

## **Phonological Metathesis in Persian: Synchronic, Diachronic, and the Optimality Theory**

**Mohammad Reza Ahmadvkhani\***

Associate Professor, Payame Noor University, Varamin, I.R. Iran

(Received: 22 July. 2008, Accepted: 10 Oct. 2009)

### **Abstract**

Metathesis as a phonological phenomenon in order to reverse segments has been focus of many studies. Metathesis according to the range of application can be sporadic or regular. It links synchronic studies of language to diachronic ones and thereby has some consequences for phonological theory. The central goal of this paper is to elucidate the conditions under which metathesis occurs synchronically in modern Persian and diachronically in Pahlavi (Middle Iranian Persian). In this paper, first metathesis is viewed from different aspects especially a historical one. And particular attention is paid to its causes and contexts. Then, metathesis is studied within Optimality Theory, using constraints such as Syllable Contact Law (SCL), Sonority Sequence Principle (SSP),... Also it was found that segments don't behave identically in the metathesis process. Phoneme /r/ is the most frequent and /z/ is the least one found in Persian.

**Key Words:** Metathesis, Persian, Constraint, Optimality Theory.

---

\* Tel: 0292-21157111, Fax: 0292-2114282, E-mail:ahmadvkhani@pnu.ac.ir

### **1. Introduction**

One of the long standing issues in linguistic theory is metathesis. Metathesis can be defined as the process where by in certain languages, under certain conditions sounds appear to switch positions with one another. Thus in a string of sounds where we would expect the linear ordering of two sounds to be ...xy..., we find instead...yx.....

The explanation to the metathesis has been to say that this process is indeed less natural phonetically than other processes, and has a relatively greater phonological motivation. First suggested by neogrammarian movement (Osthoff & Brugman 1878: xvi), this view was clearly stated by Brugmann (1902:246): "Metathesis arises when the order of sounds and the syllable boundary make inconvenience; it causes a group of sounds to be placed where it is easier for the speaker". This phonetic optimization approach has prevailed in descriptive and typological studies. According to Grammont (1950:239), for instance, metathesis yields a better syllable structure safeguards unity and harmony of languages sound system in replacing unusual groups by common groups which are or have become unpronounceable in substituting simple types for them and avoids useless articulatory effects. Ultan's (1985:395) survey also concludes that the superficial cause of most metatheses is conversion of a phonologically inadmissible or disfavored sequence into an acceptable one. Finally, Hock (1985:532-33) contends that metathesis can become regular only when it serves a specific structural purpose usually that of converting phonologically or perceptually marked structures into more acceptable ones.

### **2. The Nature of metathesis**

Metathesis has resisted a unified, explanatory treatment in nonlinear phonology despite advancements in the formalism used to account for many other processes, such as assimilation (Clements, 1985) and dissimilation (Odden 1987). Unlike these phenomena, there is no unique formalism for characterizing metathesis as a primitive rule type. Instead metathesis effects have been derived by a variety of different means including: successive application of rules of deletion and insertion

(Besnier 1987; Hume 1991), single feature spreading (Rice 1992), Planar segregation (McCarthy 1989), template maximization (Van Der Hulst and Van Engelenhoven 1994), vowel epenthesis into degenerate syllables (Lyche, 1995), Optimality Theory (McCarthy and Prince 1999).

Sound changes mainly are caused by listener-based reinterpretation. This in turn may arise in several ways, for example, the actual phonetic string may simply misperceive the utterance due to speaker variation on a continuum from hyper articulated listener oriented clear speech to reduced hypoarticulated casual speech. To be exact acoustic/auditory similarity between sounds can have the effect of diminishing the degree of distinctiveness of the sound thereby making them and their order less easily identifiable (Hume 1998). So ease of production and perception are motivations for phonological processes.

Phonetic cues and contexts are crucial for identification of speech sound. For example when intervocalic stop and fricative are involved, the stop consistently surfaces before vowel (Steriade, 2001). This claim accounts for metathesis in Udi (see Salvia 1973; Makashay, 2001).

