Intra-Representational Correspondence and the Realization of Empty Morphemes

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Introduction

A **morpheme** is a unit of grammar that can (and often does) have an effect on the phonological properties of a word. This effect is usually called the **realization** of the morpheme. For example, the past tense morpheme in English is often realized as a word-final [d] in weak verbs, as in *dragged*, *played*, and *seemed*. Not all morphemes are realized by the addition of novel segments unrelated to the base word. For instance, the morpheme responsible for reduplication (commonly referred to as **RED**) is realized by copying segments of the base word. The string of copied segments is called the **reduplicant**. In Mbe (a Benue-Congo language spoken in Nigeria), some imperative verbs undergo reduplication with a prefixed reduplicant (underlined in the data below) which copies the segments in the first syllable of the base:

(1) *imperative reduplication in Mbe (see Walker 1998 for further data and references)*

rû	>	rû-rû	‘pull’
ʃîe	>	ʃî-ʃîe	‘sell’
g͡bárî	>	g͡bə̂-g͡bârì	‘embrace’

I call any morpheme like RED an **empty morpheme** since it does not provide its own segments. Instead, segments in the realization of an empty morpheme are obtained from the word the empty morpheme is attached to.

Many theories have been developed to account for reduplicative patterns like that in Mbe with varying degrees of success. Within the constraint-based parallel framework of Optimality Theory (Prince and Smolensky 1993), Correspondence Theory (McCarthy and Prince 1993a, 1995) has emerged as the most widely accepted theory of copying in reduplication. In

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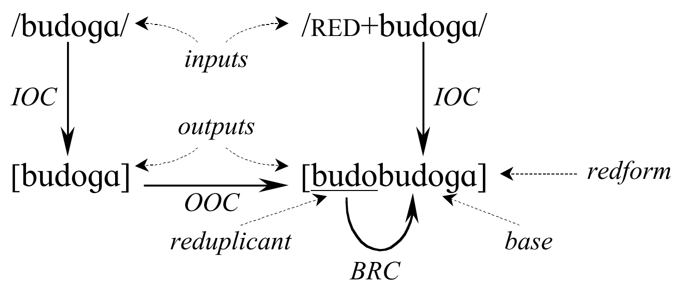
Correspondence Theory, one phonological string *x* can influence another phonological string *y* via a **correspondence** relation *R*, where *R* is a set of ordered pairs ⟨*a*,*b*⟩, *a* is a segment in *X*, and *b*, the **correspondent** of *a*, is a segment in *y*.[1] A family of **faithfulness** constraints govern the properties of *R*. For example, the faithfulness constraint MAXIMALITY-*xy* (or MAX-*xy* for short) ensures that every segment in *x* has a correspondent in *y*, while IDENTITY-*xy* (IDENT-*xy*) requires that every pair of correspondents agree in their phonological features. For reduplication, *x* and *y* are substrings of the entire reduplicated form; *x* is the base[2] and *y* is the reduplicant. The MAX constraint governing the correspondence between the base and the reduplicant is often violated in Mbe since only the first syllable of each base is copied, leaving the rest of the segments in the base without correspondents in the reduplicant. Thus, if the base is only a single syllable, as in *rû-rû*, MAX is satisfied. But for words like *g͡bə̂-g͡bârì*, MAX is violated because the second syllable *rì* in the base is not copied into the reduplicant. On the other hand, the relevant IDENT constraint is generally satisfied in Mbe since the copied segments do not undergo any changes, though the form *g͡bə̂-g͡bârì* violates IDENT since the correspondents [ə̂] and [ɑ̂] are not phonologically identical.

Correspondence has been argued to exist between many different strings other than just the base and the reduplicant in reduplication. **Input-Output Correspondence** is correspondence from an input to its output (McCarthy and Prince 1993a, 1995), replacing the PARSE-FILL model of Prince and Smolensky's (1993) Containment Theory. **Output-Output Correspondence** is correspondence from one output to different outputs that are morphologically derived from it (Benua 1995, 1998; Burzio 1996; Kenstowicz 1995); and (iii) Sympathetic Correspondence is correspondence from one specially selected possible output to all of its fellow possible outputs (McCarthy 1997a, 1997b). In all of these cases, the correspondence exists between strings that are not part of the same form (or representation). However, McCarthy and Prince (1993a, 1995)

[1] In other words, *R* is a subset of $x \times y$, the Cartesian product of *x* and *y*.

[2] The use of the term *base* is potentially troublesome, given the various meanings attributed to it in the literature. I clarify my terminology later in this paper.

argue that **Base-Reduplicant Correspondence**, the correspondence between the base and reduplicant in reduplication, must occur within the *same* output representation, what Spaelti (1997) calls the *redform*. In the diagram in (2), three correspondences Input-Output Correspondence, Output-Output Correspondence, and Base-Reduplicant Correspondence are all shown for two hypothetical inputs, /budogɑ/ and /RED+budogɑ/. Solid arrows indicate the three types of correspondences, while the strings which participate in these correspondences are labeled with dotted arrows:

(2)


As is apparent from this diagram, Input-Output Correspondence and Output-Output Correspondence are relations between distinct representations, while Base-Reduplicant Correspondence is **intra-representational** in that it is a relation between strings which are part of the same representation, the redform. I propose that Base-Reduplicant Correspondence is merely one member of a larger class of correspondence relations that involve two strings that occur within the same representation. I call this class of correspondence relations **Intra-Representational Correspondence** (IRC).

Why should such a broader class of correspondences be needed? Base-Reduplicant Correspondence is assumed to be triggered by the existence of the reduplicative morpheme RED in the input. Input-Output Correspondence, Output-Output Correspondence, Sympathetic Correspondence, and most other types of correspondence used in the literature are not instances of IRC, yet nothing in McCarthy and Prince (1993a, 1995) offers any motivation for limiting IRC only to cases in which RED is in the input. Two other morphemes trigger processes which bear striking similarities to reduplication: the truncation morpheme TRUNC, and the reversal ludling[3] morpheme LUD. At minimum, these three morpheme share the following properties: (i) they are all empty morphemes which have realizations that are expressed through manipulations of the base; (ii) the shape of their realizations are highly sensitive to prosody, often conforming to prosodic units such as the syllable or foot; and (iii) what semantic content they might have is very often based on the nature of their realizations (i.e. their meanings are iconic): reduplication often carries a meaning of repetition, plurality, or continuance; truncation often marks the diminutive form of nouns; and in some reversal ludlings, the ludling form can have a sinister or secretive connotation. It is far less common (though not impossible, as with Mbe) to find any of these morphemes representing a meaning, such as dative case, future tense, or passive, that is not related to the manipulations inherent in their realizations. Thus, it is natural to analyze the realizations of these three morphemes as related variants within the same framework, rather than as completely independent, yet accidentally similar, phenomena. At minimum, an analysis that does group them is less stipulative than one that arbitrarily treats them differently simply to account for the facts. Since Base-Reduplicant Correspondence is an excellent framework to analyze reduplication, I propose that truncation and reversal ludlings can be analyzed as instances of a similar type of correspondence, motivating the existence of IRC as a general version of Base-Reduplicant Correspondence.

In Section 1, I build a formal definition of IRC, including formalizations for strings, morpheme realizations, representations, correspondence relations, and faithfulness constraints. I provide an IRC analysis of Japanese, Icelandic, and English truncation in Section 2, arguing against the emergence of the unmarked (McCarthy and Prince 1994) aspect of the Output-Output Correspondence analysis in Benua 1995, 1998. Additionally, I examine data from French hypocoristics (nicknames), in which truncation is the default realization, but reduplication and ludling-like reversal are also possible hypocoristic forms in certain phonological contexts

[3] **Ludlings** (from Latin *ludus* 'game' and *lingua* 'language') are also referred to as *play languages*, *language games*, *speech disguises*, *child's languages*, *secret languages*, and *argots* (among other names) in other literature. I follow Bagemihl 1989 in the use of the term *ludling* since other terms have socio-linguistic connotations unrelated to the phonological issues at hand and/or are too burdensome to be used repetitively.

(Nelson 1998). In Section 3, I present an IRC analysis of reversal ludlings in Tagalog and Japanese, arguing in favor of Restricted Generalized Alignment, a version of Generalized Alignment (McCarthy and Prince 1993b) that excludes opposite-edge alignment constraints. I also follow up on Restricted Generalized Alignment with a same-edge alignment analyses of Ulwa possessive infixes which have been argued to exhibit opposite-edge effects. Finally, I conclude in Section 4 with a summary of the major points made in this paper.

