTIGUITY
a) bluk-*pi*	*!		*
b) blu-*pi*-k		*!	
☞ c) blu-*p*-k-*i*			**

A similar case of metathesis over the morpheme boundary is found in Basaa. The indirect causative suffix /-hà/ is a suffix after a vowel or a consonant cluster, but is realized as a "partial infix" if the stem ends in a single consonant. Stemberger and Bernhardt analyze this alternation as driven by the preference of codas not to have consonantal place features. The stems with only one final consonant are the only ones to allow metathesis, since only in those cases metathesis saves the marked structure.

(50) Basaa (Schmidt 1994)

cí-**hà**	'destroy'	kóbl-**àhà**	'peel'	lé-**h**-l-**à**	'cross'
lò-**hà**	'arrive'	énl-**àhà**	'tell'	tì-**h**-n-**à**	'tie'

It is important to note here that this kind of discontinuous affix is always split by a minimal number of stem segments. Hume (2002) reports that plural formation in Dɛg is the only known case where the two parts of the affix are separated by more than one segment (51). And even in Dɛg only one of the two segments is part of the stem (the other one is an epenthetic schwa). The plural in Dɛg is formed with the suffix /-rV$_{high}$/. When the plural suffix follows /m/ or /w/ metathesis occurs.

(51) Dɛg (Hume 2002 (Crouch 1994))

[dem]	/dem + ri/	[derəmi]	'house'
[dom]	/dom + ri/	[dorəmi]	'sleep'

Discontinuous affixes created to avoid violations of prosodic constraints are therefore possible in human languages. But the distance between the positions of the two parts is always minimal.

1.3.4.2 Multiply split root/affix

The next set of predictions is even more interesting, but it is less clear whether it is attested or not. The predicted case involves a split affix inside a split root. There are many different patterns we can derive since every root will behave differently with different affixes as shown in the following tableaux (52)-(54). The ranking used is the same as the one given for Tagalog in (7) and (8) – i.e. MARKEDNESS >> MORPH. ALIGN$_{(AFF,R)}$ (again taken as non-gradient for reasons of simplicity) and CONTIGUITY are left unranked only because their ranking makes no difference in the lower cases.

In (52) a *vc* affix is added to a VCCVVC stem. The optimal candidate is the one with only one violation of ONSET but a lot of violations of CONTIGUITY. Each splitting of a morpheme is understood as a separate violation. The other question is whether all kinds of splitting violate CONTIGUITY in the same way or not. The affix in (52c) is split by two segments of the stem. This can be counted either as a single violation of CONTIGUITY (non-gradient), or as a double violation (gradient). I plan to leave this issue open.

(52)

VCCVVC + ***vc***	ONSET	ALIGN$_{(AFF,R)}$	CONTIGUITY
a) VC.CV.V.C***vc***	**!		
b) VC.CV.***v.c***VC	**!	*	*
☞ c) V.C***v.***CV.***c***VC	*	*	***
d) ***v.c***VC.CV.VC	**!	*	

In (53) the affix is taken to be *cc*. When this kind of affix combines with a stem like CVVV, both the affix and the stem split to satisfy ONSET. The result is a split affix, which splits the stem twice.

(53)

CVVV + ***cc***	ONSET	ALIGN$_{(AFF,R)}$	CONTIGUITY
a) CV.V.V***cc***	*!*		
b) CV.V.***c***V***c***	*!		**
c) CV.***c***V.V***c***	*!		**
☞ d) CV.***c***V.***c***V		*	***

The upper two examples seem to be counter-intuitive, but the one given in (54) will probably look more familiar. Here the stem is taken to be CCC, while the affix is taken to be *vv*. In addition to ONSET another prosodic constraint is used – FINAL-C (Prosodic word must end with a consonant). The result again is a stem split by two pieces of the split affix.

(54)

tbk + ***ia***	ONSET	FINAL-C	ALIGN$_{(AFF,R)}$	CONTIGUITY
a) tbk***i.a***	*!	*		
b) tb***i***.k***a***		*!		**
c) t***i***b.k***a***		*!		**
☞ d) t***i***.b***a***k			*	***

The winner in (54) resembles Semitic languages, with a consonantal root and vowel infixation. Underlying triconsonantal roots were posited for Semitic in the analysis by McCarthy (1981), Hoberman (1988) and more recently by Prunet et al. (2000), but their actual status is still a controversial issue. Ussishkin (2000) gives a prosodic account of Hebrew verbal system. Although he does not posit triconsonantal roots, the whole analysis seems to rest on the same basic idea. The idea is that the affix(es)

is(are) distributed around the root to satisfy some prosodic constraints. Ussishkin does not use any prosodic markedness constraints to determine the actual output, but rather $\text{IDENT}_{\text{O-O}}$ constraints to compare the actual output with the output of the basic form of the verb – the unmarked pattern paʕal, i.e. *gadal* 'he grew'. The type and actual identity of the constraint are not crucial at this point. I do not plan to go into this any further. I just wanted to point out the possibility that a case where a root is split in the output by an (split) affix, whose distribution is governed by some constraint, exists.

It is important to note here, that although the morphology of Semitic languages seems to involve the last described pattern, it crucially does not involve any alternations (e.g. between an exfix and a disjoint affix) since Arabic (Semitic) roots consist only of consonants.

1.3.4.3 Exfix - disjoint affix

Only one ranking remains to be presented. This is the ranking given in (55) with an undominated alignment constraint and the prosodic markedness constraint dominating CONTIGUITY. Only candidates violating CONTIGUITY are allowed to help make the word less marked.

(55)

Edge of the affix is always aligned with the right edge of the PrWd – it will always be (at least partially) realized as a suffix. An ONSET violation can only be avoided with a violation of CONTIGUITY. Affix edge must be aligned with the edge of the PrWd – resulting in metathesis over morpheme boundaries and disjoint affixation.	RIGHTMOST	ONSET	CONTIGUITY

This ranking predicts the alternation between an exfix and a disjoint affix, which is both a prefix and a suffix at the same time. This ranking also predicts other patterns, but I will discuss only this one, since it is the most interesting one.

In (56) and (57) a hypothetical prefix ***na*** is added to two different hypothetical stems, one of a simple CVCV structure and the other of a more marked VCVC. Since the active markedness constraint is ONSET, faithfulness to CONTIGUITY is sacrificed to avoid the violation of coda consonants. CONTIGUITY is dominated by both markedness and alignment constraints, resulting in the candidate with the split affix as the winner. Such patterns are unattested.

(55)

na + polo	$\text{ALIGN}_{(\text{na,R})}$	ONSET	CONTIGUITY
☞ po.lo.***na***			
po.***na***.lo	*!		*
npo.lo.***a***			*!

(56)

na + apak	$\text{ALIGN}_{(\text{na,R})}$	ONSET	CONTIGUITY
a.pak.***na***		*!	
a.***na***.pak	*!	*	*
☞ ***n***a.pa.k***a***			*

The same kind of alternation is derived also from the ranking of the Tagalog type as in (57) and (58). The affix has the form *cvc* and is added to a CVCV stem in (57) and to VCVVC in (58). In (57) the *cvc* affix becomes a suffix, satisfying ALIGN, and CONTIGUITY.

(57)

CVCV + ***cvc***	ONSET	$\text{ALIGN}_{(\text{AFF,R})}$	CONTIGUITY
a) ***cv***.CV.CV***c***			*!
☞ b) CV.CV.***cvc***			
c) ***c***CV.CV.***vc***	*!		*
d) ***cvc***.CV.CV		*!	