#### 1. Udi

/tad – esun/	[tastun]	“to give”
/bafd –sa/	[bafsta]	“falling into”

With respect to word position, it has been claimed that the left edge of the root or word is special for word recognition (Beckman 1998; Cutler et al., 1985; Marslen-Wilson, 1989; Marslen-Wilson and Switserland, 1989), since lexical access is generally achieved on the basis of the initial part of the word. Hence, salient information tends to occur at the beginning of words, and this location tends to resist phonological processes. Observed patterns of metathesis are consistent with this over all patterns.

Perceptual optimization may also play a key role in shaping patterns of metathesis. As discussed in Hume (1998, 2000), metathesis frequently occurs in contexts of low salience and serves to enhance the contrast of the sounds in that context. Thus the form metathesis is superior to the expected unmetathesised form in

terms of the overall perceptual salience of the segments involved. This can be achieved by shifting a consonant from an environment in which the clues to its identification are more robust, or by reordering segments in order to improve the overall salience of a neighboring sound or sounds.

Ulan (1978; 383-90) mentions some conditions for occurrence of metathesis:

a) reduction as in apocopy of vowels in Persian : *suxr* (Pahlavi) > *surx* ( Persian)

b) open syllable canon, as in French, *vervecem* > *berbis* (young)

(also see Martinet, 1955:349-356)

c) phonetic constraint such as eliminating initial or final clusters with liquids as *setl* (Old English) > *seld* (English)

d) attraction, such as *drit*, *brid* (middle English) > *dirt*, *bird* (Modern English), in which although Cr cluster is admissible, post vocalic dental exerted a strong attraction on the *r*.

Alexander (1985: 34-5) formalize this attraction as following:

2. [- coronal]    r    v    [+ coronal ]    →    1,3,2,4  
                   1    2    3                    4

Thereby he suggests a hierarchy of consonants (3) to be drawn up, with the left most consonants being the ones strongest in the attraction of *r*. The notation “ > ” when used in (3) below, means ‘is stronger than’:

3. d > l > θ > k > f > h  
       t    s                    g    w  
       n                                    p  
   b  
   m

Hock (1985:534) suggests that regular metathesis serves to eliminate clusters when it fails to conform to the preferred syllable structure according to which sonority increases in the onset and decreases in the coda. According to Selkirk (1984) the Sonority Sequence Principle in (4) specifies the order in which consonants arrange themselves from the syllable nucleus to its edge:

stop-fricative-nasal-liquid-glide-vowel-glide-liquid-nasal-fricative-stop

The proneness of different phonetic classes to metathesis tends to stand in direct correlation with a hierarchy of resonance. By increasing the sonorant quality of a sound, its tendency to undergo the metathesis also increases. The sole exception involves an original sequence of voiceless stop + sibilant, metathesis of which was found to be fairly common and widespread. In Armenia, the evidence points to a chronological hierarchy in the introduction of metathesis of original clusters of the type consonant + semi vowel. The first to metathesis were clusters containing semivowels, followed by the liquids, nasals, spirants, stops, and possibly the affricates, in that order (Ulan 1978:395). It is governed phonotactically, according to Grammont (1923) that less sonorant consonants (those with smaller aperture) are always positioned closer to syllable boundary and more sonorous consonants closer to syllabus nucleus.

The disproportionally high (and widespread) frequency of occurrence of liquids in metathesis is proverbial. A partial list of language for which this is true includes:

Liquids: Breton, Cornish, Eastern Eskimo, Middle and Old French, Gaelic, Ancient Greek, Old Icelandic, Indo-European, Indonesia, Old Irish, Latin, Mandaic Aramic, Persian, South Slavic, Old Spanish, Tagalog, and Zoque.

R only: Anglo-Norman, Armenian, Avestic (and Zend), Bagneres -de- Luchon, Middle English, Italian (Supraselva), Kamhmu, Mauritian Creole, Vedic Sanskrit, Sardinian, and Toba.

