



Bibliographic Details

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Sections

- 1 Local metathesis
- 2 Non-local effects
- 3 Related processes
- Note
- REFERENCES

The term *metathesis* – Greek for ‘transposition’ – refers to a reordering of segments. This chapter outlines the range of phenomena that fall under this description, and theoretical perspectives on their insightful analysis. Other cross-linguistic surveys of this topic include **Webb (1974)**, **Ultan (1978)**, **Hock (1985)**, **Wanner (1989)**, **Blevins and Garrett (1998, 2004)**, **Becker (2000)**, and **Hume (2001, 2004)**.

The term has traditionally been best known for the description of historical sound changes (**CHAPTER 93**: SOUND CHANGE), often described as sporadic. For example, **Osthoff and Brugmann (1878**: xiv, n. 1) cite metathesis, along with dissimilation (**CHAPTER 60**: DISSIMILATION), as lacking the “mechanical” character of regular sound change. **Hock (1985)**, however, argues that diachronic metathesis is regular when it serves to enforce a structural constraint. For example, in early attestations of Persian, as well as in reconstructed forms, clusters of an obstruent or nasal plus a liquid can be found before a final vowel. Loss of that vowel leads to a final cluster with a rising sonority profile (**CHAPTER 49**: SONORITY; **CHAPTER 46**: POSITIONAL EFFECTS IN CONSONANT CLUSTERS); this configuration is repaired by metathesis of the two consonants, so that the more sonorous liquid is closer to the vowel. (The segments involved are underlined in (1).)

(1) *Persian liquid metathesis* (Hock 1985: 534)

s <u>x</u> ra	>	sur <u>x</u>	‘red’
va <u>f</u> ra	>	ba <u>r</u> f	‘snow, ice’
as <u>r</u> u	>	ar <u>s</u>	‘tear’
*na <u>m</u> ra	>	na <u>r</u> m	‘soft’

Although much of the literature discusses historical metathesis – where copious examples can be found – this chapter focuses on instances of metathesis that are active synchronically. By this I mean alternations in the ordering of segments that appear to be part of a speaker’s productive grammatical knowledge, and therefore must be accounted for in theories of linguistic competence. There is of course an intimate connection between diachronic metathesis and the synchronic alternations that may persist in the grammar as a result, but I will take care to distinguish examples for which only diachronic change is well attested, and where the results of the change appear to be new underlying forms rather than a new phonological alternation. Similarly, although the emphasis is on phonologically defined patterns, some types of metathesis require reference to morphological context, even if the specific change is expressed in terms of phonological categories.

For most of the twentieth century, metathesis was described either in prose or, as formalisms became more sophisticated, as reorderings of indexed objects in a string. **Chomsky and Halle (1968**: 361) describe metathesis as “a perfectly common phonological process,” and permit transformations that effect permutation. In their notation, /skt/ → [kst] metathesis in

Faroese, shown below in (3), could be expressed as follows.

(2) *Metathesis as a transformation*

Structural description	s	k	t
Structural change	1	2	3 → 2 1 3

The need for indexation distinguishes metathesis from most other processes, such as insertion (**CHAPTER 67**: VOWEL EPENTHESIS), deletion (**CHAPTER 68**: DELETION), and featural assimilation (**CHAPTER 81**: LOCAL ASSIMILATION). In those sorts of changes, whatever elements of the representation remain after the change maintain their relative ordering on their tier. A true featural equivalent to segmental metathesis would be a swap in feature values on the same tier (or at some non-root node), such as a change from LH to HL tone in a context where underspecification of the L with simple shift of H is not a plausible analysis. As noted in §1.4, there is limited evidence for tonal metathesis of this sort.

Following the most common modern usage, in this chapter I apply the term *metathesis* to permutations of segments regardless of intervening material. §1 deals with *local* metathesis, including the sequences CC, CV, and VV, followed by brief consideration of other types. §2 considers the *long-distance* metathesis of non-adjacent segments, as well as the displacement of a segment that is not exchanged with another. §3 considers the relation of metathesis to other phenomena with which it shares some formal properties, such as infixation.

1 Local metathesis

In local metathesis, two adjacent segments are swapped, without any necessary change in their features, although in some cases other processes may affect the outcome. These can be classified formally according to the segments involved in the reversal: two consonants, a consonant and a vowel (in either order), or two vowels.

1.1 CC metathesis

To organize this presentation, I group the processes according to the features of the segments involved. These include the special role of sibilants, place of articulation, and manner of articulation.

1.1.1 Sibilants

Sibilant consonants are often observed to reverse order with an adjacent stop consonant (**Silva 1973**; **Hume 2001**: 12–14; **Seo and Hume 2001**; **Steriade 2001**: 234f.; **Blevins and Garrett 2004**: 139f.; **Hume and Seo 2004**: 36–39). An example is found in Faroese, where /sk/ followed by /t/ is reversed (**Lockwood 1955**: 23f.).

(3) *Faroese metathesis of /sk/ (Lockwood 1955: 24)*

<i>masculine</i>	<i>neuter</i>	
fesk-ur	feks-t	'fresh'
rask-ur	raks-t	'energetic'
dansk-ur	danks-t	'Danish'

As noted above, metathesis has typically been considered a sporadic or irregular process, unlike phenomena such as assimilation that can often be described in very general and regular terms (see **Hume 2001**: 1f. for representative quotations). But the Faroese reversal illustrates that a process of metathesis can be fully regular while also quite restricted in scope, simply because the necessary configuration does not often arise. Thus the neuter noun suffix /t/ provides the environment for reversal of stem-final /sk/; but a similar environment in verbs also triggers the changes, as can be seen in /ʊʏŋks-ti/ 'wish (PAST SG)' compared to the present singular /ʊʏnsk-ir/ with the underlying ordering thanks to the following vowel (**Hume 1999**: 294).

It was traditionally claimed that metathesis yields sequences that are in some way better formed than the input ordering, usually in the sense of "ease of articulation" or satisfying a language's phonotactic constraints (**Wechsler 1900**: 497; **Grammont 1933**: 239; **Ultan 1978**: 390). More recent work has placed greater emphasis on the role of perception (**CHAPTER 98**: SPEECH PERCEPTION AND PHONOLOGY), and on historical explanations for how metathesis arises (**CHAPTER 93**: SOUND CHANGE). Faroese can be seen as *auditory metathesis* – the temporal decoupling of the noise of a fricative, especially a sibilant, from the surrounding signal, which can lead to a sibilant and an adjacent stop being reinterpreted as occurring in the opposite of the original order (**Blevins and Garrett 2004**: 120). A segment often moves to a position in which it is more easily perceptible, especially due to the formant transitions in an adjacent vowel (**Hume 1999**: 295f.; **Seo and Hume 2001**: 215–217). Thus Faroese metathesis places the stop /k/ in a more perceptible position, adjacent to the preceding vowel, while the sibilant remains perceptible without an adjacent vowel. This directionality suggests that confusibility in the ordering of the segments is not the sole factor, since symmetrical confusion predicts random reordering according to the two

possible interpretations of an ambiguous auditory signal (Steriade 2001: 233–235); but see Blevins and Garrett (2004: 119f.) for a defense of the misperception account. The outcome in particular languages may depend on prosody, such as the location of stress, and phonetic detail, such as the release of final stops; such differences may explain the symmetrically opposite changes in Late West Saxon (/frosk/ → [froks] ‘frog’) and a certain variety of colloquial French (/fiks/ → [fisk] ‘fixed’) (Blevins and Garrett 2004: 139f.).

A transformational rule that reverses the order of segments does not make reference to the apparent motivations of the reordering, such as an improvement in markedness (CHAPTER 4: MARKEDNESS). But like other phonological processes, metathesis may operate in order to satisfy the phonotactic restrictions of a language. That is, just as the place assimilation in *anba* → *amba* satisfies a condition that nasal codas must agree in place with a following stop, so a metathesis such as *inma* → *imna* in (6) satisfies a condition on the sequencing of coronal and labial consonants. Recent approaches have attempted to capture this insight and to treat metathesis more on a par with other processes.

In the surface orientation of Optimality Theory (Prince and Smolensky 2004), the expected Faroese sequence [skt] can be penalized by a constraint against a stop that occurs between two other consonants (Hume 1999: 298), whether it is defined directly in terms of perceptibility or as a more abstract configuration. This pressure must dominate the correspondence constraint LINEARITY, which otherwise prevents reorderings of segments, and obviously plays a central role in the analysis of metathesis (Hume 1998: 149, 68f.; McCarthy and Prince 1995: 371f.; McCarthy 2000: 173). Metathesis occurs only when LINEARITY is ranked below faithfulness constraints such as MAX and DEP; these prevent deletion or insertion of material that otherwise might serve to remedy the surface constraint that metathesis addresses.

