

Consequences of Word Recognition for Metathesis

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1. Introduction

While metathesis is attested cross-linguistically in a wide range of languages, it is nonetheless less frequent than common processes such as assimilation. Why does metathesis not occur with greater frequency? We hypothesize that considerations of word recognition are relevant, that reversing the order of sounds in a word may disrupt word recognition.

If our hypothesis is on the right track, we would predict that the metatheses that are attested apply in such a way as to minimally disrupt word recognition. We will address two factors predicted to be important if minimal disruption of word recognition is indeed relevant: word position and adjacency.

The left edge of the root or word is special for word recognition. According to Cutler et al. (1985), lexical access is generally achieved on the basis of the initial part of the word and salient information tends to occur at the beginning. Beginnings of words also tend to be particularly robust and able to resist phonological processes (Hall 1992). We hypothesize that for metathesis to be minimally disruptive to word recognition, it will be less prevalent at the left edge of a word (Hume 1998).

Long-distance changes are generally more disruptive to word recognition than adjacent ones (Connine et al. 1993; Marslen-Wilson (various)). With respect to metathesis, long-distance segment switching may not yield successful recovery of the intended word, at least not easily, whereas adjacent segment switching may do so more of the time (Mark Pitt, p.c).¹ We hypothesize that for metathesis to be minimally disruptive to word recognition, it will involve adjacent segments.

In this paper we will look at data from a wide range of languages with metathesis to see if these hypotheses are borne out. In §2 we present data that shows cross-linguistic patterning of metathesis with respect to word position. In §3 we look at the data with respect to adjacency. In §4 we discuss the consequences word-recognition considerations for metathesis has for phonological

¹ Of course, constraints on word recognition are not the only factors that could impact adjacency. Phonetic considerations surely also play a role. For example, most, if not all, cases of consonant/consonant metathesis are perceptually motivated, affecting sounds in perceptually poor contexts (Hume 1998, 2000); what often contributes to poor perceptibility is the adjacency of one consonant to another acoustically similar consonant.

theory. In §5 we discuss the consequences for diachronic metathesis. §6 is the conclusion.

2. Word Position

2.1. Data:

The data set includes 54 languages with synchronic metathesis (some languages contain more than one example of metathesis). These involve cases in which a consonant metathesizes with a vowel, and cases in which a consonant metathesizes with another consonant. There are no cases in which a vowel metathesizes with another vowel.² In all cases of metathesis included, metathesis can be observed in the relevant language either through surface alternations or free variation of metathesized and non-metathesized forms. Language sources are listed in the References section.

Apparent cases of metathesis that can instead be considered segment merger were excluded from the study. A well-known example of this type comes from Zoque. In this language, [y] appears to metathesize with following consonants, with subsequent palatalization of coronal consonants. A look at regional varieties of Zoque (Wichmann 1995) shows that this is not the case. [y] is not metathesizing with the following consonant, but rather merging with it. In Northeastern and Central Zoque, merger has begun even though the [y] still remains to the left of the consonant. Metathesis need not be assumed, as shown by Sagey (1986).

(1) *Segment merger in Zoque (not metathesis)*

	*-yt-	*-yh-
Northern Zoque	-t ^y -	-h ^y -
Northeastern Zoque	-yt ^y -	-yh ^y -
Central Zoque	-yt ^y -	-yh-
Southern Zoque	-yt-	-yh-

In our analysis of the data from 54 languages, metatheses was classified according to the following seven categories:

(2)	<i>Word Position</i>	<i>Description</i>
	Prefix	Both segments are contained in a prefix.
	Prefix/Root	One segment is in a prefix, one is in the root.
	Root	
	Left edge	The leftmost segment is at the left edge of the root.

² Chomsky & Halle (1968) claim that Kasem has V/V metathesis though this case has been convincingly shown to not involve metathesis in Phelps (1975, 1979).