L only: Amuzgo and Yokuts (Ulan, 1978:392)

Hume (1997:153-56) explains some motivations for metathesis in Leti. Metathesis before a consonant cluster serves to avoid a complex syllable margin. Thus, the surface syllabification of a form such as */ulit prail/* is claimed to be *ul.tip.ra.i* with the first consonant of the second morpheme syllabifying as coda of the preceding syllable. Were metathesis not to apply, we would expect the initial consonant of the second morpheme to syllabify as part of a complex syllable margin, e.g. *\*u.lit.pra.i* or *\*u.litp.ra.i.*, more examples:

Leti

/ukar+ppalu/	ukrappalu	‘index finger’
/danat+kviali/	dantakviali	‘millipede’

Support for this claim comes from this fact that before a morpheme beginning with a simple onset, as in the followings, a consonant final morpheme does not undergoes metathesis:

Leti

/urun/                      urun moa

/lout/                      lout de

Another function of metathesis in Leti is the avoidance of onsetless syllables. In /ukar +muani/ > ukramwan metathesis occurs before a morpheme initial /CVV/ sequence, where the final vowel and consonant of the initial morpheme reverse positions. In this case metathesis is motivated by the need to avoid vowel hiatus: that is, an onsetless syllable:

In this section it was argued that metathesis arises to have a better syllable structure to produce and perceive speech sounds. Also for accounting metathesis the nature of sound and the context of occurrence are important.

### 3. Types of metathesis

Metathesis is categorized into four types: perceptual metathesis, compensatory metathesis, articulatory metathesis, auditory metathesis.

#### 3.1. Perceptual metathesis

Perceptual metathesis in which certain features in effect jump over adjacent segments is closely linked to the segmentation problem. Perceptual metathesis originates when features, extending across a CV or VC domain or perceived as extending across such a domain, are perceived as originating in a position which is not the surface position. As emphasized by Ohala (1993) in his discussion of dissimilation, certain perceptual features are typically realized over relatively short time duration, whereas others are typically realized over relatively long duration. For example, irrespective of its phonological association with a consonant, vowel or glide, pharyngealization is typically phonetically realized over a minimal CV or VC domain. In case of perceptual metathesis, a segment (or feature) with elongated

phonetic cues shifts its linear position in a phonological string. This fact partly reflects the perceptual difficulty of localizing the origin of phonetic cue with long-distance effects (Blevins and Garrett 1998:510).

The result of perceptual metathesis is a mistake from the point of view of the previous linguistic system; a segment (or feature) is reinterpreted as originating in a new position within the elongated span. This will involve the transposition of adjacent elements in some cases, and in other cases metathesis will be non-local. Examples from Cayuga (Foster 1982) are in (7):

- (7) Cayuga
- |                   |               |
|-------------------|---------------|
| a. /kahwista?eks/ | [khawisd?aes] |
| b. /akekaha?/     | [agekhaa?]    |

A comparable sound change has occurred in Rendille (a Cushitic language in Kenya) and is still manifested in synchronic alternation involving underlying obstruent or and nasal- r sequence (Heine 1926, Oomen 1981, Sim 1981).

- (8) Rendille
- |                       |                      |
|-----------------------|----------------------|
| agar-te (2sg=3sa.FEM) | arg-e (1SG=3SG.MASC) |
| ugar (singular)       | urg-o (plural)       |

Long distance liquid metathesis has occurred as a sound change in South Italian dialects of Greek (Rohlf's 1924). In this dialect, prevocalic or in a non-initial syllable has been transposed into the initial syllable in certain circumstances. This occurred whenever (i) the liquid was positioned after an obstruent and either (ii) a the initial syllable had a prevocalic non-coronal obstruent or (ii) b the liquid was *r* and the initial syllable had a prevocalic *l*. If these conditions were satisfied, the liquid moved into prevocalic position in the initial syllable as in Greek (9):

- (9) Classic Greek                      South Italian Greek
- |         |        |              |
|---------|--------|--------------|
| kopros  | kropo  | “dung”       |
| gambros | grambo | “son-in-law” |

However following examples show that (10a) the intervocalic and preconsonantal liquids are unaffected (10b) liquids are transposed only into initial syllables with prevocalic obstruents (10c) that metathesis never yields clusters

consisting of a coronal obstruent plus *l* or consisting of a coronal fricative or affricate plus *r*.

(10) Classic Greek	South Italian Greek	
a. kalos	kalo	“attractive”
b. metron	metro	“measure”
c. seklion	sekli	“beet greens”

Perceptual metathesis involving labialization and palatalization is also well attested. Comparable long-distance cases are found among the Ethiopian Semitic labialization and palatalization processes described by Hetzron (1971,1977:45-49).