1 Formalization of IRC

I begin by defining some basic terminology (adapted from Partee, ter Meulen, and Wall 1993, with modifications suitable to the purposes of this paper):

(3) A **(phonological) string** x is a finite ordered sequence of n phoneme tokens[4] $p_1 \ldots p_n$. Each p_i is said to be a **segment** in the string x, notated as $p_i \in_s x$. The **left edge** of x is its first segment p_1, and the **right edge** of x is its nth segment p_n. Every $p_i \in_s x$ is said to be **adjacent** to both p_{i-1} and p_{i+1} (when either exist).

Two strings x and y can be **concatenated**, notated as $x\hat{}y$ or simply xy, resulting in a new string with a left edge that is the left edge of x and a right edge that is the right edge of y. In addition, the segments of xy retain the adjacency of x and y, plus adjacency between the right edge of x and the left edge of y. Concatenation is an associative, non-commutative binary operation with the **empty string** as its identity element.

A string y is a **substring** of a string x, notated as $y \subseteq_s x$, iff there are two strings w and z such that $x = wyz$. Since both w and z may be the empty string, all strings are substrings of themselves. A string y is a **proper substring** of x, notated as $y \subset_s x$, iff y is a substring of x and $y \neq x$.

I use the term *string* to refer specifically to a phonological string since I am not concerned with other strings in this paper. The notion of string is not sufficient to describe candidates in Optimality Theory, since the same phonological string can behave differently depending on its morphological structure. In the following table of possible outputs in (4) for the hypothetical input /RED+budogɑ/, a single underline indicates the reduplicant (the realization of RED), while a wavy underline indicates the base (the realization of the input /budogɑ/). Subscripts are used to differentiate tokens of the same phoneme:

[4] Tokens are unique instances of the same element that can be referred to separately. Thus, in a string such as *abca*, the element *a* occurs twice, but each of the tokens of *a* only occur once each. It is necessary for defining morphological structures that segments of a string be tokens rather than elements.

(4)		*representation*	*string*	*phonological properties*
	a.	bubudogɑ	$b_1u_1b_2u_2$dogɑ	unnecessary epenthesis of b_1u_1, no reduplicant (RED is unrealized)
	b.	bubudogɑ	$b_1u_1b_2u_2$dogɑ	infixed reduplicant b_2u_2 not completely aligned to the left edge of the word
	c.	bubudogɑ	$b_1u_1b_2u_2$dogɑ	prefixed reduplicant b_1u_1 aligned to the left edge of the word

From this table, it is clear that possible outputs must contain more information than just a string of phonemes since there are Optimality Theoretic constraints which punish epenthesis, lack of morpheme realization, and misalignment, and these constraints can be ranked differently with respect to other constraints in the hierarchy.

In (5), a representation is defined as an ordered pair of a phonological string and a morphological structure:[5]

(5) A **morphological structure** M over a string x is a finite set $\{\langle m_1,y_1\rangle,\ldots,\langle m_k,y_k\rangle\}$ of k ordered pairs, such that each m_i is a morpheme from a designated set of morphemes in the language and each y_i is some substring of x. Each y_i is said to be the **realization** of m_i in x. Thus, a morphological structure over x is a mapping from morphemes to their realizations as substrings of x.

A **representation** is an ordered pair $\langle x,M\rangle$, such that M is a morphological structure over the string x.[6]

By convention, when not referring to specific strings, I use small capitals to indicate morphemes (such as BASE, RED, etc.) and lowercase Greek letters for morpheme realizations (β, ρ, etc.). The definitions in (5) can be used to formalize the representations in (4) as follows:

(6)		*representation*	*string*	*morphological structure*
	a.	bubudogɑ	$b_1u_1b_2u_2$dogɑ	{⟨BASE,$b_2u_2$dogɑ⟩}
	b.	bubudogɑ	$b_1u_1b_2u_2$dogɑ	{⟨BASE,b_1u_1⟩,⟨BASE,dogɑ⟩,⟨RED,b_2u_2⟩}
	c.	bubudogɑ	$b_1u_1b_2u_2$dogɑ	{⟨BASE,budogɑ⟩,⟨RED,b_1u_1⟩}

[5] Representations could potentially include many other properties as well, such as prosodic structure. However, I assume for this paper that the mapping of prosodic categories over a string is derivable from the string itself and need not be independently specified, and I abstract away from any other properties of representations.

[6] See recent work by Kurisu (1999, 2000b) for a similar, but slightly different, approach to defining morpheme realizations.

Representation (6a) does not have a realization for RED.since its morphological structure does not contain an ordered pair of the form ⟨RED,*y*⟩ where *y* is a substring of *x*. Additionally, (6a) has a substring b_1u_1 which is not the realization of any morpheme (i.e. it is epenthesized). In contrast, representations (6b) and (6c) have realizations for both of the morphemes in the input, and neither representation has any epenthesized substrings. These two representations are distinguished by their relative leftwards alignment of the reduplicant. Different constraint rankings in Optimality Theory could potentially select one representation as more harmonic than the others by making reference to both the strings and the morphological structure (though generally, (6c) will be harmonic than either (6a) or (6b)).

I can now define IRC as a relation within a single representation:

(7) *R* is a $\mu_1\mu_2$ **intra-representational correspondence** (IRC) on a representation $\langle x,M \rangle$ iff μ_1 and μ_2 are the respective realizations in *x* of some morphemes m_1 and m_2, and *R* is a relation from μ_1 to μ_2. If $\langle a,b \rangle$ is in *R*, then *b* is said to be the **correspondent** of *a* in μ_2.[7]

For reduplication, μ_1 and μ_2 are the base β and the reduplicant ρ respectively (i.e. m_1 is BASE, and m_2 is RED). This general definition of IRC defines many correspondences which are not of any linguistic interest and will never emerge as part of a winning candidate in Optimality Theory. Such ill-formed IRCs are ruled out by the constraints on IRCs which exist in the grammar. One family of such constraints are the faithfulness constraints such as the Base-Reduplicant Correspondence faithfulness constraints which govern the relationship between the base β and the reduplicant ρ. I propose that there are at least two other sets of similar faithfulness constraints, one for truncation and one for reversal ludlings. Faithfulness in IRC is defined below:

[7] To my knowledge, extending Base-Reduplicant Correspondence in this way to a broader class of correspondences between substrings of the same representation was first suggested in Sanders 1998 to analyze reversal ludlings and first given the name *IRC* in Sanders 1999a, in an analysis of truncation. Since then, IRC in concept and name has made some recent appearances in the literature. For example, IRC has appeared explicitly in Kurisu 2000a and implicitly (as *segmental/consonantal correspondence*) in work by Walker (2000a, 2000b, to appear).

(8) Let R be a $\mu_1\mu_2$ IRC on $\langle x,M \rangle$, with μ_1 and μ_2 the respective realizations in x of some morphemes m_1 and m_2. The constraint **MAX-$\mu_1\mu_2$** is violated for every segment in μ_1 which does not have a correspondent in μ_2. The constraint **DEP-$\mu_1\mu_2$** is violated for every segment in μ_2 which is not the correspondent of a segment in μ_1. The constraint **IDENT-[F]-$\mu_1\mu_2$** is violated for every ordered pair $\langle a,b \rangle \in R$ such that a and b differ in their value for the phonological feature [F]. These constraints are **$\mu_1\mu_2$ faithfulness** constraints.

There are other possible faithfulness constraints, but these are the only ones relevant to this paper. I can now show how truncation can be analyzed as an instance of IRC.

2 Truncation as IRC[8]

Segmental loss between related forms can be motivated either by surface markedness conditions or purely by morphology. It is this latter type of truncation that I am concerned with in this section. Many languages have truncation processes for a variety of functions:

(9) a. *English hypocoristics*
ɹɪt͡ʃɚd 'Richard' > ɹɪt͡ʃ 'Richard'
suzən 'Susan' > su 'Susan'

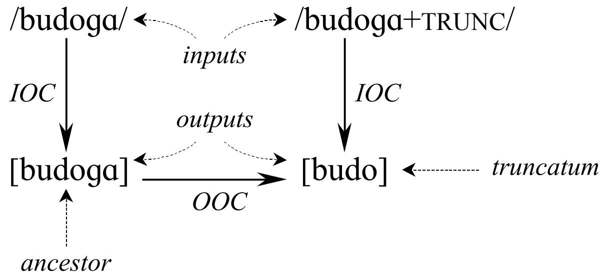
b. *deverbalized infinitives in Icelandic (Benua 1995)*
grenjɑ 'to cry' > grenj 'crying'
klifrɑ 'to climb' > klifr 'climbing'

c. *Yapese vocatives (Jensen 1977)*
luʔɑg > luʔ 'Luag'
mɑŋɛːfɛːl' > mɑŋ 'Mangefel''

Benua (1995, 1998) motivates the segmental loss found in truncation via emergence of an unmarked prosodic structure, as has been done with reduplication (McCarthy and Prince 1994). Working within Optimality Theory, Benua provides an Output-Output Correspondence analysis in which truncated forms are subject to constraints on prosodic size that non-truncated forms are not. The truncated form, which Benua calls the **truncatum**, is taken to be derived from an independently occurring output. In an unfortunate use of terminology, Benua calls this independent output the *base*. I have followed McCarthy and Prince 1993a, 1995 in the use of *base* to refer to the realization of BASE generally. For Output-Output Correspondence, I will use the term **derivational ancestor** (or simply **ancestor** for short) to refer to a base in the sense of Benua. The following diagram displays the various relationships between the relevant strings:

[8] This section derives primarily from research in Sanders 1999a.

