

Recoverability as Faithfulness Relations in Correspondence Theory*

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Borim Lee. 1997. Recoverability as Faithfulness Relations in Correspondence Theory. *Studies in Phonetics, Phonology and Morphology* 3, 167-181. The goal of this paper is to reexamine a set of phenomena related to truncation in Lardil within the framework of Optimality Theory. Truncation causes loss of information, and it sometimes is compensated by some processes which help in retrieving the lost information. Those processes of a global property have defied plausible analyses within the traditional rule-ordering framework. I argue in this paper that the right key to the problem is in capturing the notion of recoverability within a formal framework. In Correspondence theory, I propose, recoverability of lost features can be measured by faithfulness relations applied to featural correspondence between input and output. (Wonkwang University)

1. The Issues

1.1. Background

In this section, I will present the Lardil sound system and its well-known word-final truncation phenomena. Lardil is an Australian language spoken on Mornington Island, which is one of the Wellesley group at the bottom of the Gulf of Carpentaria (Hale 1973:421). The vowel and consonant system of Lardil is as follows:

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(1)

Vowels		Consonants					
i u ε a		Bilabial	Lam-den	Api-den	Api-pal	Lam-pal	Velar
		p	t̪	t	t̺	tʲ	k
		m	ɱ	n	ɲ	nʲ	ŋ
				l			
				r	r̺		
		w			y		

As shown in the above table, Lardil has a rich system of coronal consonants: apico-alveolar, apico-alveopalatal (=retroflex), lamino-dental (=interdental), and lamino-alveopalatal.

A set of extensive phonological alternations in nominal paradigm of Lardil has been well documented in literature (Hale 1973, Wilkinson 1976, Prince and Smolensky 1993 among others). In this section I will illustrate just three alternations that lead to word-final truncation, which will be sufficient for our purpose.

First, a word-final vowel is deleted when a word has more than two syllables in it. Though truncation occurs only in the nominative, all three paradigms are presented for the purpose of identifying stems.

(2)	Nominal	Nonfut-acc	Future-acc	Gloss
	yalul	yalulu-n	yalulu-r	'flame'
	mayar	mayara-n	mayara-r	'rainbow'
	karikar	karikari-n	karikari-wur	'butter-fish'
	yiliyil	yiliyili-n	yiliyili-wur	'oyster sp.'

Apocope may result in a consonant cluster in the word-final position. Since Lardil does not allow complex segments in the onset or coda, the cluster is simplified by deletion of the final consonant.

(3)	Nominal	Nonfut-acc	Future-acc	Gloss
	yukar	yukarpa-n	yukarpa-r	'husband'
	wulun	wulunka-n	wulunka-r	'fruit sp.'

wuʔal	wuʔaltʰi-n	wuʔaltʰi-wur	'meat'
kantukan	kantukantu-n	kantukantu-r	'red'
karwakar	karwakarwa-n	karwakarwa-r	'wattle sp.'

Finally, some consonants in the word-final position are again deleted irrespectively of their origin. The deleted consonants are always non-apical, and consequently Lardil retains only vowels and apical consonants word-finally in the surface.

(4) Nominal	Nonfut-acc	Future-acc	Gloss
turara	turaraŋ-in	turaraŋ-kur	'shark'
galu	galuk-in	galuk-ur	'story'
putu	putuka-n	putuka-r	'short'
murkuni	murkunima-n	murkunima-r	'nullah'
ɣawuɣa	ɣawuɣawu-n	ɣawuɣawu-r	'termite'
tipiti	tipitipi-n	tipitipi-wur	'rock-cod sp.'
ʔapu	ʔaputʰi-n	ʔaputʰi-wur	'older brother'
tʰumputʰu	tʰumputʰumpu-n	tʰumputʰumpu-r	'dragon-fly'
mugkumu	mugkumugku-n	mugkumugku-r	'wooden axe'

The reality of the above alternations is illustrated in the productive reduplicated nominative forms in the lexicon, e.g., /mugkumugku/ → [mugkumu], where apocope, cluster simplification and nonapical deletion seem to have applied sequentially.¹⁾ Truncation is also a part of borrowed words from English, e.g., /ʔarawuʔa/ → [ʔarawu] 'trousers', /watʰpela/ → [watʰpel] 'white-fellow' (Hale 1973:435 fn.).²⁾

¹ Most of the reduplicated forms do not have their original underlying forms in the lexicon. In the rare cases where they do exist, there is not always the obvious semantic relationships between the forms.

