

Variable phonological rules and 'quantal' perception as a source of probabilistic sound change: The case of intervocalic voicing in Old Tuscan

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Goals of this talk

- I will try to answer a long-debated problem in the historical phonology of Italian: did voicing of intervocalic stops occur or not?
- As I will argue that there was a voicing process but it was not systematic, I will also discuss how a sporadic (or rather probabilistic) sound change may arise

The outcomes of Latin -p-, -t-, -k- in Romance

- It is well known that in several Romance languages (collectively known as the 'Western' Romance branch) the intervocalic voiceless stops of Latin were regularly voiced. This change took place all the Romance languages from Portugal to northern Italy

Latin -p- -t- -k- in Western Romance

| Latin | RŎTA(M) 'wheel' | JOCĀRE 'to play' | CAPRA(M) 'goat' |
|------------------------|---------------------|----------------------|-----------------|
| Portuguese | <i>roda</i> | <i>jogar</i> | <i>cabra</i> |
| Spanish | <i>rueda</i> | <i>jugar</i> | <i>cabra</i> |
| Catalan | <i>roda</i> | <i>jugar</i> | <i>cabra</i> |
| French | <i>roue</i> (d > Ø) | <i>jouer</i> (g > Ø) | <i>chèvre</i> |
| Occitan (Maira valley) | <i>ruda</i> | <i>jogar</i> | <i>chabra</i> |
| Piedmontese | <i>rua</i> (d > Ø) | <i>giüghé</i> | <i>crava</i> |
| Lombard | <i>röda</i> | <i>giügà</i> | <i>cavra</i> |
| Venetan | <i>roda</i> | <i>zogar</i> | <i>cavara</i> |
| Friulian | <i>ruede</i> | <i>zujâ</i> | <i>cjavre</i> |

Latin -p-, -t-, -k- in Eastern Romance

- It is equally well known that in the vernaculars of southern Italy and in Romanian (= 'Eastern' Romance) intervocalic stops remained voiceless

| | RŎTA(M) | JOCĀRE | CAPRA(M) |
|------------|--------------|------------------|--------------|
| Neapolitan | <i>rota</i> | <i>iucà</i> | <i>capra</i> |
| Sicilian | <i>rota</i> | <i>jucari</i> | <i>crapa</i> |
| Romanian | <i>roată</i> | <i>a se juca</i> | <i>capră</i> |

Previous hypotheses

- Since Diez (1836) most Romanists have argued that (1) represents the only 'real' outcome – words as in (2) were borrowed from Western Romance (especially northern Italian vernaculars, Old French, Old Occitan) in the Early Middle Ages (a.o., Pieri 1901, Clark 1903, Bertoni 1916, Rohlf's 1966, Tekavčić 1980, Izzo 1980, Castellani 1960, 2000)
- A minority has held that the only native outcome is (2), and words with voiceless stops are learned (mainly Merlo 1933, Urciolo 1965)

My hypothesis

- Since the late 70s, some have argued that the dual outcome is the result of a variable voicing rule (a.o., Giannelli & Savoia 1979-80, Wanner & Cravens 1980, Maiden 1995, Cravens 2002)
- Following this hypothesis, I will show that the distribution of voiced outcomes in Old Tuscan is phonologically conditioned, in a way incompatible with lexical borrowing from Western Romance
- Voiced outcomes are more likely if the stop is velar, next to low vowels, next to stressed vowels, if the following consonant is a sonorant
- On the contrary, in WR the only necessary and sufficient condition for voicing was intervocalic position

My hypothesis

- But this means that voicing in Old Tuscan was a probabilistic rather than deterministic sound change
- What about the systematicity of sound change?
- Tentative explanation: voicing in Old Tuscan was an allophonic process, with highly variable realization depending on the phonological environment
- Although not fully voiced, some intervocalic stops were voiced enough to be perceptually ambiguous, and hence to be perceived (also) as voiced phonemes

Borrowing or native sound change?

- The dual outcome of Tuscan intervocalic stops has been extensively debated
- Therefore it is impossible to mention all data, arguments and previous hypotheses here
- In following slides only the most important ones in favour of the ‘borrowing’ and the ‘native voicing’ hypotheses

“It must be borrowing, because...”