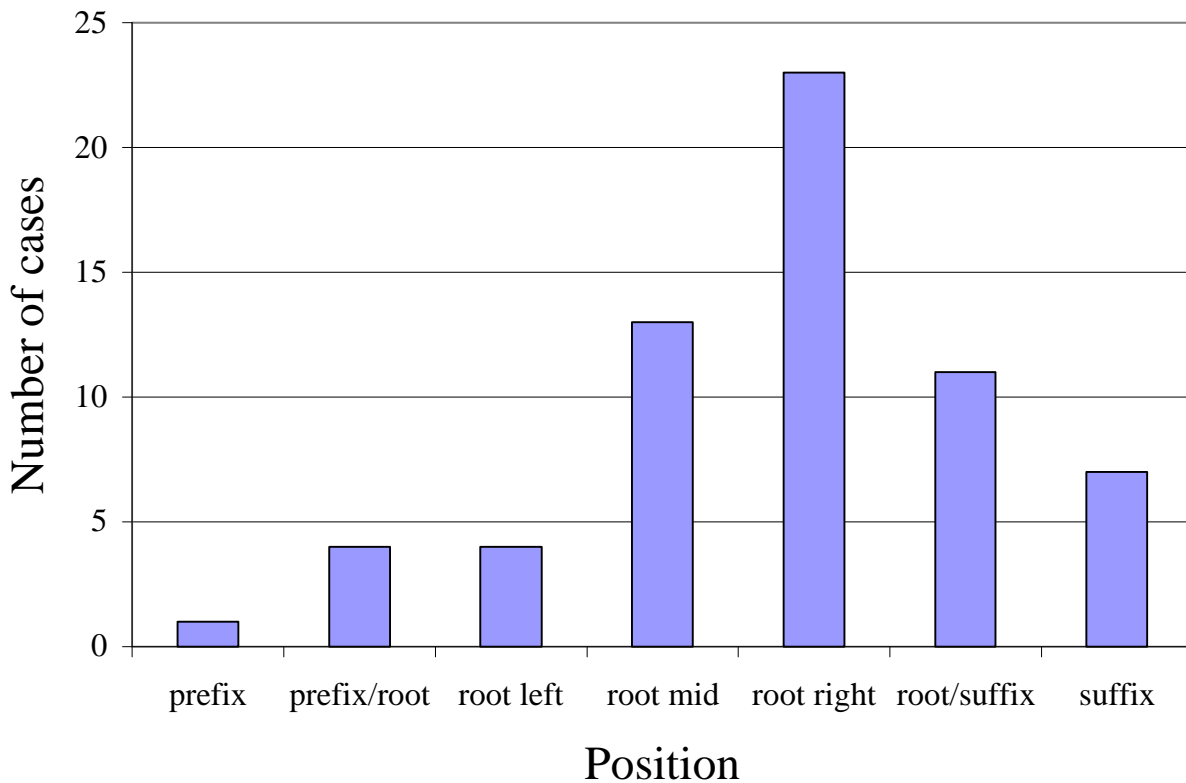
Mid	Both segments are in the root, but neither is at the edge.
Right edge	The rightmost segment is at the right edge of the root.
Root/Suffix	One segment is in the root, one is in a suffix.
Suffix	Both segments are contained in a suffix.

(3) *Synchronic metathesis by position*

Morpheme	Position	Languages
prefix		1 Wichita
prefix/root		4 Cherokee, Modern Hebrew, Wichita, Yagua
root	left edge	4 Cajun French, Fur, Hanunoo, Turkana
	mid	13 Balangao, Basaa, Bedouin Arabic, Cajun French, Cayuga, Eggon, Finnish, Kuvi, Maltese, Mohawk, Najdi Arabic, Saanich, Twana
	right edge	23 Balangao, Faroese, Fur, Hiliganyon, Hixkaryana, Clallam, Colville, Elmolo, Galla, Greenlandic, Kwara'ae, Leti, Lithuanian, Meto, Mohawk, Nle?kepmxcín, Old Spanish, Rendille, Rotuman, Sierra Miwok, Somali, Tagalog, Turkana
root/suffix		11 Deg, Georgian, Hixkaryana, Kui, Maori, Mohawk, Oromo, Sidamo, Tübatulabal, Wichita, Yagua
suffix		7 Chawchila, Clallam, Incahuasi Quechua, Kabardian, Mutsun, Wichita, Yagua

In the 54 languages examined, there are only four cases (7.4%) of metathesis involving segments at the left edge of the root. In contrast, there are 23 cases (42.6%) of metathesis at the right edge of the root and 13 cases (24.1%) of root-medial metathesis. Four cases (7.4%) involve metathesis between prefix and root segments, while 11 cases (20.4%) involve metathesis between root and suffix segments. One case (1.9%) involves only prefixes, while seven involve (13.0%) only suffixes.

