Gemination in English loans in American varieties of Italian*

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Why do geminate consonants frequently appear in borrowed words when the foreign form does not contain a geminate? In this paper I review previous approaches to this problem, and suggest that they are insufficient in accounting for consonant length contrasts in English loan words in North American varieties of Italian. I suggest that many factors are involved in the determination of consonant length in loans, including aspects of the grammar of the borrowing language (in this case, Italian) — such as the inventory of segments, the structure of the stressed syllable, and the presence of similar native lexical items — as well as the interpretation of the morphological structure and phonetic details of the foreign word.

1. Introduction

Non-etymological geminates often appear in the adapted form of loan words, and are attested in Japanese, Finnish, Kannada, Maltese Arabic, Hungarian, and Italian, including North American varieties of Italian (henceforth "American-Italian") (1), as well as many other languages.

(1)	English	American-Italian
a.	*coal*	[ˈkolle]
b.	*gingerale*	[ˈdʒindʒaˈrella]
c.	*brush*	[ˈbroʃʃa]
d.	*bushel*	[ˈbuʃʃolo]
e.	*creek*	[ˈkrikka]
f.	*fell*	[ˈfelli]
g.	*tape*	[ˈteppa]
h.	*team*	[ˈtimme]

The phenomenon whereby a singleton consonant in the loaning language is adapted as a geminate consonant in the borrowing language is very common cross-linguistically, and has vexed phonologists for some time. In this paper, I will show that a wide variety of factors — including phonetic, phonological, morphological, and lexical considerations — may come into play in determining which, if any, consonants will lengthen in the integration of foreign loans. I will illustrate this approach using data from American-Italian, which is the variety of Italian spoken by Italian immigrants to North America whose native language is/was an Italian dialect. (Data are from various published sources referenced in the Bibliography and from field research.)

Analyses of gemination in loans abound in the literature. Gemination of the consonant following the stressed vowel has been attributed to syllable structure, whereby borrowers try to preserve the syllable structure of the foreign form, and specifically the moraicity of final consonants, through gemination (Katayama 1998). Metrical requirements have also been invoked: if the stressed syllable in the borrowing language must be bimoraic, gemination is a means of satisfying this requirement (Repetti 1993). It has also been claimed that morpho-phonological alignment constraints are at work: the foreign noun is identified as a stem, the stem must be aligned with a syllable, and gemination is the means by which this require-ment is met (Shinohara 2003; Repetti 2003, 2006). Finally, it has been proposed that borrowers interpret fine acoustic details of vowel and consonant length in terms of their own phonological system, rendering the consonant following a (phoneti-cally) short vowel as long, and the consonant following a (phonetically) long vowel as short (Abraham 2004; Peperkamp & Dupoux 2003).

While these approaches can account for some of the data in (1), the problem is that not all English loan words in American-Italian undergo gemination (2). Fur-thermore, those that do and those that do not, don't seem to form natural classes. (Compare the forms in (1) with the data in (2).)

	(2)	English	American-Italian
a.		*bowl*	['bolo]
b.		*wholesale*	[ol'sele]
c.		*bruise*	['brusa]
d.		*people*	['pipoli]
e.		*strike*	['strajko]
f.		*fellow*	['falo]
g.		*paper*	['pepa]
h.		*steam*	['stima]

We will see that the American-Italian data are not consistent with any *one* of the analyses mentioned above. Instead, a combination of factors is needed to determine consonant length in loan words: lexical considerations, morpho-phonological constraints, and perceptual factors. In particular, I show how the following factors

play a role in determining consonant length in loans: the presence of lexical items in the borrowing language with a similar phonological structure and a compatible meaning (§2), facts about the phonemic inventory and syllable structure of the borrowing language (§3–§4), morpho-phonological alignment constraints (§5), the interpretation of acoustic details of the foreign words (§6), and a universal principle regarding sonorant geminates (§6). I show how, within the framework of Optimality Theory (OT) (Prince & Smolensky 1993; McCarthy & Prince 1993), we can account for the American-Italian data by using ranked constraints. (See also Friesner in this volume for a discussion of various social and grammatical factors affecting loanword nativization in Romanian.)[1]

2.   Similar native lexical items

If the foreign word is similar in phonological form to a word in the borrowing language, and the two words have compatible meanings, the native word (along with its consonant length) is used.