In (58) the affix becomes a disjoint affix on the VCVVC stem. A suffix that becomes a prefix violates alignment just like the suffix that becomes an infix. As explained before, split affixes do not violate alignment, since the constraint only refers to morpheme edges. As long as the edge of the affix aligns with the appropriate edge, alignment is not violated. Because of this, candidates (58a) and (58c) both satisfy the alignment constraint. They do differ with respect to violations of CONTIGUITY, which is why (58a) is chosen as the optimal candidate. Only the affix is split in (58a), while both affix and stem are in (58c).

(58)

VCVVC + ***cvc***	ONSET	$\text{ALIGN}_{(\text{AFF,R})}$	CONTIGUITY
☞ a) ***c***V.CV.V.C***vc***	*		*
b) V.CV.VC.***cvc***	**!		
c) V.CV.***c***V.C***vc***	*		**!
d) V.CV.***cv.c***VC	*	*!	*

Given these predictions made by the theory the first question is: Are there any exfix-disjoint affix alternations? My answer is: No. A negative claim like this cannot be proven at all (the relevant natural language might not exist any more because it died or because it changed). The closest I can come to an argument is to consider possible examples and show that what they appear to involve is not what I am looking for. No alternations between an exfix and a disjoinet affix are reported to exist. The only case that resembles the relevant alternation is sentence negation in Egyptian Arabic[10], involving an alternation between a separate prosodic word and a circumfix. The other potentially relevant case is negation in Alabama, for which I argue in section 1.3.3 that it involves 2 affixes.[11]

1.3.4.4 A possible disjoint affix

A possible disjoint affix is observed in Egyptian Arabic.[12] The phenomenon observed is an alternation between a separate prosodic word and a circumfix to express sentence negation. Negation is marked with the circumfix *ma-…-š* on the verb as in (59a) and with a separate prosodic word *miš* in equational sentences with a nominal, adjectival or participial predicate, as shown in (59b). The alternation is not phonologically conditioned but rather syntactic.

(59) a.	ma-aktib-š	maktibš	I do not write	
	ma-ansa-š	mansaaš	'I do not forget'	
	ma-katab-š	makatabš	'He did not write'	
b.	miš ilbint	-noun	'is not the girl'	
	miš kibiir	-adj.	'is not big'	
	miš maktuub	-participle	'is not written'	(Abdel-Massih 1975)

The two alternating forms of negation are similar enough to be considered as related. The difference between the circumfix (prefix+suffix) version *ma-…-š* and the independent word *miš* is only in the vowel quality. Arabic is independently a very good candidate for discontinuous morphology as was already mentioned. The Arabic consonantal root was proposed to be an underlying morpheme to which vowels are added in a particular pattern (see McCarthy 1981, Hoberman 1988, Prunet et al. 2000).

But arguments for *ma-* being an independent functional morpheme in Arabic can also be made. (60) gives two examples with the free functional morpheme *ma*.

(60) *baʕd ma* – "after"
ʔabl ma – "before"

[10] Thanks to Ellen Broselow for pointing out this case to me.
[11] The only case of circumfixation in which the constituent parts do not so clearly exist as separate morphemes is the negative morpheme in Chukchee as reported in Spencer (1997). I discuss this case in Appendix 3.
[12] Palestinian Arabic seems to involve a somewhat similar alternation, but the case is most clearly seen in Egyptian Arabic.

This is not true for -š. The suffixal part of the circumfix is not found in any other morphological processes in Egyptian Arabic. To see whether this is really a syntactically conditioned prosodic word – disjoint affix alternation, we now turn to more complex syntactic structures. (61a) gives negation of a coordination in which both verbs are negated. The prefixal part of the negative circumfix shows up only on the first verb in the coordination, while the suffix is added to both verbs – the second verb has only one part of the circumfix. If this is a true disjoint affix we do not expect to find only half of it being realized. If a disjoint affix fails to be realized on one side of the stem, the prediction is that it should be realized as a full morpheme on the other, unaffected side. This is not what we see. Similarly in (61b) where the negation either negates the adverb or the verb, the suffixal part of negation on the verb can be omitted without any changes in meaning. This is unexpected for the same reasons as (61a): this is a syntactic alternation, but syntax only operates on whole morphemes.

(61) a. *ma-ʔaraa-š wala ∅-katab-š* – 'He neither read nor wrote.'
ma- read ***-š*** or write ***-š***

b. *laʔ, maʕumriiš kalt ilbaʔlaawa*. – 'No, I've never eaten baklava.'
No, ***ma***-never-***š*** eat baklava
laʔ, ʕumr̥i makalt(-š) ilbaʔlaawa. – 'No, I've never eaten baklava.'
No, never ***ma***-eat(***-š***) baklava

The data in (61) show that this is not the kind of phenomenon the theory has predicted to exist – it does not involve any phonological alternation, where a markedness (or any other structure describing) constraint would enforce a different kind of affixation. And it also does not involve true disjoint affixes.

This circumfix is not a single morpheme also with respect to its origin. It is derived out of the original negative morpheme *ma* and the word *šayʔ* "thing", which was reduced to *š*: *Ma aktib šayʔ* > *maaktibš* "I don't write" (Robert Hoberman p.c.). The answer to the question about existence of alternating disjoint affixes is therefore confirmed to be: "No".

When the negative morpheme surfaces as a separate prosodic word, the two parts of the circumfix are simply put together. The negative prosodic word might be just negating a copula. Since Arabic has a null copula, the two affixes are just put together.

1.3.5 Summary of the typology

In the previous sections I showed cases of alternation between a prefix and an infix (Tagalog), an infix and a suffix (Alabama), and between a suffix and partial infix (Kui). The typology is summarized in (62). Other possible alternations, side switching and disjoined affixation, were shown to be nonexistent.

(62)

Language	**Type of affixes**	**RANKING OF CONSTRAINTS**
Tagalog, Alabama, …	exfix[13] – infix	MARKEDNESS >> CONTIGUITY >> ALIGNMENT
~~Huave~~, ~~Afar~~	prefix – suffix	
*Circumfixian	exfix – disjoint affix	
Tagalog, Alabama …	exfix – infix	MARKEDNESS >> ALIGNMENT >> CONTIGUITY
~~Huave~~, ~~Afar~~	prefix – suffix	
Kui, Basaa …	infix/suffix – suffix	
*Circumfixian	exfix – disjoint affix	
Kui, Basaa …	infix/suffix – suffix	ALIGNMENT >> MARKEDNESS >> CONTIGUITY
*Circumfixian	exfix – disjoint affix	
~~Huave~~, ~~Afar~~	prefix – suffix	CONTIGUITY >> MARKEDNESS >> ALIGNMENT
All languages with affixation	no alternation	CONTIGUITY >> ALIGNMENT >> MARKEDNESS
	no alternation	ALIGNMENT >> CONTIGUITY >> MARKEDNESS

[13] Exfix refers to any affix located external to the stem – prefix or suffix (as opposed to infix).

The theory of affixation used here predicts the existence of an affix that splits into a prefix and a suffix for phonological reasons[14]. There seem to be no cases of disjoint affixation in natural languages, where a disjoint affix is an affix split into two parts, each of which goes to a different side of the stem, and where the split is a prosodically conditioned alternation. The existing theory also predicts the existence of side switching affixes. This prediction is also not attested with a natural language.

All analyses of infixation within a constraint-based approach posit some sort of alignment constraints in a Prosodic Morphology kind of ranking with Prosodic constraints. As long as we have both P(rosodic) and M(orphological) constraints in the same grammar, we can get P>>M as well as the above discussed M>>ALIGN, CONTIGUITY ranking. Therefore the theory has to be modified. In the next sections I propose a modification of the existing theory to satisfy the predictions.