(4)

/raskt/	*STOP/C__C	MAX	DEP	LINEARITY
a. raskt	*!			
b. rast		*!		
c. rask		*!		
d. raskit			*!	
e. rakst				*

Naturally, no violation of LINEARITY is required in a form such as [raskur], where the stop /k/ is adjacent to a vowel, and the sequence surfaces intact.

Another relatively restricted case of stop—sibilant metathesis is the Tiberian Hebrew *hitpa'el* verb form, where the /t/ of the prefix reverses with a stem-initial sibilant (Malone 1993: 52f.; Coetzee 1999: 106; see Malone 1971 for similar facts in other Semitic languages; see also CHAPTER 108: SEMITIC TEMPLATES). The examples in (5a) show the lack of metathesis with non-sibilants.

(5) *Tiberian Hebrew metathesis* (Coetzee 1999: 106)

a.	hit-pallel	→	hitpallel	‘he prayed’
	hit-qaddef	→	hitqaddef	‘he sanctified himself’
b.	hit-sappex	→	histappex	‘he felt attached to’
	hit-šammer	→	hištammer	‘he protected himself’
	hit-šakker	→	hištakker	‘he gave himself into service’
	hit-zakker	→	hizdakker	‘he remembered’
	hit-šaddeq	→	hištaddeq	‘he considered himself righteous’

For Coetzee (1999: 122f.), the motivation for metathesis in exactly this context, when a /t/ would otherwise precede a sibilant, is that a [t] + sibilant sequence would be subject to reinterpretation as an affricate, a type of segment disfavored in Tiberian Hebrew. He proposes a constraint *t+SIBILANT against that sequence, again with relatively low-ranked LINEARITY. Hume (2004: 222f.), discussing the equivalent metathesis in Modern Hebrew, argues that the poor attestation of [t] + sibilant sequences in Hebrew sets the stage for a reinterpretation with the sibilant in first position: an ambiguous acoustic signal is likely to be interpreted sequentially according to the most commonly attested ordering of those segments, dependent not necessarily on universal principles, but on the lexicon and grammar of the language in question.

1.1.2 Place of articulation

Many instances of CC metathesis depend on place of articulation (CHAPTER 22: CONSONANTAL PLACE OF ARTICULATION), with certain orderings of place favored over others. Permutation of this type is found in a range of Malayo–Polynesian languages (Blevins and Garrett 2004: 136). In Cebuano, for instance, a coronal stop or nasal followed by a labial or velar consonant is reversed, optionally in some cases (Blust 1979: 110).¹ The consonants come to be adjacent as the result of vowel syncope after a vowel-initial suffix is added.

(6) *Cebuano metathesis of coronal + non-coronal clusters* (Blust 1979: 110)

<i>stem</i>	<i>suffixed form</i>	
lutuk	lukt-un	'put the finger in'
gitik	gitk-anun ~ gikt-anun	'ticklish'
atup	atp-an ~ apt-an	'roof'
inum	imn-a	'drink'

Stems such as /lakat/ 'walk' that already have the preferred ordering maintain it ([lakt-un]), showing that the process is not simply an across-the-board reversal in consonant clusters. In this case, the favored ordering places the coronal in second position.

The two changes in Cebuano – deletion of the vowel and reversal in the resulting cluster – were likely ordered historical events, and this history can be modeled easily by ordered synchronic rules. But the same facts are also consistent with simultaneous satisfaction of two surface constraints in OT. The candidates *[lutukun] and *[lutkun] both violate one of these constraints – by the lack of syncope, or the disfavored consonant ordering – whereas [luktun] satisfies both, and wins under low ranking of LINEARITY and MAX-V.

(7)

/lutuk-un/	*VCVCV	*TK	LINEARITY	MAX-V
a. lutukun	*!			
b. lutkun		*!		*
c. luktun			*	*

A phonetic explanation for this type of reordering is *co-articulatory metathesis*, which results from the overlap in adjacent consonant gestures (Blevins and Garrett 2004: 136–138); for example, overlapping coronal (T) and non-coronal closures (K) are perceived as the non-coronal, which leads to reversals such as TK → KT in Cebuano (6). A general preference for apicals to follow non-apicals has been cited with regard to metathesis in other languages such as Greek, which may be related to the tendency for coronal codas to assimilate to following non-coronals (Bailey 1970: 348). One abstract phonological approach formalizes the licensing properties of different places of articulation (Rubin 2001: 194–199); unmarked Coronal is a *natural head* and licenses the place features of a preceding non-coronal, favoring KT over TK. See also Blust (1979: 102f.) and Winters (2001) on the general preference for coronals to occur second in a cluster.

Some reorderings have considerably more complex origins. In the Kondh branch of Dravidian, sequences of a velar /k g/ plus a labial /p b/ are reversed. The Pengo examples below illustrate two allomorphs /-pa/ and /-ba/ of the intensive-frequentative or plural action suffix, both of which also occur in contexts without metathesis as seen in (8a). For similar Kui examples, see Hume (2001: 8).

(8) *Pengo velar + labial metathesis* (Burrow and Bhattacharya 1970: 82f., 201)

a.	gru:t-pa-	→	gru:t-pa-	'fell'
	huz-ba-	→	huz-ba-	'roast'
b.	ɖrik-pa-	→	ɖripka-	'break'
	ku:k-pa-	→	ku:pka-	'call'
	ɾa:k-ba-	→	ɾa:bga-	'sacrifice'
	tog-ba-	→	tobga-	'be split'

According to Garrett and Blevins (2009: 538ff.), this metathesis pattern arose by re-analysis of complex allomorphy deep in the history of Dravidian. Briefly, causative /p/ could replace the last consonant of the stem, as in Kolami [melg-] 'grow (INTR)' and derived [mel-p-] 'rear'. This was interpreted as a rule deleting the velar before the labial, which was extended to other labial-initial suffixes, including the plural action containing [-p-]. This would yield an alternation between simple */ku:k-/ 'call' and plural action */ku:k-p/ → *[ku:-p-]. But there is another basic allomorph of the plural action suffix containing /-k-/; if this were added to the existing plural action in order to make the exponence of that category clearer, the result is the pair *[ku:k-] and *[ku:-p-k-], which then gives the appearance of metathesis of the suffixal /p/ and the stem-final /k/.

Whatever the historical origin of Pengo metathesis, it became part of the grammar thanks to learners treating it as an active synchronic process. The constraint encoding the Pengo alternation must penalize a velar + labial sequence; call it *KP. In addition to MAX and DEP, it is especially relevant here to include the constraint IDENT to prevent changes to the features targeted by the phonotactic constraint.

(9)

	/togba/	*KP	MAX	DEP	IDENT	LINEARITY
a.	togba	*!				
b.	toba		*!			
c.	togiba			*!		
d.	tomba				*!	
e.	tobga					*

Perceptual factors may contribute to such re-analyses. Placing the labial first in the cluster, at least in related Kui, puts it in the stressed syllable, which may enhance its perceptibility; the weak bursts of labial stops reduce the benefit of being located in the onset (Hume 1999: 296). Experimental evidence indicates that labial place is more perceptible in codas than is velar, and that velars benefit more in perceptibility from being in the onset than do labials (Winters 2001: 238–241). This means that the ordering PK is overall more likely to be heard correctly than KP. Emphasizing historical origin, however, Blevins and Garrett (2004: 136) consider the perceptually based prediction to be PK → KP, as attested in other languages such as Mokilese /apkas/ → [akpas] ‘now’, and claim that the Dravidian pattern favoring PK could arise only by such means as re-analysis of a morphological pattern.

Segments undergoing metathesis may originate in different morphemes, as in Pengo, but may also occur inside a single morpheme. Across a morpheme boundary, the offending cluster is created by concatenation; within a morpheme, the context for metathesis may be created directly by a syncope rule that brings the consonants into contact (as in Cebuano (6)), or a triggering context introduced by concatenation but affecting two consonants that are underlyingly adjacent (as in Faroese (3)).