(3)   <u>English</u>   <u>American-Italian</u>
      coal   *colle* (standard Italian 'hill')
      furniture   *fornitura* (standard Italian 'supply')

If the English word ends in a series of segments identified as an Italian suffix, that suffix is used along with its lexically determined consonant length.

(4)   *basket*   [bas'ketto]   (diminutive suffix: -étto/a)
      machine   [maʃ'ʃina]   (diminutive suffix: -íno/a)
      ginger ale   [dʒindʒa'rella]   (diminutive suffix: -éllo/a)
      coupon   [ku'pone]   (augmentative suffix: -óne)
      bricklayer   [brikkaʎ'ʎere]   (agentive suffix: iére)
      contractor   [kontrat'tore]   (agentive suffix: óre)

These considerations outweigh any other phonetic, phonological, or morphological considerations that affect consonant length.

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1.   There are a few of aspects of the data that I will not address in this paper. (i) A final vowel is added to consonant-final English words. The quality of the final vowel is determined by morphological considerations that are not directly relevant for the question of gemination. I will not discuss these facts in this article. (ii) The mid vowels are all transcribed as tense, although their tenseness may vary. This is also irrelevant for the current purposes. (iii) The position of the stressed vowel in the adapted form is usually the same as in the etymological form (see Kenstowicz 2003 for discussion of the Max-Stress constraint). However, there are exceptions, and I will not discuss the principles that determine when stress is shifted, and which syllable it is shifted to.

3. Segments

The length of a segment may be determined by the phoneme inventory of the borrowing language. Italian has a series of consonant that must be long in intervocalic position: /ts/, /dz/, /ʃ/, /ɲ/, /ʎ/ (Chierchia 1986). When an English word contains one of these sounds, it is adapted as long in intervocalic position.

(5) *peanuts*   [pi'notstsa]
     brush   ['broʃʃa]
     Flatbush   [fla'buʃʃe]

In many varieties of Italian, including most northern varieties, the dental fricative has two realizations in intervocalic position: the geminate fricative is always voiceless intervocalically [ss], and the singleton fricative is always voiced intervocalically [z]. In other words, in some varieties, a singleton voiceless [s] is not allowed in intervocalic position, and a geminate voiced [zz] is not permitted at all. Hence, the difference between the singleton and geminate dental fricative in intervocalic position is not just one of length, but also voice.

(6) Italian: *cassa*   ['kassa] 'case'
                 casa   ['kaza] 'home'

Not surprisingly, when an English word contains a voiceless alveolar fricative, that segment is borrowed as long in intervocalic position (7a.) And when an English word contains a voiced alveolar fricative, that segment is realized as short in intervocalic position (7b).

(7) <u>English</u>   <u>American-Italian</u>
  a. *lease*   ['lissa]
     fussy   ['fassi]
  b. *bruise*   ['bruza]
     crazy   ['krezi]

4. Syllable structure

The metrical structure of the borrowing language can also play an important role in determining consonant length. For example, Italian allows optimally and maximally bimoraic tonic syllables. If the stressed syllable contains a falling diphthong ([aj], [aw], [oj]), which I analyze as bimoraic, the following consonant is always short. If the consonant following the diphthong were long, the stressed syllable would contain an unacceptable trimoraic structure.

(8) *strike*   ['strajko]/*['strajkko]
     pipe   ['pajpa]/*['pajppa]
     unemployment   [anem'plojme]/*[anem'plojmme]

If there happens to be a falling diphthong plus a consonant that we expect to be long because of the segmental considerations mentioned above in §3, the conflict is resolved in favor of the diphthong, and not the consonant.

(9) *house*   ['hau<u>z</u>a]/*['hau<u>ss</u>a]

We can illustrate this within the framework of Optimality Theory, by positing four constraints ranked in a particular order relative to each other, and crucially the familiar markedness >> faithfulness ranking common in loan word adaptations.

(10) *3μ — no trimoraic syllables (Kager 1999)
      *VsV — no intervocalic short voiceless dental fricative
      Ident-I-O(diphthong) — no changes to diphthongs
      Ident-I-O(voice) — no changes in voicing (Kager 1999)

(11) ranking: *3μ, *VsV, Ident-I-O(diphthong) >> Ident-I-O(voice)

(12)

backhouse	*3μ	*VsV	Ident-I-O(diph)	Ident-I-O(voice)
a. [bak.'kaus.sa]	*!			
b. [bak.'kau.sa]		*!		
c. [bak.'kas.sa]			*!	
d. [bak.'kau.za]←				*

We have just seen how markedness and faithfulness constraints interact in the loan adaptation process. In the next section we will see how morphological considerations — and specifically the identification of the stem — affect loan word adaptation and consonant length.