/kantu/	'blood'	/kantukantu/	'red'
/karmu/	'bone'	/karmukarmu/	'bony, skinny'
/paŋa/	'stone'	/paŋapaŋa/	'stony, rocky'
/wiʔe/	'inside'	/wiʔewiʔe/	'open sea'
/karwa/	'hard'	/karwakarwa/	'wattle sp.'
/ɣawu/	'dog'	/ɣawuɣawu/	'termite'

² It may be strange to note that truncation processes do not normally apply to

1.2. Phantom-Limb Phenomenon

Extensive truncation in Lardil causes loss of information to a greater or lesser extent. There can, however, be some mechanism which helps retrieve the lost information, if the effect is not far-reaching. Hale (1973:439 fn.) indeed presents some puzzling data involving influence of deleted segments over the remaining segments.

The first case is the behavior of [r], which alternates with [n] before a nasal. The choice is usually optional; if a following nasal is lost, however, the choice is always [n].

(5) /karmukarmu-n/	[karmukarmun]	nonfuture
	[kanmukanmun]	
/karmukarmu/	[karmukan]	nominative
	[kanmukan]	
	*[karmukar] or *[kanmukar]	
(6) /kiyaŋ-in/	[kiyaŋin]	nonfuture
	[kiyaŋin]	
/kiyaŋ/	[kiyan]	nominative
	*[kiyar]	

The second case is palatalization of the final [n] to [nʲ] before a palatal consonant only if a triggering palatal is deleted.

(7) /puŋtuntʲa/	[puŋtunʲ]	'tree sp.'
/puŋtuntʲa-n/	[puŋtuntʲan]	nonfuture

The final case is observed in extratenseness (indicated by boldface letters) in the final vowels before deleted glides.

(8) /pukatʲiya/	[pukatʲi]	'hawk sp.'
/rulguriwa/	[rulguri]	'white crane'
/pawuwa/	[pawu]	'pelican'

the borrowings from Mainland Australian languages. Examples such as /garitypalan/, /panarinyi/, /palyarinyi/, and /kamaragi/ do not normally truncate, but introduce an alien phonological segment into the language, i.e., /ly/. (Hale 1973:435, fn.)

Hale notes that the above phenomenon of surviving features of deleted segments in the remaining segments was dubbed "phantom-limb phenomenon" by S.J. Keyser. In the following subsection, an attempt to account for the above data within a rule-ordering framework will be provided.

1.3. An Analysis of syllable readjustment in rule-ordering framework

Donegan and Stampe (1978:25-6) propose a syllabification solution for the first two cases of phantom-limb phenomenon above. They suggest that the optional assimilation of [r] to a following nasal become obligatory within syllables. Regarding palatalization of [n] before [t^y], they assume that it is obligatory within a syllable and inapplicable in larger domains. Their proposal within a rule-ordering framework would look like the following, where . indicates a syllable boundary.

(9)	a.	kar . mu . kar . mu	b.	puŋ . tuŋ . t ^y a
	apocope	kar . mu . karm		puŋ . tuŋ ^y
	assim	kar . mu . kanm		puŋ . tuŋ ^y t ^y
		(kan . mu . kanm)		
	simpli	kar . mu . kan		puŋ . tuŋ ^y
		(kan . mu . kan)		
		[karmukan] or [kanmukan]		[puŋtuŋ ^y]

Donegan and Stampe then assert that these examples provide evidence of syllabification on nonterminal stages, not just on the output. Extratenseness case in final vowels before deleted glides, which Donegan and Stampe do not discuss, has to introduce an intermediate glide-final syllable, which is undocumented in Lardil.