2. Proposal

As seen from the typology, discontinuous affixation exists. Even if we take Semitic morphology to be completely different from what is suggested above, there are still cases of metathesis from Kui, Basaa, and Dɛg that prevent us from excluding discontinuous affixation in general. Excluding discontinuous affixes also does not help us in avoiding side switching affixation, which does not involve any morpheme splitting. Therefore the question why we do not find any alternation between a disjoint affix and an exfix, between two different shapes of a disjoint affix, and between a prefix and a suffix becomes even more interesting.

Stemberger and Bernhardt (1999) claim that the theory does not have to account for the absence of disjoint affixation. The fact that we cannot find any disjoint affixes is just a gap in the typology. They claim that disjoint affixes are impossible because of learning. Learners might treat the two parts of a disjoint affix as two affixes if the two are always split. Furthermore, since the two affixes are redundant in meaning one of the two would eventually be lost. I claim this answer is inadequate. We don't find any such alternations, not because they are rare, but because they are impossible. Even though their explanation is possibly correct[15], I want to pursue a different possible approach.

There are a number of problems with their approach. As Stemberger and Bernhardt say, learners might treat this affix as two if it is *always* split, but they say nothing about the learning of the alternation. In the case of alternation, the affix is not always split and the learner should have evidence not to take it as two affixes. Yet this alternation is precisely something that we do not find. I claim that there should be no disjoint affixes, but I say nothing about circumfixes, which have a permanent shape (two affixes that are always split). Not only does it seem reasonable to treat circumfixes as two affixes, but this is precisely how they should be/are treated, because, as I have shown for Arabic and Dutch (and as is usually argued), they are two different affixes. Stemberger and Bernhardt's claim that learners take one part of this kind of affixation to be redundant seems wrong, since circumfixation is quite well represented in natural languages.

If Stemberger and Bernhardt are correct, then splitting the affix presents a way of forming new affixes. When reducing a disjoint affix to an exfix, we would not necessarily delete the newly formed one, but could also omit the original one. But Hall (1988) argues that the process described by Stemberger and Bernhardt is not really a valid source of new affixes. "The process of attrition from free lexical item to bound morpheme is a natural phonological process, and as such is apparently the *only* major candidate process, which can explain the introduction of affixes into a language" (Hall 1988: 329). In fact, circumfixes are usually derived from two different co-occurring affixes. For example the Kajobalean

[14] This observation was first made by Stemberger and Bernhardt (1999) (on independent grounds).

[15] Chomsky (2000, 124) says something that would support this kind of view: "that languages are "learnable" would be a surprising empirical discovery; there is no general biological or other reason why languages made available by the language faculty should be fully accessible. The conclusion that languages are partially unusable, however, is not at all surprising. It has long been known that performance systems often "fail", meaning that they provide ..."

(Mayan) ergative marker for 3rd person plural is the circumfix *s-…-eb'*. The suffixal part *-eb'* (following Robertson 1980) was originally not a pronoun, but a numeral classifier. Numbers 1-19 have to be followed by one of the following affixes: *-eʔ* 'singular', *-eb'* 'things', *-wan;* 'people', *-k'on;* 'animals', e.g. *ʔoš-eb' šila* – '*three-classifier chair*' – "three chairs". The source of this sircumfix has therefore nothing to do with its prefixal part. The circumfix was created out of two unrelated affixes. In addition, these suffixes in Mayan languages tend to become prefixes (case affixes in Mayan languages are usually prefixes). So for example in Kekchi (a related Mayan language) *-eb'* has been completely integrated into the absolutive system, being prefixed along with the rest of the Absolutive pronouns. This development is exactly the opposite of the one proposed by Stemberger and Bernhardt.

2.1 Disjoint affixes do not exist

I claim that disjoint and side switching affixes do not and should not exist. No set of freely rankable constraints can successfully avoid them, which is why a constraint of a higher kind has to be posited. How can such a stipulation be encoded into the grammar? The best possibility seems to be a constraint on the generator of candidates that enter the evaluation. In this way unwanted candidates cannot even compete in EVAL. As I will show in the next section, such a constraint has support not only in typological studies but also in psycholinguistic properties of morphological operations. Both disjoint and side switching affixes create a lot of processing difficulties, which is why they should be excluded from the set of candidates. Claiming they are unprocessable (Hall 1992) is a bit difficult without an experiment to prove the claim, but until I conduct one I have to justify my claims on theoretical grounds.

But how does a constraint on GEN work? According to Prince and Smolensky (1993) GEN is not a simple randomizer. Gen produces a set of candidates that are 'one change away' (Prince and Smolensky (1993, 86 fn49)). McCarthy and Prince (1993, 21) assign GEN three basic properties: *Freedom of Analysis* (any structure), *Containment* (input contained in every candidate), and *Consistency of Exponence* (epenthetic segments are not part of the morphemes). GEN is restricted, but it is not so clear how this is done. McCarthy and Prince say that GEN produces all linguistically possible candidates – candidates that exist as outputs in natural languages. This cannot be used as a restriction on GEN, it's a bit circular (and we cannot use it, since we have not yet analyzed all languages). Such a claim is only useful to include new candidates, but not to exclude possible ones.

GEN could be restricted with consistency of the morphological make-up of the candidates it produces. This consistency requirement could prevent GEN from changing syntax. But morphology does not completely correspond to syntax. Affix alignment for example does not always correspond to syntax as is the case with infixes. The same problem occurs also with circumfixes, which are arguably a single syntactic head yet show up as two separate units. This description of GEN is again unsatisfactory.

Different restrictions were already posited for GEN. GEN supposedly generates an infinite number of candidates, but not all imaginable candidates. GEN does not produce candidates that are not consistent with phonological representation. But what is phonologically possible and what isn't is a matter of the theory and the analysis. Still, GEN is not supposed to produce candidates with crossed tonal association lines, candidates with non-local feature spreading (Ní Chiosáin & Padgett 1997), etc. Such candidates are considered impossible in human languages.

To facilitate understanding we can posit the existence of a randomizer, whose output is subject to a filter that can be called GEN. GEN excludes candidates that never make it to the actual evaluation. Some sort of filter excluding all irrelevant candidates also facilitates evaluation. I do not plan to answer the question how should such a filter decide what is a good/reasonable candidate and what is not. No matter how such a filter works, it excludes the candidates under discussion. If we had an independent way of seeing what can and what cannot be processed, e.g. an experiment to prove that disjoint affixes cannot be processed (as suggested by Hall 1992), positing such a filter becomes even easier. If GEN checks every candidate whether it is an appropriate candidate (to see whether it is worthy of entering EVAL), than excluding such candidates is not really difficult. With the filter as some sort of a parser, every

candidate that cannot be processed is automatically excluded. In this case the constraint on the generator could simply be: *GEN does not recognize as acceptable output candidates that cannot be processed*.[16]

But as said above we need independent evidence (experiments) to test our parsing capacity.

2.1.1 Disjoint affixes are not processable

So far I argued that disjoint and side switching affixes are not found in human languages. At least no language using them has been reported to exist. This lack is attributed to the properties of GEN, which does not produce these candidates. I will now give support for this proposal from psycholinguistic properties of morphological operations.

Hawkins & Cutler (1988) provide a series of arguments to explain the morphological patterns found in typological studies. Across human languages suffixes are much more common than prefixes and both are much more common than infixes. There are languages that have no prefixes – typically head-final languages – but there seems to be no language with exclusive prefixation. This generalization was established by Greenberg (1966).[17]

Hawkins and Cutler claim that the preference for suffixes reflects properties of lexical access in speech understanding. The most salient part of any word is its beginning portion. The beginning of a word is therefore best for its recognition. Distorting the beginning of a word is much more serious than distorting any other part. Psychological experiments (Cooper 1980, cited in H&C) showed that speakers are aware of the importance of word beginnings and try not to distort them.