5. Structure of the English word

Whether or not the consonant following the stressed vowel is geminated, may depend on the structure of the English word, and, in particular, the position of the stressed vowel and whether the word ends in a vowel or a consonant. (For more on the treatment of consonant-final lexical items in Florentine and Neapolitan, see Bafile 2002.)

5.1 English v́cv#

If the English word contains a final unstressed vowel, the consonant following the stressed vowel is not geminated. (In older/other varieties of American-Italian, English words ending in an unstressed /i/ or /o/ were pronounced with stress shifted to the

final vowel, and again no gemination, as in *fellow* [fa lo]. See Repetti 2003, 2006 for discussion.)

(13) *fellow*   ['falo]
       money   ['moni]

This pattern is particularly well-attested in varieties of Italian spoken in New York and Boston and other /r/-dropping areas of the United States where words ending in /r/ are pronounced with final schwa. They are adapted with a final /a/ and no gemination (although these words never undergo stress shift).

(14) *lover*   ['lova]
       shoe-maker   ['ʃu meka]
       teacher   ['titʃa]

There is another set of data containing a non-geminate consonant that could be analyzed in two ways. American English has a rule of flapping of intervocalic /t/ and /d/: *city* ['sɪɾi], and not *['sɪti] (as in, for example, British English). In the adaptation of English words containing a flap, we never find gemination.

(15) *city*   ['siɾi]
       water   ['vwoɾa]
       what's the matter? [vatstsa'maɾa]

The use of a singleton consonant in these cases might be due to the fact that English flap is most similar to the Italian singleton [ɾ] phoneme, along the lines of what we saw in (7) above. And a tap, by definition, is short. Alternatively, these data might pattern with the data in (13) and (14) above. An analysis of this latter approach is presented below in §5.4.

5.2 English ˈcvcv#

If the English word ends in a consonant, and stress is on the penultimate syllable, the Italian adaptation will have an additional final vowel, thereby adding a syllable, and stress will be on the antepenultimate syllable. Crucially, the consonant following the stressed vowel is not geminated.

(16) *shovel*   ['ʃabola]
       trouble   ['trobolo]
       people   ['pipoli]

This generalization is violated when the consonant following the stressed vowel is one of the 'inherently long' consonants discussed in §2 above.

(17) *bushel*   ['buʃʃolo]

5.3   English v́c#

If the English word contains a final stressed VC syllable, the final C is an obstruent (final sonorants will be discussed in §6 below), the adapted form contains an added final vowel, and the obstruent is geminated.

(18)   *bread*   ['breddi]
       beach   ['bitʃtʃa]
       mistake   [mis'tekka]
       roof   ['ruffo]
       book   ['bukko]

5.4   Analysis

All of the data in §5.1, §5.2, §5.3 can be accounted for in a unified way. First, we must posit the *Principle of Morphological Analysis of Borrowed Nouns* whereby a foreign noun is identified as an Italian stem (Repetti 2006).

(19)   foreign noun = native stem

The way in which the stem is incorporated into the phonological structure of Italian is determined by an alignment constraint active the loan adaptation process (Repetti 2006; Shinohara 2003). The constraint Align-R(stem, σ) requires the right edge of the stem (identified as the foreign noun) to be aligned with a syllable. This alignment constraint is part of the integration process, and is not part of the regular production grammar. Gemination, therefore, can be understood as a means of keeping the foreign stem separate from the Italian suffix, as illustrated in the data in §5.3. Cases in §5.1 in which the consonant is not geminated are due to the fact that the foreign stem is already aligned with a syllable, and gemination would be superfluous. The data in §5.2 are also immune to gemination despite the fact that they violate the alignment constraint. Gemination is blocked in these cases because of more highly ranked markedness constraints banning certain metrical structures, and in particular a heavy syllable following a stressed syllable.

