Multiple faithfulness relations in Fox (Central Algonquian) reduplication

Petra Burkhardt

This paper presents an Optimality Theoretic analysis of a bisyllabic reduplication pattern found in the Central Algonquian language Fox (discussed by Dahlstrom 1997 in a pre-OT analysis), utilizing the framework of Correspondence Theory (McCarthy & Prince 1995). It suggests the need for a large arsenal of faithfulness constraints within Correspondence Theory - i.e., the need not only for Input-Base Faithfulness and Base-Reduplicant Faithfulness, but also for Input-Reduplicant and Output-Output Faithfulness, thus contributing to two major debates within recent reduplicative morphology. The role of the latter two constraints will be discussed in detail.

1. Introduction

Reduplication has been a central theme within current research in Prosodic Morphology within OT. Assuming the model of Correspondence Theory (McCarthy & Prince 1995), this paper presents an analysis of a bisyllabic reduplication pattern found in the Central Algonquian language Fox (discussed by Dahlstrom 1997 in a pre-OT analysis) and crucially suggests the need for a large arsenal of faithfulness constraints within Correspondence Theory - i.e., the need not only for Input-Base and Base-Reduplicant Faithfulness, but also for Input-Reduplicant and Output-Output Faithfulness. As a consequence, the Fox data challenge two controversies within recent reduplicative morphology:

The first controversy has evolved around the status of Input-Reduplicant Faithfulness. Correspondence Theory states that the elements of a representation exhibit mutual faithfulness relations, i.e. faithfulness constraints apply to the relation of input and base, input and reduplicant, as well as base and reduplicant. The existence of Input-Base Faithfulness and Base-Reduplicant Faithfulness are widely accepted (e.g., McCarthy & Prince 1995 (henceforth MP 1995); Kager 1999; Struijke 1998). However, the status of Input-Reduplicant Faithfulness is controversial, in that it has been suggested that 'the reduplicant can never be more faithful to the input than the base is' (MP 1995). As a consequence of this metacondition on ranking, Input-Reduplicant Faithfulness should never dominate Input-Base Faithfulness in the

constraint hierarchy. However, the data presented below indicate that Input-Reduplicant Faithfulness must be ranked above Input-Base Faithfulness in Fox.

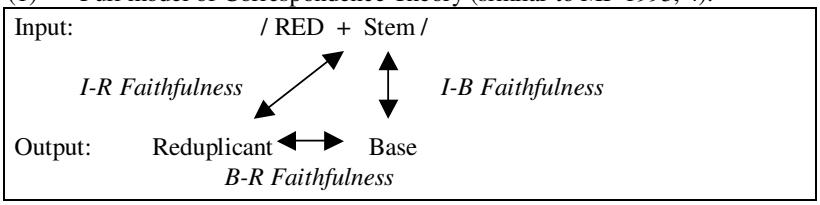
Second, Benua (1997/2000) introduced Output-Output Faithfulness to the Correspondence Theory debate. This faithfulness constraint represents the relation between two paradigmatically related surface forms: an output base is evaluated with respect to an already derived word. Not only is the mere existence of this constraint highly controversial (e.g., Hale, Kissock, & Reiss 1997; Reiss 1997), but also its position within a constraint hierarchy. Yet, the Fox data reveal the need for a highly ranked Output-Output Faithfulness.

This paper supplies a full Correspondence-based analysis of the Fox reduplication pattern and discusses general implications for correspondence relations in OT that may be drawn from the data. In light of the two controversial debates mentioned above, it provides data that first support the need for Output-Output Faithfulness and secondly suggest that faithfulness constraints governing roots (e.g., Input-Base Faithfulness) do not always have to dominate faithfulness constraints that govern affixes (e.g., Input-Reduplicant Faithfulness).

2. Correspondence Theory

Correspondence Theory (MP 1995) states that the elements of a representation exhibit mutual faithfulness relations, and as a consequence they strive to preserve identity and resist change. In particular, faithfulness conditions within a Correspondence-based model are applied to input-output relations 'and indeed to any domain where identity relations are imposed on pairs of related representations' (MP 1995: 4). The latter statement might be taken to validate the introduction of Output-Output Faithfulness (O-O F) (Benua 1995), but see below for a detailed discussion of this constraint. The full model of Correspondence Theory comprises Input-Base Faithfulness (I-B F), Input-Reduplicant Faithfulness (I-R F), and Base-Reduplicant Faithfulness (B-R F):

(1) Full model of Correspondence Theory (similar to MP 1995, 4):



Of these constraints, B-R F (e.g., MP 1995; Struijke 1998) and I-B F (e.g., MP 1995; Kager 1999) are the most widely accepted.[1] The status of Input-

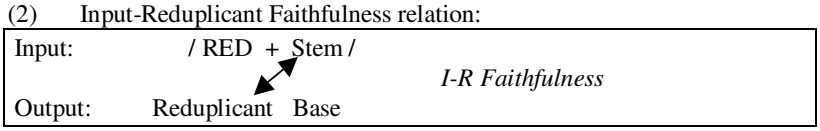
[1] One of the few divergent theories on B-R F is provided by Inkelas & Zoll (1998), who propose to abandon B-R F. They suggest that reduplication is not a phonological process, but a morphosyntactic one, where morphosyntactic feature bundles are doubled (i.e. concatenation of two

Reduplicant Faithfulness within the constraint hierarchy is controversial. In the following, the general argument that has emerged around I-R F and O-O F will be outlined, before presenting an analysis of the bisyllabic reduplication pattern in Fox and its implication for the correspondence relations.