(4) *Synchronic metathesis by position*



2.2. Four cases of root-initial metathesis

A closer look at the four cases of root-initial (left edge) metathesis reveals that some of them may be considered marginal cases.

2.2.1. Turkana

The Eastern Nilotic language Turkana has C/C metathesis, according to Dimmendaal (1983). Three examples are given, and one of them involves a root-initial consonant. In each case the form on the left is the preferred form, and the form on the right may also occur in fast speech.

- | | | | | |
|-----|-------------------------|---|-------------------------|----------------|
| (5) | Na-kEmEr-a | ~ | Na-kErEm-a | ‘mole’ |
| | Ni -kwaN•r•m•k-a | ~ | Ni -kwaN•m•r•k-a | ‘kind of tree’ |
| | E-sIkIn-a | ~ | E-kIsIn-a | ‘breast’ |

The process does not appear to be regular, given that there are only three words reported to have metathesis. The process is also irregular from a typological

perspective, as cases of synchronic metathesis in which two consonants metathesize across an intervening vowel are rare or perhaps otherwise unattested. The discussion of adjacency is taken up in more detail in §3.

In the sole example of root-initial metathesis (**E-sIkIn-a** ~ **E-kIsIn-a**), the non-preferred “fast speech” form is very similar to the cognate form in the related language Teso (**e-ki si n-a**). This then may be an instance of borrowing and not synchronic metathesis at all.

2.2.2. Hanunóo

There are six forms in Hanunóo, an Austronesian language, which undergo root-initial metathesis (Conklin 1953). Three involve C/C metathesis, with a glottal stop metathesizing with the following consonant after the deletion of the intervening vowel.

(6)	?usaŪ	‘one’	kaŪs?a	‘once’
	?uŪpat	‘four’	kap?at	‘four times’
	?uŪnum	‘six’	kan?um	‘six times’

The other three involve root-initial C/V metathesis.

(7)	duwaŪ	‘two’	ti gudwaŪ	‘two apiece’
	tuŪlu	‘three’	ti guŪtlu	‘three apiece’
	liŪma	‘five’	ti gi Ūl ma	‘five apiece’

An important consideration is that all the Hanunóo words with metathesis involve numerals. Numerals form a closed set of words. As a result, the number of words that form the basis of comparison for word recognition is very small.

Word frequency may also be relevant. Numbers are fairly frequent lexical items, and so are typically more prone to modification (Bybee 2000 and various earlier works). It is reasonable to assume that by being both more frequent and part of a closed set, the words with metathesis are more predictable and, as a result, disruption to the word recognition system is minimal.

2.2.3. Cajun French

Word-initial [r«] varies freely with [«r] after a word ending in a consonant (Lyche 1995). The same phenomena occurs in varieties of Canadian French.

(8)	pour retourner	‘to go back’	[purr«turne]	
	[pur«rtur			
	d’êt’ revenue	‘to be back’	[dEtr«v«ny]	[dEt«rv«ny]

cf. a's'a retournée 'she went back' [asar«turne] *
 [asa«rturne]

This example of root-initial metathesis in Cajun French is well-attested. It is perhaps significant, though, that the metathesis occurs only with [r] and, we suspect, with common lexical items ('re' is a common word beginning). As a result, confusion with other words is probably minimal.

2.2.4. Fur

Fur, a Biltine language, features a robust case of root-initial metathesis (Jakobi 1986). When a consonantal person prefix (such as k- 'we') is affixed to certain consonant-initial verbs, metathesis occurs. Jakobi lists 60 verbs where the first consonant metathesizes with the first vowel in the presence of a consonantal person prefix. The metathesis occurs because the prefix and the initial consonant do not form a permissible word-initial cluster.

