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Vowel deletion and stress in Tundra Nenets.

Abstract.

In this paper I analyze the process of vowel deletion in Tundra Nenets, a Uralic (Samoyedic) language of Northern Russia. I will argue that the existing analysis of Salminen (1997) should be improved and present the new data confirming this claim as well as the new information about the stress system of Tundra Nenets.

In the first section I provide the general information on Tundra Nenets and describe the sources of data for this research. The second section briefly summarizes the Salminen's (1997) description of Tundra Nenets phonology. In the third section I discuss the acoustic correlates of stress in the studied dialect of Tundra Nenets. In the fourth section I argue that the process that Salminen calls "vowel reduction" is better analyzed as vowel deletion. Finally the section 5 gives the analysis of the processes discussed in this paper in terms of stratal OT and the section 6 sums up my conclusions.

1. Facts about Nenets.

Nenets is a North-Samoyedic language of Uralic language family. Two major dialect groups that are often treated as different languages are Tundra Nenets (Tereschhenko 1956, Janhunen 1986, 1993 Salminen 1997; the major dictionaries: Tereschenko 1965, Lehtisalo 1956, Salminen 1998) and Forest Nenets (Popova 1978). Tundra Nenets is spoken in the vast tundra area of Russian north from the Kanin Peninsula in the west to the Yenisey river in the east. Forest Nenets is spread in Siberia to the south of Tundra Nenets territory.

The closest living relatives of Nenets are Enets with its remaining 100 speakers and Nganasan.

According to the Ethnologue survey, the number of Nenets speakers is 26,300 (approximately 25,000 speakers of Tundra Nenets and 1,300 speakers of Forest Nenets). Many Tundra Nenets dialects are not sufficiently documented and are close to extinction because of unfavorable sociolinguistic situation.

Even though for Nenets people their language is strongly associated with their ethnic identity, the language is rarely used in everyday communication and is not always transmitted to the young Nenets. The average age of fluent Nenets speakers in the villages is above forty. The members of younger generations understand the language to some extent but can not speak it. This situation is expected since all Nenets speak Russian that is the language of administration and secondary education.

As Salminen (1997: 14) points out "[d]espite the vastness of the area in which it is spoken, Tundra Nenets itself is a relatively uniform language without profound dialectal differences (cf. Tereshchenko 1956: 182-246, Janurik 1985). The most important dialect boundary follows the Pechora River and separates the phonologically innovative Western dialects from the Central-Eastern dialect group. The differences between the Central and Eastern dialects, demarcated by the Ural Mountains, are less significant..."

The author's data about Tundra Nenets come from three field trips (2003-2005) to the village of Nelmin Nos which were organized by the Moscow State University. Nelmin Nos belongs to the Malozemelski Western dialect group of Tundra Nenets spoken in the outfall of Pechora river. Probably some of the phenomena I will mention are restricted to this dialect group.

2. Phonology of Tundra Nenets: Salminen's (1997) analysis.

In this section I describe the segmental phonology of Tundra Nenets following Salminen (1997). However Salminen does not pay much attention to the acoustic correlates of the postulated contrasts so all phonetic data in this section come from my own elicitations.

2.1. Consonants

	labial	**dental**	**palatal**	**velar**	**glottal**
stops	p, p^j b, b^j	t, t^j d, d^j		k	$ʔ_1$, $ʔ_2$
nasals	m m^j	n, n^j		ŋ	
fricatives		s, s^j, z, z^j		x	
liquids		r, r^j l, l^j			
glides	w		j		

The table above shows the consonant phonemes inventory of Tundra Nenets. The phonemes signified as $ʔ_1$ and $ʔ_2$ (termed *non-nasalizable* and *nasalizable* glottal stop and written as /q/ and /h/ in Salminen 1997)[1] are both pronounced in the same way and do not differ in any acoustic properties (1). Both can be dropped in fast speech.

(1) ja$ʔ_1$ [jaʔ] 'piece of hair'; ja$ʔ_2$ [jaʔ] 'soot'

The only difference between the two glottal stop phonemes is in the way they behave in consonant sandhi (2)[2]. The relevant rules from Salminen 1997 are given below: $ʔ_2$ is deleted before nasals and $ʔ_1$ - before obstruents. $ʔ_2$ assimilates in place to the following obstruent.

- $ʔ_2$ → m n ŋ / _C [obstruent with corresponding place of articulation]
- $ʔ_1$ → Ø / _C [obstruent]
- $ʔ_2$ → Ø / _C [sonorant]

(2) a. n^je-$ʔ_1$ xan [n^jexān] ;
woman-GEN.PL sledge
'a women's sledge'

b. n^je-$ʔ_2$ xan [n^jeŋgān]
woman-GEN.SG sledge
'a woman's sledge'

c. ja-m$ʔ_2$ [jāmʔ]
soot-ACC
'soot'

d. n^ja$ʔ_1$ŋa [n^jāʔŋa]
undress.3SG
'he undressed (someone)'

[1] I propose some minor notational changes to make Salminen's orthography correspond to the IPA phonetic alphabet. In particular I use the symbol "ă" for Salminen's /ø/, /q/ is signified by "$ʔ_1$"; /h/ - by "$ʔ_2$". I use the symbol "ŋ" in place of the digraph /ng/. In the examples that still need to be cited in Salminen's notation the underlying form is given in figure brackets {} and the surface form in slashes //. These brackets indicate that a particular sequence is written exactly as Salminen would write it.

[2] Please refer to the appendix for the list of glosses and abbreviations.

2.2. Vowels

i u

e o

(æ)[3] a, ă

The inventory of Tundra Nenets vowel phonemes is shown above. In the following sections I briefly discuss the main controversial points of Tundra Nenets vowel phonology.

2.2.1. a and ă phonemes.

Phonologically the two phonemes differ in length. However this difference shows up only in the first syllable as suggested by the fact that the informants clearly distinguish the words in (3a) but may confuse the words in (3b).

(3) a. xada [xāda] ‘grandmother’; xăda [xada] ‘nail’
sawik [sāwik] ‘sharp’; săwik [sawik] ’type of national clothes’
b. ŋilad [ŋilad] ‘bottom’; ŋilăd [ŋilad] ‘from under’

2.2.2. “Vowel reduction”. Possibility of schwa phoneme. Syllable structure.

Salminen suggests that vowel reduction is an alternation between ă (/ø/ in his notation) and /ᵊ/ (a special schwa phoneme). However schwa is hardly ever pronounced and if it is pronounced it is realized similarly to the “reduced vowel” /ø/.

He also makes an attempt to relate vowel reduction with stress. On his analysis the stress placement depends on the presence of schwa. But because schwa occurs only due to reduction all reduction rules must apply before the stress placement and hence stress can not determine reduction. This problem will be considered in the section 3.

Salminen postulates a fairly simple syllable structure CV(C). This can be done by assuming a non-pronounced schwa to be present in what sounds as complex consonant clusters.

The purpose that makes Salminen postulate a phoneme that is hardly ever phonetically realized is that this phoneme does its job in many cases of surface opaque interactions. For example, consider the interaction of vowel reduction and consonant voicing processes.