2.1. The status of Input-Reduplicant Faithfulness

Input-Reduplicant Faithfulness represents the relation between the stem in the input and the reduplicant in the output:

(2) Input-Reduplicant Faithfulness relation:



The necessity for I-R F is uncontroversial. This has for instance been illustrated in Klamath (Clements & Keyser 1983), where in one particular reduplcation pattern, the reduplicant is more faithful to the input than the base is, which in an OT-framework is motivated by I-R F outranking B-R F (MP 1995:112). However, the position of I-R F within a given constraint hierarchy has been claimed to be restricted relative to other faithfulness constraints. Here, it has been proposed that there is a 'universal metacondition on ranking' (MP 1995: 4) that requires Input-Base correspondence to dominate Input-Reduplicant correspondence. This assumption has been formalized by introducing the Root-Affix Faithfulness Metaconstraint (MP 1995:116), in which I-R F is considered to be the subordinate affix-faithfulness constraint:

(3) Root-Faith >> Affix-Faith

The underlying presumption for this metaconstraint is that morphological affixes are always unmarked relative to roots. As a consequence of this metacondition on ranking, I-R F should never dominate I-B F in the constraint hierarchy. This dominance of the root over the affix is also alluded to in the presentation of Correspondence theory, in which McCarthy & Prince distinguish between a Basic Model and a Full Model, where the former does not include I-R F, implying the low-ranked nature of this constraint. However, as examples from Klamath indicates (and as the authors state themselves (MP 1995:111)), the reduplicant can be more faithful to the input than the base is. In addition to the pattern in Klamath, the Fox data provide evidence for the inevitability of a Full Model and substantiate the overall need for I-R F.

Yet, even though the Full Model allows for I-R F, the Root-Affix Faithfulness Metaconstraint in (3) above enforces restrictions on the constraint

---

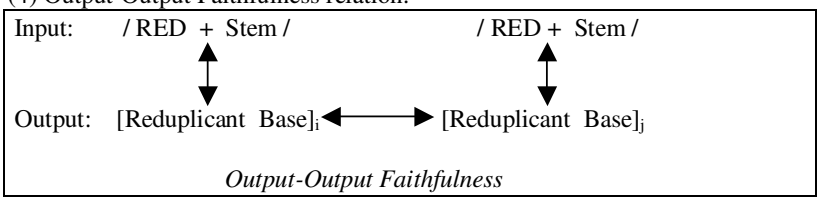
stems with identical feature bundles). A reduplicated form is thus derived from two (identical) input stems. Misapplication phenomena are explained in terms of 'co-phonologies', which specify distinct constraint ranking for each of the stems.

hierarchy and the relative ranking of I-R F. However, it will be shown that this does not hold for the analysis of the Fox reduplication pattern, and the conditions for McCarthy & Prince's proposed metaconstraint need to be revisited in order to consolidate the theoretical claims with the empirical data.

2.2. The status of Output-Output Correspondence

The second faithfulness constraint that needs to be considered in more detail for the purposes of this paper is Output-Output Faithfulness, which has become widely known through Benua's (1997)[2] work on transderivational identity relations (but see also Kager (1999) for further references on O-O relations). O-O F draws a correspondence relation between surface forms that are paradigmatically related with each other: a potential output candidate is evaluated with respect to an already successfully derived output, such that the two forms that are compared are paradigmatically related. The principle notion underlying this paradigmatic O-O correspondence is that morphologically related words are required to be phonologically identical (Benua 2000:29). This idea is compatible with the concept known as paradigm uniformity or uniform exponence (e.g., Kenstowicz 1997).

(4) Output-Output Faithfulness relation:[3]



Evidently, the interplay of phonology and morphology leads to the misapplication of phonological processes. In cases of overapplication, a process applies in an environment that does not license the structural requirements under which the process may occur. Classical cases of overapplication have been discussed for nasal harmony in Sundanese (Benua 2000) and Malay (e.g., Kager 1999 and references therein). Another interesting example of overapplication will be presented in the Fox reduplication pattern. In contrast, in underapplication, a linguistic process does not take place even though the structural environment licenses its application. A classical example for underapplication occurs in the truncation of names in English (e.g., *Lærry–Lær*) (Benua 2000; inter alia). In general, over- and underapplication have been analyzed as instances of phonological identity preservation.