1.1.3 Manner of articulation

Classes of consonants defined by manner, such as liquids or sonorants (see CHAPTER 13: THE STRUCTURE FEATURES), are often targeted specifically by metathesis. (One might also include here the sibilants discussed in §1.1.1.) Metathesis involving the class of liquids is found in a number of languages (Blevins and Garrett 2004: 128f.); a historical example from Persian was cited in (1). In Rendille (Cushitic, Kenya), an /r/ and a preceding obstruent or nasal reverse in order after they become adjacent upon deletion of the intervening vowel (Sim 1981: 7, 9f.; Hume 1998: 178; Blevins and Garrett 2004: 129).

(10) Rendille metathesis of /r/ in clusters (Sim 1981: 7, 9)

<i>feminine</i>	<i>masculine</i>	
údur-te	úrd-e	‘s/he slept’
ágar-te	árg-e	‘s/he saw’
hámar-te	hárm-e	‘s/he shivered’

In the framework of Blevins and Garrett (2004: 121–125), this *perceptual metathesis* arises when the cues for a sequence of sounds are perceived by the listener as reordered relative to the speaker’s intention, which is possible when some feature is realized over a relatively long duration and therefore contains ambiguity of analysis. This is true for consonant clusters as well as vowel–consonant sequences (see §1.2). Besides liquids (CHAPTER 30: THE REPRESENTATION OF RHOTICS; CHAPTER 31: LATERAL CONSONANTS), other segment types with elongated cues include pharyngeals (CHAPTER 25: PHARYNGEALS), secondary labialization (CHAPTER 29: SECONDARY AND DOUBLE ARTICULATION), palatalization (CHAPTER 71: PALATALIZATION), and glottalization or aspiration (Blevins and Garrett 2004: 123). Hume (2004: 220–227) argues similarly that ambiguity or indeterminacy in the auditory signal sets the stage for a reinterpretation of linear order, but places a special emphasis on the role of the specific attested sequences in the language, as discussed for Hebrew above.

In Kambata (East Cushitic, Ethiopia), a suffix–initial nasal transposes with a preceding obstruent, and is also subject to place assimilation in this position, as illustrated by [ŋk] and [mb] resulting from an /n/–initial suffix (Hudson 1980: 105); similarly the related language Sidamo (Vennemann 1988: 55) and several other East Cushitic languages (Garrett and Blevins 2009: 532f.).

(11) Kambata metathesis of obstruent + nasal clusters (Hudson 1980: 105)

it-ne:mmi	→	inte:mmi	‘we have eaten’
t’u:d-na:mmi	→	t’u:nda:mmi	‘we will see’
oros-na:mmi	→	oronsa:mmi	‘we will take’
sok-ne:mmi	→	soŋke:mmi	‘we have sent’
hab-no:mmi	→	hambo:mmi	‘we forgot’

This metathesis is part of a conspiracy (CHAPTER 70: CONSPIRACIES) of changes (including complete assimilation and vowel epenthesis) that avoid ill-formed consonant clusters, in this case obstruent + sonorant; see Hume (1999: 300–302) for a

perceptual–optimization account. In a novel strategy that anticipates Optimality Theory, **Hudson (1980: 109)** proposes that affixation generates two outputs with alternate orderings of juxtaposed consonants (such as [itne:m̩mi], [inte:m̩mi]), where the choice between the outputs is made according to conditions on phonotactics. This technique would not, however, generalize to examples such as Faroese and Cebuano, in which the relevant consonants are not juxtaposed across a morpheme boundary.

The obstruent + nasal reversal in East Cushitic has been cited as an example of a metathesis that does not result from a conventional source such as a mis–perception of the ordering of the cues (**Garrett and Blevins 2009: 532–537**). Rather, it appears to reflect the pressure of other consonant interactions; I illustrate with the facts of Kambata, but follow the argument of Garrett and Blevins, who use data from related Bayso. In some clusters that occur at stem boundaries, we find regressive assimilation, as in /rn/ → [nn] and /mt/ → [nt]; but in others, there is apparent progressive assimilation to create a geminate, as in /bt/ → [bb].

(12) *Kambata assimilation in clusters* (Hudson 1980: 105)

a.	im-to:ʔi	→	into:ʔi	‘she dug’
	ful-na:m̩mi	→	funna:m̩mi	‘we will go out’
	kam-no:m̩mi	→	kanno:m̩mi	‘we forbade’
	mar-ni	→	manni	‘we, going’
b.	ub-to:ʔi	→	ubbo:ʔi	‘she fell’
	dag-tonti	→	daggonti	‘you knew’
	tʰu:d-tenti	→	tʰu:ddenti	‘you have seen’
	oros-ta:nti	→	orossa:nti	‘you will go’

If the learner seeks to generalize to a single process of regressive assimilation, then an intermediate step of metathesis is necessary to create the right outcome: /bt/ → tb → [bb]. Extending this to instances of obstruent + nasal, such as /bn/ → nb → [mb], also has the effect of preserving the features of the root–final consonant and yielding a nasal + obstruent sequence of the sort that is common in other concatenations. Interestingly, whereas Kambata assimilation and metathesis apply to all places of articulation, in Bayso both are restricted to coronals, which reinforces the connection; this correlation is found across the East Cushitic languages (**Garrett and Blevins 2009: 536f.**). From the perspective of synchronic phonology, an unavoidable conclusion is that metathesis processes are available to the learner, whether the pattern results from a misperception of the phonetic signal or a generalization of an existing pattern.

1.2 CV metathesis

Ordering reversals of a consonant and vowel involve many of the same principles of explanation and analysis as CC reversals – for example, the historical reinterpretation of an ambiguous signal, and a synchronic constraint that dominates LINEARITY. From the examples in the literature, however, synchronic CV metathesis appears to be strongly associated with specific morphological contexts, and the reordering may be the main exponent of a grammatical category, something that is not typical of CC metathesis. But before considering such cases, we examine a few more strictly phonological examples.

1.2.1 Phonological reorderings

A well-known case that has been treated as metathesis is Cayuga (Iroquoian), in which a laryngeal consonant /hʔ/ transposes with a preceding vowel when it occurs in an odd-numbered, non-final syllable (**Foster 1982: 69f.**; **Blevins and Garrett 1998: 509–512**). The necessary prosodic context can be analyzed as the weak branch of an iambic foot (**Hayes 1995: 222f.**; see also **CHAPTER 44: THE IAMBIC—TROCHAIC LAW**).

(13) *Cayuga laryngeal metathesis* (Foster 1982: 69f.)

ka <u>h</u> wistaʔeks	→	k ^h <u>a</u> ʔwisdʔaes	‘it strikes, chimes’
koʔnikō <u>h</u> aʔ	→	g ^ʔ <u>o</u> ʔnik <u>h</u> waʔ	‘her mind’
akeka <u>h</u> aʔ	→	aʔgek <u>h</u> aaʔ	‘my eye’
aha <u>h</u> o <u>h</u> aeʔ	→	aʔhan <u>h</u> waeʔ	‘he washed it’

To some degree, however, it is uncertain whether this process is truly a reversal of segment order or instead a spreading of features across the vowel, resulting in overlap rather than reordering (**Foster 1982: 70**). Somewhat similar metathesis of vowel + /h/ occurs in Cherokee when a stop consonant precedes the vowel; the result is that the laryngeal is realized as aspiration on the stop (**Flemming 1996; Blevins and Garrett 1998: 520f.**).

In the framework of **Blevins and Garrett (1998: 509f., 2004: 121–125)**, Cayuga and Cherokee show the results of *perceptual metathesis*. Just as with the CC metathesis involving liquids and other segment types, the spread of laryngealization or devoicing through the vowel leads to the possibility of reinterpretation. Diachronic instances of the same

phenomenon include liquid metathesis in Slavic, as in *orbota ‘work’ > Polish /robota/; and reordering of /r/ with schwa in Le Havre French, such as [bærbɪ] ‘ewe’ compared to standard [bræbi] (**Blevins and Garrett 1998**: 513, 16f.). The Slavic example is somewhat unusual, in that it involves an initial sequence undergoing metathesis; reordering is cross-linguistically disfavored for root-initial segments, since a disruption in that position interferes with effective word recognition more than metathesis of other segments (**Hume and Mielke 2001**).

A clearer example of synchronic CV metathesis is found in the Austronesian language Leti, discussed in detail by **Hume (1998)** and **Blevins and Garrett (1998**: 541–547). Alternating stem forms in Leti are phonologically conditioned according to the following context; in particular, morpheme-final VC reverses to CV to avoid an illicit consonant cluster within a phrase.