- (9) k+ba- → kab- 'we drink'
 k+teer- → keter- 'we forge'
 k+saar- → kasar- 'we expose for sale'
 k+neen- → kenen- 'we bewitch'
 k+lat- → kald- 'we beat, hit'
 k+raaN- → karaN- 'we take out'

Of the 4 potential cases of metathesis involving root-initial segments, Turkana is marginal since it only affects a few words in the language. In Hanunóo and Cajun French, root-initial metathesis involves lexical items which we hypothesize to be of high frequency. Further, in Hanunóo the words involved form a closed set.

Our results suggest that the overwhelming majority of metatheses affect non-initial segments, thus supporting the view that word recognition plays a role in metathesis. For metathesis to be minimally disruptive to word recognition, it will be less prevalent at the left edge of a word.

3. Adjacency

In 54 languages with synchronic metathesis, only one, Turkana, has non-adjacent metathesis³, and Turkana metathesis has already been shown to be marginal. There are however, a few cases of apparent non-adjacent metathesis, which can be shown to be multiple instances of adjacent metatheses, rather than non-adjacent metathesis.

3.1. Mutsun: [-mak] ~ [-kma]

In the Costanoan language Mutsun, metathesis involves the commonly occurring nominal thematic plural suffix, which has two alternants: [-mak] and [-kma] (Okrand 1977, Hume 1997, 1998). [-mak] occurs after a stem ending in a consonant, and [kma] occurs after a stem-final vowel.

- (10) **?i nni s** 'son' **?i nni s-mak**
rukka 'house' **rukka-kma**

Two metatheses are involved. One is C/V metathesis, which occurs regularly in the language, e.g. in the locative suffix [-tak] ~ [-tka].

- (11) **?urkan** 'mortar' **?urkan-tak**
rukka 'house' **rukka-tka**

The second is C/C metathesis. In to [-mak] and [-kma], the ordering of the consonants also changes. Given the alternations with the locative suffix we would predict [-mak] to alternate with *[-mka], not [-kma]. C/C metathesis occurs to avoid a preconsonantal labial nasal, which is prohibited (Hume 1997).

3.2. Fur:

A similar apparent non-adjacent metathesis in Fur receives the same account. Not that [b], the segment that appears to be skipping over two consonants at once, changes to [m] as a result of an independent process.

- (12) k+bul → kulm 'find'

While [b/m] appears to undergo non-adjacent metathesis to skip two segments, this can be shown to be two cases of adjacent metathesis. The first is

³ Many Salish languages exhibit root inversion, in which C_1VC_2 roots correspond to C_2VC_1 roots in other languages or in the same language (Noonan 1997). On the surface this may appear to be non-adjacent metathesis, but it could be the result of any of a variety of processes such as reduplication and deletion. See Noonan (1997) for a discussion of several possible ways this phenomena may have come about.

C/V metathesis, the same as in (9), and the second is C/C metathesis, which resolves the impermissible sequence [ml].

- (13) k+ba → kab ‘drink’
 k+bul → kuml → kulm ‘find’

We conclude that cases of non-adjacent synchronic metatheses are rare, if they exist at all. One consequence of this is that if metathesis only involves adjacent segments, this may account in part for why cases of V/V are not attested, under the assumption that vowels are most commonly separated by one or more consonants. The adjacency patterns support the hypothesis that for metathesis to be minimally disruptive to word recognition, it will involve adjacent segments.

4. Consequences for Phonological Theory

4.1. Theoretical assumptions

We assume Optimality Theory/Correspondence Theory (Prince & Smolensky 1993, McCarthy & Prince 1995). Particularly relevant is the constraint LINEARITY, which prohibits metathesis.

(14) *Optimality Theory*

LINEARITY: (Don't metathesize.) (McCarthy & Prince 1995)

S₁ is consistent with the precedence structure of S₂, and vice versa.