According to Hawkins and Cutler, just like sentence processing, word processing is done in real time, meaning that it goes left-to-right (left is what occurs first in time). The beginning is therefore important because of left-to-right lexical access. Priming experiments show equally strong priming with inflected forms as with base forms, suggesting that it is only the base that appears in the lexicon. Since only lexical stems are searched for in the lexicon, there is a functional reason why they should occur first.

It is also not surprising that although both affix and stem must be processed, they are processed separately. Studies show that stems are processed before affixes. The effect of a suffix often cannot be determined without knowing what stem it has combined with, while the feedback from the affix is not of value in constraining lexical access. Therefore it makes no sense to process the affix first.

In prefixed words, the uniqueness point (point where the stem is recognized as a unique word) occurs much later than in a suffixed word (a lot of words have the same prefixes). This delays lexical access for prefixed words in comparison with suffixed ones, making prefixing non-optimal. Infrequency of infixing is also predicted from processing facts: languages are reluctant to break up structural units both in syntax and morphology. Adjacency of immediate constituents facilitates processing. In this respect disjoint affixes are the worst. A disjoint affix thus greatly – to a much greater degree than an infix – disrupts processing of a word. Hall (1992) actually says that processing reasons do not allow this kind of circumfixation (as he calls it).

Infixes are disfavored also because the middle of the word is its least salient part. Affixes are simply too informative to be inserted in the middle of the word. In case of circumfixes and disjoint affixes, the lexical stem is in the middle of the word, meaning in the least salient part. Therefore this kind of morphology is again disfavored. There is another argument against disjoint affixes showing how processing of disjoint affixes (and possibly also side switching ones) becomes circular.

[16] Another possibility would be to say that the set of Candidates in EVAL is actually always the same – that is, regardless of the input the output candidates always come from the same pool of candidates. This possibility actually sounds quite impossible, but it does seem to be in accordance with the standard view of GEN. Ruling out disjoint affixes with such a GEN is even easier – they are simply not present in the universal GEN.

[17] These generalizations hold for inflectional affixes. Inflectional affixes are more constant across languages and therefore more appropriate for cross-language comparison. Derivational affixes are more language particular and idiosyncratic.

In order to successfully identify the affix we need to identify the stem, since the stem helps us in the interpretation of the affix. Knowing the meaning of the affix helps us in its prosodic identification. And after we complete its prosodic identification, we can separate it from the stem. We cannot separate the variable position affix from the stem before we have processed the stem. In short: to successfully separate the disjoint affix from the stem, we have to first process the stem, which we cannot do until they are not separated them from the stem. Same goes for side switching affixes.

Processing of stems is claimed to occur before processing of affixes. In case of a prosodic alternation, where the position and shape of the affix depends on the prosodic shape of the stem, without knowing what kind of stem the affix is attached to, we cannot predict the shape and position of the affix. A disjoint affix involves prefixation as well as suffixation, therefore knowing when the prefixing part is present and when it is not is crucial for the identification of the stem, hence the circularity.

Stem has to be processed to help get the meaning of the affix.
Stem has to be recognized to determine the type of alternation.
Affix has to be recognized to get separated from the stem.

A disjoint affix, the way I have described it, is just an allomorph of the suffix/prefix. It is not stored in our lexicon in that form, since its form is predictable from the shape of the stem. The problem is that since the prefixal component of the disjoint affix is not an individual morpheme it cannot be recognized – we do not have it stored in that form. Since it is not recognized, the shape of the stem cannot be determined. The stem is not individualized. But since the allomorph is conditioned by the shape of the stem, we cannot get either of the two. The allomorph of the affix cannot be determined because we don't know which stem it is attached to and the stem cannot be individualized because we don't know there is an allomorph attached to it.

Further evidence showing the difficulties involved in any alternations with disjoint or side switching affixes comes from the difference between biased prefix and biased suffix processing. According to Cole et al. (1989) prefixed words bias whole word access because the word starts with the prefix and this is what enters into the search. With suffixed words, the first thing to hit our ears is the root, which is why they bias root based access. Cole et al. actually claim that only suffixed words are accessed via the root.

Following Cole there is a processing difference between prefixed and suffixed words. If a single morphological process involves an alternation between a suffix and a prefix or a disjoint affix then a single morphological affixation is predicted to have two different paths of processing. This seems highly unlikely. How could it be that regardless of their frequency some affixed words would be stored in the lexicon, while others with the same affix would not be?

Psycholinguistic evidence show that an alternation involving changes in positioning such as the alternation between an exfix and a disjoint affix or an alternation between a suffix and a prefix create a number of processing problems. Processing reasons cannot be said to completely exclude these variable position affix alternations, but they certainly point in this direction. An experiment to test these claims is proposed in Appendix 4.

3. Possible alternative analyses

This section shows that a number of possible alternative analyses fail in making the same predictions as the original set of constraints, that is, predicting the existence of disjoint affixes. I leave the unattested prediction of side switching affixes aside in this section. Its lack seems more easily explained than the one involving disjoint affixation.

3.1 Positional faithfulness

One way to describe the observed difference between root and affix discontinuity is to say that discontinuous affixes are significantly less common than discontinuous roots. There are many occasions of infixation (Tagalog, Ilokano, Arabic, …), there are some cases where both affix and root are split (Baasa, Kui, Dɛg …), but there is no language with disjoint affixation.

The familiar root-affix asymmetry comes to mind. The root-affix asymmetry is well documented. Affixes are in general less marked than roots. For example, Standard Arabic makes no use of pharyngeals in affixes, while showing no such restrictions on root morphemes (McCarthy and Prince 1995); similarly in Cuzco Quechua (Parker 1997), laryngealized stops are only found in roots, etc.

To account for the described asymmetry, Beckman (1998) proposes the theory of positional faithfulness. She claims that faithfulness constraints have two different domains of application: they apply either to the whole word or to the root alone, so that we only have a general FAITH and a specific $\text{FAITH}_{\text{ROOT}}$ constraint. In this way, root morphemes are more faithful to their input than affixes. Having a specific and a general constraint is just another way of getting the result obtained with the fixed ranking $\text{FAITH}_{\text{root}}$>>$\text{FAITH}_{\text{aff}}$.

But positional faithfulness cannot be so simply applied to CONTIGUITY. CONTIGUITY is also a correspondence constraint, but with respect to this property, we find the inverse of what Beckman describes – discontinuous (unfaithful to their underlying order) functional morphemes are less common than discontinuous roots. Therefore we have to invert the domain of the relevant FAITH constraint. A possible solution is that there are only two constraints: the general one $\text{CONTIGUITY}_{\text{Morpheme}}$ (Landmann 1999) and the specific one $\text{CONTIGUITY}_{\text{Affix}}$.

The prediction of these two constraints seems to be that discontinuous affixes only exist in languages with discontinuous roots as well. This appears to be true. Undeniably discontinuous affixes are observed only in cases of metathesis (48)-(51), and in languages like Palauan and Tagalog (and probably similar Austronesian languages), which also have infixes.

To test this possibility I turn to the test cases from section 1.4.3. No matter where CONTIGUITY is ranked, as long as it is below ONSET, it cannot rule out the only candidate that satisfies ONSET in (64b).