[2] The following citations refer to Benua (2000), the published version of her 1997 dissertation.

[3] The corresponding output is a reduplicated form in this figure (/RED+stem/) to illustrate the process that is observed for Fox below. It is also possible that the corresponding output for a reduplicated form represents an unreduplicated base.

Phonological theories have tried to capture the misapplication phenomena by means of derived environment rules and cyclicity (e.g., Mascaró 1976; Kiparsky 1982), in which the derivation proceeds in stages, and rules are applied repeatedly to newly formed identities. Contrary to these approaches, transderivational correspondence and O-O F do not operate in cycles or stages, but represent a parallel process without intermediate stages, which is a core characteristic of OT at large. Benua (2000) points out that this parallelism posits an advantage of a transderivational approach over a cyclic theory, since it is more restricted and because the output directly corresponds to the input (whereas in a cyclic derivation, access to the original input is lost the more cycles are added). However, these benefits are overshadowed by the need to refer to an external output correspondent and by the problem of how to select and define this correspondent. In the analysis below, the corresponding output represents the 'least marked' form within the paradigm and is further specified in the lexical entry of the reduplication pattern.

3. Bisyllabic reduplication in Fox

3.1. Fox

Fox is a central Algonquian dialect spoken in Iowa, Oklahoma and on the Eastern Kansas-Nebraska border. It is also referred to as Mesquakie or Sauk-Fox. According to the 1990 census (*Ethnologue*), there are 673 Fox speakers including two monolinguals. (No estimates exist for the more recent census.)

3.2. Fox reduplication

Reduplication is a prominent element in Fox's morphology and is found in verbs, adverbs, quantifiers, and numbers. Its semantic distribution stretches from expressing intensity, continuity, and repetition of action, to customary action, plurality, duration, quantity, and onomatopoeia (Jones 1911:814-5). Different patterns of copying exist in Fox. This paper concentrates on a pattern of reduplication on verbs that involves the prefixation of a bisyllabic reduplicant, with a left-to-right mapping of the initial foot of the base.[4] Semantically, this pattern expresses iteration, signifying either the repetition of an action over time or action distributed over a group (Dahlstrom 1997: 206).

The following are examples of this prefixation process; /*-wa*/ represents the third person marker.[5] For notational purposes, the base is underlined and the reduplicant is italicized:

[4] The data is primarily based on the description of Fox reduplication by Dahlstrom (1997). Additional examples are taken from Jones (1911) and Goddard (1994).

[5] Some notational preliminaries: (i) Fox has short and long vowels. The latter are transcribed with (ː). (ii) Fox has a complex inflectional system. The following inflectional markers will be seen: animate 3rd person singular proximate subject of intransitive is /*-wa*/, animate 3rd person singular proximate subject acting on animate third person obviative object is /*-eːwa*/, and 1st person singular is /*ne*(*t*)-/. (The stop serves the function to avoid onsetless syllables word-internally.)

(5) a.	nepe·wa	*nepe*nepe·wa
	sleep-3RD	RED-sleep-3RD
	'he sleeps'	'he sleeps repeatedly'
b.	kanawiwa	*kana*kanawiwa
	speak-3RD	RED-speak-3RD
	'he speaks'	'he speaks repeatedly'
c.	nakiškawe·wa	*naki*nakiškawe·wa
	meet-3RD/TRANS	RED-meet-3RD/TRANS
	'he meets him'	'he meets him repeatedly'

The first syllable of the melody is mapped entirely onto the template. The second syllable, however, is subject to two language-specific constraints, in which a long vowel is reduced to a short vowel (e.g. *nepe*nepe·wa vs. **nepe·*nepe·wa) and in which codas undergo deletion (e.g. *naki*nakiškawe·wa vs. **nakiš*nakiškawe·wa). This indicates that the second syllable of the reduplicant must be a light syllable (σ_μ). The following chart summarizes the morphological characteristics of this reduplication pattern:

(6) a.	template:	Ft ($\sigma\sigma_\mu$)
b.	mapping:	left-to-right
c.	melody:	base
d.	WFR(prefixation):	verb→ RED verb-root
e.	semantic contribution:	iteration ('X repeatedly')

An additional alternation within this pattern is found with vowel-initial stems:

(7)a.	atame·wa	*atah*atame·wa
	smoke-3RD	RED-h-smoke-3RD
	'he smokes'	'he smokes repeatedly'
b.	i·tepihe·wa	*i·teh*i·tepihe·wa
	go-3RD	RED-h-go-3RD
	'he goes there'	'he goes there repeatedly'

An epenthetic /h/ is inserted between the reduplicant - which due to the lightness of the second syllable ends in a vowel - and the vowel-initial base.[6]

[6] Epenthesis occurs extensively in Fox: onsetless syllables are allowed only word-initially, and therefore inflectional and derivational processes that attach a prefix to the base trigger the insertion of a consonant to form an onset. Fox thus has a relatively high-ranked constraint prohibiting word-internal onsetless syllables (ONSET). For the current analysis, the concrete ranking of ONSET is not relevant as well as the violation of DEP-IO by the epenthesis. The two constraints do not affect this particular analysis, since they are violated in every output form that is considered below.

