Glossa a journal of general linguistics

Jurgec, Peter. 2016. Velar palatalization in Slovenian: Local and long-distance interactions in a derived environment effect. *Glossa: a journal of general linguistics* 1(1): 24. 1–28, DOI: http://dx.doi.org/10.5334/gjgl.129

RESEARCH

Velar palatalization in Slovenian: Local and long-distance interactions in a derived environment effect

Peter Jurgec
Department of Linguistics, University of Toronto, 100 St George Street, Toronto, ON, Canada M5S 3G3, CA
peter.jurgec@utoronto.ca

Slovenian velar palatalization has been described as a morphologically and lexically restricted, variable derived environment effect. This paper presents a corpus-based study that for the first time also considers synchronic phonological factors. Much of the variation turns out to be conditioned by local and long-distance consonant co-occurrence restrictions. In terms of local interactions, palatalization invariantly applies to remove an illicit consonant cluster while being blocked when it would result in an illicit consonant cluster. The more surprising finding is that other consonants within the stem also strongly affect palatalization. Palatalization of the stem-final velar is less likely if the stem contains another velar, and palatalization is categorically blocked if the stem contains a postalveolar obstruent, at any distance from the suffix. These data constitute a previously unreported type of local derived environment effects that are blocked at a distance. This interpretation of the Slovenian data sheds a new perspective on typologically similar patterns. The local and long-distance interactions found in Slovenian are modeled within the Maximum Entropy weighted constraint framework.

Keywords: palatalization; Slovenian; variation; dissimilation; consonant harmony; Maximum Entropy

1 Introduction

Slovenian velar palatalization is a process that turns stem-final velar obstruents into postalveolars when followed by certain suffixes (Toporišič 1976/2000: 151–153, 262–264). Some of these suffixes are given in (1). The suffixes variably palatalize the stem-final velar (a), but this is not always the case some forms are clearly ungrammatical (b).

(1) Variation in Slovenian palatalization

a. Unpredictable variation

STEM		NON-PALATALIZED	PALATALIZED	
stɾaŋk-a	‘political party’	stɾaŋ**k**-itsa	stɾan**tʃ**-itsa	‘party-DIMINUTIVE’
sux-a	‘slim’	su**x**-itsa	su**ʃ**-itsa	‘slim female’
nɔg-a	‘leg’	nɔ**g**-itsa	nɔ**ʒ**-itsa	‘leg-DIMINUTIVE’
bɾeg-a	‘river bank-GEN’	bɾe**g**-nat	bɾe**ʒ**-nat	‘alluvial’
gɾax-a	‘pea-GEN’	gɾa**x**-ka	gɾa**ʃ**-ka	‘pea-DIMINUTIVE.GEN’

b. No variation

STEM		NON-PALATALIZED	PALATALIZED	
tʃəɾk-a	‘letter’	tʃəɾ**k**-itsa	*tʃəɾ**tʃ**-itsa	‘letter-DIMINUTIVE’
kokoʃk-a	‘hen’	kokoʃ**k**-itsa	*kokoʃ**tʃ**-itsa	‘hen-DIMINUTIVE’
oblak-a	‘cloud-GEN’	*obla**k**-ka	obla**tʃ**-ka	‘cloud-DIMINUTIVE.GEN’
smɾek-a	‘spruce’	*smɾe**k**-je	smɾe**tʃ**-je	‘spruce branches’

The aim of this paper is to look at this variation more closely. I conducted a corpus study of palatalization in Slovenian, focusing primarily on the phonological factors. The results confirm that much of the variation is in fact conditioned by local and long-distance interactions. Both vowels and consonants at the stem–suffix boundary influence the likelihood of palatalization. Unexpectedly, other consonants within the root also have a strong effect. Palatalization is less likely if the stem contains a second velar, and palatalization is categorically blocked if the stem contains a postalveolar obstruent, at any distance from the suffix. These data constitute a previously unnoticed type of local derived environment effect that is blocked at a distance. I analyze the interactions using the Maximum Entropy weighted constraint framework (MaxEnt; Wilson 2006; Hayes & Wilson 2008).

Section 2 provides more background about Slovenian palatalization. Section 3 introduces the findings of the corpus study across all suffixes. Section 4 discusses local interactions, whereas section 5 provides an overview of long-distance interactions. Section 6 analyzes both local and long-distance interactions using MaxEnt. Section 7 concludes.

2 Background

In this section, I outline the current state of knowledge about Slovenian palatalization. First, I show that the morphological properties of Slovenian palatalization are well understood (section 2.1). Second, I outline the historical developments that lead to the current state of palatalization (section 2.2). Finally, I discuss variation and its phonological underpinnings that will be the focus of the subsequent sections (section 2.3).

2.1 Morphological characteristics

Slovenian velar palatalization is an alternation which turns velars into postalveolars, before certain suffixes (a). Less frequent is second velar palatalization (here termed velar fronting) which turns velars into alveolars (b). Finally, iotation affects all segments except postalveolars and palatals (c). Iotation is a heterogenous pattern that includes velar (k → ʧ) and coronal palatalization (t → ʧ), lenition (d → j), and l-epenthesis after labials.

(2) Types of palatalization in Slovenian

a. Velar palatalization: velars palatalize to postalveolars

baɾ**k**-a	'boat'	baɾ**ʧ**-iʦa	'boat-DIMINUTIVE'
kɾo**g**-a	'circle-GEN'	kɾo**ʒ**-əʦ	'circle-DIMINUTIVE'
pɾa**x**	'dust'	pɾa**ʃ**-ək	'powder'

b. Velar fronting: velars front to alveolars

ɾe**k**-u	'say-PART.M'	ɾɛ**ʦ**-i	'say-IMPERATIVE'
se**g**-u	'reach-PART.M'	se**z**-i	'reach-IMPERATIVE'

c. Iotatization: all consonants undergo a variety of palatalization-like processes

bo**g**-a	'god-GEN'	bɔ**ʒ**-ji	'godly'
tele**t**-a	'calves'	tele**ʧ**-ji	'calf-ADJ'
gove**d**-o	'bovine-N'	govɛ**j**-ɉi	'bovine-ADJ'
glo**b**-ɔk	'deep'	glob**l**-ji	'deeper'
bli**z**-u	'close-ADV'	bli**ʒ**-ji	'closer'

The three patterns share the same set of targets, which are velars turning into coronal sounds. At the same time, it is easy to distinguish the three processes. First, they are all morphologically conditioned, which means that any given suffix triggers at most one of the alternations. Second, the segments affected are only partially overlapping. Labials, for instance, show alternations only in iotation. Hence, the processes are clearly distinct.

This paper examines velar palatalization (henceforth, palatalization) rather than the other two patterns. Palatalization is considerably more productive than velar fronting.

Furthermore, palatalization is frequent in nominal paradigms, where morpheme boundaries are relatively easy to determine from surface realizations. Iotation, in contrast, is often triggered by affixes that are not realized independently, i.e., as zero affixes, which makes morpheme boundaries harder to identify in a written corpus. In terms of the variation in individual stems, palatalization and iotation appear to be quite similar in Slovenian, so it is likely that the results reported in this paper are representative for both phenomena even though only palatalization will be analyzed.

Velar palatalization in Slovenian is triggered by the suffixes listed in Table 1. Many of these suffixes begin with a front vowel or glide *j*. There is a strong cross-linguistic tendency for these segments to be likely triggers of palatalization (Bhat 1978; Bateman 2007; Kochetov 2011). Other suffixes begin with a consonant or a back vowel, which are atypical triggers.[1]

	i/j/e-initial	**C-suffixes**	**Other**
‘DIMINUTIVE’	–its(a), –itʃ	–k, –ts	
‘ABSTRACT’	–in(a), –iʃtʃ(e), –j(e)		–tv(o), –owj(e), –Ø
‘ADJECTIVE’		–n	–nat, –sk(i)
‘VERBAL’	–i		–Ø

Table 1: Suffixes that trigger palatalization (Toporišič 1976/2000).

C-suffixes consist of a single consonant; these suffixes may be preceded by schwa to avoid raising sonority codas or syllabic consonants, typically in the masculine nominative/accusative singular only. The status of Slovenian schwa is controversial. Synchronically speaking, various descriptions have analyzed schwa as underlying (e.g. Toporišič 1976/2000), epenthetic (Jurgec 2007) or morphologically predictable (Bidwell 1969).

An anonymous reviewer suggests that schwa is underlying based on the generalizations from other Slavic languages. Historically, Slovenian schwa has developed from the Common Slavic yer in certain positions, but the synchronic data suggest that the speakers have reanalyzed schwa as epenthetic. The main argument for schwa being epenthetic is that its distribution is to a large extent predictable. Schwa appears in a small set of native roots (e.g. *sən* ‘dream’ ~ *sna* ‘-GEN.SG’, *pəs* ‘dog’ ~ *psa* ‘-GEN.SG’, *məgla* ‘fog-NOM.SG’ ~ *məgəl* ‘-GEN.PL’), in the position before *ɾ* when not adjacent to a vowel (e.g. *bom əɾ ˈdɛtʃ* ‘I will be red’ ~ *bo ɾˈdɛtʃ* ‘he will be red’), and at the boundary between roots and suffixes (e.g. *ˈɾekəw* ‘he said’ ~ *ˈɾɛkla* ‘she said’, *ˈdedək* ‘grandpa’ ~ *ˈdetka* ‘GEN.SG’), or to break an illicit cluster (*ˈpalma* ‘palm’ ~ *ˈpaləm* ‘-GEN.SG’, *ˈkamən* ‘rock’ ~ *ˈkamna* ‘GEN.SG’). Schwa never appears word-finally and generally avoids stress. Perhaps the most convincing evidence is that schwa does not count as a vowel for purposes of allomorphy. For instance, monosyllabic or shorter inanimate stems ending in *ɾ* take the allomorph *–a* in the genitive singular (*tɪɾ* ‘rail, track’ ~ *ˈtɪɾa* ‘-GEN.SG’, *mɛɾ* ‘mayor’ ~ *ˈmɛɾa* ‘-GEN.SG’), whereas disyllabic or longer roots take the allomorph *–ja* (*ˈkuteɾ* ‘boat’ ~ *ˈkuteɾja* ‘-GEN.SG’; *ˈɡɾubeɾ* ‘name’ ~ *ˈɡɾubeɾja* ‘-GEN.SG’). Schwa, crucially, does not count as syllabic for the purposes of allomorph selection (*ˈputəɾ* ‘butter’ ~ *ˈputɾa* ‘-GEN.SG’, *ˈtʃɛbəɾ* ‘bucket’ ~ *ˈtʃɛbəɾa* ‘-GEN.SG’), even though the forms with *–ja* would be well-formed in terms of phonotactics; both unattested forms **ˈputəɾja* and **ˈtʃɛbəɾja* would have schwa in the phonotactically expected positions. Hence, the choice of *–a* instead of *–ja* in roots with schwa remains unexplained if we assume that schwa is underlying, but not if it is considered epenthetic. In derivational

[1] In Table 1 bracketed vowels are the nominative singular inflectional suffixes.

terms, allomorph selection applies first and blocks schwa epenthesis (along the lines of Hall et al. under review).

In synchronic terms thus both the second and third group of suffixes begin with a consonant and palatalization is unexpected with such suffixes.

Finally, the data in (3) show that not all suffixes beginning with *i* trigger palatalization.