Perceptual metathesis involve pharyngeals. A local pharyngeal metathesis is said to exist in Rendille (11), where the pharyngeal fricative switches with an adjacent consonant when preceded by the low vowel (Hume 1997:294):

Rendille	
non-prevocalic	prevocalic
aham (sg)	amh-a (pl)
Bahab (sg)	babh-o (pl)

Glottalization metathesis is found in some languages. The following examples (12) from Interior Salish language, Shurwap, show various forms associated with a single suffix containing a glottalized sonorant. In this language nonsyllabic glottalized sonorants do not surface in postconsonantal position. If an underlying glottalized sonorant is post consonantal and to the right of the main accent, its glottalization shifts leftward unto an immediately post tonic sonorant, if there is one (Kuipers 1974).

(12) Root and suffix		Derived forms	
-él'qs	“clothing”	t-kwl'tk-él'qs	“underwear”
qwey-	“black”	qwey'-lqs	“priest”

The table (1) shows consonant types attested in perceptual CV metathesis (Blevins and Garrett, 1998: 513):

Table (1)

segment	feature	examples
liquids		Slavic-Bagneres-De-French
laterals	laterality	Latin
rhotics	rhoticity	Le Harve French
laryngeals		Cayuga, Kl'kepmcin
h	aspiration	Cherokee
?	glottalization	Zoque, Mohawk
pharyngeals	pharyngealization	Proto-Indo-European, Arabic dialect
glides/vowels		Koshin, Birom, Leti
j/i	palatalization	Greek
w/u	labialization	Aghem, Noni

### 3.2. Compensatory metathesis

Compensatory metathesis, as the name suggest, is prosodically conditioned. In this type of metathesis a vowel at the edge of the phonological domain undergoes phonetic weakening in quality and duration, with compensation for this weakening by anticipatory or perseverative coarticulation of the original vowel quality in stressed position. The sequence of sound changes occurring at each end of the relevant phonological domain is shown in (13):

- (13) right edge:  $V_1CV_2 > \dots V_1V_2CV_2 > \dots V_1V_2C$   
left edge:  $V_1CV_2 \dots > V_1CV_1V_2 \dots > CV_1V_2 \dots$

where a vowel at the edge of the phonological domain undergoes phonetic weakening in quality and duration, with compensation or preservative coarticulation of the original peripheral vowel quality in non peripheral stressed position. Followings are examples from Rotuman and Nako (Blevins and Garrett 1998:527):

- (14) Rotuman:
- |      |      |
|------|------|
| futi | fyt  |
| tiko | tiok |

### 3.3. Coarticulatory metathesis

Coarticulatory metathesis is a type of metathesis with articulatory origin. Extreme

coarticulation is possible in a sequence of stops, each of which involves closures of a distinct articulator. When  $C_1C_2$  gestural overlap results in nearly simultaneous closure, with  $C_2$  realized after  $C_1$ , a  $C_2C_1$  cluster may be perceived. One of these types is labial velar stop sequence. In Bisayan languages, Cebuano and Aklanon, (15) we see this kind of metathesis (Zorc 1964:97):

- |              |         |               |
|--------------|---------|---------------|
| (15) Cebuano | Aklanon |               |
| libgus       | ligbus  | “mushroom”    |
| palibga      | paligba | “confuse him” |

In this type there is coronal-non coronal stop sequences, examples from Cebuano Bisayan. Data is cited below (16) from Blust (1979:110).

- |                       |                         |
|-----------------------|-------------------------|
| (16) metathesis       | no metathesis           |
| nm inum:imn-a “drink” | mn daman:damn-un “talk” |

### 3.4. Auditory metathesis

Auditory stream decoupling leads to metathesis involving sibilant + stop and stop + sibilant metathesis. Some Examples from West Saxon dialect of Old English are in (17) (Weyhe 1908; Campbell, 1959:177-78; Luick, 1921:913-14; Jordan, 1974:168-70). In this dialect *sk* clusters regularly inverted their linear order and

became *ks* clusters.

(17) Old English	Late West Saxon
frosk	froks
husk	huks
aske	akse
fiskas	fiksas

According to Grammont (1923:73) a *ks* > *sk* change has occurred word-finally in colloquial French.