Note further that the nature of the epenthetic consonant varies and is closely linked to the involved morphological process. It is for instance /n/ after the temporal particle, or /t/ 'in an inanimate relation' (Jones 1911:750), or /h/ for the bisyllabic reduplication pattern.

3.3. Reduplication and /e/-initial bases

A specific alternation within this bisyllabic reduplication pattern is the main focus of this paper. It primarily discusses verbs with /e/-initial bases, which are subject to a language-specific alternation between /e/ and /i/ (Bloomfield 1925:231; Dahlstrom 1997:216).[7] Fox does not permit /e/ in word-initial position, which gives rise to the structural constraint in (8.a). In a rule-based framework, this is expressed as a phonological rule of the form in (8.b):

(8) a. No word-initial /e/: *#e
b. Phonological rule for /e/ ~ /i/: [e] → [i] / # _ [8]

The interesting observation about this alternation is that in combination with bisyllabic reduplication, the constraint on word-initial /e/ expands to the (word-internal) base, thus violating the rule in (8.b), which is confined to the left edge of a word. While the base over applies, the reduplicant satisfies the constraint *#e as the examples for */ena·pi/* ('look [there]') and */ešawi/* ('do [thus]') indicate - for additional examples see Dahlstrom (1997:216):

(9)a. net-*ena*-h-ina·pi
1ST-RED-h-look
'I look [there] repeatedly'
b. *ina*-h-ina·pi-wa
RED-h-look-3RD
'he looks [there] repeatedly'
c. net-*eša*-h-išawi
1ST-RED-h-do
'I do [thus] repeatedly'
d. *iša*-h-išawi-wa
RED-h-do-3RD
'he does [thus] repeatedly''

The constraint *#e refers only to word-initial instances of /e/, and it is therefore not expected to find a form like (9.b), but rather **inahena·piwa*, where the word-internal base remains unaltered. However, the data do not support this anticipated pattern, and the correct output form, where *#e expands to the (word-internal) base, thus illustrates an instance of overapplication. Notice also, that examples (9.a) and (9.c) with the first person marker reveal an even

[7] Fox has a 4-vowel system and distinguishes between short and long vowels (a, a·, e, e·, i, i·, o, o·). The language-specific restriction analyzed in the following occurs with initial short /e/ only.

[8] Dahlstrom (1997:216) illustrates the /e/~/i/ alternation in a stem such as */ena·pi/* ('look [there]') with prefixation of the first person marker /*ne*(*t*)-/ in (i) and suffixation of the third person marker /-*wa*/ in (ii), where only the process of suffixation forces the /e/~/i/ alternation:

(i) ne-t-ena·pi
1ST - look
'I look [there]'

(ii) ina·pi-wa
look – 3RD
'he looks [there]'

more striking pattern, where the word-internal base undergoes vowel raising, while the reduplicant (which this time is not word-initial, because of the prefixed person marker) keeps the vowel as it is in the input stem.

In the following, an analysis of these patterns is approached from an Optimality Theoretic point of view, and it will be shown that a constraint-based grammar can account for the output forms by invoking multiple correspondence relations.

4. /e/-initial bisyllabic reduplication in OT

We can now turn to a thorough analysis of the bisyllabic reduplication of forms with /e/-initial bases and introduce a number of faithfulness constraints that play an important role in selecting the best candidate. This will be demonstrated by first concentrating on a morphologically less marked form and then examining a more marked form within the reduplicative paradigm.

An example of a less marked form is the third person singular marker, which involves suffixation of /-*wa*/ to the verb stem. For instance, 'he looks [there] repeatedly', which has the input /RED-*ena·pi-wa*/, surfaces with the output *inahina·piwa* (9.b). The tableau in (10) demonstrates how the structural constraint *#e and two correspondence constraints - B-R F and I-O F - contribute to the selection of the optimal output candidate. The input-output constraint that is introduced into the hierarchy in (10) is defined broadly, in the sense that output is understood as referring to both base and reduplicant at this point, while it will be distinguished later in the analysis (into I-B F and I-R F).

(10) /RED - ena·pi-wa/, *#e >> B-R F >> I-O F

Candidates	*#e	B-R F	I-O F
a. *ena*henа·piwa	*!		
b. *ena*hina·piwa	*!	*	*
c. *ina*henа·piwa		*!	*
d. ☞ ***ina*hina·piwa**			**

The candidates of (10.a) and (10.b) are immediately ruled out by the structural constraint from (8.a) prohibiting word-initial /e/; the constraint is fatal for these two output candidates. (10.c) and (10.d) exhibit the initial vowel change from /e/ to /i/, but they differ in the form of the base. To select the correct output candidate, two distinct correspondence conditions may be called upon. The base could either be required to agree with the reduplicant or, alternatively, with the input. The former scenario requires a highly ranked B-R Faithfulness, which demands a correspondence between the base and the reduplicant. The latter scenario can be represented in a constraint hierarchy that includes a dominant I-O Faithfulness constraint, where the base is required to correspond directly with the input stem rather than with the reduplicant.