(10)



In this section, I detail Benua's Output-Output Correspondence analysis and outline an alternative analysis of truncation as an instance of IRC. Then, I apply the IRC analysis to French hypocoristics, which utilize not only truncation, but also reduplication and a ludling-like reversal. Finally, I explore two problems that arise from Benua's analysis, exemplified by data from English hypocoristics and from Icelandic deverbalization, and I present possible IRC solutions to these problems.

2.1 Emergence of the Unmarked Prosodic Structure

Given the variety of correspondence relations that can involve the same strings, it is not unexpected for them to interact. One type of possible interaction is called **emergence of the unmarked** (EoU; McCarthy and Prince 1994), in which some marked structure is allowed to occur by one type of correspondence, but not by another. EoU effects are characterized by the following constraint ranking schema, in which the markedness constraint $*\mathfrak{M}$ punishes some marked phonological structure from emerging in any representation, and the faithfulness constraint FAITH-*xy* ensures that *y* is similar to *x*:[9]

(11) FAITH-x_1y_1 >> $*\mathfrak{M}$ >> FAITH-x_2y_2

Because FAITH-x_1y_1 outranks $*\mathfrak{M}$, if the marked structure specified by $*\mathfrak{M}$ exists in x_1, it will survive in y_1 in order to satisfy FAITH-x_1y_1 at the expense of $*\mathfrak{M}$. However, with $*\mathfrak{M}$ outranking FAITH-x_2y_2, y_2 can never have the marked structure, even if x_2 has it, resulting in an unmarked structure emerging, incurring a violation of FAITH-x_2y_2. This asymmetry between y_1 and y_2 forms

[9] FAITH-*xy* is just a cover constraint for faithfulness constraints such as MAX-*xy* and IDENT-*xy*.

the basis of EoU analyses and can be seen in the following data from Sanskrit perfect tense formation (Steriade 1988):

(12)

prɑt^{h}	‘spread’	pɑ-prɑt^{h}-ɑ	‘spread (perfect)’
kʂ̥ɑd	‘divide’	kɑ-kʂ̥ɑd-ɑ	‘divided’
mnɑː	‘note’	mɑ-mnɑː-u	‘noted’

The data in the first column show that Sanskrit allows complex onsets, which are ruled out by the constraint *COMPLEX:

(13) The constraint ***COMPLEX** is violated for every onset with more than one segment.

Since the complex onsets do surface, *COMPLEX must be outranked by MAX-IO, which prevents deletion:

(14) The Input-Output Correspondence constraint **MAX-IO** is violated for every segment in the input which does not have a correspondent in the output.

Thus, rather than delete one of the offending segments in the complex onset as in candidate (15b), Sanskrit tolerates the complex onset and candidate (15a) emerges as the output:

(15) /prɑt^{h}/ ‘spread’

	MAX-IO	*COMPLEX
✔ a. prɑt^{h}		*
b. pɑt^{h}	r!	

However, the complex onset does not survive in the reduplicant of the reduplicated perfect form of the verb. This requires the constraint MAX-BR to be ranked lower than the markedness constraint *COMPLEX:

(16) The Base-Reduplicant Correspondence constraint **MAX-BR** is violated for every segment in the base which does not have a correspondent the reduplicant.

The result is EoU: the reduplicant displays an unmarked onset with only one segment, despite the fact that Sanskrit normally allows marked (i.e. complex) onsets:

(17) /RED+prɑt^h+ɑ/ 'spread (perfect)'

	MAX-IO	*COMPLEX	MAX-BR
✔ a. <u>pɑ</u>-prɑt^h-ɑ			r
b. <u>prɑ</u>-prɑt^h-ɑ		*!	
c. <u>pɑ</u>-pɑt^h-ɑ	r!		

The winning candidate *<u>pa</u>-prat^h-a* (17a) surfaces even with a complex onset, since simplifying the onset by deletion results in a fatal violation of MAX-IO, as for *<u>pa</u>-pat^h-a* (17c). However, if the reduplicant contains the complex onset, as in *<u>pra</u>-prat^h-a* (17b), the entire word incurs a fatal violation of *COMPLEX, allowing (17a) to win despite violating MAX-BR.[10]

Benua proposes that the segmental loss seen in truncation processes is the result of EoU with respect to prosodic structure, where smaller prosodic shapes are less marked than larger ones. Specifically, in Benua's analysis, the relevant faithfulness constraints are MAX-IO and MAX-OO, with the intervening markedness constraint being an alignment constraint which limits the prosodic size of the output:

(18) MAX-IO >> prosodic limit >> MAX-OO

The constraint MAX-OO is defined analogously to MAX-IO and MAX-BR:

(19) The Output-Output Correspondence constraint **MAX-OO** is violated for every segment in the output's ancestor which does not have a correspondent the output.

The prosodic markedness constraint will vary from language to language, depending on the size of the truncatum. For Japanese hypocoristics, which are foot-sized truncated forms, Benua utilizes the alignment constraint ALLFOOTLEFT:

(20) The constraint **ALLFOOTLEFT** is violated for every foot which is not word initial.

[10] All of these candidates incur a shared violation of MAX-BR by not reduplicating *t^h*. This is not relevant here.

With high-ranking MAX-IO, ancestors are not subject to the prosodic limitations imposed by ALLFOOTLEFT, so there is no deletion from the input to the output for the regular word:[11]

(21) /kɑzuhiko/ 'Kazuhiko'

	MAX-IO	ALLFOOTLEFT
✔ a. (kɑzu)(hiko)		*
b. (kɑzu)	hiko!	

The fully realized candidate *(kazu)(hiko)* satisfies the higher ranking MAX-IO, and thus emerges as the correct output, despite violating ALLFOOTLEFT, whereas the truncated candidate *(kazu)* violates MAX-IO in order to satisfy the lower ranked ALLFOOTLEFT.

The key to using EoU effects as the impetus for the segmental deletion in truncation relies on Benua's assertion that truncation is not sensitive to IO faithfulness. That is, there is simply no correspondence between the input and the truncatum, so constraints such as MAX-IO are effectively ignored. The unmarked prosodic structure can then emerge in truncation, if MAX-OO is ranked lower than the prosodic limitations as seen in the following tableau for the hypocoristic form of *kazuhiko*:

(22) /kɑzuhiko+TRUNC/ 'Kazu', ancestor = *kazuhiko*

	MAX-IO	ALLFOOTLEFT	MAX-OO
a. (kɑzu)(hiko)		*!	
✔ b. (kɑzu)			hiko

I now offer an alternative analysis of truncation utilizing IRC to account for a variety of patterns of hypocoristic formation in French.

[11] Only binary feet are allowed (ensured by high-ranking FOOTBINARITY), and all syllables must be parsed into feet (high-ranking PARSE-σ). Thus, candidates with a non-binary foot like *(kazuhiko)* or with some unparsed syllables like *(kazu)hiko* will be ruled out and are not considered here.

2.2 An IRC Analysis of French Hypocoristics

French hypocoristics display a number of patterns, ranging from truncation, to reduplication, to a ludling-like reversal of segments (Nelson 1998).

2.2.1 Truncated Hypocoristics

Trisyllabic names have bisyllabic truncated hypocoristic forms in French, which may either be anchored to the left or to the right of the input, depending on whether the ancestor begins with a consonant or a vowel:

(23)

		ancestor	*hypocoristic*	*gloss*
	C-initial, left-anchored	dorote	doro	'Dorothée'
		kɑrolin	kɑro	'Caroline'
	V-initial, right-anchored	elizɑbet	zɑbet	'Elizabeth'
		ɑmeli	meli	'Amélie'

Nelson argues that the selection of an edge for anchoring is driven by satisfaction of ONSET. This aspect of the data is not crucial to my analysis, so I will simply assume her constraints and constraint ranking for these anchoring effects without further discussion:

(24) ANCHOR-Edge >> ONSET >> ANCHOR-Left

The constraint **ANCHOR-Edge** is violated if some edge of the truncatum is not the correspondent of the same edge of the ancestor.