(3) I-initial suffixes are not necessary palatalization triggers

STEM		TRIGGERS		NON-TRIGGERS	
bog-a	'god-GEN'	u-bo**ʒ**-itsa	'poor women'	bo**g**-inja	'party-DIM'
dowg-a	'long-FEM'	dow**ʒ**-ina	'length'	dow**g**-in	'tall male'
dux	'smell, ghost'	du**ʃ**-k-a	'breath-GEN'	du**x**-i	'smell-pl'
baɾok	'baroque'	baɾo**tʃ**-n-i	'baroque-ADJ-DEF'	baɾo**k**-ist	'baroque-PER'

An anonymous reviewer points out that one way to think of the distinction between triggering and non-triggering suffixes would be to say that there is they are of two classes of suffixes in terms of derivation, which would be consistent with other Slavic languages (for such an analysis of Russian, see Blumenfeld 2002, and for Polish, see Rubach to appear). This may well be the case, but the evidence would have to be particular to palatalization as there does not seem to be any other evidence for these two classes of suffixes. The palatalization-triggering suffixes are all derivational, some of which are nominal whereas other are verbal. In terms of stress, some shift stress, some shift it variably, but others do not. The non-triggering suffixes are all nominal. No inflectional suffix triggers palatalization. Non-triggering suffixes appear to be more recent, appearing in loanwords. In any case, the argument for the two classes of suffixes appears to be tied to palatalization facts alone.

When taken together, the data in this section demonstrate that palatalization is a morphologically conditioned process: only certain suffixes, apparently regardless of their phonological content, trigger palatalization.

2.2 Slovenian palatalization in the Slavic context

Slovenian resembles other Slavic languages in that it exhibits several palatalization-like processes. Common Slavic distinguished three kinds of palatalization and iotation (Shevelov 1964). Determining which of the three processes applied depended on the phonological triggers. Some front vowels triggered first palatalization, whereas others triggered the second or third palatalization. Iotation was triggered by the palatal approximant /j/. The palatalizations also differed in targets. While palatalization affected only velars, iotation affected most consonants. The resulting palatalized segments differ across Slavic languages.

To put the Slovenian facts in the broader Slavic context, let us consider palatalization-like processes in the most closely related language, Bosnian/Croatian/Serbian (henceforth, BCS). Both Slovenian and BCS evidently exhibit all three patterns, albeit with some significant differences. To start with, BCS has a larger set of coronals, which include apical and laminal postalveolars; all Slovenian postalveolars are apical. Velar palatalization in BCS involves the same targets, velars, that turn into postalveolars (Browne 1993; Morén 2006). However, unlike Slovenian, the suffixes that trigger palatalization in BCS all begin with a front vowel. In Slovenian, this is not the case; some suffixes begin with a back vowel or consonant. As such, only the BCS velar palatalization has a clear phonological trigger. Velar fronting in BCS is triggered by some i-initial suffixes, and the resulting consonants are alveolar. In this sense, BCS and Slovenian are identical. However, while BCS shows velar fronting with several suffixes, such as the masculine nominative, dative/instrumental/locative plural and imperfective, Slovenian velar fronting is productive only in the imperative; all other examples are limited to a small set of exceptional nouns (e.g. *otrɔ**k*** 'child' ~ *otrɔ**ts**-i*/*co*ll. *otrɔ**k**-i* '-NOM.PL'). Iotation appears to be the most similar across the two languages, with the largest set of targets. The difference between the two languages is in the resulting iotized segments; BCS has a set of palatal sonorants, which Slovenian lacks. In short, while there are significant differences between the two languages, the overall facts are strikingly similar. Crucially for the discussion that follows, in both languages palatalization-like processes are morphologically conditioned.

When focusing on velar palatalization, what the two languages have in common is that the process is no longer completely phonological. Not all suffixes that begin with a front vowel trigger palatalization, as seen for Slovenian in (3). However, only Slovenian has suffixes that start with other segments, such as back vowels or consonants in Table 1. Because Morén (2006) posits that the trigger of palatalization is phonological, a front vowel *i,* his analysis cannot be straightforwardly extended to Slovenian. Another way of analyzing the Slovenian pattern would be to say that the triggering segment must be sufficiently abstract, such as a floating feature bundle (along the lines of Morén's analysis of velar fronting) or a ghost segment (Szpira 1992). Such a segment can be found at the beginning of the palatalizing suffixes. The Slavic literature refers to these segments as yers, to mirror the Common Slavic schwa-like segments which have been deleted in late Common Slavic. For instance, Havlík's Law states that most yers are deleted, except for strings of schwas in adjacent syllables where every even yer (counting from the right) is retained. Yer segments that are subject to deletion thus cannot be realized independently, but can palatalize the preceding root. Thus, yers could be thought of as underlying on the synchronic level. For such an analysis of Slovenian see Morén & Jurgec (2007).

The focus of this paper is variation in palatalization. As such, the ghost segment trigger could not account for the full set of facts. As we will see, the suffixes starting with *i/j* are better palatalizers than other palatalizing suffixes.[2] Furthermore, palatalization is less frequent in roots containing another postalveolar. Whatever the ultimate account of the triggering segment is, it will have to capture these tendencies. Because the morphological facts about palatalization are well established in the literature, this paper will not attempt a different analysis. I will instead assume that the set of triggering suffixes is lexically marked and the palatalization triggering constraint refers only to those suffixes. In short, the constraint PALATALIZATION is lexically indexed to specific suffixes. Lexical indexation is a common and well-established approach to capturing such morphological exceptionality (Pater 2000; 2007; 2009; Inkelas & Zoll 2007; Gouskova 2007; Flack 2007; Jurgec 2010). This makes sense since the focus of this paper is on the phonological factors that condition the variability of palatalization, not morphology.

[2] An anonymous reviewer points out that the analysis provided in this paper is consistent with ghost segments appearing at the beginning of all palatalizing suffixes. In particular, the constraints that capture the difference between *i/j*-initial suffixes and other suffixes would apply even if a ghost segment is included in the representation. While I acknowledge this is indeed the case, this situation also means that ghost segments are a representational equivalent of lexical indexation to the set of all palatalizing suffixes. Formally however, the palatalization constraints that would require reference not only to ghost segments but also to the following (non-ghost) segments appear to be a much more parochial solution than indexed palatalization constraints that refer only to the initial segment of the suffix. For an analysis of Russian yers with indexed constraints, see Gouskova (2012).

2.3 Phonological characteristics

The literature already addresses some phonological characteristics of palatalization in Slovenian. In particular, only velars {k g x} undergo palatalization and map to postalveolars {ʧ ʒ ʃ}. Nothing can be said about the triggering segments on the synchronic level, even though historically these triggers were all front vowels. Thus, the focus of this paper will be the phonological factors that affect palatalization. The main contribution of this paper is in demonstrating that variation in Slovenian velar palatalization is tied to purely phonological factors, such as the initial segment of the suffix, the phonotactic restrictions at the morpheme boundary and long-distance interactions between consonants in the whole word.

3 Overall variation

This section provides the first glimpse of the corpus data, focusing on results across suffixes. Section 3.1 details the data collection method. Section 3.2 compares palatalization by suffix, whereas section 3.3 compares different stems. Section 3.4 summarizes the findings.

3.1 Data collection

To determine the scope of variation, I first searched for words ending in palatalizing suffixes in two dictionaries of Standard Slovenian: *The Dictionary of Standard Slovenian* (Bajec 2000) and *The Slovenian Orthographic Dictionary* (Toporišič 2001). The Dictionary of Standard Slovenian contains about 110,000 words and was published between 1970 and 1991. The Slovenian Orthographic Dictionary contains about 130,000 words and was produced in the 1990s. The searchable versions of these dictionaries are available online at http://bos.zrc-sazu.si. The dictionaries were produced using pre-digital techniques. Words with only a handful of records or words that have multiple overt derivational suffixes are less likely to be included (see Bajec 2000).

I searched for stems ending in velars and followed by palatalizing suffixes. Palatalization is reliably indicated in the orthography; variable words are counted as two separate entries. I made the following exclusions. First, I excluded null suffixes, which would require a full morphological analysis of a large part of the sources. This rules out two null suffixes ‘ABSTRACT’ and ‘VERBAL’ (Table 1).[3] Second, I only included those words in which the relevant suffixes were the rightmost derivational suffixes within a word. The more morphologically complex the word is, the less likely it is to be included in the sources, regardless of the frequency. As such, morphologically very complex words are not adequately represented in the sources. Third, I excluded verbs as they failed to display any variation. The findings regarding the adjectival and nominal suffixes turned out to be entirely consistent with the verbal suffixes (e.g. i-initial suffixes display little variation). Finally, I only included the suffixes that appeared in the dictionary in at least

[3] An anonymous reviewer asks whether null affixes are consistent with the analysis proposed for segmentally realized suffixes. As we will see, the PALATALIZATION constraint (11-b) refers to the set of affixes that are lexically specified for palatalization (≡ Velars must not be followed by a palatalizing suffix). Hence, this constraint applies to segmentally realized suffixes and zero suffixes alike, as long as we assume that null suffixes are linearized after the stem. Yet this does not need to be an assumption. There is independent evidence that null affixes are indeed suffixes. For instance, there is a process of final coronal deletion that applies to the nominative singular which has no suffix (/ˈdètet̲/ → [ˈdète] ‘baby’), while deletion is blocked in the corresponding genitive plural because there is a null inflectional suffix which also triggers a tonal change (/ˈdète**t**-Ø/ → [ˈdétet̲] ‘baby-GEN.PL’). Blocking of final coronal deletion suggests that inflectional affixes are always suffixes, even if segmentally empty. By extension, null suffixes that trigger palatalization must be linearized after the stem, just as other palatalizing suffixes. The PALATALIZATION constraint will thus apply to segmentally realized and null suffixes alike.

20 words. Two palatalizing suffixes, *–tv(o)* and *–iʃtʃ(e)* ‘ABSTRACT’ in Table 1, failed to meet this threshold.

The words collected from the dictionary sources were then checked for frequencies in the text corpus *Gigafida* (Logar-Berginc et al. 2012). This text corpus contains 1.2 billion tokens from a variety of written sources, published between 1990–2011 (with very few sources dated before 1997). The corpus is partially morphologically parsed (stem-inflection boundary only), but not lexically disambiguated. Each item was checked for accuracy and homophonous items were manually discarded. For very frequent suffixes, an estimate of valid tokens was made on the basis of the first 200 hits.

The subsequent descriptive and inferential statistics was performed in R (R Core Team 2013).

3.2 Palatalization by suffix

The search turned out 9 suffixes with more than 20 pairs of word-types in the dictionaries. A type-pair consists of two words, one with palatalization and the other without (e.g. *nɔgitsa* ~ *nɔʒitsa* ‘leg-DIMINUTIVE’). Some dictionary words did not appear in the corpus at all. These type-pairs were excluded from analysis. As a result, one suffix, *–nat,* had only 17 type-pairs.

All in all, 612 type-pairs had at least one token in the corpus. There were 5.7 million tokens collected, which represents 0.5% of all tokens in the corpus, leading to the conclusion that the palatalizing suffixes are quite frequent. Of the 612 type-pairs, 447 or 73% exhibit palatalization in the majority of tokens. This represents 4.9 million tokens or an 86% share. While this suggests that very frequent suffixes display more palatalization, this is not the case statistically. The Pearson product-moment correlation coefficient is 0.072, indicating that type frequency plays little role in palatalization. Frequency of individual types will not be discussed further.