Invoking a dominant I-O F constraint, it would be relevant for the constraint hierarchy that the base of (10.c) uses the stem */ena·pi/* faithfully, while (10.d) violates the general constraint on input-output correspondence. However, as the tableau in (10) illustrates, I-O F cannot be the crucial constraint for the current analysis, because if it were only ranked with *#e (i.e., *#e >> I-O F), it would select the incorrect output (10.c) *inahena·piwa*, since (10.d) violates I-O F to a greater extent than (10.c) does, with two output correspondents (the base and the reduplicant) violating the input features.

This suggests that B-R F must outrank I-O F in the constraint hierarchy, as indicated in the tableau in (10). B-R F asks for a featural identity between base and reduplicant. It thus rules out candidate (10.c), which fails to exhibit the required congruence, as it carries a segment that is not identical between the base (i.e., /e/) and the reduplicant (/i/), while in (10.d) the features of the base correspond entirely with the features of the reduplicant. As a consequence, the application of B-R F is successful in selecting the correct output (10.d). This is sufficient evidence for postulating a partial ranking *#e >> B-R F >> I-O F, in which I-O F is irrelevant for the selection of the optimal output since the best candidate is already found by evaluating *#e and B-R F successively.

If we analyze the paradigmatically related, but more marked form 'I look [there] repeatedly' (*netenahina·pi* in (9.a)), which contains the first person singular prefix */ne-(t)/*, the ranking *#e >> B-R F >> I-O F does not generate the expected output as shown in (11) below. However, it has also been established above that a reranking of these three constraints is not feasible, and that in particular the partial ranking B-R F >> I-O F must be maintained.

(11) /ne-t-RED-ena·pi/, *#e >> B-R F >> I-O F[9]

Candidates	*#e	B-R F	I-O F
a. * ☞ net*ena*hena·pi			
b. **net*ena*hina·pi**		*!	*
c. net*ina*hena·pi		*!	*
d. net*ina*hina·pi			**!

The candidates in (11) are not at all affected by the constraint *#e because of the morphological process of prefixation of the person marker, due to which an /e/-initial environment is not created. Furthermore, I-O F eliminates candidate (11.d), and B-R F is fatally violated by (11.c) and, more importantly, by the desired output (11.b). Therefore, other faithfulness constraints need to be taken into consideration that dominate B-R F and rule out the selection of (11.a). One option that might serve to accomplish this is the introduction of I-R F. This constraint should be high-ranked, since the desired output candidate (11.b) does not violate I-R F. In what follows in (12), the broad I-O F constraint, which so far has referred to both base and reduplicant as outputs, is

[9] In tableaux where the ranking selects the wrong candidate, the correct candidate found in the language is highlighted in bold, while the candidate selected by the hierarchy is preceded by ' * ☞'.

divided into I-R F (signifying the correspondence between stem and reduplicant) and I-B F (denoting the correspondence between stem and base only):

(12) /ne-t-RED-ena·pi/, I-R F >> B-R F >> I-B F[10]

Candidates	I-R F	B-R F	I-B F
a. * ☞ net*ena*hena·pi			
b. **net*ena*hina·pi**		*!	*
c. net*ina*hena·pi	*!	*	
d. net*ina*hina·pi	*!		*

However, this does not bring us significantly closer to selecting the correct output. Even though I-R F rates (12.c) and (12.d) less optimal than (12.a) and (12.b), the desired output (12.b) violates both B-R F and I-B F. It thus seems inaccurate to merely concentrate on the correspondence of the input with the elements constituting the candidate, because any input-X faithfulness favors (12.a), in which both base and reduplicant faithfully reflect the stem, while the other candidates fail to correspond to the stem in at least one instance.

Another faithfulness constraint is O-O F, which - as indicated in 2.2 - draws a correspondence relation between paradigmatically connected words. In the case of Fox, the O-O correspondence then links *inahina·piwa* ('he looks [there] repeatedly') and *netenahina·pi* ('I look [there] repeatedly'), where the former represents the least marked form of the paradigm and hence qualifies as the output correspondent in the O-O F evaluation:[11]

(13) /ne-t-RED-ena·pi/, I-R F >> O-O F >> B-R F >> I-B F

Candidates	I-R F	O-O F [inahina·piwa]	B-R F	I-B F
a. net*ena*hena·pi		**!		
b. ☞ **net*ena*hina·pi**		*	*	*
c. net*ina*hena·pi	*!	*	*	
d. net*ina*hina·pi	*!			*

[10] The constraint *#e will not appear in the subsequent tableaux because it is not violated by a candidate that is prefixed with */net-/*. Nevertheless, *#e is a highly ranked constraint in Fox and must be ranked above the correspondence constraints in the complete framework.