(63)

napa + ***ka***	ONSET	$\text{ALIGN}_{\text{Aff-R}}$	CONTIGUITY	$\text{CONTIGUITY}_{\text{Aff}}$
☞ a) napa***ka***				
b) ***k***napa***a***	*!		*	*
c) na***ka***pa		*!	*	
d) nap***ka******a***	*!		**	*

(64)

atod + ***ka***	ONSET	$\text{ALIGN}_{\text{Aff-R}}$	CONTIGUITY	$\text{CONTIGUITY}_{\text{Aff}}$
a) atod***ka***	*!			
☞ b) ***k***atod***a***			*	*
c) ato***ka***d	*!	*	*	
d) ato***k***d***a***	*!		**	*

The prediction under discussion is not avoided. Regardless of the fact that the unwanted pattern is still predicted, a question remains to be tested. Does $\text{CONTIGUITY}_{\text{Aff}}$ exist as a constraint or not? If there exists a language (or better a morphological process in a language) where we find alternation between an exfix and an infix and in which the dominant prosodic markedness constraint could be satisfied also by metathesis of the edge of the affix, then we could conclude that splitting the affix is worse than splitting the stem. This would prove the existence of the specific CONTIGUITY constraint. The opposite cannot be tested for the nonexistence of $\text{CONTIGUITY}_{\text{Aff}}$. In cases of metathesis the reason why the affix wants to be split might be an undominated Alignment constraint aligning the affix to the right edge of the PrWd.

The two cases of infixation discussed in the typology above are not revealing with respect to this question. Metathesis of the affix-final consonant [m] in Tagalog cannot save violation of NOCODA, therefore no conclusion can be drawn from this. In Alabama, on the other hand, a split affix cannot be seen since the vowel at the end of the word is always suppressed by the final *-o*. This is also true when the *-ki* is a suffix and only [k] is realized. Again no conclusion can be drawn.

3.2 Positional markedness

The problem of malpredictions is not in the positional faithfulness used in 3.1 to capture the asymmetry. Even if the constraint in question is a markedness constraint like INTEGRITY, unattested predictions cannot be avoided.

Instead of splitting the faithfulness constraints into the *general* and *root/affix only*, we can split markedness constraints into *general* and *affix only*. We avoid the asymmetry observed in the implementation of positional faithfulness between segmental content and segmental order, but we do not avoid the malpredictions. Suppose we have a constraint that prevents splitting of a morpheme by another meaningful unit. A similar constraint has been already proposed:

(65) INTEGRITY: A meaningful/morphological/syntactic unit may not be interrupted by phonological material that is not part of that unit. (Anderson 1995, Taylor 1997)

Markedness constraints do not make any reference to the input, but this one does, and it applies to the morphemes, which are units in the input. It is quite obvious that INTEGRITY as a constraint behaves in exactly the same way as CONTIGUITY, and that no actual test is needed to see that this possibility does not avoid malpredictions in the test case of (63) and (64).

The claim made for the positional faithfulness solution holds also for this one. Whenever there is a choice between the two possibilities, either to split the stem or the affix, it is always the stem that is split. But as seen in tableaux (63) and (64), such choices are not always available. In other words, the proposed set, whether it uses positional faithfulness or positional markedness, does not avoid unwanted predictions. If one of the allomorphs of an affix is a disjoint affix than the same affixation also allows split roots, but in the case presented in (63)-(64), splitting the root does not avoid the violation of ONSET.

When a candidate violates a superset of constraints of some other candidate, it will never win. As long as there is a constraint that is only satisfied by that candidate, there exists a grammar (ranking) where the candidate in question will be the winner. From (64) we can see that a markedness constraint like ONSET can only be satisfied with a split affix, thus licensing disjoint affixes. To avoid this (unwanted result) we only have three possibilities:

a) exclusion of candidates with disjoint affixes from EVAL.

b) redefinition of all markedness constraints, and conditions of their satisfaction.

c) redefinition of the way affixes are put into words, so that disjoint affixes violate other constraints which license other candidates.

Possibility a) is the proposal I gave in 2.1. Possibility b) seems to be impossible because there is overhelming evidence for such basic markedness constraints as ONSET and needs no further discussion since it is clearly unwanted. In addition the constraint forcing the alternation is not necessarily a markedness constraint, so that a global change of constraints is required and this is definitely not what we want. We are left with possibility c), which I discuss in 3.3.

According to Kurisu (2001) circumfixation in Tagalog involves a single split affix, which is split because of the two alignment constraints. The most obvious problem with his claim that both parts of the circumfix in (66) belong to a single morpheme is their inalterability in different environments. No matter what the shape of the stem, the prefix and the suffix never change their shapes. They are both independently existing affixes, just like all other circumfixes as discussed in section 2.

(66) pag-mataas-an "be snobbish toward"
pag-hati-an "share"

pag-sawa-an "be tired of"

If the two really are the same morpheme, and the alignment constraints are as Kurisu formulates them – aligning only the outer edges of the affix with the edges of the prosodic word, making no reference to the inner edges – then we assume (67) is the optimal candidates for division of the affix because the initial complex onset is avoided. This is not what we find. The two parts of the circumfix have constant shape.

(67) *pa-hati-gan
*pa-sawa-gan

3.3 Two different approaches to affix alignment

The third possible way to avoid disjoint affixes is, as I said, a redefinition of the way affixes are put into words. The idea is to explain alignment in such a way that a disjoint affix violates in addition to CONTIGUITY also LINEARITY ("no metathesis" McCarthy and Prince 1999). Forcing a disjoint affix into violation of LINEARITY allows us to evaluate other candidates that might satisfy the dominant prosodic constraint. Linearity cannot be undominated, which is why candidates with stem internal metathesis become relevant – possible winners. Two proposals employing this idea are Horwood (2002) and de Lacy (1999). Both systems exclude alignment constraints from CON and give the affix its position already in the input. Assuming affixes can only be positioned in the input by syntax, there cannot be any infixes in the input. But then in such a system we cannot get any invariable infixes. The two systems, taking them as proposed without any modification, predict the existence of both disjoint affixation and side switching affixes. Although they have a number of nice features, the two systems are still unsatisfactory.

4. Conclusion

I have shown that the tightest possible restriction on disjoint affixation constructed with available tools within the theory can only exclude disjoint affixes in languages with no infixation, but cannot exclude disjoint affixation in general. Since processing reasons seem not to allow any kind of disjoint affixes (or at least strongly disprefer them), I suggest this restriction is in the grammar itself.

Although I lack crucial data (as explained in section 3.1), there is every reason to restrict the occurrence of discontinuous affixes. I formalize the observation that affixes are more faithful to their underlying order of segments than are roots, claiming there is only one specific faithfulness constraint for CONTIGUITY, which is the one for affixes. This contrasts with recent accounts of root-affix asymmetry, which regard root morphemes as more faithful to their inputs than affixes (e.g. Beckman 1998). I argue that we need to distinguish two domains of faithfulness: faithfulness to segmental content, and faithfulness to contiguity (segment order). The proposed set of constraints ($\text{CONTIGUITY}_{\text{MORPHEME}}$ & $\text{CONTIGUITY}_{\text{AFFIX}}$) predicts that discontinuous affixes only exist in languages with discontinuous roots. The set does not avoid disjoint affixation and is therefore insufficient.

In addition, processing reasons suggest that disjoint and side switching affixes should not be found in natural languages. Indeed that is what we find. No language exhibits an alternation involving a disjoint affix, where an underlyingly single contiguous string of segments would surface either as an affix or as two split strings of segments on both sides of the word and no language involves a prosodically conditioned alternation between a prefix and a suffix. In order to avoid these kinds of affixations completely, I claim there exists a constraint on the generator of candidates which filters candidates entering the evaluation. This constraint excludes all candidates with a disjoint or side switching affix (all candidates which cause a significant amount of processing difficulties).