Individual suffixes differ in frequency from one another, ranging from 17 to 169 types, shown in Table 2. The most common suffix is *–n* which stands out with 169 types and almost 3.9 million tokens (over two thirds of all tokens). At the other extreme, *–nat* has a tenth of the types and less than one hundredth of the tokens.

The suffixes also vary in terms of how frequently they trigger palatalization. On the one hand, all 20 type-pairs with *–itʃ* trigger palatalization more frequently than not, and only 31 tokens lack palatalization. On the other hand, only 32 out of 86 (37%) type-pairs with *–ts* display palatalization in the majority of tokens.

	ts	k	n	itʃ	itsa	ina	je	nat	owje	Σ
Number of types	86	92	169	20	107	36	59	17	26	612
>50% palatalized	32	81	151	20	49	34	58	12	10	447
Number of tokens	38.1	300.8	3,916.3	63.5	313.6	840.9	174.8	3.4	4.4	5,655.8
(in 1000s) palatalized	7.5	292.1	3,233.9	63.4	242.2	840.1	174.8	2.2	0.8	4,857.0

Table 2: Types and tokens by suffix.

For each type-pair, I calculated a palatalization ratio which is the share of palatalized tokens among all tokens for that type-pair. The higher the palatalization ratio, the more frequent the palatalization is within the type-pair. A palatalization ratio of 1.00 means that all tokens in the corpus were palatalized, whereas the ratio of 0.00 indicates a complete lack of palatalization.

The palatalization ratios across type-pairs and suffixes differ considerably (Table 3). The mean value for all data is 0.72, varying from 0.36 for *–ts* and *–owje* to 0.99 for *–je.* The median value for all data is 1.00, which means that the majority of types show palatalization. In fact, the median value of palatalization ratios for most suffixes is 1.00, with the exception of *–owje* (0.00), *–je* (0.02) and *–itsa* (0.27).

	ts	k	n	itʃ	itsa	ina	je	nat	owje	Σ
Mean	0.36	0.87	0.89	0.98	0.45	0.93	0.99	0.69	0.36	0.72
Median	0.02	1.00	1.00	1.00	0.27	1.00	1.00	1.00	0.00	1.00

Table 3: Palatalization ratios by suffix.

The Shapiro-Wilk test reveals that palatalization ratios are not normally distributed for any of the suffixes ($p < 0.0001$ for all suffixes). To get a better idea how the palatalization ratios are distributed for each suffix, I will visualize the data using the package Beanplot in R (Kampstra 2008). The function draws one bean per group of data. A bean consists of (i) a one-dimensional scatter plot, (ii) its distribution as a density shape, and (iii) a thick mean/median line for the distribution. The dashed line represents the overall mean/median (across all beans). Showing both mean and median appeared confusing, so I chose only the more informative measure of central tendency for each figure.

Figure 1 presents palatalization ratios by suffix, with mean values for each suffix. Each short horizontal dash represents the palatalization ratio of one type-pair. (The overall frequency is not represented here, so a rare type-pair is treated the same way as a very frequent type-pair.) The ranges with more type-pairs have a broader density shape. For example, *–ts* has mostly types with low palatalization ratios, which is indicated by a broader density shape and more dashes at the lower end. The same suffix also has quite a few type-pairs with palatalization ratios around 1.00, which is marked with a broader density shape at the top of the bean. Very few type-pairs have palatalization ratios around 0.5, hence the density shape is thin in that range. In short, the bean of the suffix *–ts* resembles the number 8, with many type-pairs at both extremes, but very few in the middle. The distribution is bimodal.

Three other suffixes exhibit bimodal distributions: *–itsa, –nat,* and *–owje.* Combined with *–ts*, these suffixes have the lowest mean values. The remaining suffixes have mean palatalization ratios close to 1.00, with very few outliers.

These results indicate significant differences among the suffixes. Many suffixes almost invariantly trigger palatalization in all stems, and the remaining suffixes exhibit less palatalization. Only a small share of stems have ratios around 0.50, suggesting that the variation is not random. In the following sections, I will show that much of the variation can be attributed to phonological factors.

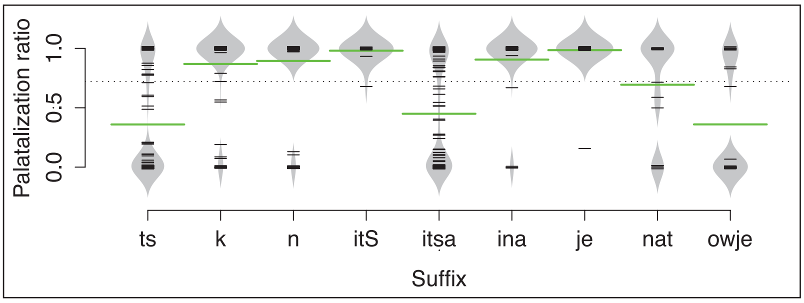

Figure 1: Palatalization ratios by suffix, with means. Vertical beans represent the density distributions, with short lines corresponding to stems. The longer lines (green) mark mean values for each suffix. The dotted line indicates the mean value across all suffixes.

3.3 Palatalization by stem

The results so far suggest that individual suffixes differ significantly in their likelihood to trigger palatalization. This section looks at the overall results in stems.

Several stems appear with multiple suffixes that trigger palatalization. Of these stems, twelve appear with four or more suffixes, shown in Table 4. Individual stems show high degrees of similarity amongst varying suffixes: if a stem has a high palatalization ratio with one suffix, the same stem will have a high palatalization ratio with another suffix. For example, *dlak* 'hair' has palatalization ratios ranging from 1.00–0.83. Some roots show more variation. For instance, *bog* 'god' has low palatalization ratios with two suffixes (*–ʦ* = 0.12, *–k* = 0.08), but high palatalization ratios with the other three (*–iʧ* = 1.00, *–ʦa* = 0.92, *–ina* = 1.00). It is likely that these differences are conditioned by the phonological properties of the suffixes rather than the stem itself.[4]

	ʦ	**k**	**n**	**iʧ**	**iʦa**	**ina**	**je**	**nat**	**owje**	
smɾek			1		.85	.94	1	1	.06	'spruce'
dlak			1		.99		1		.83	'hair'
oblak	.05	1	1		1		1			'cloud'
strok	0	.98					1	1		'clove'
bɾeg	.86		1	1		1		.50	0	'bank'
sneg	.21	1	1			1		1	0	'snow'
bog	.12	.08		1	.92		1			'god'
vɾag	0		1	1	1					'devil'
pɾax	0	1	1	1		1		1		'dust'
sux	.78		1		.65	1	1	1		'dry'
vəɾx		.20	.98	1		1			0	'top'
stɾex			1		.85	1	1			'roof'

Table 4: Palatalization ratios of stems appearing with four or more suffixes.

We can also group stems by the stem-final velar. Not all of them are equally common, which mirrors the general trends in the lexicon (Table 5).

x	**k**	**g**	**Σ**
112	333	167	612
18%	54%	27%	(100%)

Table 5: Stems by final consonant.

Figure 2 presents palatalization ratios by stem-final consonant, with mean values for each consonant. The beans are horizontal, to make the distinction between stems and suffixes apparent. Each short vertical dash represents the palatalization ratio of one type-pair (henceforth, stem). The differences between the three groups of stems do not appear to be clearly distinct, with the mean only slightly higher for the stops when compared to the fricative.

To test whether the effects of suffixes and stem-final consonants on palatalization ratios were significant, I fit the data into a linear mixed-effects model with the target velar and suffix as fixed effects, and with random intercept and slopes for stem, using the `lmer` package in R. Both fixed factors were dummy-coded, with target *g* and suffix *–ʦ* serving as the reference levels.

[4] For ease of reading, palatalization ratios of 1.00 and 0.00 are abbreviated to 1 and 0, respectively in Table 4. Stems are given in the underlying forms.

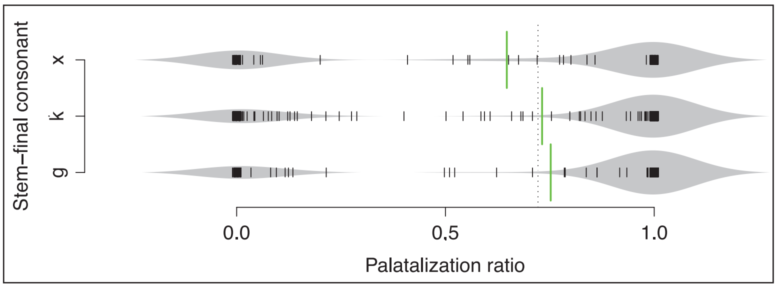

Figure 2: Palatalization ratios by stem-final consonant, with means. Horizontal beans represent the density distributions, with short lines corresponding to stems. The longer lines (green) mark mean values for each suffix. The dotted line indicates the mean value across all words.

The results for fixed effects are presented in Table 6. Significant predictors have t-values above 2 or below –2. When compared to the stem-final *g*, only *x* is significantly different, while *k* is not. Most suffixes have rather high t-values when compared to the suffix *–ts*, which suggests that they affect the palatalization ratios significantly.

Factor	Estimate	Std. error	t-value
(Intercept)	0.40355	0.04304	9.376
Stem-final k	−0.05921	0.03616	−1.638
Stem-final x	−0.23790	0.05312	−4.478
Suffix –k	0.56859	0.05118	11.110
Suffix –n	0.56224	0.04499	12.498
Suffix –itʃ	0.65348	0.08125	8.043
Suffix –itsa	0.12222	0.04887	2.501
Suffix –ina	0.58610	0.06581	8.905
Suffix –je	0.62641	0.05728	10.936
Suffix –nat	0.39386	0.08712	4.521
Suffix –owje	0.03385	0.07427	0.456

Table 6: Statistical results from a linear mixed-effects model.

3.4 Interim summary

The data reviewed so far suggest that palatalization may be less variable than assumed at the outset of this paper. It may be, for example, that palatalization is triggered in most instances of a particular stem or suffix, but a particular phonotactic restriction may block palatalization in some combinations. These phonological restrictions will be the focus of the rest of the paper. Another source of variation is lexical, namely that each suffix has its own likelihood to cause palatalization, independently of its phonological shape (Pater 2009; Gouskova & Linzen 2015). While the ultimate analysis will need to account for this second source of variation, lexical variation will not be the focus of the analysis in this paper. The vast majority of variation will be shown to be phonological.

4 Local interactions

Phonological interactions are generally local. Most typically, a segment affects an adjacent segment. Thus, it makes sense to look at these patterns first. Other phonological processes may apply at a distance, ignoring intermediate segments. Such patterns include vowel harmony (where consonants are typically not affected), consonant harmony (where vowels and some consonants are unaffected) and dissimilation (which often restricts similar segments within some domain, such as a word). Slovenian is well-known for several long-distance interactions, which will thus also be examined in this paper (section 5).

The local effects in palatalization are fairly well studied. The cross-linguistic comparisons have uncovered several asymmetries in terms of triggers and targets. This section examines these asymmetries in Slovenian. I first look at trigger segments (section 4.1), followed by target segments (section 4.2). Then, I focus on interactions between segments of both sides of the morpheme boundary (section 4.3). The findings are summarized in section 4.4.