(14) *Leti VC metathesis* (**Hume 1998**: 153)

- | | | | | |
|----|------------|---|------------|------------------|
| a. | ukar lavan | → | ukarlavan | ‘thumb, big toe’ |
| b. | ukar ppalu | → | ukrappallu | ‘index finger’ |
| | ukar muani | → | ukramwani | ‘middle finger’ |

There is, additionally, the same reversal in phrase-final position, so that ‘finger’ appears as [ukra]; here, rather than serving general phonotactics, the metathesized form appears to mark the word as phrase-final (**Bonthuis 2001**: 37f.).

Because metathesis in Leti affects all consonant types – compare /ulit/ → [ulti] ‘skin’, /metam/ → [metma] ‘black’ – it cannot be attributed to the elongated phonetic realization of a class such as laryngeals, and is not perceptual metathesis. Instead, **Blevins and Garrett (1998**: 539–547) identify it as *pseudo-metathesis*. By this they mean an alternation in ordering that did not arise historically as a direct reinterpretation of segment order. In the case of Leti, two main steps are posited, with evidence from other patterns within Leti and in related languages. First, an epenthetic vowel was inserted after final consonants, /ulit/ → [ulitʰ]. Although the inserted vowel was not a copy of the preceding vowel, it nevertheless would have been subject to co-articulatory effects of the more palatal or labial quality of a preceding /i/ or /u/, as in [ulitʰ]. Second, syncope of medial vowels led to loss of that schwa preceding another word beginning CV ([ulitʰ] → [ulit]), but loss of the original medial vowel in other contexts ([ulitʰ] > [ultʰ]); here, however, the vowel quality of the deleted vowel is preserved in the final schwa due to the co-articulation ([ultʰ] > [ulti]). Words containing the low vowel, such as /ukar/, do not show palatal or labial co-articulation, but result from the fact that schwa more generally became /a/ in the history of Leti (thus /ukarə/ > /ukrə/ > /ukra/). From the point of view of synchronic phonology, the crucial point is that alternations such as [ulit] ~ [ulti] were successfully integrated into the grammar as learners re-analyzed the historical patterns.

1.2.2 Morphological context

As noted above, CV metathesis often appears to occur in the presence of a particular morphological trigger, even if the reordering that occurs can be defined phonologically. A famous example, also from Austronesian, is found in Rotuman. In this language, words appear in two different “phases,” called complete and incomplete (**Churchward 1940**). The incomplete form is derived from the complete by a variety of means, but the default strategy is metathesis of the final CV to VC, often forming a short diphthong with the preceding vowel.

(15) *Metathesis in Rotuman phase alternations* (**Churchward 1940**: 14)

<i>complete</i>	<i>incomplete</i>	
ho.sa	hoas	‘flower’
i.ʔa	iaʔ	‘fish’
pu.re	puer	‘to rule, decide’
ti.ko	tiok	‘flesh’
se.se.va	se.seav	‘erroneous’

The process applies to loanwords as well, such as /pe.pa/ → [peap] ‘paper’. Consistent with many other languages, Rotuman short diphthongs must consist of two vowels with rising sonority (i.e. movement from a higher to a lower vowel). Where this condition is not met, the incomplete phase is realized in other ways: by dropping a final vowel, as in /to.ki.ri/ → [to.kir] ‘to roll’; by fusing two vowels brought together by metathesis, as in /mo.se/ → [møs] ‘to sleep’; or by directly changing a vowel sequence to a long diphthong, as in /ke.u/ → [keu] ‘to push’.

Blevins and Garrett (1998: 527–529) categorize the Rotuman alternation as *compensatory metathesis*. Historically, this entails an anticipation or perseveration of vowel features across an intervening consonant toward the stressed vowel, leading to “extreme vowel-to-vowel coarticulation.” In Rotuman there would have been anticipation of the final vowel in the direction of the preceding stressed syllable, followed by loss of the final vowel, essentially /hosa/ > /hoasa/ > /hoas/. In some vowel sequences, further changes occurred, such as /mose/ > /moese/ > /moes/ > /møs/. Metathesis of similar origin is also pervasive in the related language Kwara’ae, where final CV changes in most communicative contexts to VC to mark phrasal boundaries (**Sohn 1980**: 311f.); the details of Kwara’ae vowel realization lend particular support to the proposed historical origin as compensatory metathesis (**Blevins and Garrett 1998**: 530f.).

The phases of Rotuman were originally described by Churchward in complex syntactic and semantic terms, but some recent work has argued that their specific realization depends on prosody, and therefore that they are basically phonologically determined rather than triggered by a morphological or other grammatical context (Hale and Kissock 1998: 120–123). For example, it has been proposed that the desired outcome achieved by metathesis as well as the other processes is a word-final heavy syllable (Blevins and Garrett 1998: 531–534; McCarthy 2000: 159, 73f.). From this point of view, the reversal in order is just one way of satisfying the heavy-syllable constraint; there is no specific rule demanding metathesis. This analysis relies on the claim of Hale and Kissock (1998) that the complete phase occurs before monomoraic morphemes such as /-me/ ‘hither’ in [hoʔa-me] ‘to bring’, and the incomplete before bimoraic morphemes such as transitive /-kia/ in [hoaʔ-kia] ‘to take (TRANS)’. The essential idea is that right-aligned prosodic structure in [hoʔa-me] requires the stem-final CV syllable to be grouped with the CV suffix in a proper bimoraic foot, and the pressure for a stem-final heavy syllable is thwarted. But in [(hoaʔ)-(kia)], the stem and the suffix are footed independently, and the stem undergoes metathesis to ensure a stem-final heavy syllable. The same result is predicted in the absence of a suffix.

Kurusu (2001: 187) cites, in addition to certain exceptional suffixes, minimal pairs from Churchward (1940: 15) showing that the two phases can occur in an identical phonological context, such as complete [ʔepa la hoaʔ] ‘the mats will be taken’ and incomplete [ʔeap la hoaʔ] ‘some mats will be taken’. This overlap indicates that the phase changes must in some way be triggered by the presence of a morphosyntactic category, the Incomplete Phase. For Kurisu, the high-ranked constraint REALIZE MORPHEME forces the incomplete to be phonologically distinct from the complete phase (CHAPTER 103: PHONOLOGICAL SENSITIVITY TO MORPHOLOGICAL STRUCTURE); the relative ranking of phonological constraints, including LINEARITY, determines exactly how the base form is modified. The metathesis outcome is favored by the constraint ranking, although particular configurations (such as vowel sequences with falling sonority) lead to other outcomes, including fusion of the vowel features. Notably, in this more morphologically oriented approach, there is still no specific morphological demand for metathesis; rather, the drive for distinctness of word forms interacts with phonological constraints to produce metathesis, among other results.

The examples presented so far involve underlying CV changing to VC, especially stem-finally. The converse change at the left edge, where initial VC changes to CV, is attested in some Northern Paman languages such as Ngkoʔ, following the historical loss of initial consonants (Hale 1976: 17f., 23–28; Blevins and Garrett 1998: 537f., 2004: 135f.).

(16) *Ngkoʔ initial VC metathesis* (Hale 1976: 23–28)

*nʔipul-	>	*ipul-	>	pjul-	‘you (NON-SG)’
*nʔi:na-	>	*ina-	>	nja-	‘to sit’
*kulan-	>	*ulan-	>	lwan-	‘possum’
*puŋa-	>	*uŋa-	>	ŋwa-	‘son’
*ŋali-	>	*ali-	>	laj-	‘we (DUAL INCL)’
*kami-	>	*ami-	>	maj-	‘mother’s mother’

Unlike in Rotuman and a number of other Austronesian languages, however, this metathesis appears to be diachronic only.

A somewhat similar pattern is found synchronically for a number of verbs in the Nilo-Saharan language Fur (Jakobi 1990: 57f., 64–74; Hume and Mielke 2001: 141f.). These verbs, when preceded by a monoconsonantal person-marking prefix, undergo reversal of the initial CV.

(17) *Fur CV metathesis under prefixation* (Jakobi 1990: 57f., 64–74)

k-ba-	→	kab-	‘we drink’
k-teer-	→	keter-	‘we forge’
k-lat-	→	kald-	‘we beat, hit’

Some alternations are quite irregular, such as /li-/ → [al-] ‘wash’ and /tii-/ → [ei-] ‘catch’, so that a plausible alternative is that the allomorphs are lexically listed. This account would also address the formal problems in alternations such as /bul-/ → [ulb-] (→ [ulm-]) ‘find’, which involve two apparent metatheses (Hume 2001: 18f.); see §2.3 below. Even if the allomorphs are listed, however, metathesis was a crucial historical source.