LINEARITY is violated when there is a mismatch between the ordering of segments in the input and the corresponding segments in the output, and vice versa.

A candidate with a mismatch in ordering between input and output will always be less faithful than a candidate without such a mismatch (all else being equal).

(15) *LINEARITY rules out candidates with precedence reversals, all else being equal.*

		I: C ₁ V ₂ C ₃ C ₄ V ₅	LINEARITY
☞	a.	C ₁ V ₂ C ₃ C ₄ V ₅	
	b.	C ₁ V ₂ C ₄ C ₃ V ₅	*!

A candidate with metathesis will surface when the candidate without the mismatch violates some phonological constraint (C) that is crucially ranked above LINEARITY.

(16) *LINEARITY is outranked by another constraint.*

		I: C ₁ V ₂ C ₃ C ₄ V ₅	C	LINEARITY
	a.	C ₁ V ₂ C ₃ C ₄ V ₅	*!	
☞	b.	C ₁ V ₂ C ₄ C ₃ V ₅		*

4.2. Adjacency and phonological theory

What in phonological theory prevents non-adjacent metatheses? For example, what rules out unattested metatheses like the following?

(17) C₁V₂C₃ + C₄V₅C₆ → C₁V₂C₆C₄V₅C₃ e.g. tob + nak → [toknab]
 (Motivated, perhaps, by a constraint against labials in preconsonantal position, as required in Mutsun.)

More generally, how do we account for the observation that minimal changes in the ordering of segments are always preferred, all else being equal?

(18) *Leti /ukar/ @ [ukra] 'finger' Why not *[urka]?*

		I: /ukar/	C	LINEARITY
	a.	ukar	*!	
☞	b.	ukra		*
?	c.	urka		*

The reason candidate (b) is selected over candidate (c) is that violations of LINEARITY are gradiently evaluated. Each precedence reversal incurs a violation of LINEARITY (Hume 1998).

(19) *LINEARITY is gradiently violated.*

		I: / u ₁ k ₂ a ₃ r ₄ /	C	LINEARITY
	a.	u ₁ k ₂ a ₃ r ₄	*!	
☞	b.	u ₁ k ₂ r ₄ a ₃		*
	c.	u ₁ r ₄ k ₂ a ₃		**!

Candidate (a): no precedence violations

Candidate (b): 1 violation: *4 < 3

Candidate (c): 2 violations: *4 < 2, *4 < 3

Under the assumptions that: a. LINEARITY violations are gradiently evaluated, and b. metathesis only occurs when there is motivation for change, we predict a language in which the optimal output may incur more than a single violation of LINEARITY.

This prediction is borne out in Mutsun and Fur, where certain words undergo independently-motivated C/C and C/V metatheses, with each instance violating LINEARITY once.

(20) *The prediction is borne out: Mutsun*

		I: ?innis+mak ⁴	C ₁	*m/ __C	C ₂	LINEARITY
☞	a.	?innis.mak			*	
	b.	?innis.mka	*!	*		*
	c.	?innis.kma	*!			**

		I: relo+mak	C ₁	*m/ __C	C ₂	LINEARITY
	a.	re.lo.mak			*!	
	b.	re.lom.ka		*!		*
☞	c.	re.lok.ma				**

(Observations relevant to constraints: C₁= avoid sequences of three consonants; C₂= avoid VC word-finally)

(21) *The prediction is borne out again: Fur*

		I: k + ba	C ₁	C ₂	LINEARITY
	a.	kba	*!		
☞	b.	kab			*

		I: k + mul	C ₁	C ₂	LINEARITY
	a.	kmul	*!		
	b.	kuml		*!	*
☞	c.	kulm			**

(Observations relevant to constraints: C₁= avoid word initial clusters; C₂= avoid [ml])

To our knowledge, there are no cases of metathesis involving more than 2 violations of LINEARITY. For example, cases in which a complete array of

⁴ The ordering of segments in the suffix is not crucial to this account. The correct output is selected regardless of whether we assume /mak/ or /kma/.

segments within a word are rearranged are not attested. This is perhaps not surprising since drastic reorderings would surely inhibit word recognition.