The constraint **ANCHOR-Left** is violated if the left edge of the truncatum is not the correspondent of the left edge of the ancestor.

The constraint **ONSET** is violated for every syllable without an onset.

It is important now to discuss the representations needed for truncation within IRC. The inputs consist of two morphemes, BASE and TRUNC, and I assume that an undominated constraint such as REALIZE MORPHEME ensures that every morpheme has a realization:

(25) If *m* is a morpheme in the input for a representation ⟨*x*,*M*⟩, then the constraint **REALIZE MORPHEME** (RLZ-M) is violated if *m* has no realization in *x*. (cf. Samek-Lodovici 1993, Gnandesikan 1997, Rose 1997, *et seq*.)

As with the realization of RED, I underline the portion of the output which is the realization of the empty morpheme TRUNC. Following Benua's terminology, I call the realization of TRUNC the **truncatum**, symbolized by τ. In reduplication, the base and the reduplicant are disjoint substrings, but in truncation, I assume the base and the truncatum are the same string. The constraint which distinguishes disjoint realizations from overlapping realizations is MORPHOLOGICAL UNIFORMITY, defined below:

(26) The constraint **MORPHOLOGICAL UNIFORMITY** (MUNIF) is violated by every segment of the output which is part of more than one realization of a morpheme.

Thus, a hypothetical reduplicated form like *budobudoga* satisfies MUNIF since the reduplicant and the base do not overlap, while a truncated form like *budo* violates MUNIF since every segment in the output is part of both the truncatum and the base. The high ranking IRC faithfulness constraint MAX-$\beta\tau$ ensures that every segment in the base β is also part of the truncatum:

(27) The Output-Output Correspondence constraint **MAX-$\beta\tau$** is violated for every segment in the base which does not have a correspondent in the truncatum.

As seen in the following tableau, MAX-$\beta\tau$ must outrank MUNIF in order to ensure that the truncatum maximally spans the base:

(28) /dorote+TRUNC/ 'Doro'

	MAX-$\beta\tau$	MUNIF
✔ a. doro		doro
b. doro	ro!	do
c. doro	do!	ro

The correct truncated form has a maximal truncatum, with two extra violations of MUNIF, whereas the failed candidates better satisfy MUNIF at the expense of MAX-$\beta\tau$.[12] These two

[12] Candidates such as *do* will be ruled out by minimal word conditions, which force French hypocoristics to be composed of at least two syllables. How this requirement interacts with normal French grammar (which allows smaller words) requires further research.

constraints have antagonistic effects: MUnif prevents overlap while Max-$\beta\tau$ forces it. The tug-of-war between these two constraints cause the deletion effects seen in truncation, as I show below.

Contra Benua, I assume that Input-Output Correspondence and Max-IO are active at all times, even in cases of truncation. Thus, Max-IO must be ranked in the hierarchy in such a way that deletion is the predicted output of truncation. The required ranking is MUnif >> Max-IO. In effect, MUnif acts as a minimization constraint. High ranking Max-$\beta\tau$ requires the truncatum to stretch from one edge of the word to the other. MUnif ranked over Max-IO essentially pulls the edges together by deleting segments in order to prevent overlap of morpheme realizations. This is exemplified in the following tableau:

(29) /dorote+TRUNC/ ‘Doro’

	Max-$\beta\tau$	MUnif	Max-IO
✔ a. doro		doro	te
b. dorot		dorot!	e
c. dorote		dorote!	
d. dorote	rote!	do	

A reduplicated candidate which avoids violations of MUnif, such as *dodo* or *dorotedorote*, does not emerge as the correct output, so some high ranking constraint must rule out copying. Various proposals exist in the literature, so I adopt *Copy as a cover constraint which could be replaced by any other constraint which prevents reduplication:

(30) The markedness constraint ***Copy** is violated for every string in the output which is phonetically identical to a different string in the output.

*Copy must outrank MUnif in order to prevent the reduplicated candidates from winning:

(31) /dorote+TRUNC/ 'Doro'

	MAX-$\beta\tau$	*COPY	MUNIF
✔ a. doro			doro
b. dodo		do!	
c. dorodoro		doro!	
d. dorotedorote		dorote!	

For these basic hypocoristic forms, IRC works well, without interfering with the ancestor forms: there is no TRUNC in the ancestor's input to create a truncatum, and thus, no need to delete segments in order to adhere to constraints which reference the truncatum. However, there are some hypocoristic forms in French which do not rely on simple truncation and require further refinement of this analysis.

2.2.2 Truncated and Reduplicated Hypocoristics

When the ancestor is bisyllabic, the hypocoristic is formed by reduplication of the first syllable (or final syllable, for vowel-initial bases):

(32)

	ancestor	*hypocoristic*	*gloss*
C-initial, left-anchored	nikol	nini	'Nicole'
	miʃel	mimi	'Michelle'
V-initial, right-anchored	emil	mimil	'Émil'
	yber	beber	'Hubert'

These facts cannot be obtained with the analysis so far, which incorrectly predicts that the truncated form *niko* (marked by ✘) will be the selected hypocoristic for *nikol*, due to the violation of *COPY incurred by the correct output *nini*:

(33) /nikol+TRUNC/ 'Nico'

	MAX-$\beta\tau$	*COPY	MUNIF	MAX-IO
✔ a. nini		ni!		kol
✘ b. niko			niko	l
c. ninikol	kol!	ni		

Nelson obtains the correct output through two assumptions. The first assumption, which I adopt for lack of a better analysis, is that some meta-linguistic functional process prevents hypocoristics from being too similar to their ancestors because a nickname should be different from the real name is it derived from. Thus, candidates like *niko* need not even be considered, as they are ruled out be being too similar (differing in only one segment). Such meta-linguistic processes are not uncommon. In the dismissive Yiddish-based *schm* echoing of English, a word is fully reduplicated, and the initial onset of the reduplicant is replaced with *schm-*, as in *deadline-schmeadline*. However, words that already begin with *schm-* do not easily undergo this process: **schmuck-schmuck*. This can be attributed to a meta-linguistic requirement that the reduplicant be different from the original word similar to that assumed by Nelson for French.

Nelson's second assumption, which is unnecessary in the IRC analysis, is that the input for *nini* is specified for reduplication rather than truncation, i.e. that the input is /nikol+RED/ rather than /nikol+TRUNC/. This is not an optimal analysis; it would be more desirable to account for all hypocoristics with the same morpheme. As is clear in the following tableau, once *niko* is removed from the candidate set via the first assumption, *nini* is selected over *ninikol* without changing the input to /nikol+RED/:[13]

(34) /nikol+TRUNC/ 'Nico'

	MAX-$\beta\tau$	*COPY	MUNIF	MAX-IO
✔ a. nini		ni		kol
b. ninikol	kol!	ni		

Thus, the IRC analysis predicts the correct output using only one morpheme for two different processes used to express the same notion. The third set of data display yet another process for creating hypocoristics. As I show, this process is also predicted to emerge from an IRC analysis.

[13] Indeed, Nelson's analysis does not quite work anyway, since /nikol+RED/ should result in *ninikol*. In order to get both truncation and reduplication, an input such as /nikol+TRUNC+RED/ is required.

2.2.3 Metathesized + Reduplicated Hypocoristics

There are certain names which, in order to avoid violations of ONSET, undergo metathesis in their hypocoristic form, since they are too small to undergo right-anchored truncation (the normal repair-strategy to prevent vowel-initial hypocoristics). Because of their small size, these forms also require reduplication to bring the hypocoristic form up to two syllables:

(35)

	ancestor	*hypocoristic*	*gloss*
V-initial[14]	iv	vivi	'Ives'
	ɑn	nɑnɑ	'Anne'

The following constraints are relevant for these data:

(36) The markedness constraint **ONSET** is violated for every onsetless syllable in the output.

If *a* precedes *b* in the input, and *a′* and *b′* are their respective correspondents in the output, then the Input-Output Correspondence constraint **LINEARITY** is violated if *b′* precedes *a′*.

LINEARITY, which prevents metathesis, is obviously violated by these forms, at the expense of ONSET. *COPY is also violated, since these forms display reduplication:

(37) /iv+TRUNC/ 'Vivi'

	ONSET	LINEARITY
✔ a. vivi		v<i
b. iviv	*!	