1.2.3 Metathesis in templates

Languages with *templatic morphology* express certain inflectional or derivational categories by changes to the syllable structure of the stem (See CHAPTER 105: TIER SEGREGATION; CHAPTER 108: SEMITIC TEMPLATES). If a particular paradigm includes different orderings of C and V elements, then the result is a form of metathesis. Templatically created metathesis generally does not derive from general phonological properties of a language, but rather from potentially arbitrary exponence of a morphological category. For example, a relatively productive metathesis applies to derived Classical Arabic nominal stems two syllables in length; initial /Ca/ is reversed to [aC] and a glottal stop onset is inserted (McCarthy and Prince 1990: 213f., 279f.). Examples include /kabar/ → [ʔakbar] ‘greater, greatest’ and /dʒanib-at/ → [ʔadʒnib-at] ‘wings’; compare the underived forms [kabi:r] ‘great’ and [dʒana:b-at] ‘wing’, without metathesis. The change cannot be treated as a general

phonological process, because it is limited to certain morphological categories, and does not occur in verbs such as /katab/ 'he wrote' (*[ʔaktab]).

In Mutsun, a Costanoan language of northern California, templatic alternations include the reversal of a stem-final sequence of vowel and consonant; the primary stem is consonant-final and the derived stem is vowel-final (Okrand 1979: 126f.). The choice between alternate verb stem forms depends on what suffix is added; in other cases (18b) the primary stem is a noun, and the derived stem is a verb with related meaning. The derived stem has the uniform shape CVCCV, despite considerable variation in the primary stem shape.

(18) *Mutsun stem alternations* (Okrand 1979: 126f.)

	<i>primary</i>	<i>derived</i>	
a.	pasik-	paski-	'to visit'
	litf:ej-	litfje-	'to stand'
	mat:al-	matla-	'to be face down'
b.	lul:up-	lulpu-	'flute / to play the flute'
	to:her-	tohre-	'a cough / to cough'
	la:lak-	lalka-	'goose / to get geese'
	poso:l-	poslo-	'posole (stew) / to make posole'

Okrand observes that while the vowel-final derived stem is the form used with all suffixes that would create an illicit consonant cluster if added to the primary stem ([litfje-hte] 'standing', *[litf:ej-hte]), it also occurs with some suffixes that would be phonotactically well-formed with a preceding consonant ([matla-nu] 'put (someone) face down', alongside [mattal-pu] 'put oneself face down'). Therefore, this morphologically defined reordering does not merely repair phonological violations, even if it sometimes conspires to avoid phonotactically problematic concatenations. It has been pointed out that for similar alternations in related Sierra Miwok, a representation with V/C segregation makes a specific metathesis rule unnecessary (Smith 1985: 366f.; Goldsmith 1990: 91; Stonham 1994: 157f.); more on this below.

In Tunisian Arabic, a stem-internal alternation is a cleaner example of metathesis than what we find in Classical Arabic (Kilani-Schoch and Dressler 1986; Becker 2000: 579f.). Historical changes to vowels within stems have led to minimal differences defined by ordering, such as Classical Arabic /malak-a, milk-u/ > Tunisian /mlək, mək/; this pattern is now productive in relating trilateral surface forms.

(19) *Tunisian Arabic stem alternations* (Kilani-Schoch and Dressler 1986: 62, 65f.)

mlək	'he possessed'	mək	'property'
fhəm	'he understood'	fəhm	'understanding'
hrəm	'he forbade'	harm	'prohibition'
kɔr	'he blasphemed'	kɔr	'blasphemy'

A similar alternation is found in Alsea (Buckley 2007). In this coastal Oregon language, stems generally show at least two forms; the full stem contains a root vowel, while the short stem lacks it. For stems with a medial sonorant consonant, an additional distinction is found: the full stem occurs in two varieties, light and heavy, according to whether the root vowel follows or precedes the sonorant. The stem choice depends on the presence of particular suffixes as well as an aspectual distinction.

(20) *Alsea stems with a medial sonorant* (Buckley 2007: 8f.)

<i>light (CV)</i>	<i>heavy (VC)</i>	<i>short (no V)</i>	
stlak-	stalk-	stlk-	'slide'
twih-	tiwh-	twh-	'pour'
tms-	tums-	tms-	'close'

In the analysis of Buckley (2007: 15-18), the light stem is the underlying form; the short stem is created by deletion of the root vowel, and the heavy stem results from VC metathesis. Since only sonorants undergo this potential reordering, they alone are treated as weight-bearing in the coda, and therefore only in that case can metathesis yield satisfaction of the heavy template requirement. The same approach might be applied to Tunisian Arabic, with the difference that all consonant classes are moraic, and therefore metathesis applies to stems regardless of the medial consonant. The larger point is that the requirement for a heavy syllable is morphologically determined, but the effect is generated phonologically.

Similar is the stem alternation found in Klallam and other Straits Salish languages, in two forms called the actual and non-actual aspect (Thompson and Thompson 1969: 215-217; Demers 1974: 17f.; Montler 1989: 96f.).

(21) *Klallam stem alternations* (Thompson and Thompson 1969: 216)

<i>non-actual</i>	<i>actual</i>	
ʃk ^w u-	ʃuk ^w -	'shoot'
qq'i-	qiq'-	'restrain'
ŋq'ə-	ŋəq'-	'swallow'
mtəq ^w -	mətq ^w -	'put in water'

Anderson (2005: 9–11) argues that synchronically, Klallam and similar languages require a processual rule of metathesis to express this morphological category. **Montler (1989: 93)**, however, expresses this effect for Saanich as a CVCC template that causes metathesis in a form such as /sʌt/ 'push it' → [səʌt] 'pushing it'. In roots where the CVCC template cannot be satisfied by metathesis, other strategies are available, such as glottal stop insertion after the vowel in /weqəs/ 'yawn' → [weʔqəs] or reduplication to achieve this templatic result, as in /'qen/ 'steal' → [qeqn] (→ [qeqnən] by epenthesis). The same additional strategies occur in Klallam as well. In a prosodic version of the template approach, **Stonham (1994: 173f.)** proposes insertion of a mora in Klallam and Saanich that forces CCV to surface as CVC, a heavy syllable, and also causes the related effects of coda insertion and reduplication. The templatic and moraic approaches treat metathesis as one possible means of satisfying the morphologically determined, but phonologically expressed, restriction on shape. As with Rotuman, metathesis is one change among several, and not necessarily the direct goal of the morphological category.

In a more strictly phonological approach for closely related Lummi, **Demers (1974: 16)** proposes a rule that deletes unstressed schwa between obstruents. In this view, the actual and non-actual forms are both based on a CəCə root, but have different stress placement. Schwa deletion yields apparent metathesis in pairs with the surface shapes seen in /'CəCə/ → [CəC] and /Cə'Cə/ → [CCə]. Although the synchronic evidence for exactly this derivation is missing in Klallam, the Lummi pattern suggests the likely diachronic origin of metathesis as a re-interpretation of vowel deletion. Such a historical origin can explain why these templatic changes normally involve reorderings of consonants and vowels, but not of consonants. For example, suppose that (similar to Lummi) the Alsea stem 'to close' that alternates between [tmus] and [tums] derives from original *tumus, with deletion of the unstressed vowel in forms with distinct stress patterns due to different suffixation: *'tumus-a > /'tums-a/ 'door' and *tu'mus-ʌ > /'tmus-ʌ/ 'is closed' (**Buckley 2007: 22f.**). The alternate forms that preserve different vowels are subject to reinterpretation as a stem with a single underlying vowel that is reordered with the adjacent consonant in different suffixal contexts; but vowel deletion by itself will not result in the reordering of consonants. Given the frequency of vowel harmony and syncope, patterns like this can be expected to arise rather often.

Despite the crucial role of morphological context in conditioning these reorderings, phonological techniques can often be used to generate the necessary effects. One important tool has been the segregation of vowels and consonants onto different tiers (see **CHAPTER 105: TIER SEGREGATION**), so that they have no underlying ordering and no actual metathesis occurs in the derivation (**McCarthy 1989: 5, 22f.**). The advent of Optimality Theory, with its emphasis on output constraints rather than restricted input representations, makes V/C segregation "superfluous" (**McCarthy 2000: 180f.**). Even in an approach that does not treat the consonantal root as a morpheme listed independent of any vowels, derivational and inflectional morphemes often consist of vowels that overwrite the underlying vowels of the stem (**Ussishkin 2005**). Apparent VC metathesis among surface forms is merely the result of different overwriting patterns, as when the elements /h i i/ are imposed on Modern Hebrew /gadal/ 'grow' to form [h-igdil] 'enlarge'. Constraints on the realization of affixal material in the stem lead to particular overwriting patterns, but the vowels of the affixes still have no underlying ordering relation to the consonants of the input word.