Their analysis, however, offers problems because intermediate syllabification results in a CVCC syllable which is not allowed in the surface forms.³ The rule-ordering approach meets with more difficulties when the form [puŋtuŋ^y] is considered, since it has an otherwise

³ There might be just one exception to *CVCC syllable: [taŋka] 'barracuda'. In another source, however, it is given as [tanka] which is consistent with overall Lardil phonology.

disallowed word-final consonant, a lamino-palatal, which is subject to the non-apical deletion, therefore *[puŋtu]. Refining the rule ordering does not help, since if /tʲ/ deletes before it assimilates the preceding /n/ to [nʲ], *[puŋtun] will result. This exceptionality to the otherwise productive rule needs to be somehow explained.

In the next section, I will introduce a constraint-based framework of Optimality Theory and show how these puzzling data are treated in that alternative theory.

2. A Standard Optimality Theoretic Account

Optimality Theory (OT hereafter) is a constraint-based model proposed by Prince and Smolensky (1993) (P&S hereafter) and developed by McCarthy and Prince (1993). OT does not assume rules and derivations, but instead, a set of universal constraints that are ranked language specifically determines the well-formedness of output candidates.

Prince and Smolensky (1993) presented a thorough analysis of Lardil truncation and other related phenomena within a standard OT framework. I will begin by summarizing their analysis focusing only on three cases of truncation discussed in Section 1.

2.1. Prince and Smolensky's Analysis of Lardil Truncation

In any analysis, the deletion of word-final vowels should be treated as an idiosyncratic aspect in Lardil. P&S formulate the following constraint for that purpose (P&S1993:101).

- (10) Free-V: Word-final vowels must not be parsed (in the nominative).

Cluster simplification is then attributed to a basic syllable structure constraint (P&S 1993: 87).

- (11) *Complex: No more than one C or V may associate to any syllable position node.

Finally, non-apical deletion is taken care of by a coda condition (P&S 1993:99).

- (12) Coda-Cond: A coda consonant can have only (apical:BL) coronal place or else no place specification of its own at all.⁴⁾

Due to this constraint, Lardil codas may be occupied only by apical coronals and by nasal homorganic with a following (onset) consonant.

All three constraints above conspire to eliminate word-final segments, hence they all dominate PARSE.⁵⁾ A sample illustration below will make the point clear.

- (13) /mʊŋkumʊŋku/ → [mʊŋkumu]

	*Complex	Coda-Cond	Free-V	PARSE
a. mʊŋkumu<ŋku>				***
b. mʊŋkumʊŋku			*	
c. mʊŋkumʊŋk<u>	*			*
d. mʊŋkumʊŋ<ku>		*		**

The more faithful candidates to the underlying form lose because they violate higher ranking constraints. The least faithful candidate in (13a), therefore, wins since it violates only the low ranking PARSE.

⁴ Prince and Smolensky assume that out of four coronal places, lamino-dental, apico-dental, apico-palatal, and lamino-palatal, only lamino-dentals are not allowed in the coda and that lamino-dentals in fact have velarized character in addition to being coronal. The coronal place in their coda condition therefore should be only pure coronal, not even a coronal with secondary articulation. However, it is not clear how their analysis deals with a case where a lamino-palatal is deleted apparently by the coda condition: /tʰaputʰi/ → [tʰapu] 'older brother' from the data given in (4) in the text.

⁵ *Complex and Coda-Cond in Lardil are undominated. On the other hand, Free-V should be dominated by a constraint on word size, i.e., a word-final vowel is deleted only in a word with more than two syllables. For details, see references cited in this paper.