[11] The selection of the corresponding output might be considered a problem. In response to this, Benua (2000) first points out that O-O relations are restricted to paradigmatically related words and to specific morphological processes. This concentration of a particular O-O F on one morphological process reduces the span for potential output correspondents significantly. Furthermore, additional restrictions are imposed on the choice of the corresponding output form. Specifically, within a paradigm, the least complex form is chosen, to which the other forms are required to be faithful. This form might be an inflected word (as is the case for Fox): 'Often, the base is the word that is minimally less morphologically complex than the derived word, so that the base consists of a subset of the derived word's morphemes. But this kind of subset relation does not always hold. An obligatorily-inflected word can serve as the base of another inflected word, and the base's inflection is neither morphologically nor phonologically present in the derived word.' (Benua 2000:31)

This ranking finally generates (13.b) as the optimal candidate, because the application of O-O F based on the least marked element of the verbal paradigm results in the selection of (13.b) over (13.a).

The remaining questions are how O-O F and I-R F are ranked with regard to the other constraints. From the analysis of the third person form, it is already known that B-R F must dominate I-B F, as the former constraint is crucial in eliminating the undesirable outputs, while I-B F would rule out the optimal output, whose base does not agree with the input stem, but rather with the re-duplicant. In addition, O-O F must outrank the (partial) ranking B-R F>>I-B F to guarantee that (13.a) is not selected as optimal output, since O-O F is the only constraint that determines (13.a) as being non-faithful.

As far as the ranking of I-R F is concerned, it occurs that I-R F must dominate all three constraints in the partial hierarchy O-O F>>B-R F>>I-B F. The primary reason for this claim is that O-O F is violated by all candidates except for (13.d), so if I-R F did not dominate O-O F, the preference would wrongly go to (13.d). Independent from O-O F, evidence for a high ranking of I-R F comes further from the observation that I-R F should dominate B-R F and I-B F because both constraints have the potential to rule out the correct candidate (13.b). Thus it appears that I-R F must be forced at the expense of the other correspondence constraints, as the tableau in (13) presents. These observations give rise to the following final constraint hierarchy:

(14) *#e >>I-R F>> O-O F >> B-R F >> I-B F[12]

To conclude, the analysis of the bisyllabic reduplication pattern in Fox has revealed that both I-R F and O-O F are crucial and must be highly ranked for the selection of the correct output candidate. Furthermore, the final constraint hierarchy suggests that there are languages where I-R F must dominate I-B F. In the next section, the particular issues that have evolved around I-R F and O-O F will be revisited in light of these new findings.

5. Faithfulness revisited

The reduplication pattern presented above strongly suggests to reconsider the claim of the 'universal metacondition on ranking' which states that I-R F must

[12] At last, this final ranking also succeeds in generating the correct output candidate for the less marked third person singular form as shown in (i) - as well as for non-/e/-initial stems:

(i) /RED-ena·pi-wa/, *#e >> I-R F >> O-O F >> B-R F >> I-B F

Candidates	*#e	I-R F	O-O F	B-R F	I-B F
a. *ena*hena·piwa	*!				
b. *ena*hina·piwa	*!			*	*
c. *ina*hena·piwa		*		*!	
d. ☞ ***ina*hina·piwa**		*			*

be of less importance than I-B F, since the 'faithfulness constraints on the stem domain always dominate those on the affixal domains' (1995:4). This metacondition cannot be validated for Fox.

As indicated in 2.1, the absence of I-R correspondence in the Basic Model of Correspondence Theory implies only that the application of this constraint is less likely cross-linguistically and suggests that I-R F is often low-rated in a constraint hierarchy. Evidence for the reality of I-R F comes form reduction/ syncope and laryngeal neutralization in Klamath (MP 1995). And the Fox data presented here supply further proof for the need of I-R F and the Full Model.

Yet, even though the Full Model allows for I-R F, the Root-Affix Faithfulness Metaconstraint enforces restrictions on the constraint hierarchy and the relative ranking of I-R F. These do not hold for the current analysis, as it has been shown that I-R F must dominate I-B F. A closer look at the conditions for the proposed metaconstraint reveals that it is not necessarily the dominance of one correspondence constraint over another that McCarthy & Prince (1995) are concerned with, but the interplay of these constraints with a structural constraint. What they dub pathological rankings are rankings that are primarily concerned with the position of a structural constraint (ℂ) relative to the correspondence constraint, such that 'any phonological constraint ℂ that stands between the two types of faithfulness will hold true of the affixes in a language but not of the roots.' (MP 1995:117) Likewise the metacondition Root-Faith>>Affix-Faith focuses on the interaction of root or affix with a structural constraint; thus it is claimed that an affix can never have a stricter or richer marking than a root with regard to a particular structural constraint.