It is less clear how a vowel-overwriting approach for Semitic can extend to language families such as Miwok-Costanoan and Yokuts, where the vowels and consonants can be reordered, but the vowels do not have the status of separate morphemes (**McCarthy 1989: 74, 78**). Thus in Mutsun, the verb 'to visit' is lexically specified with not only the consonants /psk/ but also the vowels /ai/, combined in different ways, including [paski-] and [pasik-] (18). The overwriting operation would have to be available for subparts of one lexical entry, rather than independent morphemes, in order to account for languages like Mutsun.

1.3 VV metathesis

Although CV and CC metathesis are robustly attested, there is weak evidence for VV metathesis. **Webb (1974: 8)** states that "[e]ven as a sporadic change metathesis of vowels appears to be quite uncommon." **Kiparsky and O'Neil (1976: 531, n. 7)** believe "there are few if any rules that metathesize contiguous syllabic segments in any language." **McCarthy (2000: 176)** observes that the few synchronic analyses that posit VV reversals "involve very abstract analyses, in which the underlying representations and/or the consequences of metathesis are by no means apparent." The rarity of such reversals may be related to the much longer typical duration of vowel gestures compared to consonants, so that a considerable temporal shift would be required for re-analysis of the ordering of two vowels (**Steriade 1990: 390f.**; **McCarthy 2000: 176**).

A classic example is VV reversal in Kasem, to which **Chomsky and Halle (1968: 361)** first applied the transformational rule format for metathesis. In particular, the vowel sequence /ia/ is reversed to [ai] when followed by the plural suffix /i/; but the first /i/ deletes and then the remaining vowels coalesce, as in /pia-i/, which surfaces as [pe] 'sheep (PL)'. Needless to say,

on first inspection /piai/ → [pe] is not an obvious example of metathesis. **Phelps (1975: 303f., 10f., 25, 1979: 56f.)** argues against the Chomsky and Halle VV metathesis rule, but in favor of an entirely different CV metathesis, in derivations such as /boɑ:l-u/ → [bola:l-u] (→ [bolo] ‘valley’). This derivation is again complex, although with different assumptions about underlying forms. Both of Phelps’s general conclusions regarding Kasem metathesis – CV is transposed but not VV – are endorsed, in a more modern framework, by **Haas (1988: 241–253, 45f.)**; see also **Burton (1989: 29f.)** for an analysis of vowel coalescence without an intermediate reordering.

Similar re-analyses have been proposed for other languages with apparent VV metathesis. **Keyser (1975: 404)** posits a rule for Old English that reverses vowels in order to feed a vowel elision rule, as in /lufa-i/ → lufia → [lufa] ‘love!’. **Kiparsky and O’Neil (1976: 535f.)** argue that a revised formulation of vowel elision makes metathesis unnecessary. A rule of VV metathesis has been claimed to play “a central role” in Latvian phonology; it reverses the order of elements in the diphthongs /ai au æi æu/, although under restricted conditions (**Halle and Zeps 1966: 108**). In a more recent treatment of Latvian vowels, although not focusing on metathesis, **Anderson and Durand (1988: 34, n. 7)** reject some of the synchronic abstractness assumed by Halle and Zeps; instead they assume raising of a monophthongal vowel that then undergoes breaking to form a diphthong, where no metathesis is required.

A few diachronic examples of VV metathesis can be cited, especially if we include vowel/glide reversals in this category, since the same set of segmental features may serve as a glide or vowel before and after the metathesis (**Ultan 1978: 375f.**). Two examples from Portuguese are /genukulum/ > /geoʎo/ > /zoeʎo/ ‘knee’ and /dehonestɑ:re/ > /deostar/ > /doestar/ ‘to insult’ (**Williams 1962: 111**); these reversals may have occurred “on the analogy of the more familiar sequence *oe*” (**Ultan 1978: 376**).

1.4 Other types of metathesis

Permutations involving something larger than a segment may fall under broader definitions of metathesis (**Ultan 1978: 370**). These include syllable reversals in language games or *ludlings*, such as Chasu /i.ku.mi/ → [i.mi.ku] ‘ten’ (**Bagemihl 1995: 704**). Metathesis has also been proposed for elements such as *location* in sign language phonology (**Sandler 1993: 246**).

Hyman and Leben (2000: 590) state that there are “sporadic reports of tonal metathesis in the literature”; some examples include Bamileke–Dschang (**Pulleyblank 1986: 41, 50**), Mixtec (**Goldsmith 1990: 25**), and Dangme (**Holscher et al. 1992: 126**). These processes typically involve the movement of a floating tone, originating at the edge of a word or other domain, past a single linked tone. But – like VV metathesis in §1.3 – they are also embedded in complex derivations, and depend on multiple assumptions about how the pieces of the analysis fit together. Under other assumptions, metathesis may not be required. For example, **Pulleyblank (1986: 41)** proposes that in Bamileke–Dschang a floating L tone moves leftward across a H, and remains floating to represent downstep; **Hyman (1985: 71, 73)**, on the other hand, links the L directly to the H on a second tonal tier as a direct representation of a downstepped H. In essence, the new rule is a merger rather than a reordering, similar to Zoque palatalization in §3 below.

It should be kept in mind that “metathesis” of syllabicity, as in French /oj/ > /wɛ/ > modern /wa/ and Proto-Slavic *ew > /ju/ (**Ultan 1978: 376**), does not involve transposition of segmental features but rather a shift in affiliation relative to the head of the syllable. Thus in French /oj/ > /wɛ/, the round vocoid continues to precede the front vocoid; in Slavic *ew > /ju/, the round element is second, but remains there. The same observation can be made for English /iw/ > /ju/, found in words such as *few* (**Jespersen 1949: 101**), which is quite similar to the Proto-Slavic change. None of these represents segmental metathesis.

2 Non-local effects

Often grouped with local metathesis is the exchange of segments that are not adjacent, called *long-distance* or *non-contiguous* metathesis (**Ultan 1978: 380–383**). In fact, *metathesis* or its equivalent in another language has been used, especially by earlier writers, specifically for such long-distance effects (**Blevins and Garrett 1998: 525**). **Grammont (1933: 239ff., 339ff.)** devotes separate chapters to longdistance *métathèse* and local *interversión*, a terminology found more recently, for example, in **Pierret (1994: 61)**; but **Wechsler (1900: 496)** already uses *Metathese* for both local and long-distance transpositions. As noted at the beginning of this chapter, metathesis here refers to either type of reordering.

2.1 Diachronic

A famous diachronic example of transposition over intervening segments is the Spanish metathesis of *r ... l > l ... r*, observable in a few modern words (**Ultan 1978: 381**; **Penny 2002: 36**).

(22) *Spanish liquid metathesis* (Penny 2002: 36)

<i>Latin</i>		<i>Spanish</i>	
mi:ra:kulum	>	milagro	'miracle'
peri:kulum	>	peligro	'danger'
parabola	>	palabra	'word'

These pronunciations were probably influenced by the greater frequency of consonant + *r* in the lexicon; various sound changes had eliminated many inherited instances of consonant + *l* (Ullan 1978: 391; Penny 2002: 70–72); the change can also be viewed as two steps, first the change of /l/ to /r/ in a cluster, and then the well-attested dissimilation of identical liquids (Wanner 1989: 444f.).

Comparison of cognate words in the Yuman family of the American Southwest reveals a variety of historical metathesis processes, including root consonants in Walapai /'pil/ 'burns' ~ Cocopa /'lip/ 'flames up', or Havasupai /ka'to/ ~ Walapai /ta'ko/ 'chin' (Langdon 1976). There are also variant forms within languages, such as Ipai Diegueño /məxə'tun/ ~ /xəmə'tun/ 'knee'. These alternations are widespread, but remain lexically specific. Swapping of the consonants in largely CVC roots is also common in the Salish family, as seen in apparent cognate pairs such as Shuswap /x^wej/ ~ Twana /jəx^w/ 'disappear', and Klallam /ts'əq^w/ ~ Upper Chehalis /q^wəts'/ 'dirty' (Noonan 1997: 482). The pervasiveness of this pattern in Salish is unusual, and is possibly best explained by historical processes of reduplication and consonant deletion rather than direct metathesis (Hume and Mielke 2001: 143, n. 4; Noonan 1997: 513).