4.3. Word position and phonological theory


Should we incorporate the observation that metathesis does not typically involve segments at the left edge of words into phonological theory? Following Beckman (1998), we might propose that this observation is reflected in a series of LINEARITY constraints, which are harmonically ranked, e.g.

(22) LINEARITY_{σ1} >> LINEARITY

(A LINEARITY violation involving segments from the first syllable is the worst.)

There are a few reasons not to incorporate position-sensitive LINEARITY constraints into phonological theory. First, the observations concerning where in a word metathesis occurs are about cross-linguistic markedness. They are tendencies, not absolutes. Second, there is no phonological motivation within a single language. That is, we have not found a language where metathesis fails to occur at the left edge of a root when the conditions for metathesis are otherwise met, or where metathesis preferentially occurs at the right edge of a word even though it could just as easily occur at the left edge.

(23) *What this latter scenario might look like:*

	I: C ₁ V ₂ V ₃ C ₄ C ₅ V ₆	LINEARITY _{σ1}	*VV	LINEARITY
a.	C ₁ V ₂ V ₃ C ₄ C ₅ V ₆		*!	
 b.	C ₁ V ₂ C ₄ V ₃ C ₅ V ₆			*
c.	V ₂ C ₁ V ₃ C ₄ C ₅ V ₆	*!		*

5. Consequences for Diachronic Metathesis

5.1. Adjacency

There are a number of reported cases of non-adjacent diachronic metathesis, e.g. Bagnères-de-Luchon French *kápra > crabo (Grammont, 1905-06)

Labov (1994:17) wrote that "It is a reasonable requirement that a reconstructed language should conform to the definition of possible language structure provided by present-day theory and typology."

In light of the evidence from synchronic metathesis that non-adjacent metathesis is rare or unattested, we propose a reinterpretation of non-adjacent diachronic metathesis: Perhaps multiple steps involving more than one adjacent

metathesis were involved, as in Fur and Mutsun, or other processes were at work, e.g. deletion, insertion, with the end result looking like metathesis.

For Bagnères-de-Luchon French, we assume that two metatheses were involved: C/C and C/V, as in Mutsun and Fur. Both metatheses are attested diachronically in other varieties of French.

(24) *Proposed two-step metathesis for Bagnères-de-Luchon French*

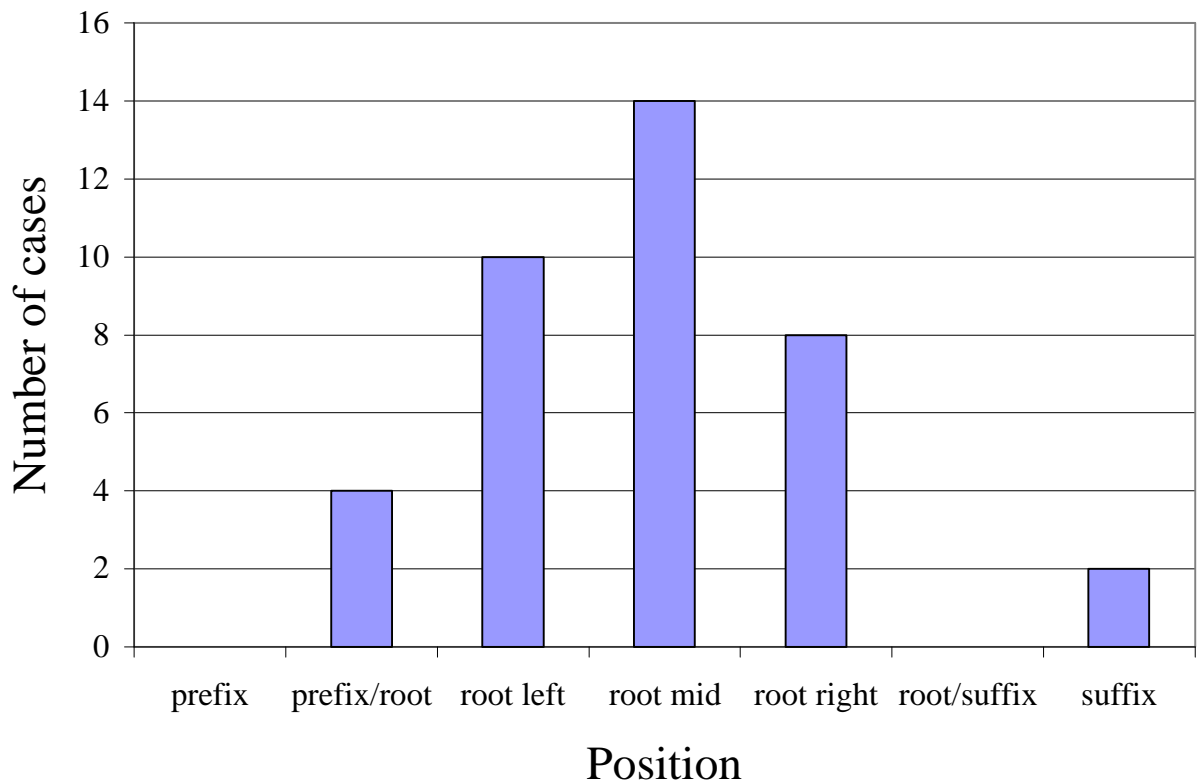
Jersey French	C/C	*SEvrEt > SErvEt 'shrimp' <i>crevette</i> in Mod. French)
Le Havre French	C/V	*f«rme > fr«me
Bagnères-de-Luchon French	both	*kaÛpra > *carpo > crabo