In the final ranking for Fox, even though I-R F is a high-ranking constraint, the structural constraint *#e is always superior to I-R F (in fact, to every correspondence constraint). Furthermore, the data indicate that the reduplicant never violates the structural constraint and is always faithful to the constraint on /e/-initial vowels. In addition, it reflects a strong allegiance with the stem, while the output base fails to comply with the input stem and reflects overapplication of the structural constraint. Thus, the part of the output that behaves extraordinarily is the base and not the reduplicant. It might therefore be more appropriate to focus on the question why I-B F is so low-ranked, instead of why I-R F must be high ranked.

Finally, the Fox data put forward the notion that the reduplicant has immediate access to the features of the input stem. This is contradictory to the statement that '[t]he absence of a direct relation between reduplicant and input in the Basic Model entails that the reduplicant can never be more faithful to the input than the base is, since the output reduplicant has no access to the input stem, except through the output base.' (MP 1995:110) On the basis of the analysis provided above, however, I suggest that the reduplicant needs to correspond directly to the input, while the orientation of the base is focused on a related output form. This then advocates further that the reduplicant is not entirely dependent on the base (via B-R F), but that normal application occurs with a partial ranking of I-R F>>B-R F, which makes the input more powerful.

In sum, the hierarchy for Fox implies that the Root-Affix Faithfulness Metaconstraint needs to be redefined in a broader context of constraint interaction and that additional rankings need to be considered. McCarthy & Prince postulate that '[b]ecause of this metaconstraint, no I-R faithfulness constraint can ever dominate its I-B cognate, and the pathological interactions can never occur.' (1995:117) This however does not hold in its entirety. The first part of this statement, that I-R F can never dominate I-B F, must be disclaimed on the basis of the findings from Fox bisyllabic reduplication. Even though the so-called pathological rankings might be found impossible cross-linguistically, the Fox data suggest that in connection with a number of other factors (such as the position of a structural constraint or the orientation of base and reduplicant towards their correspondents), I-R F can be superior to I-B F. The Metaconstraint should hence be reassessed in a more exhaustive way.

Fox further provides striking evidence for the importance of O-O correspondence. Yet, the existence of O-O F has been contested in the literature. A critical evaluation of O-O F can be found in Hale, Kissock, & Reiss (1997) and Reiss (1997). The authors argue that OT can do without O-O correspondence constraints. In general terms, their criticism is directed at the opportunistic selection of the data, the maltreatment of generalizations (due to oversimplification or neglect), and improper predictions. More specifically, the basic problem identified with O-O F is that by comparing outputs of two independent words, the system is forced to look at a form that lies outside the generative function of the input-output relation represented within a single tableau. This is not preferable in an OT framework, for it removes a certain degree of generalization from the constraint system. The process of generation and evaluation of well-formedness conditions is not expected to be capable of networking with an output that has already gone through the evaluation process. Nonetheless, advocates of O-O F argue that this correspondence relation enables us to evaluate one single process, instead of being forced to adhere to a cyclic approach. Another potential problem is how the grammar picks the output form to which a good candidate must correspond.

For the Fox data, O-O F seems to provide an effective solution to select the correct output. The base appears to be strongly oriented towards paradigm uniformity, seeking to agree with other outputs in the reduplication paradigm. Alternative phonological constraints cannot account easily for the overapplication phenomenon.[13] And improper or too far reaching predictions do not arise from the introduction of O-O F as long as the lexical entry for the reduplicant is specified as suggested in Benua (2000:31-2), where the question of how to formalize and restrict O-O F from applying randomly is solved by the proposal to mention O-O correspondences in the subcategorization frame of

[13] An alternative analysis has been suggested to me, in which the raising observed on the base might be ascribed to a word boundary between base and reduplicant. One problem that arises from this is to substantiate why /h/-epenthesis would still be required and how /h/ is syllabified. A related problem concerns the prosodic parsing and to which prosodic constituent person markers attach (i.e., since pre- and suffixation occur, it is difficult to identify a single common prosodic level). The present analysis is thus favored over such analyses.

morphological operations. This appears to be a reasonable solution in order to restrict the system's generative power. The drawback is that it increases the complexity of the lexical information associated with a linguistic process.

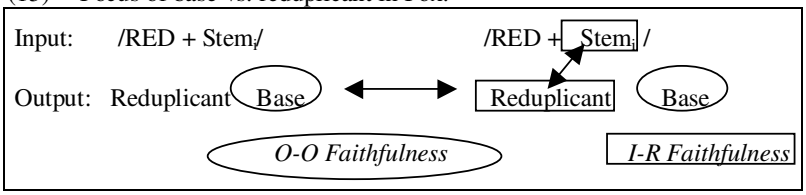
For the reduplication pattern in Fox, this implies that the process of bisyllabic reduplication is specifically linked to the (least marked) derived output of the third person singular in an O-O relation. The lexical entry for this process then has to include a reference to the correspondent, such as 'O/O correspondent: /RED-verb-wa/'. These specifications need to be added to the morphological description of the bisyllabic reduplication in (6).