Labial and dental stops are voiced after a vowel. Vowel reduction always takes place in the last syllable. /ø/ is then reduced in even syllables counting from the beginning of the word but not syllables that precede a syllable with /ᵊ/ (that is if the final vowel is reduced the one in the penultimate syllable is not). The interaction of two patterns is illustrated in (4) below by partial paradigms of the words *knife* and *house*.

(4)	‘knife’			‘house’		
nom. sg. abs	{xørø}	/xørᵊ/	‘knife’	{xarøtø}	/xarødᵊ/	‘house’
poss. 2sg	{xørørø}	/xørørᵊ/	‘your knife’	{xarøtørø}	/xarᵊdørᵊ/	‘your house’
poss. 3sg	{xørøta}	/xørᵊda/	‘his knife’	{xarøtøta}	/xarᵊdøda/	‘his house’

As we will see, schwa is never pronounced in all the examples in (4). However its presence is indicated by the voicing of /t/ into /d/ (for example in the poss.3sg form of the word *knife*).

[3] /æ/ is present in Salminen’s (1997) vowel inventory for Eastern and Central Tundra Nenets dialects but is absent in the studied dialect. It has partly merged with /e/ although some informants still tend to distinguish the relevant minimal pairs. The issue of the exact phonological status of /æ/ goes beyond the scope of the present paper. Reflecting the most frequent pronunciation I write “e” in the relevant cases.

If the rules of reduction that we have just illustrated were the only ones /˚/ could be treated as an allophone of /ø/. However several rules complicate the picture creating the positions of potential contrast between the reduced vowel and schwa. One of these rules requires obligatory reduction after a vowel (5).

(5) /xada-/ 'kill': OBJ.SG3SG /xada˚da/ 'he killed (somebody)'
cf. OBJ.SG2SG /xadaør˚/ 'he killed you'

Another rule of this kind is the rule that Salminen calls "morphophonological reduction". This refers to the cases of obligatory reduction in certain stems and affixes (the vowel undergoing this kind of reduction is written as "(ø)"): {ÿ(ø)} – special finite stem suffix, {m(ø)n(y)a} – prosecutive singular, {p(ø)q} – subordinative, {nesey(ø)} 'new'.

(6) /xada-/ 'kill': OBJ.PL.3SG /xadey˚da/ 'he killed them';
/søwa/ 'good': PROS.SG /søwaw˚na/ 'along someone or something good'

"Morphophonological reduction" does not take place after consonant clusters and before syllables with {(ø)}.

(7) /nyencyel/ 'simple': PROS.SG. /nyencyelmøna/ 'along someone or something simple';
{nesey(ø)} /nesey˚/ 'new': PROS.SG {nesey(ø)-m(ø)n(y)a} /nesey˚wøna/ 'along something new'

2.2.3. Possible challenges to Salminen's analysis.

First of all, under Salminen's approach the exact distribution of schwa phonetic realizations remains unclear. We therefore do not know when "reduction" phonetically results in deletion and when it is not the case. This problem can be solved by formulating the exact rules of phonetic realization of the schwa phoneme. In the section 4 I try to find out what these rules may look like.

Second, the interaction between the stress system of Tundra Nenets and vowel reduction needs more carefull consideration. I will analyze the relevant data in section 3.

Finally, Salminen's rule that of reduction in the last syllable seems not so well motivated. It is not clear what it is so special about Tundra Nenets last syllables that the vowel is always reduced there. In the section 5.2.2 I draw some highlights to the reanalysis of this rule. As we will see, the complete analysis requires much more data on the status of glottal stop.

3. Tundra Nenets accent[4].

3.1. The problem

A good explaination for the complicated vowel reduction patterns would be the fact that vowel reduction is always stress-driven. This is what Salminen assumes. His stress assignment rules are formulated as follows:

- Primary stress falls on initial syllables.
- Secondary stress falls on non-final odd syllables and syllables preceding a syllable with /˚/.

But schwa only occurs due to reduction and hence reduction needs to take place before the stress placement rule applies. That's why the initial generalization that vowel reduction depends on stress is lost.

[4] See also [Kavitskaya 2006].

Salminen's view of Tundra Nenets stress system also contradicts to the analyses of Tereshenko (1965) and Castrén (1854). Tereshenko assumes that stress in Tundra Nenets is unpredictable and morphologically conditioned. Castrén (1854) claims that the accent as a rule falls on the last syllable of the lexeme.

To sum up the existing descriptions of Tundra Nenets stress system make contradictory claims. The picture is obscured by the fact that the exact acoustic correlates of stress are hardly ever discussed by the cited authors.

In this section we will try to find out what these acoustic correlates are and what determines the stress placement.

3.2. The data.

Four types of data were collected. First of all, wordlist elicitations were conducted where each word was repeated trice. To analyze the words in the same position in the sentence we designed the frame sentences. The most frequently used frame sentence is shown in (8a) where the word in question begins the intonation phrase. Other similar evnironments that were also used are shown in (8b-c).

(8) a. xusuwej jalʲa **xada** wada-mʔ$_1$ xetbʲi-dmʔ$_1$
every day **grandmother** word-ACC say-1SG
'Every day I say the word *grandmother*.'

b. **xarăd** ŋarka
house big
'The house is big.'

c. **jinzʲelʲe-sʲ** tara
listen-MOD.GER need
'It is necessary to listen.'

In addition to these data full morphological paradigms were collected for several nouns and verbs and several texts were recorded.

The primary elicitation of native speakers' intuition on stress placement divided the speakers into three groups. The members of the first group denied the presence of a prominent syllable in Nenets words. The consultants belonging to the second group always placed the stress on the first syllable and the ones from the third group relied on high tone in stress placement.

Our primary hypothesis was that high tone is the acoustic correlate of stress as well as some feature making the first syllable always prominent. The statistical analysis of the acoustic features of the vowel in the first syllable is presented in 3.3 while the existing pitch patterns are described in 3.4.

3.3. Word-initial lengthening.

In this subsection we will try to find the acoustic feature that is responsible for the prominence of the first syllable in Tundra Nenets words. We tested the acoustic features that are likely to be responsible for stress placement: intensity, duration and pitch contour. To find out which feature is responsible for the prominence of the first syllable we used a sample of about 130 tokens of the words with the same vowels in the first two syllables. We attempted to select the words with similar consonantal environments in both of the first two syllables so that the influence of the consonant on vowel quality would be the same in both syllables. Some sample words are shown in (9).

(9) sutuka; sidi-da; tʲidrʲik-măna
wire thigh-3SG envious-PROS
’wire’ ’his thigh’ ‘along someone envious’

The consultants read the words (each one was repeated three times) and they were instructed not to change the speech rate.

Duration, intensity and pitch contour were measured in the first two syllables of the sample words. The resulting data allowed us to perform the accurate statistic analysis.

The existing pitch patterns and their distribution are described in the next subsection. It was evident from the preliminary analysis that pitch could not be responsible for the prominence of the first syllable.

No statistic tests have shown that the difference in intensity between the first two syllables is significant (p value on all the tests was more than 0,1).