(20)   Align-R(stem, σ) – the right edge of the stem (identified as the foreign noun)
       must be aligned with a syllable (Shinohara 2003; Repetti 2006)
       *GemCons — no geminate consonants

(21)   ranking: Align-R(stem, σ) >> *GemCons

These two constraints allow us to account for the data in §5.1–§5.3 in a straightforward way. (Remember that gemination in (17) is due to a fact about the inventory of Italian consonants: intervocalic /ʃ/ is always long, as discussed in §3.)

(22)

money	Align(stem, σ)	*GemCons
a. ['mo.ni] ←		
b. ['mon.ni]		*!

(23)

shovel	Align(stem, σ)	*GemCons
a. ['ʃa.bo.la] ←	*	
b. ['ʃab.bo.la]	*	*!

(24)

book	Align(stem, σ)	*GemCons
a. ['bu.ko]	*!	
b. ['buk.ko] ←		*

The alignment constraint is not violated in (22) since the stem is vowel final and therefore aligned with a syllable. In this case, the markedness constraint eliminates the losing candidate.

In (23) both candidates violate the alignment constraint, and *GemCons again selects the winner. Another possible candidate, such as *['ʃab.ol.la], which does not incur a violation of Align(stem, σ), is eliminated by a higher ranked metrical constraint banning post-tonic heavy syllables.

In (24) the alignment constraint eliminates candidate (a) since the stem, /buk/, is not aligned with a syllable. Candidate (b), with gemination, does not violate this constraint and is, therefore, the winner, despite its violation of *GemCons.

6.   Vowel tenseness in the English word

6.1   Data

There is one additional category of borrowings in which consonant length cannot be accounted for using the abovementioned principles. If the English word contains a final stressed VC syllable and the final consonant is a sonorant, the Italian adaptation contains an added final vowel, and the final sonorant may or may not be geminated. The choice between the geminate and singleton sonorant is determined by the tenseness of the preceding stressed vowel. I am assuming that the English tense vowels are [i u e o a ɑ], and the English lax vowels are [ɪ ʊ ɛ ɔ ʌ æ].

If the English vowel is lax, the sonorant is geminated in the Italian form. This is consistent with the patterns described in §5.3.

(25) *bill* ['billo]
      ten   ['tenne]
      pull ['pullo]
      son   ['sonni]

If the English vowel is tense, the sonorant is not geminated in the Italian adaptation.

(26) *green*   ['grini]
      bowl   ['bolo]
      high school ['ajskula]
      wholesale   ['olsele]
      lane   ['lena]

This pattern is consistent with sonorant /l/ and /n/. We cannot test this pattern with words containing a final sonorant /r/ (in non-/r/-dropping varieties) because of historical changes in English resulting in the loss of vowel tenseness distinctions before /r/. The data from non-/r/-dropping varieties (such as Canadian Italian, Danesi 1985) all have a short sonorant.

(27) *Frigidaire* [fridʒdʒi dera] (refrigerator)
      welfare   [wel'fera]
      hardware   [ard'weri]
      floor   ['floro]
      store   ['storo]

The presence of a short /r/ may be due to the realization of the vowel before /r/ as tense, in which case these data pattern with the data in (26) above. Alternatively, the lack of gemination may be due to a more general dispreference for high sonority geminates (see §6.2 and Footnote 3).

The correlation between vowel tenseness and consonant length does not hold for data with sonorant /m/. It seems that the presence of absence of a geminate /m/ is unpredictable.

(28) a. tense vowel + /m/ > [m]

          frame   ['frema]
          same   ['semi]
          steam   ['stima]
          ice cream ['skrima]
      b. tense vowel + /m/ > [mm]

          broom ['brummi]
          game   ['gemma]
          team   ['timme]

    c.   lax vowel + /m/ > [mm]

         jam   ['dʒemma]
         bum   ['bommo]

The data in (28a) with a tense vowel and a short sonorant, and the data in (28c) with a lax vowel and a long sonorant, behave as expected. But, how can we explain the data in (28b) with a tense vowel and a long sonorant? This may be due to the fact that in many central and southern varieties of Italian and Italian dialects, /m/ is always long in intervocalic position (Rohlfs 1966:§222). In other words, in some varieties, /m/ is an inherently long consonant similar to those described in §3. Hence, if there is a geminate [mm] in a borrowed form, it is not clear if it is due to the inherent length of the segment in a particular variety of Italian (28b)–(28c), or to the constraints in the integration process described in §5.4 above (28c). Unfortunately it is not possible to conduct a more detailed survey of these loans based on the regional origin of the Italian speakers since most of the data come from published sources which do not include this information. Very few native/fluent speakers of these American-Italian varieties exist, and most speakers are now heavily influenced by standard Italian.