The other constraints do not affect the outcome: MAX-$\beta\tau$, MUNIF,and MAX-IO are all satisfied by the winning output.[15] Thus, it is unclear from these data how these two sub-hierarchies are ranked with respect to each other, yielding the following partial hierarchy for French hypocoristics:

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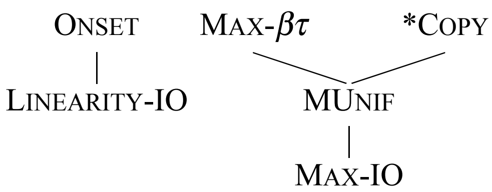
[14] Nelson does not provide cases of monosyllabic C-initial names, such as *ʒɑ̃* 'Jean'. Presumably, the hypocoristic form of these names would be simple reduplication: *ʒɑ̃ʒɑ̃*.

[15] High-ranking DEP-IO will prevent epenthesis from satisfying ONSET (as well as the minimal word conditions).

(38)



These data show that three very different phonological manipulations (truncation, reduplication, and metathesis) can be reflexes of the same word-formation processes, lending credence to IRC which treats all three as aspects of the same phenomenon. In the remainder of this section, I detail two problems with Benua's EoU analysis of truncation and offer solutions for them within IRC.

2.3 IO-Faithfulness in English Hypocoristics

In Benua's model of truncation, there is no Input-Output Correspondence relation from the input to the truncatum, so constraints like MAX-IO, FAITH-IO, etc., are ignored when evaluating a case of truncation. Benua claims that truncation is a purely transderivational process. That is, for morphologically complex words, faithfulness only exists from an ancestor to forms derived from it; only the ancestor can access the input. However, other derivational processes besides truncation certainly seem to be more faithful to the input than to an ancestor. In English, certain consonant clusters are generally prohibited in codas (**da*[mn], **bo*[mb], **you*[ŋg]), but they can appear in some derived forms (*da*[mn]*ation*, *bo*[mb]*adier*, *you*[ŋg]*er*). If the derived word could only be faithful to its ancestor, there would be no explanation for why these clusters appear. It is therefore typically assumed that such words have these clusters in the input, and that the derived words are faithful to the input, allowing the clusters to emerge. However, Benua singles out truncation, crucially preventing IO faithfulness from applying. The stipulation that truncation is different from other derivational processes is not driven by any deeper theoretical issue; it is merely an artifact of the EoU analysis, required to get the facts correct. A stronger theory would either explain why truncation should be deviant or eliminate the deviance.

This theoretical concern is not the only reason to question the EoU analysis. In some English hypocoristics, the truncated hypocoristic has an unpredictable full vowel where the ancestor has a reduced schwa:

(39) *English hypocoristics*

N[ə]thániel	>	N[é]than	J[ə]róme	>	J[ɛ́]rry
[ə]líjah	>	[í]li	Le[ə]nárdo	>	Le[ó]
Chríst[ə]pher	>	Christ[ɑ́]ph	P[ə]trícia	>	P[ǽ]t

Since this alternation is unpredictable, the quality of the vowel must be specified in the underlying form. Yet in Benua's analysis, the truncatum cannot access the vowel quality of the input, only that of the ancestor. Since the ancestor only has a schwa, the truncatum must have access to the input in order to obtain a full vowel. At minimum, Benua's analysis would have to be modified to allow for featural identity from the input to the truncatum. Yet this further weakens the EoU analysis of truncation: What theoretical motivation is there for MAX-IO (and only MAX-IO) to be ignorable exactly when TRUNC is in the input? Why do other morphemes not have this ability? Ideally, TRUNC should behave like any other morpheme, without being given special treatment.

IRC does not face this problem since there is no need to require IO faithfulness to be ignored in order to allow EoU to instigate deletion. Other constraints in the hierarchy force the truncation process to occur, so Input-Output Correspondence occurs as normal with a truncated word, as it does with any other word. Schwa is the vowel of choice in stressless syllables in English, which is why it emerges in the long forms above. I assume a cover constraint *FULLUNSTRESS which bans full vowels from being unstressed:

(40) The constraint *FULLUNSTRESS is violated by every unstressed full vowel in the output.

Ranking *FULLUNSTRESS over IDENT-IO ensures that unstressed syllables will contain schwa, regardless of the underlying vowel:

(41) /neθænjəl/ 'Nathaniel'

	*FULLUNSTRESS	IDENT-IO
✔ a. nəθǽnjəl		*
b. neθǽnjəl	*!	

The winning candidate is *nəθǽnjəl*, which has reduced [ə] in the unstressed first syllable, despite pressure from IDENT-IO to force featural identity to underlying [e]. The faithful candidate *neθǽnjəl* violates *FULLUNSTRESS due to the unstressed full vowel [e] in the first syllable.

In the shorter hypocoristic forms, the relevant syllables are not unstressed; rather, they receive primary or secondary stress, which means the vowels can be full vowels. As long as IDENT-OO is ranked lower than IDENT-IO, the hypocoristics will be more faithful to the full vowel in the input than to the schwa in the ancestor:

(42) /neθænjəl+TRUNC/ 'Nathan', ancestor = *nəθænjəl*

	*FULLUNSTRESS	IDENT-IO	IDENT-OO
✔ a. néθən		*	**
b. nə́θən		**!	*
c. néθæn	*!		*

The winning candidate *néθən* has different features from the input only in the second vowel, with reduced [ə] instead of full [æ], and it differs from the ancestor in both vowels. But the completely reduced candidate *nə́θən* differs from the input in both vowels, but from the ancestor in only the second vowel. With IDENT-IO outranking IDENT-OO, faithfulness to the input is more important than faithfulness to the ancestor, so *néθən* wins. The candidate *néθæn* is fully faithful to the input, but high ranking *FULLUNSTRESS prevents the second vowel from being full since it is unstressed. I now turn to the second problem with Benua's analysis of truncation.

2.4 A Ranking Paradox in Icelandic Deverbalization

Generally, words in Icelandic cannot have a word-final C*j* cluster (Benua 1995, 1998). They are simplified by deletion of the glide [j]. This restriction on codas is formalized below:

(43) The markedness constraint **SONCON** is violated by codas which rise in sonority.

Since deletion is used to resolve violations of SONCON, MAX-IO must be low-ranking:[16]

(44) /bylj/ ‘snowstorm’

	SONCON	MAX-IO
✔ a. byl		j
b. bylj	*!	

The correct output is *byl*, which satisfies SONCON at the expense of low ranked MAX-IO by deleting the offending *j*. The failed candidate *bylj*, while faithful to the input, violates SONCON with an ill-formed coda.

Icelandic also has a process of truncation which is used to form deverbal forms of some infinitives. If a word-final C*j* would result from this deverbalization, the *j* does not delete. Thus, MAX-OO must be ranked over SONCON:

(45) /grenjɑ+TRUNC/ ‘crying’, ancestor = *grenja*

	MAX-OO	SONCON
✔ a. grenj	ɑ	*!
b. gren	jɑ!	

The winning candidate *grenj* violates SONCON, yet manages to survive as the output via high ranking faithfulness to its ancestor *grenja*. The failed candidate incurs too many violations of high ranking MAX-OO by deleting the two segment string *ja* in order to satisfy SONCON. Combined with the previous tableau, the resulting constraint hierarchy for Icelandic is:

(46) MAX-OO >> SONCON >> MAX-IO

But if EoU is the impetus for truncation, then MAX-IO must be ranked over MAX-OO, the opposite ranking required for Icelandic. Benua does not provide any formal way to resolve this

[16] The entire analysis of Icelandic is not given here. In particular, I ignore candidates involving epenthesis, and I gloss over the specifics of SONCON.

ranking paradox. However, she does stipulate that *something* in the grammar must ensure that truncation deletes at least one segment, so that, for example, the candidate *grenja* cannot emerge as the deverbalized infinitive, despite satisfying all of the relevant constraints (in general, any language which resolves markedness through deletion, except in truncated forms, will encounter this same problem):

(47) /grenjɑ+TRUNC/ 'crying', ancestor = *grenja*

	MAX-OO	SONCON	MAX-IO
✔ a. grenj	ɑ	*!	
b. gren	jɑ!		
✘ c. grenjɑ			

While she mentions the need to eliminate *grenja* from consideration in the constraint hierarchy, Benua does not offer a formal analysis. The encoding of "delete at least one segment" directly into TRUNC is an unappealing solution for a variety of reasons. Such an encoding is very much input-dependent, rather than constraint-dependent, a step backwards for Optimality Theory, which prefers to encode phonological processes in the constraint hierarchy rather than inputs (cf. Prince and Smolensky's (1993) Richness of the Base hypothesis). In addition, there is no principled reason why TRUNC should be encoded for deletion (as opposed to epenthesis, metathesis, reduplication, etc.), or why it should be encoded to accept loss of a single segment (as opposed to two segments, a syllable, etc.). These problems point to the fact that such an encoding in the morphemes is essentially encoding derivational rules in the morphemes, allowing them to change a form in an arbitrarily specific, unmotivated fashion. Ideally, an analysis of truncation which fully conforms to the parallel ideology of Optimality Theory would move as much of the explanation out of the morphemes and into candidates and the constraint hierarchy.