Stemberger and Bernhardt (1999) observe the prediction of the disjoint affix – exfix alternation and claim that its non-occurrence is not a problem for the theory, but rather a gap. They claim that disjoint affixes are impossible because of learning. Although I agree with the reason they give for non-occurrence, I disagree with their explanation. I propose that their non-occurrence is a property of the grammar.

References:

Anderson, Stephen. 1992. *A-Morphous Morphology*. Cambridge: Cambridge University Press.

Anderson, Stephen. 1995. Toward an Optimal Account of Second-Position Phenomena. In Dekkers, J., F. van der Leeuw & J. van de Weijer (eds.) *Optimality Theory: Phonology, Syntax, and Acquisition.* Oxford, OUP.302-333

Bauer Laurie. 1988. A descriptive gap in morphology. In Booij, G. & van Merle, J. (eds.) *Yearbook of Morphology*. Dodrecht: Floris.17-27

Beckman, Jill. 1998. Positional Faithfulness. PhD thesis, UMass, Amherst.

Bliese, Loren F. 1981. *A Generative Grammar of Afar*. SIL publications.

Chomsky, Noam. 2000. *New horizons in the Study of language and mind*. Cambridge: CUP.

Cole, P., C. Beauvillain, and J. Segui. 1989. On the representation of prefixed and suffixed derived words: A differential frequency effect. In *Journal of Memory and Language* 28:1-13.

Crouch, M. 1994. The phonology of Deg. ms. GILLBT, Ghana [cited in Hume 2002].

de Lacy, Paul. 1999. A Correspondence Theory of Morpheme Order. *WCCFL* 18. [ROA 338-08991]

Fulmer, Sandra. 1991. A case of inflection before derivation. *WCCFL* 10.189-203.

Greenberg, J. 1966. Some uiversals of grammar with particular reference to the order of meaningful elements. In J.H. Greenberg (ed), *Universals of Language*, 2nd edn. Cambridge, Mass.: MIT Press.

Hall, Christopher J. 1988. Integrating Diachronic and Processing in Explaining the Suffixing Preference. in J.a. Hawkins (ed.) *Explaining Language Universals*. Oxford, Basil & Blackwell. 321-349

Hall, Christopher J. 1992. *Morphology and Mind*. London, Routledge

Halle, Morris. 2001. Infixation versus Onset Metathesis in Tagalog, Chamorro, and Toba Batak. In Michael Kenstowicz (ed.) *Ken Hale, A Life in Language*. MIT Press. 153-168.

Hawkins, J. and A. Cutler. 1988. Psycholinguistic factors in morphological asymmetry. in J.a. Hawkins (ed.) *Explaining Language Universals*. Oxford, Basil, and Blackwell.

Hawkins, J. and G. Gilligan. 1988. Left-right asymmetries in morphological universals. In J.A. Hawkins and H. Hombach (eds). *Papers in Universal Grammar*. special issue of *Lingua*.

Hayes, Bruce. 1999. Phonological Acquisition in Optimality Theory: The Early Stages. Ms UCLA.

Hoberman, Robert. 1988. Local and long-distance spreading in Semitic morphology. *Natural Language & Linguistic Theory* 6: 544-549.

Horwood, Graham. 2002. Precedence Faithfulness Governs Morpheme Position. [ROA 527-0602]

Hume, Elizabeth. 2001. Metathesis: formal and functional considerations. HIL Occasional papers. 1-25

Hume, Elizabeth. 2002. Predicting Metathesis: The ambiguity/attestation model. Ms. OSU. [ROA 546-0902].

Kenstowicz, Michael. 1994. Syllabification in Chukchee: a Constraints-Based Analysis. [ROA 30-1094].

Klein, Thomas. 2002. Infixation and segmental constraint effects: UM and IN in Tagalog, Chamorro, and Toba Batak. [ROA 535-0802]

Krause, S. R. 1980. Topics in Chukchee phonology and morphology. PhD thesis, University of Illinois at Urbana-Champaign.

Landman, Meredith. 1999. Morphological Contiguity. Ms., UMass-Amherst, MA.

Lieber, R. 1992. *Deconstructing Morphology*. The University of Chicago Press.

Lupardus, Karen Jacque. 1982. The Language of the Alabama Indians. PhD dissertation, University of Kansas.

McCarthy, John. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12:373-418.

McCarthy, John & Alan Prince. 1993a. Prosodic Morphology. Available from [ROA 482-1201]

McCharty, John & Alan Prince. 1993b. Generalized Alignment. [ROA 7-0000]

McCarthy, John & Alan Prince. 1995a. Faithfulness and Identity in Prosodic Morphology. [ROA 216-0997]

McCarthy, John & Alan Prince. 1995b. Prosodic Morphology. In J. Goldsmith (ed). *The Handbook of Phonological Theory*. Blackwell, Oxford. 318-66.

Mitchell, T.F. 1978. *An introduction to Egyptian colloquial Arabic*. Claredon Press, Oxford.
Montler, Timothy R. and Heather K. Hardy. 1991. The phonology of negation in Alabama. *International Journal of American Linguistics IJAL* 57.1:1-23
Ní Chiosáin, Máire and Jaye Padgett. 1997. Markedness, Segment Realisation, and Locality in Spreading. Report no. LRC-97-01, Linguistic Research Center, UCSC, Santa Cruz, CA.
Noyer, Ralf. 1993. Mobila Affixes in Huave: Optimality and Morphological Wellformedness. Erin Duncan, Michele Hart, and Philip Spaelti (eds.) *WCCFL* 12.67-82.
Prince, Alan & Paul Smolensky. 1993. *Optimality Theory*. Ms, Rutgers U., New Brunswick, and U. of Colorado. [ROA 537-0802]
Prunet, Jean-Francois, R. Béland & A. Idrissi. 2000. The mental representation of Semitic words. *Linguistic Inquiry* 31:609-648.
Roberts, Taylor. 1997. The optimal second position in Pashto. Ms MIT. [ROA 174-0297]
Robertson, John. 1980. *The structure of pronoun incorporation in the Mayan verbal complex*. (PhD dissertation, Harvard) Garland Publishing. New York.
Schachter, P. & Fe Otanes. 1983. *Tagalog Reference Grammar*. University of California Press, Berkeley.
Spencer, Andrew. 1991. *Morphological Theory*. Blackwell, Oxford.
Spencer, Andrew. 1998. Morphophonological Operations. In Andrew Spencer & Zwicky (eds) *The Handbook of Morphology*. Blackwell, Oxford.
Sproat, R. 1992. *Morphology and Computation*. MIT Press, Cambridge.
Stairs, Glenn A. and Emily F. Scharfe de Stairs. 1981. *Diccionario Huave de San Mateo del Mar*. Instituto Lingüístico de Verano, Mexico.
Stemberger, Joseph and Barbara Bernhardt. 1999. Contiguity, Metathesis, and Infixation. In Kimary Shahin, Susan Blake, and Eun-Sook Kim (eds.) *WCCFL* 17: 610-624.
Swanton, John. 1922. A sketch of the Alabama language. Ms. Washington D.C.
Ussishkin, Adam. 2000. Root-and-Pattern Morphology Without Roots or Patterns. Paper presented at *NELS* 30.
Winfield, W. W. 1928. *A Grammar of the Kui Language*. Calcutta: The Asiatic Society of Bengal
Yu, Alan. 2002. Understanding infixes as infixes. Handaut at NAPhC 2. [ROA 523-0602]

Appendix 1
Circum-Circumfix-fix

Urbanczyk (2001): reduplicants can be either of the shape of affix or stem. Since there do exist cases of discontinuous stems, we can expand our predictions to a case of a reduplicant violating CONTIGUITY. Needles to say, such morphological processes are unattested.