2.2. A Standard OT treatment of Phantom-Limb Phenomenon

When the above-mentioned phantom-limb phenomenon is considered within the standard OT framework, the account will be problematic in that the standard PARSE cannot distinguish a complete loss of segment from a partial loss of segmental features. Consider the following tableau:

(14) /karmukarmu/ → [karmukan]⁶⁾

	*Complex	Coda-Cond	PARSE
a. karmukar<mu>			**
b. karmukan<mu>			**
c. karmukarm<u>	*	*	*

Applying the same ranking, we end up with two candidates which tied in the proposed constraint ranking. This presents the need to elaborate the PARSE constraint, and I attempt a solution in the correspondence version of this constraint.⁷⁾

In the next section, I will explore a correspondence-based analysis of the given data through the discussion of the notion of recoverability which can be captured through faithfulness relations between input and output.

⁶ When the input has C₁C₂, C₂ gets deleted. In the traditional rule-based phonology, it was handled by stipulation in the rule formation, for example, C₁C₂ → 1 ∅. In OT, on the other hand, this phenomenon can be captured more explanatorily, by either the undominated constraint of Contiguity which ensures that we do not skip segments of a string or by a generalized alignment constraint (M&P 1993b).

⁷ See Larrontagne and Rice (1995) for a similar argument for a correspondence version of PARSE to distinguish coalescence found in many Athapaskan languages from simple deletion of segments.

3. A Correspondence Theoretic Analysis

3.1. Recoverability in Languages

If a surface form preserves underlying distinctions intact, there will be no problem in recovering the underlying form. Kaye (1974, 1975) defines recoverability as a functional notion viewing phonology as a parsing device. The fewer the number of potential sources for a given surface form, the greater its recoverability. In this sense, the altered part of the context is more easily recoverable if it has left a trace on the phonetic material that remains, such as the phantom-limb phenomenon of Lardil.

Kaye (1974) also suggests that development of a novel segment (i.e., a segment which is not part of the inventory of underlying segments) in the surface increases the recoverability of the underlying form. Lardil word-final palatal in [pʊntʊnʲ] may be one such case in that, though present in the underlying inventory of Lardil consonants, it is not normally allowed in that position in the surface. By the presence of an unusual segment, the existence of a deleted palatal can be deduced.

Below I will discuss how this functional aspect of a language can find its proper place in a formal theory of correspondence developed by McCarthy and Prince (1995).

3.2. Faithfulness and Correspondence Theory (CT)

McCarthy and Prince (1995) (M&P hereafter) capture faithfulness relations of input and output by correspondence, which was originally designed to account for base-reduplicant identity in reduplicative morphology. The function of correspondence, therefore, expresses the dependency of the output or the reduplicant (S2) on the input or the base (S1). The crucial constraints of correspondence are as follows:

- (15) Max: Every element of S1 has a correspondent in S2.
- (16) Dep: Every element of S2 has a correspondent in S1.
- (17) Ident(F): Correspondent segments have identical values for the feature F.

Max and Dep replace Parse and Fill of the standard OT framework. In M&P, Ident is based on segmental correspondence, so featural relations must be construed through segments. As M&P (1995:17) suggest, however, extending the correspondence relation to features is necessary, and I will pursue this notion of featural correspondence in the next section.

3.3. A CT Account of Phantom-Limb Phenomenon

I will begin by defining the phantom-limb phenomenon, where a feature of a deleted segment survives in a preceding segment, as a case of coalescence. In this so-called phantom-limb phenomenon, specific features of deleted segments are coalesced with the preceding segments. In terms of correspondence, some feature of input still corresponds to that of output even when there is no correspondence in the root node level. I argue that this is one of the cases of feature level correspondence M&P(1995:13-4) mention in their discussion of Ident constraints.