On the contrary, duration proved to be significantly higher in the first syllable than in the second one. To determine this we used both parametric and nonparametric statistic tests (the distribution of duration in the second syllable could more precisely be approximated by the normal distribution than the on in the first syllable). All the tests confirmed the significance of the duration difference between the first two syllables (p values were less than 0,01) except for Wald-Wolfowitz runs test (p value was about 0,08). Presumingly this test gave such odd results because it assesses not only the difference in duration between the two syllables but also the difference in the shape of duration distribution.

One way or another we can be pretty safe to conclude that Tundra Nenets has word-initial stress manifested by lengthening. Word-initial stress corresponds quite well to what Salminen claims about primary stress in Nenets.

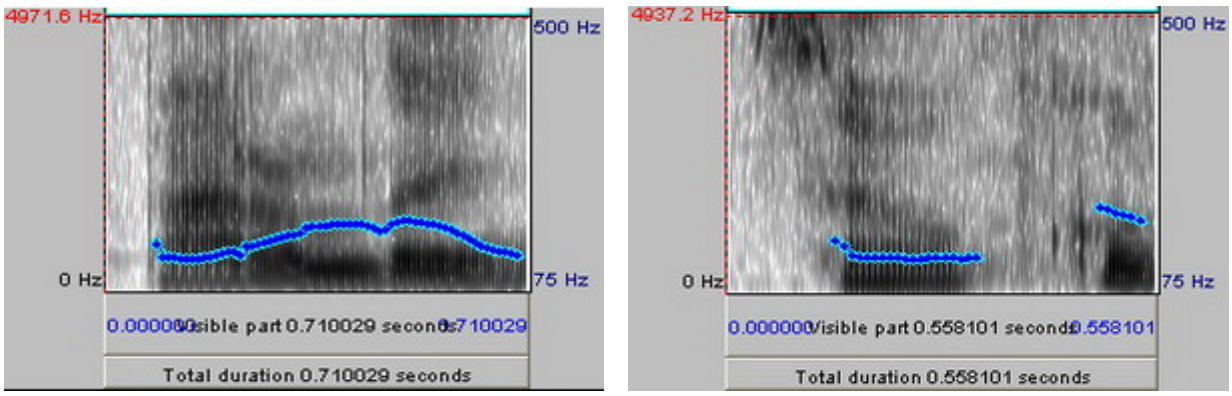
3.4. Pitch patterns.

According to the intuitions of some consultants pitch should also have been considered as a possible acoustic correlate of stress in Tundra Nenets. Furthermore the perception experiments with tokens where duration, pitch and intensity were altered have shown that the informants pay most attention to the manipulations of pitch. In this subsection we describe the existing pitch patterns and their distribution.

3.4.1. The existing pitch patterns.

As a rule all Tundra Nenets phonological phrases get the phrase-initial high tone on one of the first two syllables. The only exceptions arise due to the presence of pitch-attracting suffixes such as the diminutive -ko.

(10) paromdej ‘snow drift’ săwa-ko good-DIM

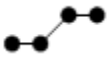


3.4.2. Pitch distribution.

The common pattern for Tundra Nenets words is illustrated in (11a-c): the pitch rises through the first syllable of the word if it is closed and through the second syllable if the first one is open. The monosyllabic words get the rise through their only syllable.

If this was the only pattern we could simply assume that the pitch rises through the first two moras of the word. However there are counterexamples (11d-e) to this pattern which indicate that the simple analysis stated above can not be true for all the cases.

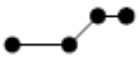
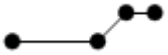
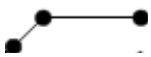
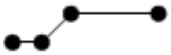
(11) a. ŋu da ’hand’ b. n^{j}ewxi ’old’ c. t i ‘deer’
yaxa ’river’ jar-ta-răxa (cry-ADJ-ADJ) ‘mournful’ t^{j}et ‘four’
xasawa ‘man’ jembd^{j}ar$ʔ_{1}$ ‘dress’ t o ‘lake’



d. ha r ăd ‘house’; e. lam ba ‘ski’
jo nar ‘thousand’ n^{j}ar-ma (red-ADJ) ‘red cheeked’

To capture the difference between (11a-c) and 11(d-e) we appeal to the lexical specification of the accent. We assume that the words in Tundra Nenets can be either lexically accented or unaccented. Lexically unaccented words are the ones that obey the generalization stated above: they have the pitch rise through the first two moras. On the contrary lexically accented words have a prelinked tone on one of the first two syllables in their lexical specification.

This analysis gets strong support from the behavior of stress-attracting affixes. Only the lexically unaccented words allow for the relevant affix to attract the tone as demonstrated in (12).

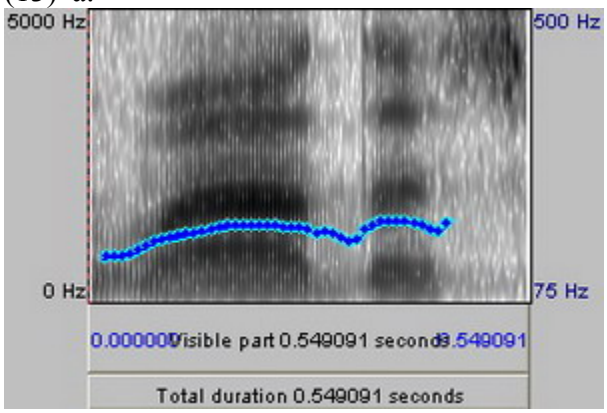
(12) a. ŋuda-ko; xasawa-ko b. harăd-ko; lam ba-ko
hand-DIM man-DIM house-DIM ski-DIM

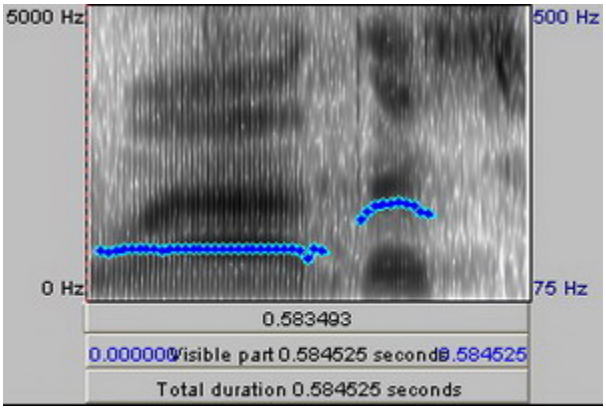
Assuming that in Tundra Nenets the tonal requirements of the lexical stem are more important than the requirements of the affix (MAX(H, ROOT) >> MAX(H, AFFIX) in terms of OT) we can easily capture this generalization.

3.4.3. Minimal pairs.

The presence of stems with lexically prelinked high tone creates the possibility of tonal minimal pairs. The pairs below illustrate the pitch contrasts in Tundra Nenets. Only the pitch differs the two words in (13a): vowel quality, duration and intensity are nearly the same. The analogous examples are given in (13b).