RED + abki	ONSET	NOCODA	ALIGN $_L$	CONTIGUITY
a) ab.ki.-ab.ki	**!	**!		
b) ab.ki.-ab.ki	**!	**!	****	
☝ c) a.b-ab.ki.-ki	*	*	*!*	*
☞ d) a.b-ab.ki.-ki	*	*		*
☝ e) a.b-ab.-ki.-ki	*	*	*!*	**

Urbanczyk, Susanne. 2001. Reduplicative form and the Root-Affix asymmetry. Ms. University of British Columbia, Victoria.

Appendix 2: Alabama

The alternation found in Alabama negation is triple. It is a variant of the alternation observed in Tagalog. The Alabama verbal negation affix alternates between a prefix, infix and suffix: *ik-*, *-ki-*, *-kii-*, -

ik-, -ki, *-ikko*. This kind of alternation is predicted to exist by the ranking MARKEDNESS >> EDGEMOST >> CONTIGUITY.

Montler & Hardy (1991) claim that this alternation is phonologically conditioned. According to them, the shape of the affix can be determined from the phonological shape of the stem with the assumption that underlying form {/k/, /i/} is unspecified for linear order, and with a general constraint on Alabama verbs – i.e. last two syllables form a heavy-light frame.

I will start with the alternation between *-ki-* and *-kii-* as the infix. The length of the affix vowel depends on the length of the penultimate vowel in the stem. When the verb ends with …VCCV] the relevant part of the negation affix is realized as the infix *-ki-* put in V-*ki*-CCV]:

(1) bassi bakísso 'poor'[18]
lokba lokíkbo 'hot'

And when a verb ends with …VVCV] the long vowel of the stem shortens, but mora count is preserved. The result is V-*kii*-CV]:

(2) pakaama pakakíimo 'tame'
ooti okíito 'kindle'

In both cases, the negative affix is aligned with the left edge of the R-aligned foot, which is without exception an uneven trochee. Such alignment is allowed under both Generalized Alignment (McCarthy and Prince 1993b) and Generalized Phonological Subcategorization (Yu 2002).

(3) $\text{ALIGN}_{(\text{Aff,L,Ft})}$: Align left edge of the affix to the left edge of the foot.

Since the negated verb always ends with an uneven trochee – a (H, L) foot – another alignment particular to this morphological process seems to be in action. This constraint is never violated and is therefore assumed to be undominated:

(4) $\text{ALIGN}_{\text{NEG}}$-Trochee-R: Align an uneven trochee with the right edge of PrWd of a negated verb.

When the penultimate vowel is long, vowel length is realized on the affix as in (2). Since the candidate has to respect the undominated trochee alignment constraint, it lengthens the vowel. A mora is taken from the long stem vowel, which in turns shortens. The constraint in (5) is used in this case to minimize the number of long vowels.

(5) $*\text{V}_{\text{LONG}}$: No long vowels

(6)

bassi + *ki* + o	$\text{ALIGN}_{\text{NEG}}$-Trochee-R	$\text{ALIGN}_{\text{aff,L,Ft}}$	NOCODA	ONSET
☞ a) ba**kí**sso			*	
b) ba**ík**sso			*	*!
c) bass**íko**	*!	*	*	
d) bás**sko**		*!	*	

Candidate (6b) is ruled out either by ONSET. In (7) NOCODA rules out candidates which satisfy the trochee alignment with metathesis. A further note is needed; the final *-o* is a separate morpheme as I will discuss later. It is added with a separate undominated ALIGNMENT, which is not included in these tableaux for simplicity reasons.

[18] Montler and Hardy (1991) do not provide stress for the affirmative form. As can be seen, the gloss is only given for the affirmative form.

(7)

ooti + *ki* + o	ALIGN$_{NEG}$-Trochee-R	ALIGN$_{aff,L,Ft}$	NOCODA	*V$_{LONG}$
☞ a) o**kíi**to				*
b) oót**ko**		*!	*	*
c) o**ík**to			*!	
d) oo**kí**to	*!			*
e) oo**kíi**to				**!

When a verb ends with …kV] sequence the realized infix -*ik*- has a different linear order than the previous infixes (and the underlying form) – X-*ik*-kV]:

(8) afaaka afaíkko 'laugh'
naałiika nałiíkko 'talk'
liska lisíkko 'beat'

To account for this I claim that in Alabama geminates are preferred over coda consonants. This is not unreasonable since many languages limit codas and allow geminates as coda consonants, e.g. Japanese only allows geminates and nasals. The order of segments of the affix is reversed if the onset of the final σ is /k/. NOCODAPLACE is ranked higher than LINEARITY and ALIGN$_{AFF}$.

(9) NOCODAPLACE (NCP): Coda consonants cannot have oral place features.

(10)

afaaka + *ki*	ALIGN$_{NEG}$-Trochee-R	NCP	ALIGN$_{aff,L,Ft}$	*V$_{LONG}$
☞ a) afa**ík**ko				
b) afa**kí**ko	*!			
c) afak**ík**o	*!		*	
d) afá**k**ko			*!	
e) afá**kíi**ko				*!

(11)

liska + *ki*	ALIGN$_{NEG}$-Trochee-R	NCP	ALIGN$_{aff,L,Ft}$
☞ a) lis**ík**ko			*
b) lis**kí**ko	*!		
c) li**kís**ko		*!	
d) lísk**k**o		*!	*

The negative morpheme can be realized also as a suffix. When the verb root ends with a consonant or long vowel it can be followed by the affirmative suffix –*li*. [19]

(12) bit-li bítko 'hit'
alkomoo-li alkomóóko 'hug'

Another case when the verb is suffixed is when the verb ends with two light syllables – (C)VCV – as in (13). The negation affix deletes the affirmative suffix -*li*.

[19] The -*li* suffix to the affirmative verb in (12) is just a verb expansion morpheme. It is added to the verb in completely predictable cases – whenever the verb root ends in a heavy syllable (VC, CVC, CVV). -*li* is added to the verb, to create a structure that conforms to the Alabama verb frame. According to Montler and Hardy (1991) the rule of -*li* insertion is ordered after the morphological rule placing negation into the verb.

(13) a) isi ísko 'take'
b) hocifa hocífko 'name'
c) hap-li-ci hapkíico 'bathe someone'

Another constraint is needed, one that prevents trimoraic syllables given in (14). This constraint rules out (15c), since it has a syllable with a long vowel followed by a coda consonant. In order to satisfy the trochee condition, a candidate has to violate either *3μ or NCP. Since in none of these cases, even if it is infixed, can ALIGN be satisfied, the decision is passed on to lower ranked constraints. My proposal is that in the end the decision is made by CONTIGUITY, choosing the suffixing candidate.

(14) *3μ: No trimoraic syllables (Kager 1999).

(15)

hocífa + *ki*	$\text{ALIGN}_{\text{NEG}}$-Trochee-R	*3μ	NCP	$\text{ALIGN}_{\text{aff,L,Ft}}$	CONT
☞ a) hocíf**k**o			*	*	
b) hoci**kí**fo	*!				
c) hoci**ík**fo		*!	*		
d) hocí**k**fo			*	*	*!