(18) French	
Standard	Colloquial
fiks	fisk
lyks	lysk

Blevins and Garrett (1998) attribute the reverse order of metathesis in Old English and French to longer sibilants in final positions in French which causes greater confusion effect on segmental order. This is based on observation that French accentual -phrase-final syllables are significantly longer than non-accentual-phrase-final syllables.

In this section different types of metathesis were examined: a) perceptual metathesis in which features of one segment is transmitted to other segments, b) compensatory metathesis in which omission of a sound and compensating it prosodically leads to metathesis c) coarticulatory metathesis in which easy articulation and overlapping of segments causes metathesis and d) auditory metathesis in which auditory stream decoupling leads to metathesis.

#### 4. Metathesis in Persian

##### 4.1 Synchronic metathesis

In Persian, metathesis is found in child language, speech error, and colloquial speech of illiterate people recorded by the author.

As the following examples (19) from Modern Persian show, liquid and sibilant

sounds metathesis with stops (k,t,b,m,q) and fricative (j,f). In (19a) the motivation for metathesis is to observe Sonority Sequence Principle (SSP) and in (19) the motivation is to observe Syllable Contact Law (Hooper, 1972), according to which in heterosyllabic cluster of C<sub>1</sub> C<sub>2</sub> there is the tendency of C<sub>1</sub> to be more sonorant than C<sub>2</sub>.

## (19) Persian

a.	luks	lusk	“luxurious”
	boks	bosk	“fisting”
	aks	ask	“photo”
	puḍr	puḍ	“powder”
	qofl	qolf	“lock”
b.	madrese	mardese	“school”
	tubre	turbe	“bag”
	kobra	korba	“proper name”
	qomri	qormi	“pigeon”
	soqra	sorqa	“proper name”
	batri	barti	“battery”
	taksi	taski	“taxi”
	sabzi	sazbi	“vegetable”
	aleksandr	eskandar	“proper name”
	ketri	kerti	“kettle”
	omlet	olmet	“omelet”
	qablame	qalbame	“pan”
	tajriš	tarjiš	“proper name”
	kebrit	kerbit	“match”

The skeletal model of metathesis in *lusk* is shown in (20):

(20)



#### 4.2. Diachronic metathesis

Diachronic metathesis includes examples (21) from Pahlavi (Boyce, 1977; Nyberg 1931) in which consonant + liquid undergoes metathesis to be liquid + consonant to follow Sonority Sequence Principle. In (21a) apocope of the final vowel in the final syllable provides the context for metathesis.

(21)	Pahlavi	Persian	
a.	suxra	surx	“red”
	žafra	žarf	“deep”
	wafra	barf	“snow”
	asru	ars	“tear”
	čaxra	čarx	“wheel”
	namra	narm	“soft”
b.	taxl	talx	“bitter”
	hagriz	hargez	“never”
	wrata-	rvata-	“doctrine”
	wrinati-	rvinati	“crushing”
	haqle	halqe	“ring”
	laqtan	qaltan	“rolling”

In the followings, (22) consonant cluster Cr of the first syllable of Pahlavi words eliminated by metathesis of liquid *r* with vowels to avoid complex onset (Prince and Smolensky, 1993). In the examples, *r* is attracted by *d*, *h* and *j* in (a)-(c), and by *z* and *y* in (d) and (e).

22.	Pahlavi	Persian	
a.	Fradum	fard	“odd”
b.	frahang	farhang	“culture”
c.	frajam	farjam	“end”
d.	frazanag	farzane	“intellectual”
	frazand	farzand	“son”
e.	drayah	daryah	“sea”
	frayad	faryad	“shout”

Here, changing CCV pattern in Pahlavi to CV in initial syllable of words in Persian as an attempt to avoid complexity (CC) in the syllable onset (Prince and Smolensky, 1993) is the motivation for the metathesis. On the basis of the data in (19),(21) and (22), figure (1) shows the frequency of metathesised phonemes in Persian words. The high frequency of *r* is related to the articulator, tongue, which is the most moveable and dynamic speech articulator. Also, according to the figure, *r* is more frequent than *l* since it is produced by the tip of the tongue which is more moveable than the blade of the tongue which is involved in the articulation of *l*.

