

On the formal description of metathesis

A case study of *v*-metathesis in Modern Georgian

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1 Introduction and preliminaries

Metathesis, or the transposition of whole segments either synchronically or from one historical language stage to another, has usually been regarded as one of the less common phonological processes, even to such an extent that researchers have asked the question whether it exists at all as a synchronic (morpho)phonological process (Hock 1991). Where it is discussed, the question is debated whether the process is driven by phonotactics, or whether phonetic, perception-driven forces also play a role (see e.g. Blevins & Garrett 1998). At any rate, the formalization of metathesis has long been a problem for phonological theories: specific analyses have typically been subject to the criticism that while being descriptively adequate, they could not explain the process, let alone address the question of what types of metathesis are possible, and what types are not. In this paper we explore previous approaches to metathesis, as in SPE and autosegmental phonology, and argue that Optimality Theory is a better candidate to account for processes of this type, on the basis of a fully productive metathesis process found in Modern Georgian.

On v-metathesis in Modern Georgian

1.1 Approaches to metathesis

To illustrate the metathesis process and the problems that an explanatory analysis will have to solve¹, consider the etymologically related forms in (1) (La=Latin, OHG=Old High German, Germ.=Germanic):

(1)		<i>Dutch</i>	
	La. <u>cr</u> usta	:	<u>k</u> orst 'crust'
	La. <u>pr</u> essa	:	<u>p</u> ers 'press'
	OHG. <u>br</u> ust	:	<u>b</u> orst 'breast'
	OHG. <u>fr</u> isc	:	<u>v</u> ers 'fresh'
	Germ. * <u>fr</u> usta	:	<u>v</u> orst 'frost'

In every case, a sequence of *r* followed by short vowel in the older languages corresponds to the opposite sequence in Dutch; in all cases the original order is reflected by the English glosses and cognates. The historical aspects of this change will not concern us here; suffice it to notice that in every instance *r* has been juxtaposed with a short vowel. In standard generative phonology (e.g. Chomsky & Halle 1968: 358-64), the change could be described in a number of ways, for instance by the 'transformational rule' format in (2a), or by a pair of rules (2b).

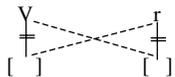
$$(2) \quad \text{a.} \quad V r \rightarrow r V$$
$$1 \quad 2 \rightarrow 2 \quad 1$$

- b. $r \rightarrow \emptyset / _ _ V$ } deletion
 $\emptyset \rightarrow r / V _ _$ } insertion

Using rule types of this sort does not provide an explanatory account for processes of metathesis. There is, for instance, no reason why another segment could not intervene between V and /r/ in either (2a) or (2b). In actual fact, however, the metathesizing segments are typically adjacent, as they were in the data in (1). The transformational rule format has therefore widely been abandoned as overly powerful.

The adjacency requirement referred to above is better expressed in autosegmental phonology (Goldsmith 1976, Clements & Keyser 1983, Clements 1985), which, however, needs no fewer than four operations of spreading and delinking to characterize the same phenomenon:

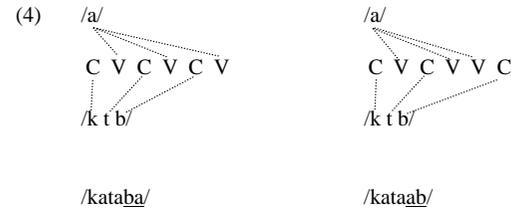
(3)



Although this approach has the advantage of characterizing the fact that metathesizing segments are typically adjacent (intervening segments would lead to line crossing constraint violations), it still strikes one as unnecessarily powerful. In particular, descriptive mechanisms such as those depicted in (3) fail to provide insight into the reason *why* metathesis should occur. Related to the type of analysis in (3) is the templatic solution in (4), which has been used, for instance, to specify

¹ See especially Hume (2001), and many of the other contributions to Hume, Smith & van de Weijer (eds.) (2001).

the Arabic root pattern morphology: in the form in (4) /ba/ transposes to /ab/. Such templates are also adequate as descriptive devices, and have occasionally been used to characterize metathesis (e.g. by van der Hulst & van Engelenhoven 1995), but simply stipulate the outcome of a phonological process rather than explaining it.