Now consider the case of /r/ to [n] before a deleted nasal. The data are repeated below for convenience of reference:

- | | |
|-------------------|--|
| (18) /karmukarmu/ | [karmukan] or [kanmukan]
*[karmukar] or *[kanmukar] |
| (19) /kiyarŋ/ | [kiyan] but *[kiyar] |
| /kiyarŋ-in/ | [kiyanŋin] or [kiyarŋin] |

The key to this problem should be found in the faithfulness constraint on nasality, specifically Ident constraint on [nasal]. It is also necessary to distinguish the constraint in terms of its feature value. Note that [+nasal] in the input should never be lost in the output, whether under the original root node or coalesced with the remaining segment. On the other hand, identity on [-nasal] doesn't seem to be considered as important: /r/ turns into [n] (sometimes optionally). I suggest that Ident constraint on nasal be interpreted along the line of Parse on the basis of featural correspondence. In addition, Max-IO(root node) will check for segmental level faithfulness. Faced with various

syllable phonotactic constraints, segments are truncated, resulting in Max-IO (root node) violations. Ident-IO[+nas] should be higher ranked than Ident-IO[-nas] and at the same time a constraint against coalescence, namely Uniformity (M&P 1995:66).

An example tableau will follow the constraints and their ranking.

(20) Ident-IO[+nas]: A [+nasal] feature in the input should be present in the output.

Ident-IO[-nas]: A [-nasal] feature in the input should be present in the output.

Uniformity: Multiple input elements may not be mapped to a single correspondent in the output.

(21) Max-IO[+nas] > Ident-IO[-nas], Uniformity

(22) /kiyar₁ŋ₂/ → [kiyan]

/kiyar ₁ ŋ ₂ /	*Complex	Max-IO (root)	Ident-IO [+nas]	Ident-IO [-nas]	Uniform
a. kiyar ₁₂		*		*	*
b. kiyar ₁		*	*		
c. kiyar ₁ ŋ ₂	*				

The constraint against complex onset and coda excludes the candidate in (22c) successfully. Candidates (22a) and (b) tie with respect to that constraint by deleting the final consonant, each thereby violating the root parsing constraint once. Then the deciding vote is cast by a feature level faithfulness constraint, Ident-IO[+nas]. The optimal candidate in (22a) wins by preserving nasality of input at the expense of violating the less important constraints on nonnasal identity and uniformity of input and output.

Before taking up the next case of feature survival, let us discuss the subject of optionality of sonorant nasalization when the source nasal segment is preserved in the output because it is not subject to various truncation, e.g., [karmukan] and [kanmukan]. Other things being equal, the proposed ranking of the constraints will only choose [karmukan] as an optimal output, because it is the most faithful candidate and still does not violate any of the proposed constraints.

For [kanmukan] to surface, then, we would need constraints to foster sonorant assimilation when two sonorant consonants are juxtaposed. It is sufficient to have a negative constraint prohibiting a consecutive sonorant cluster with conflicting nasal features to output [kanmukan] instead of some imaginable *[karwukan], since a more dominant constraint, Ident-IO[+nas], prevents an input nasal from turning into a nonnasal in the output. These constraints are in conflict with Ident-IO[-nas] that we placed very low in the tableau (22). If Ident-IO[-nas] is placed higher than *Nasal Clash in (23), there can be no nasal assimilation as in tableau (24) below; otherwise, the result is -nm- cluster as in tableau (25).

- (23) *Nasal Clash (NC) : * [+son]
 / \
 [-nas] [+nas]

(24) /karmukarmu/ → [karmukan]

	Ident-IO[+nas]	Ident-IO[-nas]	*NC
a. kanmukan		**	
b. karmukan		*	*
c. karwukan	*	*	

(25) /karmukarmu/ → [kanmukan]

	Ident-IO[+nas]	*NC	Ident-IO[-nas]
a. kanmukan			**
b. karmukan		*	*
c. karwukan	*		*

Let us now turn to the second case of the phantom-limb phenomenon, where /n/ before a deleting [tʲ] surfaces as /nʲ/. The relevant data are repeated in (26):

- (26) a. /pʌntʌntʲa/ [pʌntʌnʲ] 'tree sp.'
 b. /pʌntʌntʲa-n/ [pʌntʌntʲan] nonfuture

This case can be handled in the same way as the previous one,

except that it also involves the emergence of a normally prohibited segment in the word-final position, namely, a lamino-palatal. I argue that, as briefly mentioned in section 3.1, this is a case where faithfulness wins over structural constraint such as coda condition, to enhance recoverability of the underlying form.