Prunet (2006: 57–61) discusses examples of consonant metathesis within Semitic roots. These are said to be particularly common in the Hebrew lexicon, as in synonymous variants such as [keveš] ~ [kešev] 'lamb' and related meanings such as [ʔa:raz] 'tie packages' ~ [ʔa:zar] 'bind, girdle' (Horowitz 1960: 228–234). More dramatic examples of non-contiguous consonant metatheses are found in language games in Bedouin Hijazi and Moroccan Arabic, in which the root consonants are scrambled (Prunet et al. 2000: 623f.); in Hijazi, /kattab/ 'caused to write' can be realized as [battak], [takkab], [kabbat], [tabbak], and [bakkat]. Although this radical permutation is not part of the basic grammar, such language games show an impressive computational capacity for synchronically active metathesis (Bagemihl 1995: 703f.; Anderson 2005: 11f.).

2.2 Synchronic

Typological surveys have claimed that permutation of non-adjacent segments does not occur as a regular synchronic process (Webb 1974: 5; Wanner 1989: 445; Hume and Mielke 2001: 145f.). Certainly, the permutation of non-adjacent segments is common in speech errors, such as classic Spoonerisms, but such errors also involve strings of segments such as complex onsets and rhymes (Fromkin 1971: 31f.).

(23) *Metathesis in speech errors* (Fromkin 1971: 31f.)

<i>intended</i>		<i>error</i>	
kip ə teɪp	→	tip ə keɪp	'keep a tape'
fɑr mɔr	→	mɔr fɔr	'far more'
peɪ skeɪl	→	skeɪ peɪl	'pay scale'
swɛrə drɑɪɪŋ	→	drɛrə swɑɪɪŋ	'sweater drying'
hɪp əv dʒʌŋk	→	hʌŋk əv dʒɪp	'heap of junk'

These form part of a larger phenomenon of anticipation, perseveration, deletion, and so forth. Speech errors may, however, be a source of sporadic metathesis in historical change (Wanner 1989: 445). The outputs of speech errors, like more systematic metathesis, overwhelmingly respect the existing phonotactics of the language (Wells 1951: 26; Fromkin 1971: 40–42; Dell 1995: 200); but transposition of adjacent consonants, so common in regular metathesis, is "exceptionally rare" as a speech error, such as *whipser* for *whisper* (Berg 1987: 9). Elements that transpose by error usually occupy parallel syllable positions, which is not the case for adjacent consonants; instead, as discussed above, metathesis of such segments normally arises historically by misperception rather than production or planning errors.

An interesting comparison is an optional metathesis reported for a few words in Turkana (Dimmendaal 1983: 48f.; Hume and Mielke 2001: 139f.; Hume 2004: 218). Here two consonants with the same value of [sonorant] that serve as onsets to successive syllables, and are adjacent to identical vowels, are optionally transposed in fast speech.

(24) *Turkana onset metathesis* (Dimmendaal 1983: 48f.)

<i>preferred</i>		<i>alternate</i>	
ŋa-kɛmɛr-a		ŋa-kɛrɛm-a	'mole'
ŋi-kwanɔrɔmɔk-à		ŋi-kwanɔmɔrɔk-à	'a kind of tree'
ɛ-sɪkɪn-a`		ɛ-kɪsɪn-a`	'breast'

These alternations have the appearance of a common speech error that has become somewhat conventionalized. In particular, it has been widely observed that exchange (and other) errors are more likely when the sounds in question are found in similar phonological environments, so that for example *left hemisphere* → *heft lemisphere*, where the initial consonants are both followed by /ε/, is more likely than the parallel error in *right hemisphere*, where the vowels are different (MacKay 1970: 325–328; Dell 1984: 222).

Morphologically restricted metathesis (§1.2.2) can apply synchronically to surface non-adjacent segments. For example, Akkadian has a /t/ infixed in reciprocal verbs; it surfaces there in most cases, exemplified by [pitrus-] (25a), which motivates the stem-internal position as basic. But this stop is transposed to word-initial position when the root has an initial coronal obstruent as in (25b) (Caldwell et al. 1977: 118; McCarthy 1981: 381; Buccellati 1996: 233f.; Huehnergard 2005: 390, 531, 611).

(25) *Akkadian long-distance metathesis* (Caldwell et al. 1977; Huehnergard 2005)

	<i>root</i>	<i>infinitive</i>	<i>reciprocal</i>	
a.	/prs/	para:s-	pitrus-	'divide'
	/rkb/	raka:b-	ritkub-	'mount, ride'
	/kmr/	kama:r-	kitmur-	'heap up'
b.	/sʰbt/	sʰaba:t-	tisʰbut- *sʰitbut-	'seize'
	/snq/	sana:q-	tisnuq- *sitnuq-	'be near'
	/zkr/	zaka:r-	tizkur- *zitkur-	'declare'
	/dkʃ/	daka:f-	tidkuʃ- *ditkuʃ-	'swell'

The same metathesis occurs in iterative stems: [pitarrus-] but [tisʰabbut-] (*[sʰitabbut-]). In the analysis of Lubowicz (2009), Akkadian metathesis serves to move the /t/ outside the stem domain, where it would cause a violation of the Obligatory Contour Principle (OCP) penalizing two tier-adjacent coronal consonants; thus [tizkur] does not violate this constraint, whereas *[zitkur] would, because the /t/ is located within the stem. This approach gives a relatively prominent role to phonology (the OCP constraint on coronals) while maintaining a crucial morphological component, due to the role of the stem domain.

2.3 Displacement

A related phenomenon, which is also called metathesis by many authors (Grammont 1933: 339; Ultan 1978: 372), involves the shift or *displacement* of a segment over more than one intervening segment. A famous example comes from the Occitan dialect of Bagnères-de-Luchon in southwestern France (Grammont 1905–6: 74, 85, 1933: 341; Blevins and Garrett 1998: 526). Among other processes, a liquid following a stop shifts leftward to form a cluster in the preceding syllable.

(26) *Bagnères-de-Luchon long-distance shift of liquids* (Grammont 1905–6: 74, 85, 1933: 341)

*kabra	>	'krabo	'goat'
*bespras	>	'brespes	'vespers'
*pawpro	>	'prawbe	'poor'
*tendro	>	'trende	'tender'
*kambra	>	'krambo	'room'
*kum'pra	>	krum'pa	'to buy'
*e'spingla	>	e'splingo	'pin'

A shift like this is formally identical to metathesis when just one segment is skipped. However, with intervening material that includes non-constituent strings such as /esp/, it must be movement of /r/ rather than exchange. A similar shift of /r/ to the initial syllable is attested in South Italian Greek (Rohlf's 1930; Blevins and Garrett 2004: 130f., 34f.).

If it is to be classified with long-distance metathesis, displacement might be expected to be absent from synchronic grammars. But synchronically active long-distance displacement is attested at least for laryngeal and pharyngeal features (Blevins and Garrett 2004: 132–134; see also CHAPTER 25: PHARYNGEALS). For example, in the Interior Salish language Colville (Nxilxcin), the pharyngeal consonant of a root is displaced to a stressed suffix, where it lowers the adjacent vowel to [a] (Mattina 1979).

(27) *Colville pharyngeal displacement* (Mattina 1979: 17f.)

$q^{rwc}aj$	→	$q^{rwc}aj$	‘black’
$q^{rwc}aj^{-1}us$	→	$q^{rwc}aj^{1}as$	‘black man’
$q^{rwc}aj^{-1}lst^{s}ut$	→	$q^{rwc}ajlst^{s1}at$	‘his clothes are dirty’

Both pharyngealization and laryngealization can be seen as suprasegmental features in Salish (Mattina 1979: 19f.). Displacement of these features appears to reflect the spread of features over multiple syllables that may then be localized to a salient position (Blevins and Garrett 2004: 122f.). Such displacement resembles the *mobility* of a tone that shifts from the morpheme with which it is underlyingly affiliated to some phonologically defined position such as the penultimate syllable (Yip 2002: 65f., 89f., 132). A reasonable synchronic analysis is a [pharyngeal] feature affiliated with the root, which is attracted to the stressed syllable and possibly realized there as a segment. By the same token, the displacement of /r/ to the initial syllable in South Italian Greek reflects the salience and perceptual prominence of such syllables due to their location in the word (Blevins and Garrett 2004: 134); in Luchonnais, both stress and initial position favor the first syllable.