Optimality Theory (Prince & Smolensky 1993, et seq.) would seem to provide a rather more promising perspective on metathesis. In Optimality Theory, output forms are derived from underlying representations (inputs) by examining possible candidates against a language-specific constraint hierarchy. It is clear that divergence from the input (technically: a violation of one or more faithfulness constraints) must be triggered by satisfaction of one or more higher-ranked well-formedness (or markedness) constraints. Thus, Optimality Theory *forces* the researcher to look for the reason why phonological processes happen, including metathesis. This is illustrated *in abstracto* in the tableau in (5), where an input /korst/ is examined.

(5)

input: /korst/	X	LINEARITY
cand ₁ : [korst]	*!	
cand ₂ : [krost]		*

For the metathesized candidate 2 to win, it is necessary to find the constraint X, which is higher ranked than the constraint LINEARITY (McCarthy & Prince 1995; see also below), which penalizes deviations from the linear order of segments in the input, as given in (6):

(6) LINEARITY: Consonants that are contiguous in the input must be contiguous in the output (“No metathesis”)

In the case at hand, notice that candidate 1 in (5) has a simplex onset but three coda consonants, while candidate 2 has a complex onset but only two consonants. One can easily imagine that either situation is selected as optimal in specific languages. Indeed, syllable structure optimization is often at the basis of regular metathesis. However, we will not explore this case in more detail, but now turn to a regular type of metathesis in Modern Georgian. We will see that both syllable wellformedness and segment wellformedness act as constraints dominating LINEARITY, forcing surface metathesis.

1.2 Georgian

Georgian has five vowels /i e a o u/. Length is not distinctive in the vowel system, and there are no diphthongs. The consonants can be divided into three groups. The first, presented in (7), consists of non-continuant obstruents, i.e. stops and affricates. Place of articulation (PA) is either bilabial, dental, alveolar, palato-alveolar or velar, cross-classified with laryngeal specification, distinguishing voiced, voiceless and glottalized sounds (we provide the transcription symbols usually found in descriptions of Georgian as well as their IPA equivalents in square brackets):

(7)

place:	bilabial	dental	alveolar	palato-alveolar	velar
laryngeal:					
voiced	b	d	j ([dz])	ǰ ([dʒ])	g
voiceless	p	t	c ([ts])	č ([tʃ])	k
glottalized	pʼ	tʼ	cʼ ([tsʼ])	čʼ ([tʃʼ])	kʼ

Fricatives differ by place of articulation (alveolar, palato-alveolar, post-alveolar) and laryngeal specification (voiced, voiceless):

(8)

place:	alveolar	palato-alveolar	post-alveolar
laryngeal:			
voiced	z	ž ([ʒ])	ʁ
voiceless	s	š ([ʃ])	x

Next, there are five sonorants in Georgian: the liquids /r l/, the nasals /n m/ and the labio-velar /v/, which has the allophones [v Φ w], depending on the phonetic context (see below). Finally, there are two additional phonemes, viz. the glottalized uvular stop /qʔ/, which can be grouped together with the velar fricatives. It behaves like the fricatives /ɣ/ and /x/, in that it can form a particular type of complex segments known as harmonic groups (see also below) when combined with anterior consonants.

According to Tevdoradze (1978), primary stress in Georgian always falls on the first syllable of a word. In polysyllabic words, secondary stress occurs. In four-syllable words, the secondary stress falls on the second syllable from the end, in five-syllable words it occurs on the third syllable from the end, and in six syllable-words on the fourth syllable from the end. We now turn to the metathesis facts of Modern Georgian.