(13) a.





wadas^{j} ‘to lead’		wadăs^{j} ‘to bring up’	
[a_1] = 185ms	[a_2] = 60ms	[a_1] = 165 ms	[a_2] = 63ms
F_1 ~ 830 Hz	F_1 ~ 500 Hz	F_1 ~ 800 Hz	F_1 ~ 480 Hz
F_2 ~ 1700 Hz	F_2 ~ 1870 Hz	F_2 ~ 1625 Hz	F_2 ~ 1920 Hz
F_3 ~ 2950 Hz	F_3 ~ 3232 Hz	F_3 ~ 2990 Hz	F_3 ~ 3400 Hz
int = 82,8 dB	int = 78,8 dB	int = 79,3 dB	int = 80,4 dB

b. todăsj ‘to vomit’; todasj ‘to stoke’; xonăsj ‘to go to bed’; xonasj ‘to find’
judăsj ‘to cut’; judasj ‘to warm up’; tarăsj ‘to push’; tarasj ‘to be needed’

Interestingly all of the minimal pairs are of the same morphophonological nature: they are all verbs that differ in the last vowel of the stem (a vs ă).

3.5. Summary: Tundra Nenets stress system.

We have provided the relevant data on Tundra Nenets stress system. We got some evidence in favor of Salminen’s analysis. Namely the word-initial lengthening corresponds quite well to the claim about word-initial primary stress. However we didn’t manage to get any evidence of secondary stress in the studied dialect. Neither the consultants’ intuition nor phonetic data show that there might secondary stress. That’s why the foot structure that is probably responsible for the process of “vowel reduction” is not surfacely present. However the very reduction may be a sufficient evidence of the foot structure that is presumably obscured by some other processes.

One of this processes probably has to do with pitch patterns. The presence of pitch accent in Nenets was not reported in previous works so we can suppose that this is an innovation in the stress system of Tundra Nents. Our hypothesis here would be that Tundra Nenets stress system gradually changes from stress described by Salminen to pitch accent on the first two moras. The secondary stress has probably already gone but the pitch distribution is not yet stable.

This hypothesis needs to be tested more carefully. It gets some support from the consultants’ marginal errors. Some consultants tend to pronounce certain words with level pitch even though they are pronounced with high pitch on some syllable by other consultants (and even by the same consultants on another elicitation session). Also there are sporadic cases when the consultants “disagree” on the high tone place in a certain word: one informant can tend to locate the high tone in the word on a different place than all the others. All of these indicate that the tonal system is not yet fixed in the studied dialect of Tundra Nenets.

4. Reduction or deletion?

In this section we will try to figure out what the exact rules of schwa phonetic realization look like. To do this we tested various contexts where Salminen postulates a schwa and saw if it is pronounced. It turned out that the phonetic realization depends on the context in which schwa occurs.

The data in (14) demonstrate that schwa is not pronounced after vowels (14b) and within the clusters of two consonants (14a). In fact even /ø/ is not pronounced after vowels.

(14) a. /læk˚-dawa/ [lekdawa]; /ŋʲew˚xi˚/ [nʲewxi];
lazy-NMZ old
'laziness' 'old'

b. /xo˚ba/ [xoba]; /mønyiye-ø-m˚h/ [manʲijem(ʔ)]; /xada˚-da/ [xādada];
hide see-GFS-1SG kill-OBJ.SG.3SG
'hide' 'I see' 'he kills him/it'

The only cases where schwa is in fact pronounced are shown in (15). The rules of schwa realization in complex consonant clusters can be summarized as follows: schwa survives only if it is needed to break up an otherwise unacceptable cluster.

(15) a. /ngerc˚-da/ [ŋerc.da]; /sømp˚lʲangg/ [samb.lʲaŋg]
scatter-OBJ.SG.3SG five
'he scatters (something)'; 'five'

/limp˚ra˚/ [limb.ra]; /nulť nø-sy˚/ [nultnasʲ]
vibrate-3SG stop-MOD.GER
'something vibrates' 'to stop'

b. /søs˚-rka-˚/ *[sasr.ka] ok[sa.sar.ka]; /ngos˚lta-sy˚/ *[ŋosl.tasʲ] ok[ŋo.sal.tasʲ]
strong-COMPAR-GFS.3SG turn_the_head_upwards-MOD.GER
'he is stronger'; 'to turn the head upwards'

/løb˚r-ŋa-˚/ *[labr.ŋa] ok[la.bar.ŋa]; /løk˚mpoy˚h/ *[lakm.boj(ʔ)] ok[la.kam.boj(ʔ)]
rattle-GFS-3SG good_bye
'(it) rattles' 'good bye'

c. /nerc˚mla-˚/ *[nerc.mla] ok[nercamla]; /løbc˚bta-sy˚/ *[labc.ptasʲ] ok[lab.cap.tasʲ]
tear-GFS.3SG fall_flatways-MOD.GER
'he tears' 'to fall flatways'

The syllabification principles turn out to be fairly simple in Tundra Nenets: no word starts with two consonants so we can assume that complex onsets are completely prohibited. Therefore the syllable boundary in VCCCV sequences always goes after the second consonant of the sequence (VCC.CV). This is confirmed by the fact that Tundra Nenets complex codas obey the sonority sequencing principle: codas like /rc/ are well-formed (15a) while codas like /br/ are ill-formed (15b).

The depicted "rules of schwa phonetic realization" make the very presence of schwa phoneme a controversial issue.

In other words we can assume that there is no schwa phoneme at all**.** The process that Salminen calls "vowel reduction" is in fact deletion that is constrained by the syllable structure principles. The cases where Salminen's schwa turns out to be pronounced can be analyzed as the cases where the reduced vowel has survived.

This assumption gets further support from many other alternations in Tundra Nenets. For example there is a process of optional devoicing of the first consonant of the cluster if the second one is unvoiced. This process is illustrated in (16).

(16) a. /wabta-/ [wāpta-] 'overturn'; /ŋebtobæørc^{j}˚h/ [ŋeptoberc^{j}ʔ] 'scissors'
b. /paď ta-/ [pātta-] 'to adorn'; /ləď køtø-/ [latkata-] 'to wear (clothes)';
/yeď ko/ [jetko] 'a kind of children's game'; /pyeď kyecya/ [p^{j}etk^{j}ec^{j}a] 'saucer'.

As we can see in (16b) this process also applies if in Salminen's notation there is an unpronounced schwa intervening between the two consonants. This schwa is invizible for consonant devoicing and hence it is likely not to be present there at all[5].

Another piece of evidence against schwa comes from the phrasal high pitch assigning patterns.

(17) /ŋ^{j}ew˚ xi˚/ [n^{j}ewxi] 'old'; /læk˚ dawa/ [lekdawa] 'laziness';
LH H LH H H

/yab˚ sawey˚/ [jābsawej] 'lucky'
LH H H

In the section 3.4.2 we have argued that the phrasal high pitch assigns to the first two moras of the prosodic word (in contrast to the lexically determined high pitch). The example (17) demonstrates the phrase-initial pronunciation of the words that do not have the lexically prelinked pitch. In all of these words we get rising pitch through the first closed syllable although in Salminen's notation this syllable is not closed because the coda consonant has a nonpronounced schwa after it. The place of rising pitch shows that the first syllable is in fact closed. The presence of schwa doesn't influence the surface syllable structure.