As IRC has been presented so far, it does not obtain the correct results for Icelandic either. The ranking derived for French hypocoristics MUNIF >> MAX-IO incorrectly predicts *gren* as the winning candidate:

(48) /grenjɑ+TRUNC/ 'crying'

	MUNIF	SONCON	MAX-IO
✔ a. grenj	grenj!	*	ɑ
✘ b. gren	gren		jɑ
c. grenjɑ	grenjɑ!		

The only way in which *gren* is worse than *grenj* is by the fact that *gren* has deleted more segments from the input than *grenj* has. This can be captured by conjoining MAX-IO with itself (cf. Smolensky 1993 and others), so that MAX-IO^2 will be violated only when two or more segments have been deleted, but not just one. MAX-IO^2 ranked over MUNIF predicts the correct output:

(49) /grenjɑ+TRUNC/ 'crying'

	MAX-IO^2	MUNIF	SONCON	MAX-IO
✔ a. grenj		grenj	*	ɑ
✘ b. gren	jɑ!	gren		jɑ
c. grenjɑ		grenjɑ!		

Note that self-conjunction of MAX-IO is not a valid option for rescuing Benua's EoU analysis, which crucially relies on IO faithfulness being ignored in truncation. Presumably, this would carry over to conjoined IO faithfulness constraints as well.

2.5 Summary

I have shown that it is possible to motivate the segmental loss seen in truncation without relying on EoU prosodic structure. Benua's EoU analysis faces two challenges: (i) accounting for apparent IO faithfulness in English hypocoristics while maintaining the stipulation that Input-Output Correspondence is not present for truncation, and (ii) resolving the ranking paradox between MAX-IO and MAX-OO in Icelandic. In the IRC analysis detailed in this section, these challenges are not a problem, since IRC does not rely on EoU, and thus Input-Output Correspondence can function normally. In addition, the IRC approach ties truncation more closely to other processes based on empty morphemes, allowing TRUNC to trigger IRC as well. Specifically, this analysis unites three very different surface phenomena in French hypocoristics with one morpheme and one constraint hierarchy dictating which of the processes will emerge.

While this analysis steers away from Benua's EoU analysis of truncation, I should note that I am not arguing for the elimination of EoU. IRC does not preclude EoU effects from occurring in truncation. Rather, I have shown that the drive to delete segments in truncation cannot come from EoU, but can be obtained from IRC. Crucially, this is shown for Icelandic deverbalization, which is impossible to analyze as EoU but can be accounted for in IRC. In the next section, I provide an IRC analysis of a different phenomena, segmental reversal in ludlings.

3 Reversal Ludlings as IRC with Same-Edge Alignment[17]

Ludlings are 'systematic deformations of ordinary language' (Laycock 1969) characterized by one or more productive phonological processes which do not change the meaning of a word but do result in speech that is difficult to recognize for someone who does not know the rules of the ludling (see Laycock 1972 and Bagemihl 1998, 1989, 1996 for further discussion of ludlings). A common type of ludling is a reversal ludling, in which edgemost portions of a regular form appear at the opposite edge in the ludling form. Pig-Latin is a well-known reversal ludling in English that requires the initial onset of the ancestor to appear as the onset of the final syllable of the Pig-Latin form (the relevant onsets are underlined in the data below):

(50)	*ancestor*	*Pig-Latin*	*gloss*
	tæp	æptej	'tap'
	træp	æptrej	'trap'
	træpəzɔjd	æpəzɔjdtrej	'trapezoid'
	træpəzɔjdəl	æpəzɔjdəltrej	'trapezoidal'
	stræpɪŋ	æpɪŋstrej	'strapping'

In this section, I show that reversal ludlings like Pig-Latin can be analyzed as instances of IRC, just like reduplication and truncation. Additionally, my analysis provides the groundwork for restricting Generalized Alignment (McCarthy and Prince's 1993b) to allow only same-edge constraints. I begin by assuming such a restriction.

3.1 Restricted Generalized Alignment

Within natural language, there are a variety of effects associated with the alignment of different pieces of a given utterance. For example, many languages have requirements that stress must occur near or at a word edge, but no language requires stress to be strictly located on the middle syllable. Such alignment phenomena have been characterized within OT via Generalized Alignment (GA), a theory which posits the existence of a family of constraints that require edge-

[17] This section derives primarily from research in Sanders 1998 and 1999a.

wise alignment between different substrings of the output, where these substrings are defined by prosodic and morphological considerations.

GA is over-generative due to its lack of specificity for which edges of which substrings can be aligned; either edge of one prosodic or morphological unit may be aligned to either edge of a different unit. This allows both same-edge alignment (right to right, left to left) and opposite-edge alignment (right to left, left to right). Indeed, GA predicts an equal number of constraints requiring opposite-edge alignment as those requiring same-edge alignment. If all of these constraints have equal status (i.e. they can occur anywhere within a constraint hierarchy), then GA implicitly claims that there should be roughly as many opposite-edge effects as same-edge effects, all else being equal. But this is simply not the case; same-edge effects are far more prevalent than opposite-edge effects. Any survey of phonological analyses involving alignment will reveal a preference for same-edge alignment.

One seeming exception to this generalization that cannot be ignored is reversal ludlings, which are often analyzed as requiring alignment of one edge of a word to the opposite edge (as in Ito, Kitagawa, and Mester's (1996) analysis of the *zuuja-go* reversal ludling in Japanese). However, as I show in this section, it is possible to analyze reversal ludlings completely with same-edge alignment. A formalization of GA based on the proposal by McCarthy and Prince (1993b) is given below:

(51) The **Generalized Alignment** constraint **ALIGN(C_1,E_1,C_2,E_2)** is violated for every segment separating E_1 of every C_1 from E_2 of some C_2, where C_1 and C_2 are prosodic categories or morpheme realizations, and where E_1 and E_2 are each edges (right or left).

Given the overwhelming number of cases in natural language of same-edge alignment in comparison to opposite-edge alignment, the basic generalization seems to be that alignment only occurs between edges of the same type. To capture this observation, I propose that the restriction $E_1 = E_2$ must be added to GA (cf. Spaelti 1997). The addition of such a restriction leads to Restricted Generalized Alignment (RGA), which has only a single parameter for edges:

(52) The **Restricted Generalized Alignment** constraint **ALIGN-*E*(C_1,C_2)** is violated for every segment separating *E* of every C_1 from *E* of some C_2, where C_1 and C_2 are prosodic categories or morpheme realizations, and where *E* is an edge (right or left).

RGA is compatible with most uses of GA (and in fact, many researchers have adopted some version of the typographically simpler RGA notation in favor of GA notation). McCarthy and Prince (1993b) cite cases of apparent opposite-edge effects which would not be immediately accounted for by RGA. I discuss one of these cases at the end of this section. More immediately, I give an analysis within the bounds of RGA for reversal ludlings, using IRC.

3.2 The Reversal Ludling *Baliktád* in Tagalog

There are a number of ludling processes in Tagalog that fall under the name *baliktád* 'reversed' (Conklin 1956), including final syllable preposing (FSP), the form used in modern Tagalog.[18] My analysis of *baliktád* differs from most analyses of other reversal ludlings through the use of RGA rather than constraints that reference opposite edges. My IRC analysis brings ludlings more in line with the remainder of natural language[19] by accounting for an apparent case of opposite-edge alignment by means of same-edge alignment.

The FSP process in *baliktád* involves movement of the final syllable of the ancestor to the beginning of the FSP form, as seen below, in which the syllable of interest is underlined:[20]

[18] According to my two informants (in their late twenties), no other forms of *baliktád* discussed in Conklin 1956 were used in their childhood.

[19] Junko Ito (personal communication) notes that this may not be a desirable state of affairs. The facts that most languages have some form of a ludling, and that the typology of ludlings is rather small suggests that ludlings are not completely alien to our capacity for language, and thus, I believe it is not a mistake to try to pull ludlings away from the outer edges of linguistic theory.