1.3 Metathesis of /v/ in Georgian

Modern Georgian has a process of metathesis that is fully regular and synchronically productive in the verbal morphology. Verbs in Georgian consist of a verbal root, a thematic suffix, and one or more suffixes for person, number or infinitival status. See Damenia (1982) and Aronson (1982)

for a discussion of the thematic suffixes of Georgian; these suffixes, of which there are about a dozen, are added to verb roots. The structure of verb forms is schematically given in (9):

(9)	[[[root] TS] sfx]	Examples:	tamaš -ob- s
	TS = thematic suffix		to play -TS- 3rdSUBJ

When the segment /v/ is part of the thematic suffix, it intrudes into the root before the infinitival suffix /a/ under certain well-defined conditions.² For example, the third person singular of the root /xar/ 'to gnaw' is [xravs], from underlying /xar-av-s/ (with deletion of the root vowel, not discussed here). The infinitival form, however, is [xvra], from underlying /xar-av-a/ (with deletion of both the root vowel and the vowel in the thematic suffix), where the thematic suffix consonant /v/ ends up in between the two root consonants. This and other examples are given in (10) below, where in each case verb root, thematic suffix and ending are divided by hyphens:

² In addition, there are some isolated cases of metathesis, e.g. as the result of diachronic change, e.g. at-rvamet'i 'eighteen' (Old Georgian) > tvramet'i (Modern Georgian.). There are also cases of metathesis in dialectal forms, e.g. gač'irveba 'difficulty' (literary Georgian) ~ gač'ivreba (in the Imeruli dialect).

(10)	root	present tense, 3.SG	infinitival form	
	xar	xr-av-s	xvr-a	'to gnaw'
	xan	xn-av-s	xvn-a	'to plough'
	k'al	k'l-av-s	k'vl-a	'to kill'
	k'ar	k'r-av-s	k'vr-a	'to tie'
	sxal	sxl-av-s	sxvl-a	'to chop off'
	jer	jr-av-s	jvr-a	'to move'
	tr	tr-ob-a 'to drink-INF'	da-tvr-a	'id.-PAST'
	kar	u-k'r-av-s	da-k'vr-a	'to play, e.g. on a musical instrument'

There are two basic conditions on /v/-metathesis, which may strike one as only coincidentally related to the process at first sight, but which will be shown to provide important keys to a deeper understanding:

- (11)
- a. The root has to end in a sonorant;
 - b. The root should begin with a non-labial;
 - c. The root should contain one of the vowels /a e o/

It is easily checked that the forms in (10) satisfy all of these conditions. The last condition might be related to the fact that the high vowels /i u/, being less sonorous than the mid or low vowels,

might be less prone to deletion. Forms that illustrate the condition in (11a) are given in (12a); forms that illustrate the condition in (11b) are given in (12b):

(12) a.	xed	xed-av-s	xedv-a (*xvd-a)	'to see'
	tes	tes-av-s	tesv-a (*tvd-a)	'to sow'
	les	les-av-s	lesv-a (*lvs-a)	'to sharpen'
b.	ber	ber-av-s	berv-a (*bvr-a)	'to blow up'
	par	par-av-s	da-parv-a (*da-pvr-a)	'to hide'

We will return to both below, where it will be seen that the first condition in (11) can be related to a natural tendency to prefer obstruent-sonorant onsets (note that the metathesized forms in (10) above have obstruent-/v/-sonorant onsets, where the /v/ in fact forms a secondary articulation on the obstruent), and the second to a constraint against adjacency of two labials, which is fully general in the language. Incidentally, metathesis also does not apply with roots consisting of two liquids, as in (12c):

(12) c.	lar	lar-av-s	lar-va (*lvr-a)	'to stretch like a string'
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This can be related to a constraint against two adjacent liquids, not separated by a vowel, undominated in the language. After having laid out the data, let us turn to an analysis in the next section.