4.1 Triggers

Languages with phonological palatalization reveal two asymmetries regarding the triggers. First, high vowels are better triggers than non-high vowels (Chen 1973; Bhat 1978; Bateman 2007; 2011; Kochetov 2011). In many languages only high vowels trigger palatalization, and in languages in which non-high vowels trigger palatalization, high vowels are also triggers.[5] Second, front vowels are better triggers than back vowels. That is, if a back vowel triggers palatalization in a particular language, front vowels will also be triggers.

As we have seen in section 2, Slovenian palatalization is not purely phonological; there is no phonological property common to the triggering suffixes. Recall that the palatalization triggering suffixes fall into three groups (Table 1). One group of suffixes starts with typical phonological triggers *(–itsa, itʃa –ina, –je),* while the rest do not. When pooled together, the suffixes with front vocoids do not differ from other suffixes. However, this is due to the effect of one single suffix, *–itsa*, which is much more variable than all other suffixes. There are phonological reasons why this suffix behaves differently than other i-initial suffixes, and this issue will be addressed in section 5.1. Once *–itsa* is excluded, front suffixes appear to be much stronger triggers than other suffixes, as shown in Figure 3.

While most suffixes have many stems with low palatalization ratios, front suffixes almost invariantly trigger palatalization in all stems. The few exceptions are shown in Table 7. Only four such words exist, with two having palatalization ratios below 0.90. The word with the lowest palatalization ratio is a predictable exception, as it contains another postalveolar—see section 5.2 for further discussion. In contrast, suffixes beginning with a segment other than a front vowel or glide have many words with low palatalization ratios. This asymmetry between the two sets of suffixes suggests that Slovenian mirrors

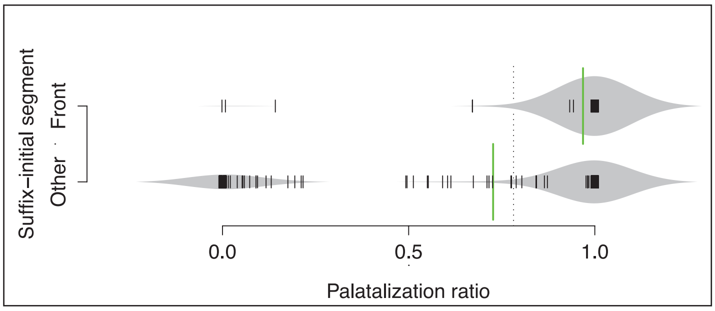

Figure 3: Palatalization ratios by suffix-initial segment, with means. Horizontal beans represent the density distributions, with short lines corresponding to stems. The longer lines (green) mark mean values for each suffix. The dotted line indicates the mean value across all words.

[5] An anonymous reviewer points out that not all languages mirror the cross-linguistic facts. For instance, mid front vowels trigger palatalization in Massachusett and Pre-Cheyenne, but high front vowels do not (Oxford 2015).

Type-pair	Gloss	Palatalization ratio	Total tokens
təɾg-itʃ ~ **təɾʒ-itʃ**	‘square-DIM’	0.94	47
smɾek-ina ~ **smɾetʃ-ina**	‘spruce forest’	0.94	16
lusk-ina ~ **luʃtʃ-ina**	‘husk’	0.68	724
dʋotʃərk-je ~ **dʋotʃərtʃ-je**	‘digraph’	0.14	7

Table 7: Stems with low palatalization ratios when followed by front suffixes (at least 5 tokens).

the cross-linguistic tendencies—despite the fact that velar palatalization in Slovenian is morphologically conditioned.

4.2 Targets

Cross-linguistically, palatalization is more likely to affect velar consonants, followed by coronals and labials (Chen 1973; Bhat 1978; Bateman 2007; 2011; Kochetov 2011). This preference is immediately clear in Slovenian, since palatalization affects only velars. Other palatalization-like patterns in Slovenian affect a larger set of consonants. For instance, iotation affects all consonants (2), yet the output of palatalization is different for different places of articulation, with velars and most coronals becoming postalveolars *(tele**t**-a* ‘calves’ ~ *tele**tʃ**-ji* ‘calf-ADJ’) while labials exhibit l-epenthesis *(glo**b**-ɔk* ‘deep’ ~ *glob**l**-ji* ‘deeper’), thus preserving the underlying place of articulation.

Other target asymmetries are less clear. There is a cross-linguistic restriction on palatalization of rhotics (Walsh Dickey 1997; Hall 2000; Hall & Hamann 2010), but other natural classes do not seem to display any clear trends. For instance, obstruents and sonorants (or stops and fricatives) may display different behavior, but there is no uniformity.

Stem-final consonants display significant differences across all suffixes, with the fricative *x* showing less palatalization than the stops *{k, g},* as seen in Figure 2. This tendency remains even after we account for all other interactions; phonotactically neutral n-suffixes mirror the general tendencies, as shown in Figure 4.

For these two suffixes, there are no clear phonotactic grounds that could explain the differences between the stem-final consonants. That is, these suffixes do not contain overt vowels that would increase the likelihood of palatalization or have clear local interactions between the consonants at the stem-suffix boundary. This general tendency is language-specific.

In other words, not all segments are equally likely to undergo palatalization. Two tentative explanations are possible. On the one hand, it could be that some velars are more marked in stem-final position compared to other velars. The problem is that there is no independent evidence for such markedness. On the other hand, it could be that some segments are

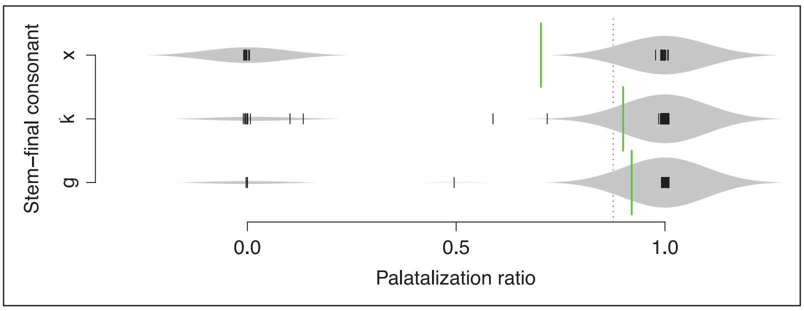

Figure 4: Palatalization ratios for the two suffixes without clear local interactions (*-n* ‘DIMINUTIVE’ and *–nat* ‘ADJECTIVE’) by stem-final consonant, with means. Vertical beans represent the density distributions, with short lines corresponding to stems. The longer lines (green) mark mean values for each suffix. The dotted line indicates the mean value across all words.

more resistant to palatalization than other segments. In the language of Optimality Theory, some segments violate more faithfulness constraints than other segments.

A particular caveat concerning Slovenian velar palatalization is an asymmetrical obstruent inventory (Table 8). Slovenian has no postalveolar stops and velar affricates; both postalveolar and velar fricatives are attested.

	Alveolar	**Postalveolar**	**Velar**
Stop	t d		k g
Fricative	s z	ʃ ʒ	x (ɣ)
Affricate	ʦ (ʣ)	ʧ (ʤ)	

Table 8: Coronal and velar obstruents in Slovenian (Toporišič 1976/2000).[6]

This asymmetry leads to different mappings between inputs and outputs in palatalization (4). While the velar fricative maps to the postalveolar fricative while preserving voicing, stops cannot map to stops. Instead, the voiceless stop maps to the voiceless affricate. Voiced velars do not have the same option, as there are no voiced postalveolar affricates. Instead, voiced velars map to voiced postalveolar fricatives.

(4) Palatalization mappings

Non-continuants	ʧ	k g
Continuants	ʃ ʒ	x

If we make use of an SPE-style representational model, the mapping *x* → *ʃ* will incur the fewest violations of faithfulness constraints, as the two segments are more similar than the other pairs. This fact alone suggests that palatalization of *x* is more likely than of the other two segments, which is contrary to the data (Figure 4). This, perhaps surprising mapping of the voiced stop *g* to the fricative *ʒ* is also found in other Slavic languages. These data have been used to support an analysis based on hierarchical contrastive models, such as in Radišić (2009). Under this approach, *g* is not specified for the feature [continuant]. These small differences among the stem-final consonants are left for further research.

4.3 Triggers and targets

The final piece of the data concerns cases in which palatalization depends on segments on both sides of the morpheme boundary. I will discuss one particularly clear example, but the generalizations extend to other similar cases.

Consider the suffix –*k* 'DIMINUTIVE'. Figure 5 shows that this suffix mirrors the general tendency in the lexicon, although at a more extreme level. The stops show all but invariant palatalization, whereas a sizable share of *x*-final stems has low palatalization ratios.

There is a single outlying g-final stem with a palatalization ratio other than 1.00: /bog/ at 0.08. When this stem is followed by the suffix –*k,* the resulting non-palatalized word contains a sequence of two identical consonants (the stops are both voiceless and released), which is exceedingly rare in Slovenian and never tautomorphemic. However, this stem is exceptional in other ways and limited to a single idiom *bok-k-ow kot* 'corner with a cross'. As such, its phonological exceptionality is not surprising.

Identical adjacent consonants are very rare in Slovenian, with the only instances limited to the boundaries between root and derivational affixes. There are several active processes that resolve such sequences. For instance, the clitic *k* 'to (directional)' dissimilates to *x* when followed by a word starting with a velar stop (5).

[6] In Table 8, the bracketed segments are not contrastive in native words.

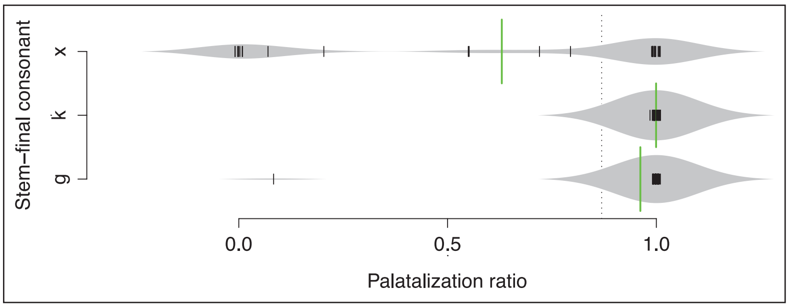

Figure 5: Palatalization ratios for –*k* 'DIMINUTIVE' by stem-final consonant, with means. Horizontal beans represent the density distributions, with short lines corresponding to stems. The longer lines (green) mark mean values for each group of stems. The dotted line indicates the mean value across all words.

(5) Dissimilation of *k* 'to'

a. [k] before sonorants and most obstruents

k otʃetu	'to father'
k mami	'to mother'
k sinu	'to son'
k xtʃɪɾi	'to daughter'
k teti	'to aunt'
k psu	'to dog'

b. [x] before velar stops

x kmetu	'to farmer'
x kameli	'to camel'
x kɾaʋi	'to cow'

Why is the restriction on identical adjacent consonants relevant to palatalization? When stems ending in velar stops *{k g}* are followed by k-initial suffixes, the resulting non-palatalized word contains a highly marked sequence. Palatalization turns velar stops into postalveolars, which avoids sequences of identical segments. For example, **otɾɔk-k-a* 'child-DIM-NOM.DUAL' contains an illicit sequence which is resolved by palatalization: *otɾɔtʃ-k-a*. In this sense, palatalization is facilitated by the phonotactic restrictions in Slovenian, resulting in more palatalization for stops. No facilitation exists for the fricative *x,* as strings *xk* are well-formed in Slovenian.