All the listed data suggest that there is no schwa phoneme in Tundra Nenets at the surface level. Hence the process known as vowel reduction is better analyzed as deletion of what Salminen calls "the reduced vowel". The peculiarities of consonant voicing (4) may help us to answer the question of when exactly the reduced vowel is deleted.

The consonant voicing that takes place after a vowel does not only occur within words. In fast Nenets speech the word-boundary consonant voicing is also possible (18a). However if a words ends in an unpronounced schwa the voicing can not apply (18b).

(18) a. /nyar-ma pas˚ koy˚/ [n^{j}ārma baskoj]; /nøk˚ ryo tara˚/ [nakr^{j}o dara]
red-ADJ beautiful prepare need.3SG
'(that) red-cheeked (one) is beautiful' 'it is necessary to get ready'

[5] The examples in (16b) also demonstrate that devoicing applies after voicing process (it is because of this process that the relevant consonants are voiced). Probably a more sofisticated analysis is needed to avoid this circular derivation. It is clear however that any alternative analysis will be hindered by postulating an unpronounced vowel between the two consonants in question.

b. /wabta-sy˚ tara˚/ [wāptas^{j} tara]; /pas˚koy˚ pedara/ [pāskoj pedara]
overturn-MOD.GER need beautiful forest
'it is necessary to overturn' ' beautiful forest'

Let us now compare these data with the example (4) repeated here as (19) showing Salminen's underlying and surface forms as well as the phonetic transcription.

(19)	'knife'		'house'	
nom. sg. abs.	{xørø} /xør˚/ [xăr]		{xarøtø}	/xarød˚/ [xarăd]
poss 2sg	{xørørø} /xørør˚/ [xărăr]		{xarøtørø}	/xar˚dør˚/ [xardăr]
poss. 3sg	{xørøta} /xør˚da/ [xărda]		{xarøtøta}	/xar˚døda/ [xardăda]

We can conclude that the deletion of the reduced vowel triggers the absence of consonant voicing only at word boundaries. This generalization can be captured staightforwardly if we assume that the deletion applies post-lexically. The detailed analysis of vowel deletion is presented in the next section.

5. Vowel deletion and consonant voicing: analysis.

In this section I provide the analysis of the processes of vowel deletion and consonant voicing in Tundra Nenets within the framework of Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993, Kager 1999a among others). I will the version of stratal OT called LPM-OT (Kiparsky 1998, 2000) that has been shown to be the felicitous in analysis of rhythmic vowel deletion (see Kiparsky's (2000) discussion of Kager's (1999b) alternative analysis in terms of OO-correspondence).

Let us briefly summarize and revise the rules proposed by Salminen for consonant voicing and vowel deletion.

Consonant voicing

- {p py t ty}→ b b' d d' / V_

Vowel deletion takes place

- In the last syllable
- In even syllables.
- After a vowel.
- Not before the syllables where the vowel is already deleted.

Our analysis is based on the assumption that there are at least two levels at which constraint evaluation applies: lexical level and post-lexical level. The difference between these levels is described in [Kiparsky 1998], among many others. In what follows we will examine the exact differences between the two levels in Tundra Nenets.

First let us locate the processes in question in terms of those levels. As demonstrated by (18) and (19) the process of consonant voicing is relevant both lexically and post-lexically (it takes place both within words and at word boundaries).

These examples also may be used to argue that vowel deletion applies only post-lexically. Indeed the labial and dental stop consonants going after a vowel that gets deleted are voiced only within a word but not at word boundaries. This indicates that at the stage of word-formation the vowel is there but when the words are combined to form prosodic phrases it gets deleted. To sum up, consonant voicing must apply both lexically and post-lexically while vowel deletion gets relevant only post-lexically.

5.1. Lexical level: consonant voicing.

The constraints relevant for describing voicing include two faithfullness constraints and one markedness constraint:

- ➲ MAX-IO: do not delete the input segments
- ➲ IDENT-IO [VCD]: do not change the input [vcd] feature value.
- ➲ *VC[+STOP; -VCD; {+LAB, +DENT}] (shortened as *VO in tableaux): prohibits a sequence of a vowel and an unvoiced stop that is either labial or dental.

I do not include the dependency constraint (formulated below) in the tableaux because it is irrelevant for the purposes of our current analysis. As far as the vowel deletion is concerned the insertion of additional segments is completely prohibited so we can simply assume this constraint to be undominated.

- ➲ DEP-IO: do not insert any segments into the input sequence.

To describe the process of consonant voicing *VO should be higher-ranked than IDENT-IO [VCD]. But it can not be ranked higher than MAX-IO because the violation of *VO can never be compensated by the deletion of a segment. Therefore the correct ranking at lexical level for Tundra Nenets is as shown in (20).

(20) MAX-IO >> *VO >> IDENT-IO [VCD]

The Tableau 1 shows the analysis of the word meaning '*house*'.

Tableau 1

xarătă 'house'	MAX-IO	*VO	IDENT-IO [VCD]
xarătă		*!	
☞ xarădă			*
xartă	*!		
xarăă	*!		

The input sequence *ăt* violates the constraint *VO. This could be repaired by deleting the consonant or the vowel. However this posibility is not the way Nenets goes because MAX-IO outranks *VO. In fact the segments are never deleted because they violate *VO in Nenets. *VO is higher ranked than IDENT-IO [VCD] and therefore *xarădă* is the output of lexical level. This is the desired result because then the deletion can apply to this form post-lexically and give us the right output.

5.2. Post-lexical vowel deletion.

In this section I will provide an analysis of the process of vowel deletion in Tundra Nenets. As stated above we assume that vowel deletion applies post-lexically. The principles that govern vowel deletion are not the same word-internally and in the last syllable (see also 2.2.3). We will deal with the two cases separately.

5.2.1. Word-internal vowel deletion.

In this section the analysis of word-internal vowel deletion is presented.

To analyze the deletion process we have to appeal to foot structure. Otherwise deleting vowels only in even syllables seems unmotivated[6].

[6] Kager (1997) suggests that deletion may also be driven by the minimization of the numebr of unparsed syllables. We do not consider his proposal in detail because of the space limits. The recent discussion may be found in Jacobs (2004). Many of the arguments cited there are also applicable in case of vowel deletion in Tundra Nenets.

However as we have seen in section 3.5 the foot structure that is responsible for vowel deletion is not apparent from the pitch assignment patterns. We suggest that the secondary stress may already be gone due to the change of the stress system in the direction of pitch-accent system. One way or another, only vowel deletion is reminiscent of foot structure in Tundra Nenets.

We assume that feet are quantity insensitive and always contain two syllables. This is needed to explain the fact that deletion takes place in both open and closed syllables. As stated above vowel deletion takes place in even syllables so the strong position in the foot is the first syllable. Hence we describe Tundra Nenets foot structure as quantity-insensitive syllabic trochee.

Following Jacobs (2004) and Kiparsky (2000) we assume that "the input to the post-lexical level is then the prosodically organized output of the preceding level" (Jacobs 2004: 86). To put it in another way the input sequence of the post-lexical level already is organized in terms of foot structure. This makes possible the application of vowel deletion. After vowel deletion has applied the sequence is resyllabified.