[20] Long vowels are not phonemic; they occur only in open non-final stressed syllables. All other vowels are short. In *baliktád*, the stress is either always initial or always final. Most of the forms from Conklin 1956 which fit the pattern seen in modern *baliktád* have final stress, though a few forms have seemingly unpredictable initial stress (*tóːʔi* and *páŋit*, for example). I ignore vowel length and stress in these data and focus on the segmental content.

(53)

	ancestor	*FSP form*	*gloss*
	kapatid	tidkapa	'sibling'
	kamatis	tiskama	'tomato'
	maganda	damagan	'beautiful'
	ʔito	toʔi	'this'
	paŋit	ŋitpa	'ugly'
	na	na[21]	'already'

I propose that, just as the reduplication morpheme RED is realized as a reduplicant in the output, the morpheme LUD is realized as a substring of the output that is sensitive to constraints that reference it. I call this substring the **ludlingant** symbolized by λ. The crucial difference between ludlingants and reduplicants lies in the amount of overlap with β, the realization of BASE. In reduplication, the reduplicant is disjoint from β. However, in *baliktád* and other reversal ludlings, there is no new material in the output. Instead, LUD is expressed only by rearrangement of the segments of β. Thus, if LUD has a ludlingant as its realization, then the lack of new segments in the output forces the ludlingant to overlap with β. In this way, LUD is more similar to TRUNC, which has a realization that overlaps β as well.

If the preposed syllables in the FSP forms for *baliktád* are taken to be the ludlingants (i.e. λ = *tid* for *tidkapa*, etc.), then it is clear that the ludlingants are perfectly aligned with the prosodic word on the left, satisfying the RGA constraint ALIGN-Left(λ,PrWd):

(54) The RGA constraint **ALIGN-Left(λ,PrWd)** (ALλW) is violated by every segment that separates the left edge of every λ from the left edge of a prosodic word.

Reversal ludlings typically involve violations of the Input-Output Correspondence constraints LINEARITY (repeated below) and CONTIGUITY (McCarthy and Prince 1995) since reversal ludlings move segments from one end of the word to the other:

[21] The word *na*, like all monosyllabic words in Tagalog, does not have a *baliktád* form distinct from the base. This contrasts with the French reversal ludling *verlan*, which reverses syllables in polysyllabic words, but reverses monosyllabic words segmentally: *paʁɑ̃ > ʁɑ̃pa* 'parents' vs. *mɛk > kɛm* 'guy, dude' (Burke 1996).

(55) If *a* precedes *b* in the input, and *a′* and *b′* are their respective correspondents in the output, then the Input-Output Correspondence constraint **LINEARITY** (LIN) is violated if *b′* precedes *a′*.

If *a* is adjacent to *b* in the input, and *a′* and *b′* are their respective correspondents in the output, then the Input-Output Correspondence constraint **CONTIGUITY** (CONT) is violated if *a′* and *b′* are not adjacent.

Since *baliktád* requires satisfaction of ALλW at the expense of LIN and CONT, Tagalog must have the constraint ranking ALλW >> {LIN,CONT}, as seen in the following tableau:

(56) /kɑpɑtid+LUD/ 'sibling'

	ALλW	LIN	CONT
✔ a. tidkɑpɑ		tid<kɑpɑ	ɑt
b. kɑpɑtid	*!		

The ludlingant is right-anchored to BASE. That is, the rightmost segment of BASE (in this case, *d*) has a correspondent in the output that is the rightmost element of the ludlingant. This is satisfaction of IO-ANCHOR-Right(BASE,λ):

(57) If *a* is in the input, and *a′* is its correspondent in the output, then the anchoring constraint **IO-ANCHOR-Right(BASE,λ)** (ARBλ) is violated if *a′* is the rightmost segment of a ludlingant, and *a* is not the rightmost segment of the BASE.[22]

High ranking of ARBλ ensures that λ is right-anchored, moving material from the rightmost edge of the BASE:

[22] The connection between anchoring and alignment is a question yet to be adequately answered. McCarthy and Prince (1995) argue that ANCHOR constraints (which they define using only one parameter for edges) can subsume most of the effects of ALIGN constraints, but do not offer a full picture of how to completely eliminate ALIGN constraints. A reasonable line of analysis (which I do not formalize here, but which is consistent with the work in this paper) is that ANCHOR constraints are the more general constraints dictating edgewise correspondence between strings, with ALIGN constraints representing those cases in which the two strings are substrings of the same string. In other words, ALIGN constraints are merely intra-representational ANCHOR constraints. See Herrick 2000 for one attempt to formalize ANCHOR constraints to subsume ALIGN constraints.

(58) /kapatid+LUD/ ‘sibling’

	ARBλ	LIN	CONT
✔ a. tidkapa		tid<kapa	at
b. kapatid	*!		

If MAX-IO is ranked too low, IRC results in truncation as in the previous section. Thus, MAX-IO must be high ranking:

(59) /kapatid+LUD/ ‘sibling’

	MAX-IO	LIN	CONT
✔ a. tidkapa		tid<kapa	at
b. tid	kapa!		

To prevent a form with no ludlingant from winning, RLZ-M must outrank LIN and CONT:

(60) /kapatid+LUD/ ‘sibling’

	RLZ-M	LIN	CONT
✔ a. tidkapa		tid<kapa	at
b. kapatid	LUD!		

In truncation, the truncatum τ is exactly equal to the base β, resulting in maximal overlap between the two morpheme realizations, and thus total satisfaction of MAX-$\beta\tau$. For reversal ludlings like *baliktád*, not every segment in β is in the ludlingant λ since the ludlingant is only one syllable of the output, so MAX-$\beta\lambda$ is violated and must be low ranking:

(61) /kapatid+LUD/ 'sibling'

	RLZ-M	MAX-IO	LIN	CONT	MAX-$\beta\lambda$
✔ a. tidkapa			tid<kapa	at	kapa
b. tid		kapa!			
c. kapatid	LUD!				

As with the truncatum in truncation, the size of the ludlingant is controlled by the constraint MUNIF. Candidates with too much overlap between morpheme realizations are ruled out by high ranking MUNIF:

(62) /kapatid+LUD/ 'sibling'

	MUNIF	LIN	CONT	MAX-$\beta\lambda$
✔ a. tidkapa	tid	tid<kapa	at	kapa
b. patidka	patid!			ka
c. kapatid	kapatid!			

Since the candidate without a ludlingant satisfies MUNIF perfectly, MUNIF must be ranked lower than RLZ-M:

(63) /kapatid+LUD/ 'sibling'

	RLZ-M	MUNIF
✔ a. tidkapa		tid
b. kapatid	LUD!	

This yields the final constraint ranking for *baliktád*:

(64) RLZ-M

MUNIF MAX-IO ARλB ALλW

MAX-$\beta\lambda$ LIN CONT

3.3 The Reversal Ludling *Zuuja-go* in Japanese

Zuuja-go is a reversal ludling in Japanese which behaves somewhat similarly to FSP in *baliktád*. In the data below, the preposed syllable is underlined:

(65)

ancestor	*zuuja-go*	*gloss*
fumeN	meNfu	'musical score'
tɑkuʃiː	ʃiːtɑku	'taxi'
kɑnoː	noːkɑ	'possible'
koːhiː	hiːkoː	'coffee'

Ito, Kitagawa, and Mester (1996) (henceforth IKM) give an extensive account of *zuuja-go*, analyzing various properties of the reversal ludling. In order to motivate the *zuuja-go* reversal, IKM devise the constraint CROSS ANCHOR, an opposite-edge constraint that anchors strings at both edges of BASE to strings at their respective opposite edges in the output. CROSS ANCHOR achieves the correct results, forcing *zuuja-go* forms to have the required reversal, but it is clear that CROSS ANCHOR is only a stipulation to drive the ludling, allowing IKM to analyze the other side effects of *zuuja-go*. In the remainder of this section, I give an analysis of *zuuja-go* in the same vein as the one just given for *baliktád*. My analysis of *zuuja*-go maintains the insights of IKM's analysis with respect to the properties of *zuuja-go* while eschewing opposite-edge constraints in favor of RGA.

I begin by assuming the same constraint hierarchy derived for *baliktád*. As the following tableaux show, the *zuuja-go* data in (65) are accounted for by this constraint hierarchy:

(66) /fumeN+LUD/ 'musical score'

	RLZ-M	MUNIF	LIN	CONT	MAX-$\beta\lambda$
✔ a. meNfu		meN	meN<fu	um	fu
b. fumeN		fumeN!			
c. fumeN	LUD!				