An anonymous reviewer notes that Slovenian is not alone in this restriction. The Common Slavic diminutive **-ьk* triggered velar palatalization, whereas the suffix **-ъk* 'similar to stem', which has a back yer, would not. However, **-ъk* would become **-ьk* after velars, and thus triggers palatalization.

Similar interactions between adjacent segments are found with the suffixes *–ts* and *–owje.* In a nutshell, the likelihood of palatalization depends on the underlying voicing in the case of *–ts* and whether the resulting target is an affricate in the case of *–owje.* Like in the examples above, these patterns can be supported by the phonotactics of Slovenian.

4.4 *Interim summary*

Slovenian palatalization displays several interactions between segments at the stem-suffix boundary. First, suffixes containing front vowels and glides are more likely to trigger palatalization than other suffixes, matching the cross-linguistic tendencies. Second, palatalization is less likely with the fricative *x* compared to the stops *{k, g}*. Finally, palatalization can be conditioned by the phonotactic restrictions applying at the morpheme boundary.

These asymmetries can be formalized in both rule-and constraint-based frameworks. In a rule-based approach, adjacency is specified in the environment of the rule. In a constraint-based approach, constraints refer to strings of segments. Because the data contain a level of inherent variation that cannot be attributed to lexical factors, I will be using a specific constraint-based model (section 6).

5 Long-distance interactions

Section 4 examined in what ways palatalization is affected by adjacent segments at the morpheme boundary. In this sense, Slovenian palatalization appears to be similar to other languages in its tendency for front high vowel triggers. This section looks at the effect of consonants in other positions.

Long-distance phonological patterns are less common cross-linguistically, and as such would normally not need to be examined. However, Slovenian has been reported to have almost all of these patterns. Examples include metaphony and umlaut (Toporišič 1976/2000), consonant harmony (Jurgec 2011), and long-distance derived environment effects (Jurgec 2014). Given this richness of long-distance sound patterns, it makes sense to examine whether palatalization is also affected by segments at some distance from the morpheme boundary. For instance, it may be that non-final consonants in the stem facilitate or block palatalization at the morpheme boundary.

The intuition based on other patterns in the language turned out to be correct. In what follows, I discuss two types of long-distance interactions that affect palatalization. The first restriction appears in the suffix (section 5.1), whereas the second one appears in the stem (section 5.2). The wider implications of these data are discussed section 5.3, with related patterns presented in section 5.4.

5.1 Suffixes

Two suffixes stand out from the rest: *–ts* and *–itsa* (see Figure 1). These suffixes display the highest amount of variation, with many words having palatalization ratios between 0.2 and 0.8, whereas most of other suffixes have very few words in that range. Why is this the case? One possible answer is that variability is a lexical property of these two suffixes. The alternative would be that the reason is phonological, related to the special status of *ts* in Slovenian. Both affricates in Slovenian are quite restricted phonotactically, such that complex onsets and codas with at least one affricate are rarer than expected by chance. Once we consider heterosyllabic sequences, there is a variety of restrictions. Alveolar sibilants, including *ts*, cannot appear immediately before postalveolars even across word boundaries, assimilating in place to the following postalveolar (e.g. *kɔnəts leta* 'end of year' ~ *kɔnət̠ʃ ʃole* 'end of school'). There is evidence that these restrictions extend across vowels. Slovenian has variant sibilant harmony, which makes anterior sibilants posterior when followed by another posterior sibilant within a word (Jurgec 2011): *sliʃi* → *ʃliʃi* 'hears'. Across a single vowel, two alveolar affricates (29 words in Toporišič 2001) or an alveolar affricate plus a postalveolar (7) are extremely rare. In contrast, velars can freely co-occur with both affricates.

These restrictions also explain why the suffix *–itsa* behaves differently than other i-initial suffixes, which all invariantly trigger palatalization (section 4.1). That is to say, *ts* can freely occur with velars but not postalveolars.

5.2 Stems

Section 4.1 revealed that i-initial suffixes are better triggers of palatalization than other suffixes, while section 5.1 discussed why *ts* inhibits palatalization. Because of these two competing tendencies, the suffix *–itsa* displays a great deal of variation. In this section, I examine other variables that influence the likelihood of palatalization with this suffix.

I focus on different consonants appearing in the stems. Two groups of consonants are large enough to be representative *and* display unique behavior—velars and postalveolars. The velar group are stems that contained at least two velars: in addition to the final velar in the stem, there is another non-adjacent velar. The postalveolar group contains an underlying postalveolar that is not adjacent to the final velar of the stem.

Consider first stems with multiple velars, for example *knjig-itsa* ~ *knjiʒ-itsa* 'booklet'. The velars do not need to match in terms of voicing. The non-final velar could appear anywhere in the root, except as one of the last two segments, ruling out any local interactions with the stem-final segment.

Figure 6 presents a consolidated beanplot. For each stem-final consonant, the bean is split in half. The lower part presents the stems without non-final velars, whereas the upper part presents stems with such velars. Palatalization is less likely in stems with multiple velar stops. The corpus does not contain enough velar fricatives to generate the beanplot or make a reliable generalization.

A much stronger generalization can be drawn from the second case, namely stems with another postalveolar, which are shown in Figure 7. In this case, the asymmetry between stems with no postalveolars and the ones with a postalveolar (at least two segments from the right edge of the stem) is striking. Palatalization does not apply in stems with another postalveolar, *without exception*.

Such convincing long-distance blocking of palatalization is surprising, as these sort of long-distance interactions are cross-linguistically rare. In what follows I provide further examples of such patterns. In fact, the Slovenian data provides evidence to draw a parallel between some well-known sound patterns.

5.3 Implications for the typology of Derived Environment Effects

To understand the significance of long-distance interactions in Slovenian palatalization, I now discuss the pattern in broader perspective of morphologically conditioned sound patterns.

Slovenian velar palatalization can be characterized as a Derived Environment Effect (DEE; Kiparsky 1973; Mascaró 1978; Wolf 2008). DEEs are alternations that appear in morphologically complex forms, typically at the morpheme boundary, but not within morphemes. To illustrate, consider a subset of the Slovenian pattern in (6).

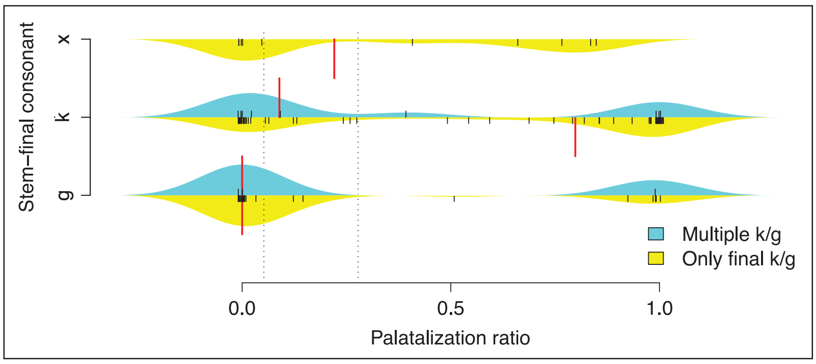

Figure 6: Palatalization ratios in stems with multiple velars for the suffix *–itsa* 'DIMINUTIVE' by stem-final consonant, with median values. Horizontal beans represent the density distributions, with short lines corresponding to stems. Each bean is split in half, with the upper half representing stems with multiple velars and the lower half representing all other stems. The longer (red) lines mark median values for each group of stems. The two dotted lines indicate the median value across all words, with the lower median value corresponding to stems with multiple velars, and the upper median value corresponding to stems with a single, final velar.

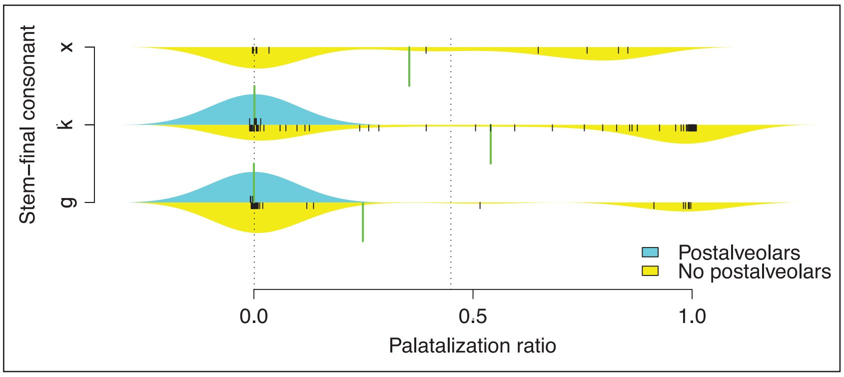

Figure 7: Palatalization ratios in stems with a non-final postaleolars for the suffix-itsa 'DIMINUTIVE' by stem-final consonant, with means. Horizontal beans represent the density distributions, with short lines corresponding to stems. Each bean is split in half, with the upper half representing stems with a non-final postalveolar and the lower half representing all other stems. The longer (green) lines mark mean values for each group of stems. The two dotted lines indicate the mean value across all words, with the lower mean value corresponding to stems with non-final postalvelars, and the upper mean value corresponding to stems without postalveolars.

(6) Palatalization as a DEE
  a. *ki* possible morpheme-internally
    kits-a 'sketch'
    kil-a 'hernia'
  b. k → tʃ at the morpheme boundary
    ɾe**tʃ-i**tsa 'river-DIM' ɾek̲-a 'river'
    smɾe**tʃ-i**na 'spruce forest' smɾek̲-a 'spruce'

To keep this illustration brief, I will simplify the pattern by taking the sequence *ki* as representative for velar palatalization as a whole. The sequence *ki* is possible within morphemes (6-a). At the morpheme boundary, *ki* is generally not possible, resulting in palatalization (b).

Slovenian palatalization is a local DEE, applying at the morpheme boundary. Long-distance DEEs are much rarer, but a few cases have been reported (Kurisu 2008; Jurgec 2014; Gouskova & Linzen 2015). In Tagalog, for instance, *f* is possible in some underived words (7-a). When prefixed, initial *f* changes to *p* (b), mirroring the local pattern observed in Slovenian. Suffixes—perhaps surprisingly—have the same effect (c). In fact, *f* appearing anywhere within the root alternates with *p* in derived words.

(7) Tagalog (Zuraw 2006; Jurgec 2014)
  a. *f* possible in non-affixed words
    filipino 'Filipino'
    fiesta 'feast'
  b. f → p in prefixed words
    mag-**p**ilipino 'Filipino language'
    paŋ-**p**iesta 'INSTR-feast'
  c. f → p in suffixed words
    pilipino-ŋ 'Filipino-DEF'
    pista-han 'festival'

DEEs do not need to invariantly apply, but can be blocked by other phonological processes. This blocking is typically local. An example comes from German (8). Sequences *tj* assibilate to *tsj* at the morpheme boundaries (a), but not if the sequence is preceded by a sibilant (b), even though *sts* is possible morpheme internally (c).

(8) DEE blocking in German (Hall 2006)

a. Assibilation of *t* before *j*

neːga**t**-iːf	nega**ts**-joːn	'negative/negation'
ɛksɪstɛn**t**	ɛksɪstɛn**ts**-jaːl	'existent/existential'

b. Assibilation blocked after sibilants

ba<u>st</u>-joːn	*bas**ts**-joːn	'bastion'
aʊtozʊgɛ<u>st</u>-joːn	*aʊtozʊgɛs**ts**-joːn	'autosuggestion'

c. Underlying tautomorphemic /sts/ sequences

di**sts**ipliːn		'discipline'
ɛk**sts**ɛs-iːf		'excessive'

The Slovenian palatalization data present a previously unnoticed case of local DEEs that are blocked at a distance. The generalization is that postalveolars and velars can freely cooccur within roots, and that palatalization can create additional postalveolars. However, palatalization is categorically blocked when the root contains another postalveolar (and to a lesser degree, another velar). More data is provided in (9).