Patterns of this sort have similar historical origins to simple exchanges of segments – in particular, phonetic cues that are relatively long in the temporal dimension and therefore subject to re-analysis, as discussed above for perceptual metathesis. But since they are displacements rather than exchanges, they are not formally equivalent to true metathesis as the exchange of positions. In particular, if local metathesis is seen as a minimal displacement (across a single segment), then long-distance metathesis would have to involve two simultaneous displacements, one leftward and one rightward, as in /abXcdYef/ → [abYcdXef]. This extra formal complexity may account for the rarity of synchronic non-local metathesis, which seems to be restricted to limited examples such as the optional reversal in Turkana (24) and the morphologically defined environment in Akkadian (25).

An ordering alternation in the form of two suffixes is reported for several Costanoan languages, including Mutsun (Okrand 1979; Hume 1998: 170f., 1999: 300f., 2004: 223f.). Both suffixes have the shape CCV after a vowel-final stem, and CVC after a consonant-final stem, which makes phonotactic sense insofar as a three-consonant cluster at the stem boundary would be ill-formed.

(28) *Mutsun suffix alternations* (Okrand 1979: 127f., n. 17)

CCV		CVC	
pire-tka	‘on the ground’	ʔurkan-tak	‘in the mortar’
rukka-kma	‘houses’	wimmah-mak	‘wings’

Although the locative [tka] ~ [tak] can be treated as local metathesis, in the plural [kma] ~ [mak], the [k] appears to move across two other segments. If LINEARITY is gradiently violable, with one violation for each segment over which another is displaced, the minimal change (one ordering reversal) is generally optimal (Hume 1998: 168–171, 2001: 17–19). Gradient violation does still permit Mutsun /mak/ → [kma] when other constraints force multiple violations of LINEARITY, and the alternation can be seen as part of the synchronic grammar; but such cases seem to be quite rare and limited in scope. In the more recent version of OT that incorporates candidate chains (OT-CC), changes to the representation occur by minimal steps, and non-contiguous metathesis is subject to the requirement that each change in linear order increase well-formedness (McCarthy 2007: 87f.). In a suffix alternation requiring the synchronic derivation /mak/ → mka → [kma], the first step might be motivated by a preference for sonorant codas, but that change does not appear to be motivated more generally in Mutsun; in fact, Hume (1998: 170f.) specifically gives the constraint *m_{codas}. It might therefore be that the architecture of OT-CC forces the Mutsun alternation to be treated as listed allomorphy (CHAPTER 99: PHONOLOGICALLY CONDITIONED ALLOMORPH SELECTION).

3 Related processes

In some cases, a pattern that was originally considered to be metathesis was later seen as non-metathesis – and occasionally vice versa. A good example is the Zoque 3rd person singular prefix /j-/ , which never surfaces as a strict prefix, but has been described as permuting with the stem-initial consonant, as in /j-pata/ → [pʲata] ‘his mat’ (Wonderly 1951: 117f.; Dell 1973: 110). Sagey (1986: 105–111) argues that the glide /j/ actually merges featurally with the following consonant to produce a palatalized segment (CHAPTER 71: PALATALIZATION), which may be realized with an offglide, as implied by transcriptions such as [pʲ]. This position is supported by the independent need for a non-metathesis source of palatalized segments found at compound boundaries; cases such as /kuj-tam/ → [kujʲtam] ‘avocado’ show that the glide spreads, rather than reversing in order. A similar pattern is found in several languages of Nigeria and Cameroon. Prefixes that can be reconstructed as the high vowels *i and *u are realized as a glide – or a secondary articulation on the consonant – after the stem-initial consonant, as in Noni /k-w-en/ ‘firewood’ from the base /ken/ (Blevins and Garrett 1998: 514–516). See also the cases in Webb (1974: 12f.).

Another phenomenon that has a certain affinity to metathesis is *infixation*, since it likewise requires a reordering from the

expected position. In particular, “infixation and metathesis commonly show the potential mobility of full segments” rather than just subsegments such as features or nodes (Zoll 2001: 51). The closest analogy can be found in the infixation of a single consonant across one other consonant, as in the active neutral infix /-m-/ of Atayal /t-m-apeh/ ‘beckon’ (Egerod 1965: 265f.); this is formally similar to the metathesis of adjacent consonants. But infixation encompasses a broader set of phenomena that can include multiple segments in the item that undergoes reordering, as well as multiple segments in the span over which the infix is displaced; both are illustrated by the Tagalog actor focus /-um-/ that (optionally) moves over complex onsets in borrowed words such as /gr-um-adwet/ ~ /g-um-radwet/ ‘graduate’ (Orgun and Sprouse 1999: 204). On the other hand, Halle (2001) argues that the apparent Tagalog infixes appearing as /-um-/ and /-in-/ are actually CV underlyingly, with non-local metathesis of the two leftmost onsets, as /mu-tawag/ → [tu-mawag]. Theoretical and empirical problems with this approach are discussed by Klein (2005: 989–991), who advocates an infixation analysis within Optimality Theory.

Another phenomenon that might be seen as involving either metathesis or infixation (or even other possibilities) is *imbrication* in Bantu languages such as Cibemba (Hyman 1995). In this process, the perfective suffix /-il/ combines with a polysyllabic stem, such that the /l/ of the suffix disappears and the /i/ combines with the rightmost vowel in the stem according to the usual coalescence rules of the language, as in /sákat-il-e/ → [sákeete] ‘seize’. The striking fact is that the suffixal vowel appears to skip over the stem-final consonant; in principle, this could be handled a variety of ways, including either CV metathesis, /sákat-il-e/ → sákaitle → [sákeete]; or infixation of the suffix inside the final consonant, /sáka-il-t-/ → sákaitl-e → [sákeete]. These approaches assume subsequent simplification of the consonant cluster, as well as vowel coalescence. Hyman (1995: 11–16) argues in favor of infixation, which he relates to the positioning of the perfective (and the applicative) before the passive and causative suffixes.

Diachronically, metathesis is the origin of some instances of infixation (Ultan 1975: 178f.; Yu 2007: 139–148). Another point of comparison is found in Horwood (2002: 170, 2004: 11), who uses LINEARITY to control the displacement of prefixes and suffixes to infixed positions. A crucial difference is that infixation of this sort (that is, excluding infixation tied to prosodically prominent constituents) is inherently edge-oriented; the infixed material remains as close to the left or right edge of the stem as possible, subject to the phonotactic constraints or other pressures that force deviation from simple prefixation or suffixation (McCarthy and Prince 1993; Prince and Smolensky 2004: 40–43; Yu 2007: 67–71). Metathesis, on the other hand, often occurs at stem edges as the result of morpheme concatenation, but in principle can occur anywhere in a word – recall the stem-medial cases in Cebuano and Rendille (§1.1). In addition, the infix has the status of a morpheme, which may happen to consist of a single segment; but in metathesis the single-segment status is fundamental, and not necessarily correlated with a particular morpheme.

It can be noted finally that metathesis as a phenomenon is important evidence in favor of the category *segment*, however it may be formalized (CHAPTER 54: THE SKELETON). Whether one considers the category of segment to be innate in the language faculty or something that emerges from the coordination of phonological gestures (Bybee 2001: 85f.), it is impossible to describe reorderings coherently in terms of disparate features or phonetic cues: the essential property of metathesis is that it moves all features associated with a segment, and the cues that instantiate these features are affected as a group. Indeed, the features may be implemented by rather different cues in the new position. For example, the Alsea alternation [stlak] ~ [stalk] affects just two of the five segments in this root. Even if /la/ were to be described as a core syllable, which is then reversed in some sense, the notion of “reversal” makes covert reference to the segments within the CV syllable. Otherwise there must be a claim that the prevocalic /l/ has the same phonetic realization as when it occurs in the coda, and that the release of the /t/ into the /a/ is no different from that into the /l/ in the non-metathesized form. The need to refer to discrete segments even to characterize metathesis, and even more so to provide a theoretical analysis, presents particularly good evidence against suggestions that segments have no psychological reality, and are a mere artifact of an alphabetic writing system (Ladefoged 2005: 191; Silverman 2006: 6, 203).

Note

1 Similar patterns are found in a number of other Philippine languages (Blust 1971: 85f.; 1979: 104f.; Crowhurst 1998: 597), including Tagalog, where, however, it is poorly attested and classified with irregular verbs (Schachter and Otanes 1972: 375–380).

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