5.2. Word Position

There are a greater number of reported cases of root-initial metatheses as compared to synchronic metatheses.

(25) *Diachronic metathesis by position*

Morpheme	Position	Count	Languages
prefix		0	
prefix/root		4	Aghem, Birom, Koshin, Noni
root	left edge	10	Ancient Greek, Armenian, Attic Greek, Baltic, Chimakum, Nganyaywana, Northern Paman, Persian, Quileute, Slavic
	mid	14	Ancient Greek, Bagnères-de-Luchon French, Cheremis, Colloquial French, Gascon, Jersey French, Latin, Le Havre French, Magadhi, Mordvin, Old Irish, Old Spanish, Sardinian, West Saxon
	right edge	8	Ancient Greek, Armenian, Avestan, Gidole, Middle English, Nyungar, Old English, Ririo
root/suffix		0	
suffix		2	English, Incahuasi Quechua



Were these really synchronic metatheses at one time? Alternatively, some could be the result of other processes (e.g. deletion and insertion). We predict that upon closer analysis, a greater number of the root-final metatheses will turn out to have been actual synchronic metatheses, while root-initial metatheses will have been the result of other processes. A distribution similar to that found for synchronic metathesis is predicted.

5.3. Chimakum and Quileute

The Chimakuan languages Chimakum and Quileute both apparently show the signs of diachronic root-initial non-adjacent metathesis (Powell 1985).

(26) *Chimakum*
 *l[?]aq^{?w}-> q^{?w}o?l- 'to shake something'

(27) *Quileute*

*l²ay- > yaʔl- ‘near, toward’

If this was synchronic metathesis at one time, it was a very unusual sort of synchronic metathesis. Upon closer examination, it begins to appear questionable. Given that Chimakuan languages have been in contact with Salish languages, and that Salish languages features “inverted roots” (see footnote 3 and Noonan 1997), which may or may not be the result of metathesis, and that there are corresponding roots in some Salish languages, it is more likely that these apparent metatheses in Chimakum and Quileute are actually borrowings. We predict that further analysis of other apparent examples of diachronic root-initial metathesis will reveal that they were never actual cases of synchronic root-initial metathesis.

6. Conclusion

Word recognition appears to influence cross-linguistic patterns of metathesis. This is most robustly seen with regards to word position. The observation that all synchronic metatheses occur between adjacent segments may also be influenced by considerations of word recognition.

In keeping with Labov’s view of “using the present to explain the past,” the results from synchronic metathesis motivate a re-examination of the reported cases of diachronic metathesis both in terms of their patterns of adjacency and word position.

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