(9) Long-distance DEE blocking in Slovenian

ROOTS	k/tʃ . . . k/tʃ	PALATALIZATION	k → tʃ	PALATALIZATION BLOCKED	k → *tʃ
s**k**ɔ**k**	'jump'	obla**tʃ**-tsa	'cloud-DIM'	**tʃ**o**k**-tsa	'slab-DIM'
ko**k**oʃ	'chicken'	mle**tʃ**-tsa	'milk-DIM'	ʃ**tʃ**u**k**-tsa	'pike-DIM'
kɾi**k**	'yelling'	baɾ**tʃ**-itsa	'boat-DIM'	**tʃ**əɾ**k**-itsa	'letter-DIM'
ka**tʃ**-a	'snake'	ɾe**tʃ**-itsa	'river-DIM'	x**tʃ**ɪɾ**k**-itsa	'daughter-DIM'
tʃu**k**	'owl'	ena**tʃ**-itsa	'equation'	**tʃ**əɾ**k**-owje	'letter-ing'
tʃen**tʃ**-a	'rumour'	bodi**tʃ**-ewje	'thornes'	ʃ**k**ol**k**-itsa	'shellfish-DIM'
tʃi**tʃ**-a-ti	'sit'	xɾuʃ**tʃ**-ewje	'pears'	**k**lju**k**-itsa	'hook-DIM'

This interpretation of the data fills the gap in the typology of DEEs and their blocking (Table 9). DEEs can be local and long-distance. Local DEEs can be blocked locally or long-distance. Slovenian palatalization is a locally triggered DEE that is blocked long-distance. Blocking in long-distance DEEs has not been studied yet. All in all, the Slovenian data fill the typological gap in DEE blocking.

DEE	Blocking	Example pattern
Local	Local	German assibilation (8)
	Long-distance	Slovenian palatalization (9)
Long-distance		Tagalog f ~ p (7)

Table 9: Typology of morphological DEEs.

5.4 Similar patterns in other languages

The Slovenian data fit the cross-linguistics typology of DEE blocking. A related question is whether there are any other similar patterns.

Slovenian palatalization involves creating a postalveolar, but not when there is another postalveolar in the stem. This characterization of DEE blocking resembles dissimilation. While dissimilation often applies to adjacent segments, many cases involve some larger domain. In Tashlhiyt Berber, for instance, a prefix *m*- dissimilates to *n*- as long as the following root contains a labial, even if root-final (El Medlaoui 1995; Odden 1994; Alderete 1997). The Slovenian case is unusual, because there is no overt dissimilation within stems. In fact, there are many instances of postalveolars within the stem (9). The crucial generalization is that sequences of postalveolars cannot be created by palatalization, whereas there are no restrictions applying to underlying postalveolars.

Unlike Tashlhiyt Berber, Slovenian distinguishes between underlying and morphologically derived segments of a particular kind. Another such language is Japanese.[7] Japanese Rendaku involves voicing of root-initial obstruents in compounds (10). Non-initial stems in certain kinds of compounds normally show voicing (a). However, voicing does not apply in roots with another voiced obstruent anywhere in the stem (b). This blocking pattern is known as Lyman's Law.

(10) Japanese Rendaku voicing (Vance 1987; Itô & Mester 1986, et seq.)

a. Compound voicing in the non-initial stem

take + sao	→ take-**z**ao	'bamboo pole'
de + kutʃi	→ de-**g**utʃi	'exit'
ori + kami	→ ori-**g**ami	'paper folding'

b. Lyman's Law: Voicing blocked by another obstruent in the same stem

kami + kaze	→ kami-**k**az̲e	'divine wind'
tsuno + tokage	→ tsuno-**t**okag̲e	'horned lizard'

Itô & Mester (1998, 2003) consider Rendaku voicing a case of DEE. Lyman's Law is a case of DEE blocking at a distance: underlying and derived voiced obstruents are well-formed, but not their combination. This matches the Slovenian data, except that different morphological constituents and phonological features are involved. A similar process is Korean compound tensification (Zuraw 2011; Ito 2012).

However, Japanese is not identical to Slovenian DEE blocking. First, Japanese involves laryngeal features, whereas Slovenian involves place features. Second, Japanese generally allows at most one voiced obstruent per root in native (Yamato) words. Slovenian, on the other hand, permits multiple underlying postalveolars within a word, either tauto- or heteromorphemic (9). It is only that a postalveolar cannot be derived by palatalization if the stem already contains another postalveolar. In this sense, Slovenian is a case of DEE blocking without a general restriction on multiple underlying postalveolars. To the best of my knowledge, no other language exhibits such a pattern.

6 Constraint-based analysis

This section provides an analysis of Slovenian palatalization using a constraint-based grammar. I make use of the Maximum Entropy grammar (MaxEnt; Goldwater & Johnson 2003; Wilson 2006; Hayes & Wilson 2008). MaxEnt differs from OT in that constraints are weighted rather than categorical, and outputs are probabilistic rather than absolute.

MaxEnt also serves as another way of modeling variation in Slovenian palatalization. The variables that have the greatest effect on palatalization will be mirrored by the constraints that have the highest weights, relative to other constraints.

A MaxEnt grammar of Slovenian palatalization could refer to specific suffixes, for example, by using constraints that would be indexed to specific suffixes. Instead, I will propose an analysis that is as phonological as possible and does not rely on constraints specific to individual morphemes. Thus, constraints will be able to see morphological boundaries and phonological properties of whole words and whether the suffix is indexed for palatalization, but not any other lexical information of individual suffixes. I will not attempt to account for the fact that some suffixes never trigger palatalization, and I will

[7] Thanks to Yoonjung Kang for drawing my attention to this generalization.

not explore in what way these suffixes differ from palatalizing suffixes. The proposed ranking is the palatalization grammar of Slovenian.

6.1 Constraints

I propose several constraints to capture the empirical generalizations about palatalization in Slovenian. I start with the local constraints (these data are reviewed in section 4), followed by long-distance consonant co-occurrence constraints (section 5).

As we have seen in section 4.1, suffixes beginning on front vowels and the glide *j* are better triggers than other suffixes. This asymmetry can be captured by splitting the markedness constraint preferring palatalization, PAL, into several constraints. Rubach (2003) proposes that each palatalization constraint penalizes subsets of segments with respect to backness. For instance, the constraint against the sequence of a back consonant followed by a high front vowel is universally ranked higher than the constraint against a back consonant and a mid or low vowel: PAL-i ≫ PAL-e ≫ PAL-æ. Since the Slovenian suffixes here fall into two groups, only two constraints are required (11). I propose a specific constraint against front vowel sequences (a) and a more general constraint which prefers palatalization before any suffix. These two constraints are in a stringency relation: a front vowel suffix can violate both constraints, whereas other suffixes can only violate PAL. If PAL-i has a non-zero weight, this would confirm an asymmetry between high vowel and other suffixes.

(11) Palatalization constraints (adapted from Rubach 2003; Kochetov 2011)
   a. PALATALIZATION-i/j (henceforth, PAL-i)
      Velars must not be followed by a palatalizing suffix starting with a front vowel or [j].
   b. PALATALIZATION (PAL)
      Velars must not be followed by a palatalizing suffix.

It is worth noting that PAL is satisfied regardless of what representational assumptions we make about the ultimate source of palatalization. One option is that the source is a ghost or similar underlying segment (Halle 1959; Szpira 1992; Gussmann 2007). In autosegmental terms, the trigger could be a floating feature. Regardless of which of these options we take, PAL constraints will be satisfied when palatalization applies. In addition, the following surface segment will also have an effect, as evident by the corpus data.

Palatalization violates several IDENT constraints. Recall that the mappings in palatalization are asymmetrical. In particular, the voiceless velar stop *k* becomes the postalveolar affricate *ʧ*, whereas the voiced velar stop *g* becomes the postalveolar fricative *ʒ*, as shown in (4). Because the featural representations of the triggers have been controversial in the literature (Morén 2006; Radišić 2009), I will model the data using a single IDENT constraint.[8]

The final local constraint penalizes adjacent identical consonants (12).

(12) $*C_iC_i$
   No sequences of identical consonants.

The second set of constraints will account for long-distance interactions in the data. As we have seen, these interactions resemble consonant harmony and dissimilation, as there are restrictions on what kind of consonants can cooccur within a stem or word. One standard

[8] An alternative model with feature-specific IDENT constraints was also run, but did not differ from the model presented in this paper.

account of consonant harmony and dissimilation is Agreement-by-Correspondence (Rose & Walker 2004; Hansson 2001; Bennett 2013/2015). According to this approach, consonants can be in correspondence with one another. Correspondence is a formal relation between segments, which is referred to by constraints. The constraints preferring consonant harmony—that is, similarity between consonants—are of two kinds: CORR(ESPONDENCE) constraints make sure that specific consonants are in correspondence, whereas CC-IDENT constraints require the corresponding consonants to be similar. The harmonized candidates have agreeing consonants in correspondence, but non-harmonized candidates can have (disagreeing) consonants in correspondence or not. Thus, there are two ways of representing identical, non-harmonized forms. Given that there is no way to tell these apart in the corpus, one could stipulate that both are equally likely. However, this arbitrary decision would significantly affect the weights of CORR and CC-IDENT.

Hansson (2014) proposed an alternative model, Agreement-by-Projection (ABP). In this approach, markedness constraints penalize sequences of segments of a particular kind on some tier (13). An example of this constraint is $*[+\text{anterior}][-\text{anterior}]_{[+\text{coronal}]}$ which penalizes anterior coronals followed by posterior coronals, as long as no other coronal intervenes.

(13) $*[-\text{F}][+\text{F}]_{[\alpha\text{G},\beta\text{H}]}$ (after Hansson 2014)
No sequences of [–F] followed by [+F] on some tier [αG,βH].

While Hansson's proposal is relatively recent, it has several crucial advantages over Agreement-by-Correspondence. The main advantage is formal simplicity. ABP does not require any abstract representational relationships, such as correspondence; phonetically identical candidates are not represented in more than one way. The new projection constraints (13) achieve the effect of two families of constraints—CORR and CC-IDENT—at the same time. Other advantages are empirical. A sequence of three segments with [F] violate the constraint in (13) at most once, whereas CC-IDENT[F] could be violated three times (once for each segment-pair). The additional violation marks create pathologies (Hansson 2007). For these reasons, I will adopt Hansson's ABP. The proposed constraints penalize co-occurrence of two specific consonants within a domain; I leave the formal implementation in terms of features and tiers for further research.

Section 5 reviewed three types of long-distance interactions found in the data. The strongest restriction was that non-stem-final postalveolars block palatalization of the final velar, which is just another way of saying that a postalveolar cannot be followed by another postalveolar within the stem (14-a). Any two postalveolars within a stem will violate the constraint *Š . . . Č, regardless of their distance. I assume that a derived postalveolar is counted as being a part of the stem, even though the place features of such a postalveolar originate from the suffix. Next, velars cannot be followed by postalveolars within the stem (14-b). The final restriction concerns suffixes containing *ts;* such suffixes have lower palatalization rates when compared to other similar suffixes. The constraint that mirrors this effect is *Š . . . C (14–c). Crucially, the suffix is included in the domain of the constraint.