The winning candidate *meNfu* incurs fewer violations of MUNIF than *fumeN* does, due to less overlap between the base and the ludlingant. High ranking RLZ-M ensures that LUD has a realization in the output, preventing *fumeN* from emerging.

(67) /fumeN+LUD/ 'musical score'

	MAX-IO	LIN	CONT	MAX-βλ
✔ a. meNfu		meN<fu	um	fu
b. meN	fu!			

Here, the winning candidate defeats the truncated candidate *meN* by high ranking MAX-IO.

(68) /fumeN+LUD/ 'musical score'

	ARBλ	ALλW	LIN	CONT
✔ a. meNfu			meN<fu	um
b. fumeN		*!		
c. fumeN	*!			

The anchoring and alignment constraints ARBλ and ALλW ensure that the ludlingant contains material from the rightmost portion of the BASE and appears as the leftmost portion of the prosodic word. The failed candidates *fumeN* and *fumeN* only satisfy one of these two constraints each. As is clear from these examples, IKM's CROSS ANCHOR constraint, which references opposite edges, is not necessary to motivate the segmental movement characteristic of *zuuja-go*. Rather, a combination of RGA and IRC can obtain the correct pattern.

In the remainder of this section, I examine a non-ludling case of apparent opposite-edge effects. Again, I show that it is possible to account for these effects using RGA rather than opposite-edge constraints allowed by GA.

3.4 Ulwa Possessive Infixation

McCarthy and Prince (1993b) cite data from Ulwa as evidence for opposite-edge alignment constraints. In Ulwa, a possessive infix immediately follows the initial syllable of the possessed noun if the first syllable is heavy (69a). If the first syllable is not heavy, the possessive infix immediately follows the second syllable, regardless of its weight (69b). In the following data, the possessive infix of interest *ka* 'his' is underlined:

(69)	*noun*	*'his' noun*	*gloss*
a.	bas	bas<u>ka</u>	'hair'
	ki:	ki:<u>ka</u>	'stone'
	su:lu	su:<u>ka</u>lu	'dog'
b.	sana	sana<u>ka</u>	'deer'
	siwanak	siwa<u>ka</u>nak	'root'
	ana:la:ka	ana:<u>ka</u>la:ka	'chin'

There is an over-riding requirement that the base β be aligned to the left of the prosodic word, which means the following constraint is high ranking:

(70) The RGA constraint **ALIGN-Left(β,PrWd)** (ALβW) is violated by every segment that separates the left edge of every β from the left edge of a prosodic word.

A secondary tendency is for the realization π of possessive morpheme POSS to also be left-aligned:

(71) The RGA constraint **ALIGN-Left(π,PrWd)** (ALπW) is violated by every segment that separates the left edge of every π from the left edge of a prosodic word.

Ranking ALβW over ALπW achieves the correct results for the data in (69a):

(72) /bas+ka/ 'his hair'

	ALβ W	ALπ W
✔ a. bas<u>ka</u>		*
b. <u>ka</u>bas	*!	

The winning candidate has the base left-aligned at the expense of left-aligning <u>*ka*</u>. Candidates such as *b<u>ka</u>as* are ruled out by undominated constraints on the well-formedness of syllables.

However, a candidate like *ba<u>ka</u>s* seems to be more harmonic than *bas<u>ka</u>*, since the <u>*ka*</u> is closer to the left edge in *ba<u>ka</u>s*:

(73) /bɑs+kɑ/ 'his hair'

	ALβ W	ALπ W
✔ a. bɑs<u>kɑ</u>		bɑs
✘ b. bɑ<u>kɑ</u>s		bɑ

An examination of the ancestor form's prosodic constituency reveals the solution to this problem. The unpossessed noun *bas* is a foot. Not only that, it is the head foot. In the desired output *bas<u>ka</u>* for /bɑs+kɑ/, the first syllable *bas* is the head foot because the leftmost head in Ulwa is the head. Thus, there must be a high ranking constraint ensuring faithfulness between the head feet of an ancestor and words derived from it. I offer the following constraint to govern this prosodic faithfulness:

(74) If *a* is in an ancestor, and *a′* is its correspondent in a form derived from that ancestor, then the Output-Output Correspondence constraint **DEPHEAD** (DEPHD) is violated if *a′* is in a head foot but *a* is not.

Ranking DEPHD over ALπW prevents *ka* from appearing in the head foot, which I now indicate with parentheses:

(75) /bɑs+kɑ/ 'his hair', ancestor = *(bas)*

	ALβ W	DEPHD	ALπ W
✔ a. (bɑs)<u>kɑ</u>			bɑs
✘ b. (bɑ<u>kɑ</u>s)		kɑ!	bɑ

McCarthy and Prince (1993b) achieve a similar result using a 'subcategorizing' opposite-edge constraint which requires the left edge of the possessive to be aligned to the right edge of a prosodic word. As stated before in this section, such constraints demonstrate the over-generative power of GA. There is no need for opposite-edge alignment if RGA and Output-Output Correspondence can account for the same range of facts.

My RGA does indeed account for these facts, including the appearance of *<u>ka</u>* immediately after the second syllable when the first syllable is not heavy, since the first two syllables comprise the head foot and thus will not allow *<u>ka</u>* to appear there:

(76) /ɑnɑːlɑːkɑ+kɑ/ 'his chin', ancestor = *(ana:)la:ka*

	ALβ W	DEPHD	ALπ W
✔ a. (ɑnɑː)<u>kɑ</u>lɑːkɑː			ɑnɑː
b. (ɑnɑː)lɑː<u>kɑ</u>kɑː			ɑnɑːlɑː!
c. (ɑnɑː)lɑːkɑː<u>kɑ</u>			ɑnɑːlɑːkɑː!
d. (ɑ<u>kɑ</u>)nɑːlɑːkɑː		nɑː!	ɑ

The winning form *(ana:)<u>ka</u>la:ka:* has a *<u>ka</u>* that is further to the left than the *<u>ka</u>* in either *(ana:)la:<u>ka</u>ka:* or *(ana:)la:ka:<u>ka</u>*, thus ALπW selects *(ana:)<u>ka</u>la:ka:*. If *<u>ka</u>* were aligned any further left, it would intrude upon the head foot, incurring a violation of DEPHD, as *(a<u>ka</u>)na:la:ka:* does.

Many other constraints must be brought into play at some point (MAX-IO, ALLFTLEFT, CONT, etc.) to completely account for the data, but the core difference between my RGA analysis and McCarthy and Prince's (1993) analysis is demonstrated above, clearly showing how this apparent case of opposite-edge alignment can be analyzed within the confines of RGA.

3.5 Summary

I have shown in this section that IRC can be used to account for the reversal patterns seen in some ludlings, such as *baliktád* in Tagalog and *zuuja-go* in Japanese. The IRC is particularly well-matched to RGA, requiring no opposite-edge alignment constraints to account for drastic movement of segments from one end of the word to another. In addition, I have shown that RGA can be used to account for other purported instances of opposite-edge alignment, thus eliminating the need for opposite-edge constraints.

4 Conclusion

In this paper, I have provided an expansion of McCarthy and Prince's (1995) base-reduplicant correspondence that allows other instances of empty morphemes to be accounted for in the same style of analysis. This is desirable for a number of reasons: (i) empty morphemes are generally expressed as manipulations of the existing segments of the base; (ii) the realizations of empty morphemes often conform to prosodic units; and (iii) empty morphemes are typically semantically empty or have only an iconic meaning. If reduplication, truncation, and reversal ludlings were analyzed as completely independent phenomena, there would be no reason within the theory why all three processes behave similarly with respect (i)–(iii) above, or why all three processes are possible ways to form hypocoristics in French. Instead, the connection between the three processes would have to be stated as a stipulation.

By analyzing the realization of empty morphemes as Intra-Representational Correspondence, I not only avoid the stipulations needed to account for their similar behavior, but I also provide solutions to other problems in the theory. The standard Output-Output Correspondence analysis of truncation due to Benua (1995, 1998) does not explain why truncation occurs at all, and it encounters a ranking paradox in Icelandic. My intra-representational analysis of truncation solves both of these problems, again by avoiding the stipulations needed to get the output-output analysis to work. By analyzing reversal ludlings as instances of Intra-Representational Correspondence, I also provide an analysis couched within Restricted Generalized Alignment, avoiding the use of opposite-edge constraints for the most extreme case of opposite-edge effects, which supports the notion of eliminating them from the theory completely.

Thus, I have shown that a modest expansion of one aspect of the theory can lead to (i) a unification of apparently related phenomena; (ii) solutions for unsolved problems, both theoretical and empirical; and (iii) the elimination of unnecessary components of the theory.

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