(16)

bit + *ki*	$\text{ALIGN}_{\text{NEG}}$-Trochee-R	*3μ	NCP	$\text{ALIGN}_{\text{aff,L,Ft}}$	CONT
☞ a) bít**k**o			*	*	
b) bi**kí**to	*!				*
c) bi**ík**to		*!	*		*
d) bí**k**to			*	*	*!

When the verb root is monosyllabic, alignment of *ki* to the left edge of the foot puts *ki* in the word initial position. Roots of the form CV are negated with *ik-* prefixed as – *ik*-CV:

(17) (i)pa íkpo 'eat'
(i)mo íkmo 'pick'

Montler and Hardy claim that the prefix "is limited to the very small set of words with the rare CV root shape" (1991:5) In addition, the prefixing class also includes 3 two-syllable verbs, which Montler and Hardy exclude from analysis. Since prefixing is apparently exceptional in some cases, I claim that it is exceptional in all cases of its occurrence. Prefixing is also the most restricted alternative, therefore it is not unplausible to claim it is exceptional.

From the tableaux in (6)-(16) the following ranking is extracted. It is shown quite clearly that Alabama negation is the case of alternation already observed in Tagalog, where PROSODIC CONSTRAINTS dominate both MORPHOLOGICAL C: $\text{ALIGN}_{\text{AFF}}$ and CONTIGUITY.

(18)

$\text{ALIGN}_{\text{NEG}}$-Trochee-R
|
NCP *3μ
w | q
$*\text{V}_{\text{LONG}}$ $\text{ALIGN}_{\text{aff,L,Ft}}$
w | i
ONSET LINEARITY CONTIGUITY

Prosodic constraints

Morphological constraints

A list of all possible environments where the negative affix gets a different shape leads us to another question. As seen in the last column, all negated verbs end with *-o*.

(19) a)	CV	prefix	/**ik**/	[CV]	→ [***ik***Co]
b)	(C)VVCV	infix	/**kii**/	…VVCV]	→ …V***kii***Co]
c)	(C)VCCV	infix	/**ki**/	…VCCV]	→ …V***ki***CCo]
d)	(C)VCkV	infix	/**ik**/	…CkV]	→ …C***ik***ko]
e)	(C)VVkV	infix	/**ik**/	…VkV]	→ …V***ik***ko]
f)	(C)VCV	suffix	/**ki**/	…(C)VCV]	→ …(C)VC***k***o]
g)	(C)VV	suffix	/**ki**/	…(C)VV]	→ …(C)VV***k***o]
h)	(C)VC	suffix	/**ki**/	…(C)VC]	→ …(C)VC***k***o]

Appendix 3: Chukchee

Spencer (1997) reports that the only known example of a circumfix not involving apparent bimorphemic affixation of independently existent affixes is the negative affix in Chukchee (a Chukotko-Kamchatkan language spoken in the extreme northeast of Russia). Its nominal negation is expressed with a *a-…-ka* circumfix as shown in (1) – because of vowel harmony the circumfix can be realized also as *e-…-ke*.

(1)	titi	'needle'	e-titi-ke	'without a needle'
	jatjol	'fox'	a-jatjol-ka	'without a fox'
	pipiqəlg	'mouse'	e-pipiqəlg-ə-ke	'without a sister' (Spencer 1999)

As said, the two parts of the negative circumfix do not exist separately as individual affixes, but the alternation this circumfix exhibits suggests that it is not a disjoint affix. Let's start with assumption this is a disjoint affix and see where this will bring us. The only way we can derive this kind of a disjoint affix is through use of two alignment constraints, both aligning the same affix but to different edges of the word. The form of the constraint itself, although not completely intuitive, is allowed within the theory of Generalized Alignment (McCarthy & Prince 1993b). An example of simultaneous alignment given by McCarthy & Prince (1993b) is Mcat=Pcat. Having two alignment constraints we can get such a permanent nonalternating disjoint affix as given in (2). Since the theory of generalized alignment does not really permit us to specify as the object of aligning an edge inside the affix, I am not considering any constraints of the type: ALIGN$_{(Aff\text{-}C,L,Root,R)}$: align the left edge of the affix consonant with the right edge of the root.

(2)

VkV + titi	CONT $_{stem}$	ALIGN $_{Aff,\ R}$	ALIGN $_{Aff,\ L}$	CONT $_{affix}$
eke-titi		*!		
titi-*eke*			*!	
☞*ek*-titi-*e*				*
☞*e*-titi-*ke*				*

The choice between the two winning candidates in (2) is done with the use of a markedness constraint like ONSET or NOCODA in (79). Since the affix is of the shape VkV, the least marked splitting on the most usual stems in terms of the two mentioned constraints is V-kV.

(3)

VkV + titi	ONSET	NOCODA
ek.-ti.ti.-*e*	**!	*!
☞*e*.-ti.ti.-*ke*	*	

When we take a look at more data the positioning of the affix becomes less clear, and its status less obvious. Kenstowicz (1994, citing Skorik 1961) reports that Chukchee regularly deletes the first vowel in hiatus, unless the second vowel is a schwa, in which case the schwa is deleted. There are vowel initial roots in Chukchee, which incur a hiatus violation when the negative affix is added to them. In these cases hiatus is resolved with an unconditional deletion of the affix vowel as shown in (4). Our assumption about the status of this affix meets a challenge. The vowel of the prefix does not show up on the other side of the word as we would expect if this was a disjoint affix. It disappears. Another interesting phenomenon can be seen in (4b). An epenthetic vowel is inserted on the right edge between the root and the suffix. Instead of the epenthetic vowel the prefix could have helped break up the consonantal cluster. If the prefix and the suffix both belong to the same underlying adjacent string why is it that the two parts don't co-occur on the same side? Why is the prefix is simply deleted?

(4) a) ococ "leader" ococ-ka "without a leader"
b) utt "wood" utt-ə-ke "without wood" (Spencer 1999)

The prefix deletes even when the root vowel is a schwa (5) although schwa represents the weakest vowel in Chukchee in other hiatus resolution contexts.

(5) a) ənʔe "elder brother" ənʔe-ke "without my elder brother"
b) ənpənacgə "old man" ənpənacgə-ka "without the old man"
(Spencer 1999, Krause 1980)

To summarize the Chukchee facts: When the root begins with a vowel, there is no reflex of the "affixal" vowel on the left edge of the prosodic word, and there is also no sign of the "affixal" vowel on the right side of the stem. In general hiatus can be avoided in many ways. The expected way for a disjoint affix in (4b) – [ek-utt-e] is not born out. Instead, the initial vowel is deleted, while the consonant cluster in the suffix region is broken up with an epenthetic schwa. The resulting output violates a number of faithfulness constraints, e.g. both DEP and MAX, while the possible one [ek-utt-e] would not violate any other FAITH but CONTIGUITY, which is (assuming this is a disjoint affix) violated by the affix anyway. Lastly, examples in (5) suggest that there was no vowel added to the beginning of the word, since the schwa, which otherwise deletes in hiatus resolution, is present in the output. But where is the missing vowel? If this affix is really a disjoint affix, the vowel should show up together with its suffixal part. A number of complications arise with the assumption this affix is a disjoint affix, leading us to conclude the assumption is wrong.

I claim that the prefix vowel deletes because of a combination of two faithfulness principles: root segments are more faithful to their input than affix segments are and initial segments of the root are more faithful than any other part of the word. But I do not plan to go any further than that.

Krause, S. R. 1980. *Topics in Chukchee phonology and morphology*. PhD thesis, University of Illinois at Urbana-Champaign.
Spencer, Andrew. 1999. Chukchee. URL: http://privatewww.essex.ec.uk/~spena/Chukchee/ 4/16/2001.

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