(14) Long-distance consonant co-occurrence constraints
a. $*\text{POSTALVEOLAR . . . POSTALVEOLAR}_{Stem} \equiv$ *Š . . . Č
A postalveolar cannot be followed by another postalveolar, within a stem.
b. $*\text{VELAR . . . POSTALVEOLAR}_{Stem} \equiv$ *K . . . Č
A velar cannot be followed by another postalveolar, within a stem.
c. $*\text{ALVEOLAR . . . ALVEOLAR AFFRICATE}_{Word} \equiv$ *Š . . . Č
A postalveolar cannot be followed by the alveolar affricate, within a word.

The constraints in (14) can be satisfied by changing one or the other of the two consonants, and only one of the options is attested in the data. To distinguish between the two repairs, we need another constraint. As it turns out, this constraint needs to mirror the difference between changing a velar into a postaveolar (attested) and vice versa (not attested). There is a variety of ways to define this constraint, either by splitting up IDENT(place) into two more specific constraints or by introducing a MAX constraint, such as MAX[+posterior] or MAX[+coronal] (Morén 1999/2001). I will take the latter. Other alternatives include positional licensing referring to the stem-final position (Zoll 1998; Crosswhite 2001; Walker 2001, 2011).

In addition to the constraints just mentioned, I also included MAX (≡ No deletion) for some instances where palatalization resulted in deletion of a penultimate consonant at the end of the stem; such instances were rare, but attested. Finally, I also considered several other long-distance constraints. Among them were the constraints against two affricates and two velars; none of these constraints had weights larger than 0.0.

6.2 Weights

The corpus frequencies and violation profiles were fed into the MaxEnt grammar tool (Hayes & Wilson 2008), which assigns weights that fit the data best. In addition to the type-pairs mentioned throughout this paper, I also included those unattested candidates (corpus frequency = 0) in which postalveolars become velars. The model learned the weights shown in Table 10.

Constraint	Weight
MAX[+cor]	15.2
*C_iC_i	6.5
*Š . . . Č	4.0
PALATALIZATION-i	3.4
*Š . . . C	3.4
PALATALIZATION	1.6
MAX	0.3
*K . . . Č	0.2
IDENT	0.0

Table 10: Slovenian Palatalization weights.

The highest weighted constraints are the ones that are violated by the least attested (and most unattested) forms—MAX[+cor] and *C_iC_i. The weight of PALATALIZATION is 1.6, while PALATALIZATION-i is weighted at 3.4, suggesting that i-suffixes are much more likely to trigger palatalization than other suffixes. Of the long-distance constraints, *Š . . . Č has the highest weight, indicating that multiple postalveolars within a stem are strongly dispreferred; the effect is much lower for velars followed by postalvolars, and the constraint *K . . . Č has a marginal weight of 0.2. The weight of the constraint *Š . . . Č is also rather high at 3.4, indicating that suffixes containing *ts* are considerably less likely to trigger palatalization than other suffixes. The faithfulness constraints have a null weight. This suggests that palatalization generally obtains in the data. Furthermore, the absence of palatalization is not due to IDENT but other markedness constraints, particularly long-distance consonant co-occurrence constraints.

Let us look at these effects more closely by examining individual tableaux. MaxEnt tableaux differ from classic OT tableaux in that constraints are weighted, with the weights decreasing from left to right. Each candidate comes with frequency in the corpus (indicated by the percentage next to the output). The sum of violations can be found in the penultimate column, indicated by '$\mathcal{H}$', and the probability estimate is in the final column ('p'). In a perfect model, the corpus frequencies and predicted frequencies match.

First, consider a stem without non-final velars or postalveolars (15). When followed by a front suffix palatalization invariably obtains, which is due to PAL-i. In fact, the weight of this constraint is so high that—absent any alveolar affricates within the suffix—all stems show palatalization, as in candidate (b).

(15) Effect of front suffixes

/breg-ina/	PAL-$i_{3.4}$	PAL$_{1.6}$	IDENT$_{0.0}$	$\mathcal{H}$	p
a. bregina (0%)	–1 × 3.4	–1 × 1.6		–5.0	0%
b. breʒina (100%)			–1 × 0.0	–0.0	100%

The same stem may be followed by another kind of suffix (16). The corpus frequencies for the palatalized candidate (b) are lower, which is attributed to the fact that PAL-i is not violated by neither candidates. The predicted frequencies are somewhat different than the ones found in the corpus, even though the general tendency is clear. It is reasonable to assume that some variation is lexical and could not be accounted for in this purely phonological MaxEnt grammar. I leave the lexical factors for further research.

(16) Other suffixes

/breg-ina/	PAL-$i_{3.4}$	PAL$_{1.6}$	IDENT$_{0.0}$	$\mathcal{H}$	p
a. bregnat (50%)		–1 × 1.6		–1.6	17%
b. breʒnat (50%)			–1 × 0.0	–0.0	83%

Sequences of identical consonants are extremely rare in Slovenian, and in the present corpus. The constraint $*C_iC_i$ has a high weight, which effectively facilitates palatalization (17). The most frequent candidate (b) does not violate any constraints with non-null weights. Note that schwa was not considered in these cases, as its distribution is opaque (see section 2.1 for further information).

(17) Local restrictions: Effect of $*C_iC_i$

/potok-ka/	$*C_iC_{i6.5}$	PAL-$i_{3.4}$	PAL$_{1.6}$	$\mathcal{H}$	p
a. potokka (0%)	–1 × 6.5		–1 × 1.6	–8.1	0%
b. pototʃka (100%)				–0.0	100%

The remaining tableaux illustrate the long-distance interactions. As we have already seen, forms without a velar or postalveolar in non-final positions generally show palatalization (18). This is particularly so for i-initial suffixes, even though the suffix may contain a *ts*, which somewhat lowers the probability of palatalization.

(18) Palatalization is generally triggered by *–itsa*

/mlak-itsa/	MAX[+cor]$_{15.2}$	*Š . . . Č$_{4.0}$	PAL-$i_{3.4}$	*Š . . . C$_{3.6}$	PAL$_{1.6}$	$\mathcal{H}$	p
a. mlakitsa (5%)			–1× 3.4		–1× 1.6	–5.0	16%
b. mlatʃitsa (95%)				–1× 3.4		–3.4	83%

The effect of long-distance constraints can be seen in forms with another velar or postalveolar within the stem (19). In this case, the most frequent candidate (a) lacks palatalization.

The palatalized candidate (b) violates *Š . . . Č. The model predicts that these forms are rare, but attested. What is not attested is depalatalization of non-final segments (c), which would violate MAX[+cor].

(19) Palatalization blocked by a distant postalveolar

/ʧəɾk-itsa/	MAX[+cor]$_{15.2}$	*Š . . . Č$_{4.0}$	PAL-i$_{3.4}$	*Š . . . C$_{3.6}$	PAL$_{1.6}$	$\mathcal{H}$	p
a. ʧəɾkitsa (100%)			–1 × 3.4		–1 × 1.6	–5.0	92%
b. ʧəɾʧitsa (0%)		–1 × 4.0		–1 × 3.4		–7.4	8%
c. kəɾkitsa (0%)	–1 × 15.2		–1 × 3.4		–1 × 1.6	–20.2	0%

The model does not match the data perfectly, and this is related to the fact that sequences of postalveolars are well-formed if underlying. Furthermore, *–itsa* may not be entirely representative for all other other suffixes, particularly because stems with a non-final postalveolar are infrequent. I also ran an alternative model in which all palatalization constraints were specific to each suffix. In this case, the weights were as follows: MAX[+cor] 16.0, *Š . . . Č 5.2, *K . . . Č 2.6, PALATALIZATION$_{\textit{-itsa}}$ 2.3, and IDENT 0.0. This grammar correctly predicts blocking in stems with another postalveolar, that is a 0% probability for candidate (19-b).

This concludes the MaxEnt analysis of variable palatalization in Slovenian, which captures both local and long-distance asymmetries by relying on purely phonological constraints.

7 Conclusions

This paper examines variable palatalization in Slovenian. Much of the variation turns out to be phonological, conditioned by local interactions between sounds. Surprisingly, long-distance restrictions also play a crucial role. Palatalization is categorically blocked in stems with a non-final postalveolar, and palatalization is less likely in stems with another velar. The empirical contribution of this paper is in documenting a rare case of long-distance blocking of a derived environment effect, thus filling a typological gap. The theoretical contribution is in modeling both local and long-distance effects using weighted constraints in the Maximum Entropy framework.

Acknowledgments

For their comments and suggestions on earlier versions of this paper, I would like to thank Jessamyn Schertz and three anonymous reviewers. I am also grateful to others who provided formative feedback: Meg Grant, Janoš Ježovnik, Yoonjung Kang, Shigeto Kawahara, Alexei Kochetov, Erika Kržišnik, Ania Łubowicz, Phil Monahan, Jaye Padgett, Keren Rice, and Matej Šekli. Any remaining errors are my own. This study was supported by the University of Toronto Connaught New Researcher Award (*The Phonology of Slovenian)* to the author.

Competing Interests

The author declares that he has no competing interests.

References

Alderete, John. 1997. Dissimilation as local conjunction. In Kiyomi Kusumoto (ed.), *Proceedings of NELS* 27, 17–31. Amherst, MA: GLSA. Available on Rutgers Optimality Archive, ROA 175, http://roa.rutgers.edu.

Bajec, Anton et al. 2000. *Slovar slovenskega knjižnega jezika: Electronic edition*. Ljubljana: SAZU and Fran Ramovš Institute for the Slovenian Langauge.