2 Syllable wellformedness and complex segment formation

As was pointed out above, we will explore an Optimality Theoretical approach to metathesis. In one branch of Optimality Theory, Correspondence Theory (McCarthy & Prince 1995), faithfulness relations between input and output are made explicit. Metathesis is not regarded as deletion (or violation of MAX(IMALITY)) or as insertion (or violation of DEP(ENCY)), nor are of course feature values changed (which would amount to a violation of IDENT(ITY)); rather, it upsets the linear order of segments between input and output, resulting in another type of less-than-perfect correspondence between the two. To illustrate, compare the infinitival input /xar-/av-/a/ with its output [xvra], where morpheme boundaries are also marked:

(13) Input	[x	a	r]	α	-	[a	v]	β	-	a
	1		2				3			
Output	[x	v	r]	α	-	[a]	β		
	1	3	2							

Segment 3 of morpheme β comes to stand in between segments 1 and 2, which are both part of morpheme α , so that 1 and 2 are no longer adjacent in the output. The constraint banning the change in linear order is commonly referred to as LINEARITY, given above in (6) and repeated in (14):

- (14) LINEARITY: Consonants that are contiguous in the input must be contiguous in the output (“No metathesis”) (McCarthy & Prince 1995).

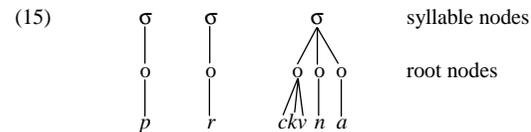
Besides changing linear order, metathesis also causes a segment from one morpheme to intrude into the segmental structure of another morpheme. Such intrusion is a violation of the constraint DISJOINTNESS (McCarthy & Prince 1995). In the case at hand, metathesis always causes violations of both LINEARITY and DISJOINTNESS, so it makes no difference whether violations of one or the other are scored.

If metathesis violates certain well-motivated constraints, then there must be a higher-ranking constraint which forces it to apply anyway. We suggest that metathesis is driven by prosodic well-formedness conditions, in particular the desire to form optimal onsets, and controlled by conditions on segment wellformedness. It is these we turn to now.

2.1 Syllable structure in Georgian: onsets

The syllable structure of Georgian is a matter of some phonological and phonetic controversy (see e.g. Vogt 1958, 1961; Nepveu 1994, Bush 1997, Chitoran 1998, forthcoming; Butskhrikidze & van Heuven 2001; Butskhrikidze 2002). There is evidence that onsets that at first blush would seem highly complex (e.g. *brdgvna* ‘to fight’, *prckvna* ‘to peel’) can be analysed as having a much simpler structure than suggested by such transcriptions. Such an analysis would take into account both morphological information (such that prefixes form a separate domain with respect to phonotactic restrictions), phonetic information (such that some sonorants, especially [r], are seen to form separate syllables) and the phonological status of certain clusters as complex segments, which are traditionally referred as ‘harmonic groups’ such as /dgv/ and /ckv/ in the two forms above (Depréz 1988, Nepveu 1994). There are several arguments to regard harmonic groups as monopositional: they always syllabify together intervocally, while other obstruent clusters are

never tautosyllabic, e.g. *sit'q'va* 'word' [si.t'q'va], *cecxi* 'fire' [ce.cxli], with harmonic groups, vs. *kar.g-i* 'good', *c'ig.n-i* 'book', *bav.šv-i* 'child', with true consonant clusters. Harmonic groups are never split across morpheme edges. They are the only obstruent groups to appear in stem-final position, e.g. *ortkl-i* 'steam', *vepxv-i* 'tiger'. No other stop clusters are attested in that position (Vogt 1961, Depréz 1988). In reduplicated forms, harmonic groups retain their complexity, e.g. *čkar-čkara* 'quickly', *cxel-cxeli* 'hot'. Other types of obstruent-obstruent clusters do not participate in reduplicated forms. Finally, harmonic groups are present in the whole Kartvelian language group (Svan, Megrelian and Laz) and show regular correspondences between these languages. Space does not permit us to develop all these important points, and we refer to the literature cited above for in-depth discussion. Incorporating these assumptions, the structure of a form like *prckvna* 'to peel' would be as in (15):



This form consists of three syllables, the first of which only has an onset /p/, the second of which has a syllabic /r/, and the third syllable has a complex onset, the first segment of which is the harmonic group /ckv/ and the second of which is the sonorant /n/.