Again, we need a faithfulness constraint of a specific feature, in this case, palatality. The secondary palatal feature of input survives after its host gets deleted due to *Complex. However, the resulting segment, [nʲ], surfaces despite being that it is against Coda-Cond, hence the following ranking in (27) and a sample tableau in (28).

(27) *Complex > Ident-IO(pal) > Coda-Cond

(28) /pʊŋtʊnʲtʲa/ → [pʊŋtʊnʲ]

/pʊŋtʊnʲtʲa/	*Complex	Ident-IO (pal)	Coda-Cond	Max-IO (root)
a. pʊŋtʊnʲtʲ			*	**
b. pʊŋtʊnʲ		*		**
c. pʊŋtʊnʲtʲ	*			*

Earlier in section 2.2, the analysis did not produce the relevant ranking for *Complex and Coda-Cond: it was sufficient to posit both of them as undominated constraints. In the above case of palatal survival, however, the emergence of a specific faithfulness constraint makes it necessary to posit a firm ranking between them by placing itself right in between them.

Finally extratenseness observed in a vowel preceding a deleted glide should receive a uniform treatment, i.e., as a case of faithfulness on a vocalic feature, dominating a constraint against coalescence. Then, it is assumed that a (high) vowel merged with additional vocalic feature under a same root node surfaces as a tense vowel.

Before concluding, let us consider a residual problem in the above cases of feature survival after the deletion of the host. The palatal case was notable in showing that feature identity can be so strong that it can even dominate a constraint which was considered undominated. However, this is not always the case when we consider an example

like /muŋkumuŋku/ → [muŋkumu]. In this case, a nasal [ŋ] is deleted by violating Coda-Cond, but its nasality does not survive in the output. Likewise, in /wuɬaltʲi/ → [wuɬal] the deleted /tʲ/ by *Complex does not leave its palatality in the output. I propose that the answer is Structure Preservation ensuring that languages may not produce segments which were not present in their underlying inventory. That is to say, Lardil does not allow nasalized vowels or palatalized lateral /tʲ/.

4. Conclusion

In this paper, I have discussed three cases of feature survival after the deletion of its host and they were treated as faithfulness of certain features between input and output under the framework of correspondence proposed by M&P (1995). In doing so, I proposed that Ident-IO(feet) be construed on the basis of feature level correspondence apart from the segment which is (or was) the host of the feature. I also showed that Ident constraints on features need to be interpreted in terms of parsing, and that Ident on a feature can be divided into its \pm values.

References

- Donegan, P.J. and D. Stampe 1978. The syllable in phonological and prosodic structure, *Syllables and Segments*, A. Bell and J. B. Hooper, eds., North-Holland Publishing Company, 25-34.
- Hale, Kenneth 1973. Deep-surface canonical disparities in relation to analysis and change: An Australian example, *Current Trends in Linguistics*, 11, 401-458.
- Kaye, Jonathan 1974. Opacity and recoverability in phonology, *Canadian Journal of Linguistics*, 11, 401-458.
- 1975. A functional explanation for rule ordering in phonology, *Papers from the parasession on functionalism*, Chicago: Chicago Linguistic Society, 244-52.
- Lee, Borim 1986. Functional Forces in a Dysfunctional Language: a case of Lardil, University of Texas at Austin, ms.
- McCarthy, John and Alan S. Prince. 1993a. Prosodic Morphology I:

- Constraint Interaction and Satisfaction, ms., University of Massachusetts, Amherst, and Rutgers University.
- 1993b. Generalized alignment, *Yearbook of Morphology* 1993, 79-154.
- 1995. Faithfulness and Reduplicative Identity. In Jill Beckman, Suzanne Urbanczyk, and Laura Walsh, eds., *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory*. Amherst, MA: Graduate Linguistic Student Association.
- Prince, Alan S., and Paul Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. ms., Rutgers University and University of Colorado, Boulder

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