At the post-lexical level the constraint that militates against all the occurences of ă (formulated below) gets higher ranked than the MAX-IO constraint.

➲ *ă: ă is prohibited.

But ă still surfaces sometimes in Tundra Nenets. This is due to the presence of a constraint that prohibits deletion in the strong position of a foot. This constraint is evidently higher ranked than *ă.

➲ MAX-IO[STRONG]: do not delete in the strong position of a foot

The Tableau 2 demonstrates the interaction of the three constraints in case of *xardăda* 'his house'. One ă needs to be deleted because MAX-IO is outranked by *ă. The constraint MAX-IO[STRONG] together with the assumed foot structure correctly predicts which ă it will be.

Tableau 2.

(xară)(dăda) 'his house'	MAX-IO[STRONG]	*ă	MAX-IO
(xară)(dăda)		**!	
☞ (xardă)da		*	*
(xarăd)da	*!	*	*

Tundra Nenets does not allow for vowel sequences and hence ă is always deleted after vowels. This is captured by the undominated constraint NO HIATUS formulated below.

➲ NO HIATUS: vowel sequences are prohibited[7].

The work of this constraint is illustrated in Tableau 3 by the form *xadada* 'he killed (somebody)'. Violating NO HIATUS is even worse than violating MAX-IO[STRONG].

Tableau 3.

(xada)-(ă-da) 'he killed (somebody)' kill-GFS-OBJ.SG3SG	NO HIATUS	MAX-IO[STRONG]	*ă
(xada)(ăda)	*!		*
☞ (xada)da		*	

[7]A possible alternative analysis may assume that NoHiatus is relevant at the lexical level. This assumption makes specific predictions concerning the behavior of ă in final closed syllables. However the complete examination of this option would lead us too far from our current topic (see the section 5.2.2.2 for a brief sketch of our proposal concerning the vowel deletion in final closed syllables).

As illustrated in (15), ă sometimes survives even in weak position in order to satisfy the syllable structure constraints. The vowel is never deleted in the sequences of four consonants or in the sequences of three consonants if such a sequence does not obey the Sonority Sequencing Principle. *COMPLEX ONSET is responsible for the absence of complex onsets in Tundra Nenets. SON-SEQ enforces the clusters to obey the Sonority Sequencing Principle.

➲ *COMPLEX ONSET: complex onsets are prohibited (shortened as *COMPL ONS in the tableaux).

➲ SON-SEQ: consonant clusters must obey the sonority sequencing principle, that is generally the sonority must rise in onset clusters and fall in coda clusters.

SON-SEQ, *COMPLEX ONSET and NO HIATUS are undominated in Tundra Nenets. Onset clusters are completely prohibited as well as ill-formed codas and vowel sequences. It is impossible and in fact unnecessary to find out how these three constraints are ranked with respect to each other.

The analysis of the word *săsărka* 'he is stronger' in Tableau 4 illustrates the work of these constraints.

Tableau 4.

(să.săr)(ka.ă) 'he is stronger'	NO HIATUS	SON-SEQ	*COMPL ONS	*ă
(să.săr) (ka.ă)	*!			***
☞ (să.săr)ka				**
(săsr.ka)		*!		*
(săs.rka)			*!	*

The foot structure together with *ă and NO HIATUS require that both ă phonemes in weak position get deleted. However only one ă in fact is out because deleting the other one would violate the syllable structure constraints.

To prohibit the deletion in the clusters of four consonants (15c) we similarly appeal to an undominated constraint prohibiting the codas of 3 consonants.

➲ *CCC|: codas of three consonants are prohibited.

The work of all syllable structure constraints is illustrated by the analysis of the form *nercămla* 'he tears' in Tableau 5.

Tableau 5.

(nercăm)(la-ă) 'he tears' tear-GFS.3SG	*CCC|	NO HIATUS	*COMPL ONS	*ă
(nercăm)(la-ă)		*!		**
☞ (nercăm)la				*
(nerc.mla)			*!	
(nercm.la)	*!			

The requirements of constraint *ă can not be fully satisfied because otherwise a sequence of four consonants would arise which either violates *CCC| or *COMPL ONS.

5.2.2. Vowel deletion in the last syllable.

Salminen's rule of obligatory deletion in the last syllable seems typologically unplausible and stipulative. Indeed we do not know what is so special about Tundra Nenets final syllables that the ă vowel always get deleted there although only once. Many Tundra Nenets words still end up in syllables containing the pronounced ă which is protected from deletion by a

"schwa" in final syllable on Salminen's analysis (for example the word /*xarəd*ᵊ/ *xarăd* 'house' analyzed below). If we agree that there is no schwa (see the exhaustive evidence in the section 4) this rule needs to be reformulated.

We propose to deal separately with the cases where ă occurs word-finally and the cases where it occurs before a word-final consonant.

5.2.2.1. Vowel deletion in final open syllables.

In this case the deletion is triggered by a constraint prohibiting word-final ă that has sufficient typological motivation (the word final position is known to be weak in many languages).

➲ *ă]$_{PRWD}$: no ă in the end of a prosodic word.

This constraint interacts with another one that prohibits the deletion in two syllables in a row. The exact formulation of the latter constraint is a complicated matter. It is hardly possible to formulate a constraint that would prohibit some operation to apply twice in terms of standard OT.

Ito and Mester (1998, 2003) propose to use the **local constraint conjunction** to describe the similar effects. A conjoined constraint is violated only if both conjuncts are violated. In fact some of the mentioned constraints can be reformulated in terms of constraint conjunction (for example the just mentioned *ă]$_{PRWD}$ constraint can be viewed as a conjunction of *ă and a general constraint prohibiting word-final vowels). Every conjoined constraint has a **domain** where it applies.

To capture the fact that the deletion does not apply twice in a row we appeal to self-conjoined constraint MAX-IO&MAX-IO formulated below.

➲ MAX-IO^{2}σ: do not delete twice in the domain of one output syllable.

We will leave for a moment the question of how MAX-IO^{2}σ and *ă]$_{PRWD}$ are ranked with respect to each other. The next example will clarify this issue. Word-final deletion may force an ă vowel to survive in weak position and hence *ă]$_{PRWD}$ should be higher ranked than *ă. That's why we get the ranking in (21)[8].

(21) MAX-IO^{2}σ >> *ă]$_{PRWD}$ >> *ă

The Tableau 6 shows the analysis of the word *xarăd* 'house'. The final vowel here has to be deleted to satisfy *ă]$_{PRWD}$ but one of the ă vowels must survive due to the presence of MAX-IO^{2}σ.

Tableau 6.

(xară)dă 'house'	MAX-IO^{2}σ	*ă]$_{PRWD}$	*ă
☞ (xarăd)			*
(xară)dă		*!	**
xard	*!		
(xardă)		*!	*

[8] It is hardly possible to find out the way *ă]$_{PRWD}$ and MAX-IO[STRONG] are ranked with respect to each other because the final vowel is never in strong position. Assuming the default ranking proposed by Ito and Mester (2003) we suggest that any faithfullness constraint should be lower ranked than a markedness constraint whenever possible and hence *ă]$_{PRWD}$ >> MAX-IO[STRONG] (see the example 23 below).