On the basis of the assumptions made above, we propose that onsets in Georgian are maximally bipositional, as expressed by the following constraint:

(16) *COMPLEX(ONSET): Root onsets consist of maximally an obstruent and a sonorant.

This constraint refers to the morphological category of root, in accordance with our observation above that different restrictions may hold in different (morphological) domains. Prefixes in Georgian, for instance, do not allow *any* complexity, but may be added freely to roots, giving again the appearance of phonological surface complexity (e.g. *m-c'eral-i* 'writer', *m-k'v'lel-i* 'murderer' or *m-c'vrtnel-i* 'trainer'). The constraint in (16) would be violated by onsets consisting of two (or more) obstruents, onsets consisting of obstruent and two sonorants, etc.

Note: /v/ which was part of the thematic suffix becomes part of the root (recall (13)), hence the constraint in (16) should hold of the resulting "root".

2.2 Segment structure in Georgian: secondary articulation

In this section we examine the position of /v/ in consonant clusters. The order of consonants in word-initial clusters in Georgian is not random, as Gvinadze (1970) among others, has noted. Almost invariably, labials occur first, optionally followed by [r], then by a coronal stop or fricative, then a dorsal, optionally followed by [v], and finally by one of the other sonorants. The schema is given in (17):

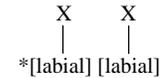
- (17)
1. {b p p' m}
 2. {r}
 3. {d t t' j c c' ʃ č č' z s ž š}
 4. {g k k' γ x q'}
 5. {v}
 6. {r l m n}

Any of the consonant groups in (17) is optional, so that a consonant from group 1 may be followed by a consonant of group 2 or 4, for instance in *prena*, 'to fly', *brali* 'fault', *mgeli*, 'wolf' and *brk'e*, 'mould'; however, the order between groups is obligatory, so that the reverse order (2-1 or 4-1) is not permitted. Above we have shown that surface clusters may be subject to further analysis, taking into account morphological, phonetic and phonological information. Here we focus on the position of /v/ in clusters. First, there are a number of restrictions in Georgian phonotactics that are not captured by the schema in (17). The segment /v/ (which solely constitutes group 5) does not occur directly after labials (group 1). In general, Georgian has an absolute ban on adjacent labial consonants. This constraint plays an active role in preventing metathesis in certain contexts. This is illustrated by the facts below:

- (18) *gamo -tkv -am -s* 'somebody is pronouncing'
 preverb -root -TS -third singular subject maker
gamo-tkma 'pronunciation' (**gamo-tkvma*, **gamo-tkmva*)

In this form, metathesis does not occur since /v/ would abut with the bilabial nasal /m/. As a result it is deleted. These restrictions point to a general constraint militating against adjacent labials in the language. We will adopt the formulation in (19), which simply penalizes two adjacent [labial] specifications, regardless of whether these would occur in a single onset, or in a single segment (note, for instance that none of the harmonic groups has a labial followed by /v/).

- (19) OCP(LABIAL)



The X's are supposed to indicate that two adjacent labial consonants are disallowed, as well as two adjacent labial (i.e. rounded) vowels.

The schema in (17) above shows that in clusters /v/ can occur after all consonants, except the sonorants. We can understand this restriction if we take into account the fact that /v/ occurs as a secondary articulation, most typically on the dorsals, where cross-linguistically it is also the most often found (Maddieson 1984). The same source shows that it is very rare for secondary articulation to occur on sonorants phonemically (the only exceptions being cases which involve clear and dark [l], i.e. velarization). We conclude that /v/ can form complex segments through secondary articulation, but not with sonorants (/r l m n/) (nor on labials for independent reasons). This can be expressed as the following constraint:

- (20) *LAB-SON: Sonorants do not allow secondary labialization

These constraints offer the tools to explain metathesis. In the tableau in (21) the input is the infinitival /xar-av-a/, where the root is underlined for maximum conspicuousness. In the first candidate, no deletion of the root vowel takes place. This leads to a fatal violation of whatever constraint(s) are necessary to effect vowel deletion, abbreviated here as MONOVOC.³ The second candidate violates the same constraint, although here it is the first suffix vowel which is unduly left. In the third candidate both vowels are deleted but the first consonants form a three-member onset, violating COMPLEX(ONS). If no segment deletion is permitted (a result of MAX(IO), not included in the tableau but inviolable), [v] must form a secondary articulation; it cannot do so on [r] (as in candidate d) so it must instead shift to the initial consonant), so that (21f) is the optimal candidate.

(21)

/xar-av-a/	MONOVOC	*COMPLEX(ONS)	*LAB-SON	LINEARITY
a. [x]a[r]ava	*!*			
b. [x][r]ava	*!			
c. [x][r][v]a		*!		
d. [x][r ^v]a			*!	
e. [x][v][r]a		*!		*
f. [☞] [x ^v][r]a				*

In the present tense, there is no reason to metathesize, since after the root vowel has been deleted, the output form [xravs] violates no constraints at all:

(22)

/xar/-av/-s/	MONOVOC	*COMPLEX(ONS)	*LAB-SON	LINEARITY
a. [x]aravs	*!			
b. [☞] [x][r]avs				
c. [x][r ^v]as			*!	
d. [x][v][r]as		*!		*
e. [x ^v][r]as				*!

Recall that labial-initial roots do not allow metathesis (12b). This shows that the OCP(LABIAL) constraint in (19) also dominates LINEARITY, as shown by the tableau in (23):

3. After the Principle of Monovocalicity, proposed by Gamkrelidze & Machavariani (1965:243): In polymorphic forms, only one vowel can surface. Obviously this constraint needs further thought.

(23)

/ber/-/av/-/a/	OCP(LABIAL)	*COMPLEX(ONS)	*LAB-SON	LINEARITY
a. \varnothing [b]erva				
b. [b][r]eva				
c. [b][r ^v]a			*!	
d. [b][r][v]a		*!		
e. [b][v][r]a	*!	*!		*
f. [b ^v][r]as	*!			*!

This tableau also shows that MONOVOCALICITY is itself dominated by OCP(LABIAL) and *COMPLEX(ONS): vowels are deleted up to the point that output onsets would become too complex or the OCP would be violated.

Finally, let us investigate another possible source of explanation, suggested to us by Beth Hume at the HIL/Ohio Metathesis workshop. Metathesis in these forms changes an input sequence like /trv/ to /tvr/, causing the sonorant to appear before a vowel, obviously a phonetically superior position. Thus, metathesis could be regarded as driven by a constraint that avoids sonorants before a consonant, in line with the AVOID family of constraints that Hume (2001) explores. However, in the present case such a line of inquiry seems to run into trouble, as Georgian allows monomorphemic sonorant-obstruent onsets quite freely, as in the following examples with initial /r/ (predicted to be well-formed by the schema in (17)):

(24) rtvel-i	‘harvest’
rk'al-i	‘semi-circle’
rgol-i	‘circle’
rc'q'il-i	‘flea’
rje	‘milk’

These examples show that clusters of sonorant plus obstruent are quite freely acceptable, so that a constraint banning them would seem too strong.

3 Conclusion

To conclude, /v/ metathesis in Modern Georgian can be understood as the result of constraint interaction. Obviously, metathesis upsets the linear ordering of segments. This is driven by the need to derive well-formed onsets, consisting of obstruent followed by sonorant, and well-formed complex segments, with labialization on coronals or dorsals.