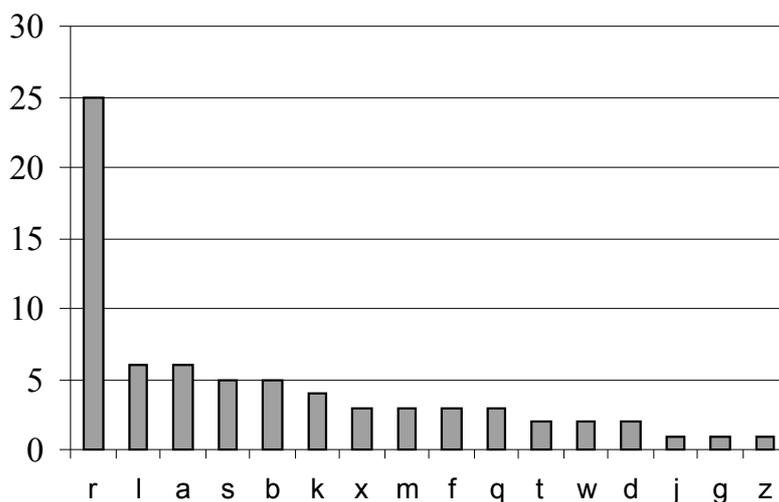


Fig (1): the frequency of phonemes involved in the metathesis

### 4.3. The Optimality Theory

Ever since Optimality Theory (Prince and Smolensky 1993) came into circulation, it has been perceived by a considerable number of generative phonologists worldwide, as perhaps current as the most promising framework of analysis. The theoretical framework of this thesis is that of OT, mainly because of OT's ability to capture universal properties and select outputs in a manner which reflect crosslinguistic tendencies as well as predict typological variations. OT's way of capturing generalizations is through conflicting constraints, and an OT grammar of a language is expressed in the ranked order of violable constraints.

Optimality theory is based on the following assumptions: Languages, or better, the words and phrases in individual languages are shaped by the interaction of universal constraints on output forms. These universal constraints stand in conflict and they are ranked with regard to each other. The notion of constraint conflict means that it is often only possible to satisfy one constraint on the coast of violating another. The notion of constraint ranking is more important than satisfying others.

In Optimality Theory, grammar consists of the following components (Prince & Smolensky 1993): Con (constraint), a set of violable universal constraints, ranked on a language-particular basis, against which the well-formedness of output candidates is evaluated; a function Gen, which associates an input form with a potentially infinite set of output candidates and orders them according to how well they satisfy the constraint system of the language in question. The actually occurring output form is that candidate which best satisfies the constraint system.

According to the optimality theory and constraints such as Linearity (no metathesis) (McCarthy and Prince, 1993, 1999), Complex Onset Avoidance (\*Complex) (Prince and Smolensky, 1993), Syllable Contact Law (SCL) and Sonority Sequence Principle (SSP) the output of *luks*, *kebrit*, and *draya* are represented respectively in tables (2),(3),and (4). The stars in the cells show that the word violates the correspondent constraint and is not optimal. Although in the tables words violate both constraints, but violation of the higher (left) constraint is fatal (!) and crashes the word.

In table (2) option (b) is optimal since it violates the Linearity constraint which is lower in the rank than SSP constraint.

**Table (2)**

	Input: /luks/	SSP	Linearity
a.	luks	!*	
b. ☞	lusk		*

In table (3) option (b) is optimal since it violates the Linearity constraint which is lower in the rank than SCL constraint.

**Table (3)**

	Input:/kebrit/	SCL	Linearity
a.	kebrit	!*	
b. ☞	kerbit		*

In table (4) option (b) is optimal since it violates the Linearity constraint which is lower in rank than \*Complex constraint.