Let us now consider the examples motivating the ranking MAX-IO^{2}σ >> *ă]$_{PrWd}$. This ranking gets relevant as we deal with the words ending in *ăă* sequences. In all such sequences only one ă is deleted. Consider for example the 3rd person singular form of the verb *jutăs^j* 'to beat' analyzed in the Tableau 7.

Tableau 7.

(jută)-ă 'he beats' beat-GFS.3SG	MAX-IO^{2}σ	*ă]$_{PrWd}$	*ă
(jut)	*!		
(jută)ă		*	**!
☞ (jută)		*	*

As we see the optimal form violates *ă]$_{PrWd}$. Hence violating this constraint is better than violating MAX-IO^{2}σ.

5.2.2.2. Vowel deletion in final closed syllables.

The process of vowel deletion in the final closed syllables is triggered by completely different factors than the ones illustrated above. These factors are of phonotactic nature.

The word-final consonant clusters in Tundra Nenets can be of more complicated structure than the ones within the word. All of the anomalous clusters contain a glottal phoneme because dental obstruents and nonlabial nasals change into glottals word-finally.

The idea that lies behind our analysis is that the glottal phoneme or phonemes behave much like vowels in that they may occupy the nuclear position in a syllable. This allows to capture the generalization formulated above in a straightforward way.

Additional evidence in favor of this analysis comes from the intuitive judgements of the consultants.

(22)	xanz-mʔ$_1$;	jib^{j}eʔ$_1$-j-ʔ$_1$;	jembaʔ$_1$-j-ʔ$_1$
	runner-ACC	be_clever-SFS-REFL.3SG	get_dressed-SFS-REFL.3SG
	'runner (part of a sledge)'	'he got clever'	'he got dressed'

The consonant sequence with a glottal was syllabified by the consultants as an additional syllable at least for some words in (22)[9].

The assumption that glottal phonemes may occupy the nuclear position also helps us to avoid many stipulations that were not motivated in Salminen's description. For example the presence of the so called "added glottal stop" and the methatesis in word-internal ʔCă sequences receive an explaination on our analysis.

Finally this assumption is not typologically unplausible. Some recent developments in the typology of glottal consonants (Ladefoged and Maddieson 1996, Kavitskaya 2002) suggest that apart from the glottal stop phonemes there are glottal approximants. The phonemes of the former type are of low sonority and hence are not likely to occur in nuclear position, the latter type phonemes are highly sonorant (presumably at least as sonorant as other sonorant phonemes). This typological distinction predicts that in some languages glottal approximants can be nuclei as well as nasals or laterals can sometimes be. The fact that such languages have not been discovered so far is presumably due to the relative rarity of glottal approximants in

[9] In this example we alter Salminen's notation in that the "added glottal stop" is represented as well as the voiced obstruents after nasals (cf. Salminen 1997: 31-32, Janhunen 1986). These decisions follow from our basic assumption that there is no schwa phoneme. The exact analysis of the mentioned processes goes beyond the scope of the present paper.

general. Tundra Nents thus seems to fill the gap that used to undermine the typological theories concerning the staus of glottals. The acoustic properties of Tundra Nenets glottal phonemes also show that these phonemes are better analyzed as approximants.

Because of the space limits we are not able to present a complete argumentation in favor of syllabic glottal approximants and reanalysis of how vowel deletion and glottal phonemes interact in Tundra Nenets. This would require to analyze even more data on all the processes concerning the glottal approximants' alternations.

In a nutshell our analysis is based on the idea that ă is always deleted in the last syllable in order to minimize the number of codas (cf. the well known NOCODA constraint of (Prince and Smolensky 1993). The vowel presumably passes its syllabicity to the glottal approximant that normally occurs word-finally (in word-final position many consonants change into glottal approximant).

One way or another it is clear that the deletion in final closed syllables is due to very special phonotactic factors and should be described apart from all other cases of vowel deletion.

5.2.3. Vowel deletion: summary of the analysis.

To sum up we have described the post-lexical constraint ranking that captures all the basic cases of vowel deletion. Integrating it with the ranking responsible for consonant voicing we get (23).

(23) *CCC|, NO HIATUS, SON-SEQ, *COMPL ONS >> MAX-IO^{2}σ >> *ă]$_{PRWD}$ >> MAX-IO[STRONG] >> *ă >> MAX-IO >> *VO >> IDENT-IO [VCD]

The only difference between the lexical and post-lexical ranking in Tundra Nenets is therefore that the costraints militating against ă (*ă]$_{PRWD}$ and *ă) get higher ranked than MAX-IO. Now we are ready to turn to the analysis of the post-lexical consonant voicing.

5.3. Post-lexical consonant voicing.

Notice that the constraints we assumed to be relevant at the lexical level are by no means irrelevant post-lexically. These constraints are responsible for post-lexical consonant voicing. In fact the correct predictions already follow from the assumed constraint ranking (23). It turns out that post-lexically word-final ăs are deleted. Hence voicing is blocked after words that lexically end in Că sequences. The examples from (18) are repeated here as (24a-b). The words in (24a) can be analyzed exactly as the word *xarăd* (see Tableau 1).

(24) a. /nyar-ma pas˚ koy˚ / [n^{j}ārma baskoj]; /nøk˚ ryo tara˚ / [nakr^{j}o dara]
red-ADJ beautiful prepare need.3SG
'(that) red-cheeked (one) is beautiful' 'it is necessary to get ready'

b. /wabta-sy˚ tara˚ / [wāptas^j tara]; /pas˚ koy˚ pedara/ [pāskoj pedara]
overturn-MOD.GER need beautiful forest
'it is necessary to overturn' ' beautiful forest'

The analysis of the examples in (24b) is shown below in Tableau 8.

Tableau 8.

(pasă)(kojă) (peda)ra 'beautiful forest'	*ă	MAX-IO	*VO	IDENT-IO [VCD]
☞ (paskoj) (peda)ra		**		
(paskoj)ă (beda)ra	*!	*		*
(paskoj)ă (peda)ra	*!	*	*	
(paskoj) (beda)ra		**		*!
(paskoj) (eda)ra		***!		

The ă vowels violate the *ă constraint and hence must be deleted as they are not in strong positions. The deletion of these vowels also satisfies *VO. Therefore no voicing is needed after the vowels are deleted.

Now we have described nearly all the listed data. The only phonological process that remains to be analyzed is the one that Salminen calls "morphophonological vowel reduction" (see section 2.2.2). This refers to a marginal process of morphologically conditioned vowel deletion. A plausible analysis here is of course to introduce the specific constraints prohibiting the occurences of ă in certain morphemes.

The constraints on morphophonological deletion are not the same as the ones that restrict the deletion in general. For example this process does not take place before all consonant clusters (not just before the ones that would violate the SON-SEQ).

We do not have much to say about the exact analysis of this marginal process. Possibly a solution here would be to attribute the attachement of these affixes to the stem level (Kiparsky 2000) while admitting that the morphophonological deletion takes place at the word level. However the detailed description of the relevant data remains a matter of future research.