    Our analysis does make a prediction about the distribution of singleton /m/. Since there are no varieties of Italian which permit only singleton /m/ (but allow other geminate consonants), if we find a singleton /m/ in intervocalic position, we should be able to explain its presence. Our analysis predicts that we should find singleton /m/ following a stressed tense vowel (although we might find a geminate here because of regional dialect influence), but we should not find singleton /m/ following a stressed lax vowels. This prediction is, in fact, borne out by the data.

   (29)   lax + /m/ > [m]
        unattested

Aside from the data involving bilabial nasals, the generalization seems to be that if you have a tense vowel in the English form, you cannot have a geminate sonorant in the Italian form. The chart below shows that consonant length is determined by vowel tenseness only with sonorants, not with obstruents.

   (30)

	sonorant	obstruent
lax vowel	*pull* ['pullo]	*foot* ['futto]
tense vowel	*high school* [aj'skula]	*suit* ['sutto]

6.2   Analysis

How can we account for these patterns involving sonorants? Clearly, the Alignment analysis alone cannot work, nor can any of the other approaches outlined above.

In other languages we find similar patterns. For example, English tense vowels are adapted as long in loan words in Japanese, while English lax vowels are adapted as short (Katayama 1998; Abraham 2004).

(31) $V_{[-tense]} > V$
         $V_{[+tense]} > VV$

I propose that a similar process takes place in American-Italian. English vowel tenseness is mapped to Italian vowel length, which is included in the phonological representation that becomes the input form.[2] (See Abraham 2004; Jacobs & Gussenhoven 2000; Kabak 2003; Katayama 1998; Peperkamp & Dupoux 2003; etc. See also Nevins & Braun in this volume for another case of mapping an L2 output to an underlying representation which attempts to match the phonetics of the L2 form.)

A constraint forcing the quantity of the input vowel to be maintained in the output is necessary: Wt-Ident-I-O. This constraint must be ranked lower than the Align(stem, σ) constraint in order to allow for gemination of obstruents following tense vowels (see §5.3 and §5.4).

(32)   Wt-Ident-I-O – the weight of output vowels must be identical to their input correspondents (Kager 1999)

(33)   ranking: Align(stem, σ) >> Wt-Ident-I-O

Clearly, an additional factor is at play since vowel tenseness appears to be relevant in determining the length of the following sonorant but not the following obstruent.

Kawahara (2005) argues that geminate sonorants are cross-linguistically more marked than geminate obstruents, and that their markedness derives from the confusability of length contrasts for sonorants: "the more sonorous a segment is, the more difficult it is to perceive its segmental duration, and hence the less perceptible its geminacy contrasts are" (Kawahara 2005:1).[3] He proposes the

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2.   A word here is in order regarding vowel length in Italian. Italian has a well-known process of vowel lengthening in stressed open syllables. Although the degree of lengthening may vary depending on the position of the stressed syllable in the word (penults lengthen the most), the generalization is that stressed vowels in open syllables are longer than stressed vowel in closed syllables (D'Imperio & Rosenthall 1999). These facts have been interpreted as a requirement on stressed syllables or head feet. I have not indicated vowel length in the previous data since it has not been relevant until this point.

3.   There are some areas of Italian grammar which can be interpreted as an attempt to avoid high sonority geminates and geminate [rr] in particular. In addition to the loan data illustrated in (27) in which only singleton [r] is attested, we find an avoidance of gemination of /r/ in "backwards raddoppiamento." ("Backwards raddoppiamento" is the lengthening of a word-final consonant before a vowel-initial word.) Obstruents and non-/r/ sonorants lengthen in

universal ranking in (34), which we can abbreviate as in (35) in which the more specific context banning geminate sonorant consonants is ranked more highly than the general context banning geminate consonants altogether.