Bateman, Nicoleta. 2007. *A crosslinguistic investigation of palatalization*. San Diego: University of California dissertation.
Bateman, Nicoleta. 2011. On the typology of palatalization. *Language and Linguistics Compass* 5(8). 588–602. DOI: http://dx.doi.org/10.1111/j.1749-818X.2011.00294.x
Bennett, William G. 2013/2015. *The phonology of consonants: Harmony, dissimilation and correspondence*. Oxford: Cambridge University Press.
Bhat, D. N. S. 1978. A general study of palatalization. In Joseph H. Greenberg (ed.), *Universals of human language*, 47–92. Palo Alto, CA: Stanford University Press.
Bidwell, Charles A. 1969. *Outline of Slovenian morphology*. Pittsburgh, PA: University Center for Interantional Studies, University of Pittsburgh.
Blumenfeld, Lev. 2002. Russian palatalization and Stratal OT: Morphology and [back]. In Wayles Brown, Ji-Yung Kim, Barbara Partee & Robert Rothstein (eds.), *Annual workshop on formal approaches to Slavic linguistics: The Amherst meeting*, 141–158. Ann Arbor, MI: Michigan Slavic Publications.
Browne, Wayles. 1993. Serbo-Croat. In Bernard Comrie & Greville G. Corbett (eds.), *The Slavonic languages*, London, New York: Routledge.
Chen, Matthew. 1973. Predictive power in phonological description. *Lingua* 32. 173–191. DOI: http://dx.doi.org/10.1016/0024-3841(73)90041-7
Crosswhite, Katherine. 2001. *Vowel reduction in Optimality Theory*. New York: Routledge.
El Medlaoui, Mohamed. 1995. *Aspects des representations phonologiques dans certaines langues Chamito-Semitiques*. Rabat: Université Mohammed V.
Flack, Kathryn. 2007. Templatic morphology and indexed markedness constraints. *Linguistic Inquiry* 38(4). 749–758. DOI: http://dx.doi.org/10.1162/ling.2007.38.4.749
Goldwater, Sharon & Mark Johnson. 2003. Learning OT constraint rankings using a Maximum Entropy model. In *Proceedings of the Workshop on variation within Optimality Theory*, Stockholm: Stockholm University.
Gouskova, Maria. 2007. The reduplicative template in Tonkawa. *Phonology* 24(3). 367–396. DOI: http://dx.doi.org/10.1017/S0952675707001261
Gouskova, Maria. 2012. Unexceptional segments. *Natural Language and Linguistic Theory* 30(1). 79–133. DOI: http://dx.doi.org/10.1007/s11049-011-9142-4
Gouskova, Maria & Tal Linzen. 2015. Morphological conditioning of phonological regularization. *The Linguistic Review* 32(3). 427–473. DOI: http://dx.doi.org/10.1515/tlr-2014-0027
Gussmann, Edmund. 2007. *The phonology of Polish*. Oxford: Oxford University Press.
Halle, Morris. 1959. *The sound pattern of Russian's*. Gravenhage: Mouton.
Hall, Erin, Peter Jurgec & Shigeto Kawahara. under review. Opaque allomorph selection in Japanese and Harmonic Serialism: A reply to Kurisu (2012).
Hall, Tracy Alan. 2000. Typological generalizations concerning secondary palatalization. *Lingua* 110. 1–25. DOI: http://dx.doi.org/10.1016/S0024-3841(99)00017-0
Hall, Tracy Alan. 2006. Derived environment blocking effects in Optimality Theory. *Natural Language and Linguistic Theory* 24. 803–856. DOI: http://dx.doi.org/10.1007/s11049-006-0003-5
Hall, Tracy Alan & Silke Hamann. 2010. On the cross-linguistic avoidance of rhotic plus high front vocoid sequences. *Lingua* 120. 1821–1844. DOI: http://dx.doi.org/10.1016/j.lingua.2009.11.004
Hansson, Gunnar Ólafur. 2001. *Theoretical and typological issues in consonant harmony*. Berkeley: University of California dissertation.
Hansson, Gunnar Ólafur. 2007. Blocking effects in Agreement by Correspondence. *Linguistic Inquiry* 38(2). 395–409. DOI: http://dx.doi.org/10.1162/ling.2007.38.2.395

Hansson, Gunnar Ólafur. 2014. (dis)agreement by (non)correspondence: Inspecting the foundations. Paper presented at the ABC↔Conference. Univeristy of California Berkeley, May 18–19.

Hayes, Bruce & Colin Wilson. 2008. A maximum entropy model of phonotactics and phonotactic learning. *Linguistic Inquiry* 39. 379–440. DOI: http://dx.doi.org/10.1162/ling.2008.39.3.379

Inkelas, Sharon & Cheryl Zoll. 2007. Is grammar dependence real? A comparison between cophonological and indexed constraint approaches to morphologically conditioned phonology. *Linguistics* 45(1). 133–172. DOI: http://dx.doi.org/10.1515/LING.2007.004

Ito, Chiyuki. 2012. Emergence of the OCP: A case study of compound tensification in Yanbian Korean. Paper presented at TEAL-7, Hiroshima University, February 18.

Itô, Junko & Armin Mester. 1986. The phonology of voicing in Japanese: theoretical consequences for morphological accessibility. *Linguistic Inquiry* 17. 49–73.

Itô, Junko & Armin Mester. 1998. Markedness and word structure: OCP effects in Japanese. Ms. Available on Rutgers Optimality Archive, ROA 255, http://roa.rutgers.edu.

Itô, Junko & Armin Mester. 2003. *Japanese morphophonemics: markedness and word structure*. Cambridge, MA: MIT Press.

Jurgec, Peter. 2007. *Novejše besedje s stališča fonologije: primer slovenščine* [Neologisms in phonology: The case of Slovenian]: University of Ljubljana dissertation.

Jurgec, Peter. 2010. Disjunctive lexical stratification. *Linguistic Inquiry* 41(1). 149–161. DOI: http://dx.doi.org/10.1162/ling.2010.41.1.149

Jurgec, Peter. 2011. *Feature spreading 2.0: A unified theory of assimilation*. Tromsø: University of Tromsø dissertation. Available on LingBuzz, http://ling.auf.net/lingBuzz/001281.

Jurgec, Peter. 2014. Morphology affects loanword phonology. In Hsin-Lun Huang, Ethan Poole & Amanda Rysling (eds.), *Proceedings of NELS 43*, vol. I, 191–202. Amherst, MA: GLSA.

Kampstra, Peter. 2008. Beanplot: A boxplot alternative for visual comparison of distributions. *Journal of Statistical Software, Code Snippets* 28(1). 1–9.

Kiparsky, Paul. 1973. Phonological representations. In Osamu Fujimura (ed.), *Three dimensions of linguistic theory*, 1–136. Tokyo: TEC.

Kochetov, Alexei. 2011. Palatalization. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren D. Rice (eds.), *The Blackwell companion to phonology*, 1666–1690. Malden, MA: Blackwell.

Kurisu, Kazutaka. 2008. Weak derived environment effects. In Emily J. Elfner & Martin Walkow (eds.), *Proceedings of NELS 37*, vol. 2, 29–42. Amherst: GLSA, University of Massachusetts.

Logar-Berginc, Nataša, Simon Krek, Tomaž Erjavec, Miha Grčar, Peter Halozan & Simon Šuster. 2012. *Gigafida corpus*. http://www.gigafida.net: Amebis.

Mascaró, Joan. 1978. *Catalan phonology and the phonological cycle*. Bloomington, IN: Indiana University Linguistics Club.

Morén, Bruce. 1999/2001. *Distinctiveness, coercion and sonority: a unified theory of weight*. New York: Routledge. Available on Rutgers Optimality Archive, ROA 349, http://roa.rutgers.edu.

Morén, Bruce. 2006. Consonant-vowel interactions in Serbian: features, representations and constraint interactions. *Lingua* 116(8). 1198–1244. DOI: http://dx.doi.org/10.1016/j.lingua.2005.04.003

Morén, Bruce & Peter Jurgec. 2007. Consonants and vowels in Slovenian and Serbian: Phonetic similarities, (morpho)phonological differences and vice versa. Paper presented at the Formal Description of Slavic Languages 7, Leipzig, Germany.

Odden, David. 1994. Adjacency paramaters in phonology. *Language* 70(2). 289–330. DOI: http://dx.doi.org/10.2307/415830

Oxford, Will. 2015. Patterns of contrast in phonological change: Evidence from Algonquian vowel systems. *Language* 91. 308–357. DOI: http://dx.doi.org/10.1353/lan.2015.0028

Pater, Joe. 2000. Non-uniformity in English secondary stress: the role of ranked and lexically specific constraints. *Phonology* 17(2). 237–274. DOI: http://dx.doi.org/10.1017/S0952675700003900

Pater, Joe. 2007. The locus of exceptionality: Morpheme-specific phonology as constraint indexation. In Leah Bateman, Michael O'Keefe, Ehren Reilly & Adam Werle (eds.), *University of Massachusetts occasional papers in linguistics 32: Papers in Optimality Theory III*, 259–296. Amherst: GLSA, University of Massachusetts. Available on Rutgers Optimality Archive, ROA 866, http://roa.rutgers.edu.

Pater, Joe. 2009. Morpheme–specific phonology: constraint indexation and inconsistency resolution. In Steve Parker (ed.), *Phonological argumentation: essays on evidence and motivation*, 123–154. London: Equinox. Available on Rutgers Optimality Archive, ROA 906, http://roa.rutgers.edu.

Radišić, Milica. 2009. Velar /g/ in Serbian – stop or fricative: A contrastive account. *Toronto Working Papers in Linguistics* 30. 91–103.

R Core Team. 2013. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing Vienna.

Rose, Sharon & Rachel Walker. 2004. A typology of consonant agreement as correspondence. *Language* 80(3). 475–531. DOI: http://dx.doi.org/10.1353/lan.2004.0144

Rubach, Jerzy. 2003. Polish palatalization in derivational optimality theory. *Lingua* 113. 197–237. DOI: http://dx.doi.org/10.1016/S0024-3841(02)00054-2

Rubach, Jerzy. to appear. Polish yers: Representation and analysis. *Journal of Linguistics*. DOI: http://dx.doi.org/10.1017/S0022226716000013

Shevelov, George Y. 1964. *A prehistory of Slavic: The historical phonology of common Slavic*. Heidelberg: Carl Winter Universitätsverlag.

Szpira, Jolanta. 1992. Ghost segments in nonlinear phonology: Polish yers. *Language* 68. 277–312. DOI: http://dx.doi.org/10.2307/416942

Toporišič, Jože. 1976/2000. *Slovenska slovnica*. Maribor: Obzorja.

Toporišič, Jože (ed.). 2001. *Slovenski pravopis*. Ljubljana: SAZU.

Vance, Timothy J. 1987. *An introduction to Japanese phonology*. Albany, NY: State University of New York Press.

Walker, Rachel. 2001. Round licensing, harmony, and bisyllabic triggers in Altaic. *Natural Language and Linguistic Theory* 19. 827–878. DOI: http://dx.doi.org/10.1023/A:1013349100242

Walker, Rachel. 2011. *Vowel patterns in language*. Cambridge: Cambridge University Press.

Walsh Dickey, Laura. 1997. *The phonology of liquids*. Amherst: University of Massachusetts dissertation. DOI: http://dx.doi.org/10.1017/CBO9780511973710

Wilson, Colin. 2006. Learning phonology with substantive bias: an experimental and computational study of velar palatalization. *Cognitive Science* 30(5). 945–982. DOI: http://dx.doi.org/10.1207/s15516709cog0000_89

Wolf, Matthew Adam. 2008. *Optimal Interleaving: Serial phonology-morphology interaction in a constraint-based model*. Amherst: University of Massachusetts dissertation. Available on Rutgers Optimality Archive, ROA 996, http://roa.rutgers.edu.

Zoll, Cheryl. 1998. *Parsing below the segment in a constraint-based framework*. Stanford, CA: CSLI Publications.

Zuraw, Kie. 2006. Using the web as a phonological corpus: a case study from Tagalog. In *EACL-2006: Proceedings of the 11th conference of the European chapter of the association for computational linguistics/proceedings of the 2nd international workshop on web as corpus*, 59–66. Trento. DOI: http://dx.doi.org/10.3115/1628297.1628306

Zuraw, Kie. 2011. Predicting Korean sai-siot: phonological and non-phonological factors. Paper presented at the 21st Japanese/Korean Linguistics Conference, Seoul National University.

How to cite this article: Jurgec, Peter. 2016. Velar palatalization in Slovenian: Local and long-distance interactions in a derived environment effect. *Glossa: a journal of general linguistics* 1(1): 24. 1–28, DOI: http://dx.doi.org/10.5334/gjgl.129

Published: 22 July 2016

]u[*Glossa: a journal of general linguistics* is a peer-reviewed open access journal published by Ubiquity Press. OPEN ACCESS