6. Conclusions.

We have provided new data on the exact phonotactic conditions of vowel deletion and on the stress system of Tundra Nenets.

Stress system of Tundra Nenets can be generally characterized as a pitch accent system with word-initial lengthening. Typologically Tundra Nenets is similar to Swedish in this respect.

A plausible diachronic explaination for the presence of peviously unknown pitch contrasts is that Tundra Nenets is gradually switching from stress to pitch accent system. Probably it is this change that obscures the foot structure responsible for vowel deletion.

Contrary to what Salminen (1997) claims we have argued that the process known as "vowel reduction" is better analyzed as vowel deletion taking place at the post-lexical level. We have provided an analysis of this process in terms of stratal OT.

The present paper focused on the process of vowel deletion so the overall consequences of our analysis for the phonological system of Tundra Nenets require further investigation. The phonotactic status of glottal phonemes (see the section 5.2.2.2) also needs to be described in more detail. Finally, we hope to open a broader prospective in the diachronic studies of Tundra Nenets stress.

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8. References

Castrén, M. A. 1854. *Grammatik der samojedischen Sprachen*. Nordische Reisen und Forschungen 5, herausgegeben von A. Schiefner. St. Petersburg.

Ito, Junko & Armin Mester. 1998. Markedness and word structure: OCP effects in Japanese. Ms. University of California, Santa Cruz.

Ito, Junko & Armin Mester. 2003. On the sources of opacity in OT: coda processes in German. In: *The syllable in Optimanlity Theory*. Fery, Caroline and Van de Vijver, Ruben [eds] New York: Cambridge University Press.

Jacobs, Haike. 2004. Rhythmic vowel deletion in OT: Syncope in Latin. PROBUS An international journal of Latin and Romance Linguistics 16 (1): 63-89. Walter de Gruyter.

Janhunen, Juha. 1986. *Glottal stop in Nenets*. Mémoires de la Société Finno-Ougrienne 196. Helsinki.

Janhunen, Juha 1993. Options for Tundra Nenets vowel analysis. In: Hajdú Péter 70 Éves. Szerkesztette Sz. Bakró-Nagy Marianne & Szíj Enikõ. Linguistica, Series A, Studia et Dissertationes 15: 143-147. Budapest: MTA Nyelvtudományi Intézet.

Janurik, Tamas. 1985. Kriterien zur Klassifizierung der Dialekte der samojedischen Sprachen. Dialectologia Uralica: Materialien des ersten Internationalen Symposions zur Dialektologie der uralischen Sprachen, 4-7 September 1984: 283-301. Wolfgang Veenker ed. Veroffentlichungen der Societas Uralo-Altaica 20; Wiesbaden: Harrassowitz.

Kager, René. 1997. Rhytmic vowel deletion in Optimality Theory. In: *Derivations and Constraints in Phonology*: 463-499. I. Roca [ed]. Oxford. Oxford University Press.

Kager, René. 1999a. *Optimality Theory*. Cambridge. Cambridge University Press.

Kager, Rene. 1999b. Surface opacity of metrical structure in optimality theory. In: *The Derivational Residue in Phonological Optimality Theory*: 207- 245. B. Hermans & M. van Oostendorp [eds.]. Amsterdam: John Benjamins.

Kavitskaya, Darya. 2002. *Compensatory lengthening: phonetics, phonology, diachrony*. Routledge, New York & London.

Kavitskaya, Darya. 2006. Tundra Nenets accent. LSA annual meeting. Handout.

Khanina, Olesya. In press. Intransitive split in Tundra Nenets, or how much semantics can hide behind syntactic alignment? to appear in Wichmann, Søren and Donohue, Mark (eds.). *The Typology of Semantic Alignment Systems*. Oxford: Oxford University Press.

Kiparsky, Paul. 1998. Paradigm effects and opacity. Ms.

Kiparsky, Paul. 2000. Opacity and cyclicity. The linguistic review17: 351-367.

Ladefoged, Peter & Ian Maddieson. 1996. *The sounds of the world's languages*. Cambridge, MA: Blackwell.

Lehtisalo, T. 1956. *Jurakosamoedisches Wörterbuch*. Lexica societatis fenno-ugricae XIII. Helsinki.

McCarthy, John & Alan Prince. 1993. Prosodic Morphology I: constraint interaction and satisfaction. Ms, University of Massachusetts, Amherst & Rutgers University.

Popova, Ja. N. 1978. *Foneticheskie osobennosti lesnogo narechiia nenetskogo iazyka*. Moskva: Nauka. [Phonetic peculiarities of the Forest Nenets dialect.]

Prince, Alan & Paul Smolensky. 1993/2004. *Optimality Theory: constraint interaction in generative grammar*. Blackwell: Malden, MA; Oxford, UK; Carlton, Aus.

Salminen, Tapani. 1997. *Tundra Nenets inflection*. Mémoires de la Société Finno-Ougrienne 227. Helsinki.

Salminen, Tapani. 1998. *A morphological dictionary of Tundra Nenets*. Lexica Societatis Fenno-Ugricae 26. Helsinki.

Tereschenko, Natal'ya Mitrofanovna. 1956. *Materialy i issledovaniya po yazyku nentsev*. Moskva & Leningrad. Izdatel'stvo AN SSSR. [Materials and research on Nenets language.]
Tereshchenko, Natal'ya Mitrofanovna. 1965. *Nenetsko-russkii slovar'*. Leningrad: Prosveschenie. [Nenets-Russian dictionary.]

Appendix: list of glosses and abbreviations.

1 – 1st person
2 – 2nd person
3 – 3rd person
ABS – absolutive declension (contrasted with possessive declension for nouns).
ACC – accusative
ADJ – adjectivizer
COMPAR – comparative
GEN – genitive
GFS – the verbal marker of the general finite stem (Salminen 1997) which is used to form the indicative forms of subjective conjugation. Khanina [in press] proposes to analyze Salminen's "stem markers" as belonging to inflection. The details of the discussion are irrelevant for our current purposes.
H – high tone
IPA – International Phonetic Association
L – low tone
MOD.GER – modal gerund, the verbal form occurring with modal verbs and in most dictionaries as a lexical entry. Sometimes the bare stem is also used with modal verbs.
NMZ – nominalization
NOM – nominative
OBJ.SG2SG – objective conjugation, object in singular, subject in 2nd person singular
OBJ.SG3SG – objective conjugation, object in singular, subject in 3rd person singular
OBJ.PL3SG – objective conjugation, object in plural, subject in 3rd person singular
OO-correspondence – a branch of Optimality Theory, a theory that admits that there may be constraints evaluating the correspondence of the output to some other output form (*the base*)
OT – Optimality Theory
PL – plural
POSS 2SG – possesive declension, 2nd person singular of the possessor, singular possessee
POSS 3SG – possesive declension, 3rd person singular of the possessor, singular possessee
PROS – prosecutive (Salminen's (1997) term for the case marker semantically close to what is known as prolative).
REFL – reflexive conjugation
SFS – the verbal marker of special finite stem which is used in reflexive conjugation (see also the notes on GFS).
SG – singular