(34)   universal ranking:
       *GemGlides » *GemLiquids » *GemNasals » *GemObs

(35)   *GemSon » *GemCons

The constraints requiring (i) the quantity of output vowels to be faithful to the input specifications (Wt-Ident-I-O), and (ii) the ban on geminate sonorants (*GemSon), are working together since geminate sonorants are banned only in an attempt to maintain the weight of the input long (tense) vowel. In other words, the markedness constraint (*GemSon) is activated only if the faithfulness constraint (Wt-Ident-I-O) is violated. In order to account for the data (26), we can posit a conjoined constraint, *GemSon & Wt-Ident-I-O, which eliminates a candidate output only if both of its conjuncts are violated (Lubowicz 2002; Prince & Smolensky 1993).

(36)   *GemSon & Wt-Ident-I-O

This constraint must be ranked higher than Align(stem, σ) in order to block gemination in the data involving a tense vowel plus sonorant consonant, but not in the other forms.

(37)   *GemSon & Wt-Ident-I-O >> Align(stem, σ)

We see how this constraint works in the following tableaux containing an input with a tense (long) or a lax (short) vowel followed by a sonorant or an obstruent.[4]

(38)

school /VV/	*GemSon & Wt-Ident-I-O	Align(stem, σ)	*GemCons
a. ['sku:.la] ←	√ & √	*	
b. ['skul.la]	* & * = *!		*

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this context (*gas asfissiante* [gá<u>ss</u> asfissiánte] 'asphyxiating gas,' *tram elettrico* [trá<u>mm</u> eléttrico] 'electric tram'), but /r/ generally does not lengthen (*bar elegante* [bá<u>r</u> elegánte] 'elegant bar'), although it may lengthen in polysyllabic oxytones (*bazar aperto* [badzdzá<u>rr</u> apérto] 'open-air bazaar'). See Chierchia (1986) and Cardinaletti & Repetti (2008).

4.   I do not include candidates with a long vowel followed by a geminate consonant. Such candidates would be eliminated by the high-ranking *3μ constraint. I also avoided candidates with a short vowel followed by a singleton consonant since those candidates violate the metrical requirement on stressed syllables/feet (see Footnote 2).

(39)

pull /V/	*GemSon & Wt-Ident-I-O	Align(stem, σ)	*GemCons
a. ['pu:.lo]	√ & *	*!	
b. ['pul.lo] ←	* & √		*

(40)

suit /VV/	*GemSon & Wt-Ident-I-O	Align(stem, σ)	*GemCons
a. ['su:.to]	√ & √	*!	
b. ['sut.to] ←	√ & *		*

(41)

foot /V/	*GemSon & Wt-Ident-I-O	Align(stem, σ)	*GemCons
a. ['fu:.to]	√ & *	*!	
b. ['fut.to] ←	√ & √		*

In (38a) neither of the conjuncts of the conjoined constraint is violated since the candidate contains a long vowel (like the input vowel), and it does not contain a geminate sonorant. Candidate (38b) violates both conjuncts of the conjoined constraint since it contains a short vowel (as opposed to the input) and a geminate sonorant. Since both conjuncts are violated, this candidate is eliminated, leaving candidate (38a) as the winner, despite the fact that it violates the lower ranked alignment constraint.

In Tableau (39) neither of the candidates violates both conjuncts of the conjoined constraint: (39a) violates the identity conjunct but not *GemSon, and (39b) violates *GemSon but not Wt-Ident-I-O. Therefore, the alignment constraint selects the winning candidate.

Finally, Tableaux (40) and (41) do not contain sonorants, so they cannot violate the *GemSon conjunct of the conjoined constraint. Hence, in these tableaux it is the alignment constraint that eliminates the loser.

7.   Conclusions

In this paper, I hope to have shown how many aspects of grammar are involved in loan word adaptation, and specifically in the determination of consonant length.

(42)   –lexicon (similar native lexical items)
        –morphology (the identification of the 'stem')
        –phonetics-phonology (segment inventory, structure of stressed syllables, mapping of vowel tenseness to length, perceptibility of geminate sonorants)

If the foreign word is phonologically similar to a native word or if the foreign word ends in a series of segments that are similar to a native suffix, the length present in the Italian items is used in the adapted form. Morphological considerations such as the identification of the stem, and morpho-phonological considerations such as the alignment of the stem and a syllable, also affect the integration process. The phonological structure of the borrowing language, including the inventory of segments and constraints on syllable and metrical structure, interact in the determination of consonant length in loans. Finally, we saw that the mapping of vowel tenseness to vowel length and a constraint banning geminate sonorants are also involved in the integration of foreign loans.

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