**Table (4)**

	Input:/draya/	*Complex	Linearity
a.	draya	!*	
b. ☞	darya		*

## 5. Conclusion

The aim of this paper was giving an account of accounting metathesis in Persian. In the synchronic study data showed that in one syllable words, the motivation for metathesis is observing Sonority Sequence Principle with

phonological tendency of *s,l,r,z* to be in the center of the syllable and less sonorant sounds in the coda of syllable and thereby observed Sonority Sequence Principle . In the two-syllable words for improving phonetic cues and perception, there is tendency of observing the Syllable Contact Law. In diachronic metathesis besides SSP, the onset Cr cluster is eliminated by metathesis of *r* with the following vowel to have simple onset which shows that explanation of the same phenomenon could be different in synchronic and diachronic studies. Regarding attraction of *r* by other segments, it was shown that attraction of coronals is stronger than semivowels and attraction of semivowels is stronger than glottal and palatals.

These generalizations show that metathesis is not an end but a means for ease of perception and production. Of course there are other constraints such as social labels which control spreading of metathesis to all potential ones to avoid pragmatically unacceptable structures. Furthermore, the tendencies contribute to claim that at least one way of accounting synchronic phonological structure is using typological generalizations resulting from the pathways of historical changes. In other words if historical change operates in such a way to favor or disfavor certain situations, its results are what we will find and such generalizations could be guides to the structure of the language faculty.

### References

- Alexander, James. (1985). "R-metathesis in English: A diachronic account". *Journal of English Linguistics*. 1:33-40
- Beckman, Jill. (1998). *Positional faithfulness*. PhD dissertation. University of Massachusetts.
- Besnier, Niko. (1987) . "An autosegmental approach to metathesis in Rotuman". *Lingua* 73.
- Blevins, j and A. Garrette. (1998). "The origins of consonant vowel metathesis". *Language* 74(3):508-555.
- Blust, Robert. (1993). "Central and Central-Eastern Malayo-Polynesian". *Oceanic Linguistics* 32:241-93
- Boyce, Mary. (1977). *A word-list of Manichaen Middle Persian and Parthian*. Tehran: Liege.

- Brugmann, Karl. (1902). *Kurze vergleichende Grammatik der indogermanischen Sprachen*. Berlin: Walter de Gruyter.
- Campbell, A. (1959). *Old English Grammar*. Oxford: Clarendon Press.
- Clements, G.N. (1985). "The Geometry of Phonological features". *Phonology Year book*.
- Cutler, A., J.A and G.Gilligan. 1985. "The suffixing preference: A processing explanation". *Linguistics* 23:723-58.
- Foster, Michael K. (1982). *Alternating weak and strong syllables in Cayuga words*. *International Journal of American Linguistics* 48.50-72.
- Grammont, Maurice. (1923). "L interverson. Festschrift Jacob Wackernagel Vollendung des 70". *Lebenjahrez am 11. Dezember 1923*, pp.72-77. Gottingen: Vandenhoeck and Ruprecht.
- Heine, Bernd. (1976). "Notes on the Rendille language (Kenya)". *Afrika und Übersee* 59: 176-223.
- Hetzron, Robert. (1971). "International labialization in the tt-group of outer South Ethiopic". *Journal of American Oriental Society* 91.192-207
- . (1977). *The Gu Oriente Ant nnan-Gurage languages*. (studi di Semitistica e del Vicino ico, Ricerche,12) Napoli: Istitute Orientale di Napoli
- Hock, Hans, Henrich . (1985). "Regular Metathesis". *Linguistics*.23:529-64.
- Hooper, J. (1972). "The syllable in Phonological Theory". *Language* 48:525-40.
- Hume, Elizabeth. (1991). "Metathesis in Maltese: Implication for the strong Morphemic Plane Hypothesis". *Proceeding of the NELS 21*. University of Massachusetts, Amherst.157-172.
- . (1998). "Metathesis in Phonological Theory: The Case of Leti". *Lingua* 104:147-86.
- . (2001). "Metathesis: formal and Functional considerations". In Hume Smith and Van de Weijer 2001.
- Jordan R. (1974). *Hand book of Middle English Grammar: Phonology*. Translated and revised by E. j. Cook. The Hague: Mouton.
- Kuipers, Aert H. (1974). *The Shuswap language: Grammr, text, dictionary*. The Hague: Mouton.
- Luick, Karl. (1921-40). *Historische grammatik der Englischen sprache*. Leipzig: Tauchnitz.
- Lyche, Chantak. (1995). Shwa metathesis in Cajun French. *Folia Linguistica* xx1x/3-4. Berlin: Mouton de Gruyter.
- Makashay, Matt. (2001). "Lexical effects in the perception of obstruent ordering". To appear in E. Hume, Norval Smith and Jeroen van der Weijer.