In spite of a lot of criticism regarding the role of O-O F, the evidence from Fox implies that it should be an inherent constraint of a universal grammar. It might be argued that if structural constraints can generate a correct form, the application of such a constraint should take precedence over O-O F (e.g., Rotuman (McCarthy 1995 vs. 2000)). Nonetheless, even though O-O F might not represent a constraint that is rated high in many language-specific grammars, there seem to be languages that rely on this kind of correspondence, and it thus should not be excluded from a grammar. Furthermore, the motivation for the alternations in the /e/-initial verb forms in Fox stems strongly from a process of paradigm leveling that by its very nature has an 'external' correspondent. This relationship is not randomly established, and the restriction to paradigmatically related comparisons minimizes the range of potential correspondents drastically. These observations make the request for O-O F more plausible.

6. Conclusion: Base vs. reduplicant correspondence

The analysis presented here proposes that both O-O F and I-R F are relevant for the selection of the optimal candidate. In general, the data suggest that reduplicant and base behave differently relative to the individual correspondence constraints. The reduplicant is primarily faithful to the input stem (and to the structural constraint *#e), whereas the base is primarily faithful to a corresponding output to achieve phonological identity via paradigm leveling:

(15) Focus of base vs. reduplicant in Fox:



As the figure illustrates, the base of an output candidate is oriented towards a corresponding base of a less marked output, while the reduplicant focuses on the stem of its input. This reveals that base and reduplicant are not in

competition with each other (which might be implied from the Metaconstraint on ranking), but that they seek to be faithful to constituents at different levels.

Acknowledgments

I am grateful to Abigail Kaun for her support in developing the initial analysis.

References

Benua, L. (1995). Identity effects in morphological truncation. Beckman, J., S. Urbanczyk, & L. Walsh (eds.), *University of Massachusetts Occasional Papers in Linguistics 18*: *Papers in Optimality Theory*, GLSA, Amherst, pp. 77-136.

Benua, L. (1997). Transderivational identity: Phonological relations between words. Ph.D. dissertation, University of Massachusetts, Amherst.

Benua, L. (2000). *Phonological relations between words*. Garland, New York/London.

Bloomfield, L. (1925). Notes on the Fox language. *International Journal of American Linguistics* 3, pp. 219-232.

Bloomfield, L. (1927). Notes on the Fox language. *International Journal of American Linguistic*s 4, pp. 181-219.

Clements, G. N. & S. J. Keyser. (1983). *CV phonology: A generative theory of the syllable.* MIT Press, Cambridge.

Dahlstrom, A. (1997). Fox (Mesquakie) reduplication. *International Journal of American Linguistics* 63, pp. 205-226.

Goddard, I. (1994). *Leonard Bloomfield's Fox lexicon: Critical edition.* Algonquian & Iroquoian Linguistics Publications, Winnipeg.

Grimes, B. F (ed.) (1996). *Ethnologue: Languages of the World. 13th Edition*. SIL, Inc., Dallas.

Hale, M., M. Kissock & C. Reiss. (1997). Output-Output correspondence in optimality theory. Curtis, E., J. Lyle, & G. Webster (eds.), *Proceedings of WCCFL XVI.*, CSLI Publications, Stanford, pp. 223-236. [also ROA 202-0697]

Inkelas, S. & C. Zoll. (1998). Reduplication as morphological doubling. [ROA 412-0800]

Jones, W. 1911. Algonquian (Fox). F. Boas (ed.), *Handbook of American Indian languages. Part 1-B*, Government Printing Office, Washington, D.C., pp. 735-873.

Kager, R. (1999). *Optimality theory.* Cambridge University Press, Cambridge.

Kenstowicz, M. (1997). Base identity and uniform exponence: Alternatives to cyclicity. J. Durand & B. Laks (eds.), *Current Trends in Phonology: Models and Methods*: *Vol. 1*, University of Salford, Salford, pp. 363-394.

Kiparsky, P. (1982). Lexical morphology and phonology. I.-S. Yang (ed.), *Linguistics in the morning calm: Vol.2*, Hanshin, Soeul, pp. 3-91.

Mascaró, J. (1976). *Catalan phonolgy and the phonological cycle*. Indiana Univ Linguistics Club, Bloomington.

McCarthy, J. J. (1995). Faithfulness in prosodic morphology and phonology: Rotuman revisited. [ROA 64]

McCarthy, J. J. (2000). The prosody of phase in Rotuman. *Natural Language and Linguistic Theory* 18, pp. 147-197.

McCarthy, J. & A. Prince. (1993). Prosodic morphology I: Constraint interaction and satisfaction. Ms., University of Massachusetts, Amherst, and Rutgers University. RuCCS-TR-3.

McCarthy, J. J. & A. Prince. (1995). Faithfulness and reduplicative identity. Ms., University of Massachusetts, Amherst and Rutgers University.

Reiss, C. (1997). Explaining analogy. [ROA: 199-0597]

Struijke, C. (1998). Reduplicant and output TETU in Kwakwala. [ROA: 261-0598]