4 Acknowledgements

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5 References

- Aronson, H.I. (1982). *Georgian. A reading grammar*. Columbus: Slavica.
- Blevins J. & A. Garrett (1998). The origins of consonant-vowel metathesis. *Language* 74, 508-556.
- Bush, R. (1997). *Georgian syllable structure*. Santa Cruz: MA thesis UC Santa Cruz.
- Butskhrikidze, M. (2002). *Consonant phonotactics of Modern Georgian*. Doctoral dissertation, ULCL/Leiden University.
- Butskhrikidze, M. & V.J. van Heuven (2001). *Georgian harmonic clusters as complex segments? A perceptual experiment*. In T. van der Wouden & H. Broekhuis (eds.), *Linguistics in the Netherlands 2001*, 31-44. Amsterdam/Boston: John Benjamins.
- Chitoran, I. (1998). *Georgian harmonic clusters: phonetic cues to phonological representation*. *Phonology* 15, 121-41.
- Chitoran, I. (forthcoming). *Gestural overlap and recoverability: Articulatory evidence from Georgian*. To appear in C. Gussenhoven & N. Warner (eds.), *Papers in Laboratory Phonology VII*. Cambridge University Press, Cambridge.
- Clements, G.N. (1985). *The geometry of phonological features*. *Phonology Yearbook* 2, 225-52.
- Clements, G.N. & S.J. Keyser (1983). *CV Phonology - A Generative Approach to the Syllable*. MIT Press, Cambridge, Massachusetts.
- Damenia, M. (1982). *Kartuli zmnuri morpemebis strukturuli modelebi [Structural models of the Georgian verbal morphemes]*. Mecniereba, Tbilisi.

- Depréz, V. (1988). *Georgian complex segments*. NELS 18, 109-23.
- Gamkrelidze T. & G. Machavariani. (1965). *Sonantta sistema da ablauti kartvelur enebshi [The system of sonorants and ablaut in the Georgian language]*. Tbilisi saxelmcpo unversitetis gamomcemloba, Tbilisi.
- Goldsmith, J.A. (1976). *Autosegmental Phonology*. Doctoral dissertation, MIT, Cambridge, Massachusetts (Garland Press edition, 1979).
- Gvinadze, C. (1970). *Tavkidura tanxmovantkompleksebi kartulshi [Initial consonant clusters in Georgian]*. Studentta samecniero konperencia XXXII 9-13. Moxsenebata tezisebi. Tbilisi saxelmcpo unversitetis gamomcemloba, Tbilisi.
- Hock, H.H. (1991). *Principles of historical linguistics*. Mouton de Gruyter, Berlin.
- Hume, E.V. (2001). *Metathesis: Formal and Functional Considerations*. In Hume, Smith & van de Weijer (eds.), 1-25.
- Hume, E.V., N.S.H. Smith & J.M. van de Weijer (eds.) (2001). *Surface Syllable Structure and Segment Sequencing*. HIL Occasional Papers 4. Holland Institute of Generative Linguistics, Leiden University.
- Maddieson, I. (1984). *Patterns of Sounds*. Cambridge University Press, Cambridge.
- McCarthy, J.J. & A.S. Prince (1995). *Faithfulness and reduplicative identity*. In J. Beckman et al. (eds.) *UMOP* 18, 249-384.
- Nepveu, D. (1994). *Georgian and Bella Coola: headless syllables and syllabic obstruents*. UC Santa Cruz MA thesis.

Prince, A.S. and P. Smolensky (1993). Optimality Theory - Constraint Interaction in Generative Grammar. Technical Report #2 of the Rutgers Center for Cognitive Science. Rutgers University, Piscataway, New Jersey.

Tevdoradze, I. (1978). Kartuli prosodies sakitxebi [Issues in Georgian prosody]. Tbilisis saxelmcpo unversitetis gamomcemloba, Tbilisi.

Vogt, H. (1958). Structure phonémique du géorgien. *Norsk Tidsskrift for Sprogvidenskap* 18, 5-90.

— (1961). Kartuli enis ponematuri struktura [The phonemic structure of the Georgian language]. Tbilisis saxelmcpo unversitetis gamomcemloba, Tbilisi.

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