- Marslen-Wilson, W. D. (1989). "Access and Integration: Projecting sound onto Meaning". W.D. Marslen-Wilson (ed.), *Lexical Representation and Process*. Cambridge, Ma: MIT Press. pp. 3-24.
- Marslen-Wilson, W.D. and P.Zwitserslood. (1989). "Accessing spoken words: The importance of word onsets". *Journal of Experimental Psychology: Human Perception and Performance*.
- Martinet, A. (1955). *Leconomie des changements phonétiques*. Berne.
- McCarthy, John. (1989). "Linear order in Phonological Representation. *Linguistic Inquiry* 20:71-99.
- McCarthy, John and Prince, Alan. (1993). *Prosodic Morphology*. MS. University of Massachusetts, Amherst and Rutgers University.
- McCarthy, John and Alan Prince. (1999). "Faithfulness and Identity in Prosodic Morphology". R. Kager, H. van der Hulst, W. Zonneveld (eds.), *The prosody Morphology Interface*. Cambridge, Uk., New York: Cambridge University Press.
- Nyberg, Henrik Samuel. (1931). *A manual of Pahlavi*. Wiesbaden: Otto Harrassowitz.
- Ohala, John. 1993. "Sound Change as Nature Speech Perception Experiment". *Speech Communication*. 13:155-61.
- Odden, David. (1987). "Dissimilation as deletion in Chukchi". In Miller and J. Power (eds.) *Proceedings from ESCOL 3*. Columbus, Ohio : OSU.235-46.
- Oomen, Antoinette. (1981). "Gender and Plurality in Rendille". *Afroasiatic linguistics*. (1)035-37.
- Osthoff, Hermann, and Brugmann, Karl. (1878). "Vorwort". *Morphologische Untersuchungen auf dem Gebiete der Indogermanischen Sprachen*, 1. Leipzig: Trubner.
- Prince, Alan and Paul Smolensky. (1993). *Optimality Theory*. MS. Rutgers University and The University of Colorado, Boulder.
- Rice, Keren. (1992). "On deriving sonority: a structural account of sonority relationships". *Phonology* 9:61-99.
- Rhofs, Gerhard. (1924) *Griechen und Romanen in Unteritalien*; Ein Beitrag zur Geschichte der unteritalienischen Sprachentwicklung. (Biblioteca dell'Archivum Romanicum, Series 2,7.). Geneva: Leo S. Olschki.
- Selkirk, Elizabeth. (1984). "On the Major Class features and Syllable theory". *Language Sound Structure*, M. Aronoff and R.Oehrle (eds.) 107-134. Cambridge, MA: MIT Press.
- Silva, Clare, M. (1973). "Metathesis of obstruent clusters". *OSU Working Papers in Linguistics* 14: 77-84
- Sim, Ronald J. (1981). "Morphophonemics of the verb in Rendille". *Afroasiatic Linguistics* 8(1) 1-33.

- Steriade, Donca (1982). *Greek prosodies and the nature of syllabification*. (MIT dissertation) Cambridge, MA.
- Ultan, Russell. (1978). "A typological View of Metathesis". *Universals of human Language*, vol.2. *Phonology*, ed. by Joseph H. Greenberg. pp 367-402. Stanford, Calif.: Stanford University Press.
- Van der Hulst, Harry and Aone van Engelenhoven. (1995). "Metathesis effects in Tutukeian–Letinese". *Leiden in last*, ed. by Harry van der Hulst and Jeroen van de Weijer, pp.243-67. (Hill Phonology Papers, 1.) The Hague: Holland Academic Graphics.
- Weyhe, Hans. (1908). "Zur Palatisierung von in-und auslautendem *sk* in Altenglischen". *Englischen Studien* 39:161-68.
- Zorc, David Paul. (1977). *The Bisayan dialect of Philippines: subgrouping and reconstruction*. (Pacific Linguistics, Series C, 44) Canberra: Department of Linguistics, research School of Pacific Studies, The Australian National University.