- Tuscany had strong political, economic and cultural connections with northern Italy and France during the early Middle Ages
- Voiced outcomes are most frequent in northern Tuscany (Lucca, Pisa), at the border with northern Italian vernaculars
- Voicing is virtually absent from place names
- Voicing is absent from inflectional morphemes (cf. p.p. *-ato* in *amato* ‘loved’ vs. Spanish *amado*)

“It must be borrowing, because...”

- Different outcomes even in near-omophones: *fuoco* ['fwɔko] < FOCU(M) ‘fire’ vs. *luogo* ['lwɔgo] < LOCU(M) ‘place’
- Most words in the core lexicon preserve voicelessness: *dito* ‘finger’, *dico* ‘I say’, *pecora* ‘sheep’, *cipolla* ‘onion’, and many others
- According to Izzo (1980) – on the basis of a word count on a selection of the entries of the *Romanisches etymologisches Wörterbuch* – only 12.8% of words display a voiced outcome

“It must be an indigenous sound change, because...”

- Although voicelessness prevails, voicing is fairly well attested in the core lexicon (e.g. *ago* ‘needle’, *budella* ‘guts’, *fregare* ‘to shrub’, *lago* ‘lake’...)
- Not true that voicing is entirely absent from place names (Cravens 2002)
- There are only two inflectional morphemes with an intervocalic stop (p.p. *-ato* and 2nd pl. *-ate*); several derivational morphemes display voicing (*-dore* < -TORE(M), *-adro* < -ATOR, *-tade* < -TATE(M))

“It must be an indigenous sound change, because...”

- Even more cogent argument against lexical borrowing: for some Tuscan words with a voiced outcome, cognates in Western Romance do not exist (or have a voiceless stop)
- Lexicon: *codesto* ‘that’ < ECCU TIBI ISTU(M), *regare* ‘to bring, carry’ < Goth. RIKAN (along with *cotesto* and *recare*)
- Phonology: voicing in Western Romance did not occur after the outcome of -AU- (Spanish *poco*, ligurian *pocu* ‘little’ < PAUCU(M)); however in some Tuscan varieties *pogo*, *oga* ‘goose’ < AUCA(M)

“It must be an indigenous sound change, because...”

- Sometimes only one of two or more stops is voiced: *fegato* < FICATU(M) ‘liver’, *segreto* < SECRETU(M) ‘secret’; but in Western Romance all stops were voiced
- -k- seems to be voiced more frequently than the other stops (educated guess, no hard figures available up to now)

“It must be an indigenous sound change, because...”

- Some modern geographically peripheral Tuscan varieties (and more in general vernaculars of central and southern Italy) do have a synchronic intervocalic voicing process (a.o. Cravens & Giannelli 1995, Marotta 2006, Hualde & Nadeu 2011)
- its output in most cases are slack voiced or murmured stops
- /k/ undergoes more voicing than /t/ and /p/
- voicing crosses word boundaries (/la tela/ ‘the cloth’ is [ladela], Elba island dialect; and in Old Tuscan there was some word-initial voicing – e.g. *caligaio* ‘shoemaker’ < CALIGARIU(M))

Variable voicing

- The available data pose a dilemma: it is highly implausible that so many words with a voiceless stop are learned words, but several words with a voiced stop are extremely difficult to explain as borrowings
- Possible solution: Old Tuscan had a variable, probably allophonic, voicing rule, which was only partially lexicalized
- Both voicing and preservation of voicelessness would be native – the sound change was not systematic

Variable voicing

- This hypothesis would solve the dilemma, but
 - 1) how to prove it? After all, claiming that a double outcome is due to a 'variable' rule by itself is little more than stating a circularity (Izzo 2003)
 - 2) Why was the change not systematic?
- Possible answer to 1: in Western Romance languages, the only necessary and sufficient condition for voicing was intervocalic position (or V_L/R). If in Old Tuscan the probability of having a voiced stop depended on different, more restricted phonological environments, voiced outcomes could not come from Western Romance languages

Material

- How to look for such a conditioning?
- A list of Old Tuscan words with etymologically voiceless intervocalic stops is needed
- To build it, the *OVI* (*Opera del Vocabolario Italiano*), an online corpus of Medieval Italian texts, was consulted
- From a corpus of 398 Old Tuscan texts, a list of 349 words with an etymologically voiceless intervocalic stops was obtained
- Learned words and clear borrowings from other Romance languages were excluded

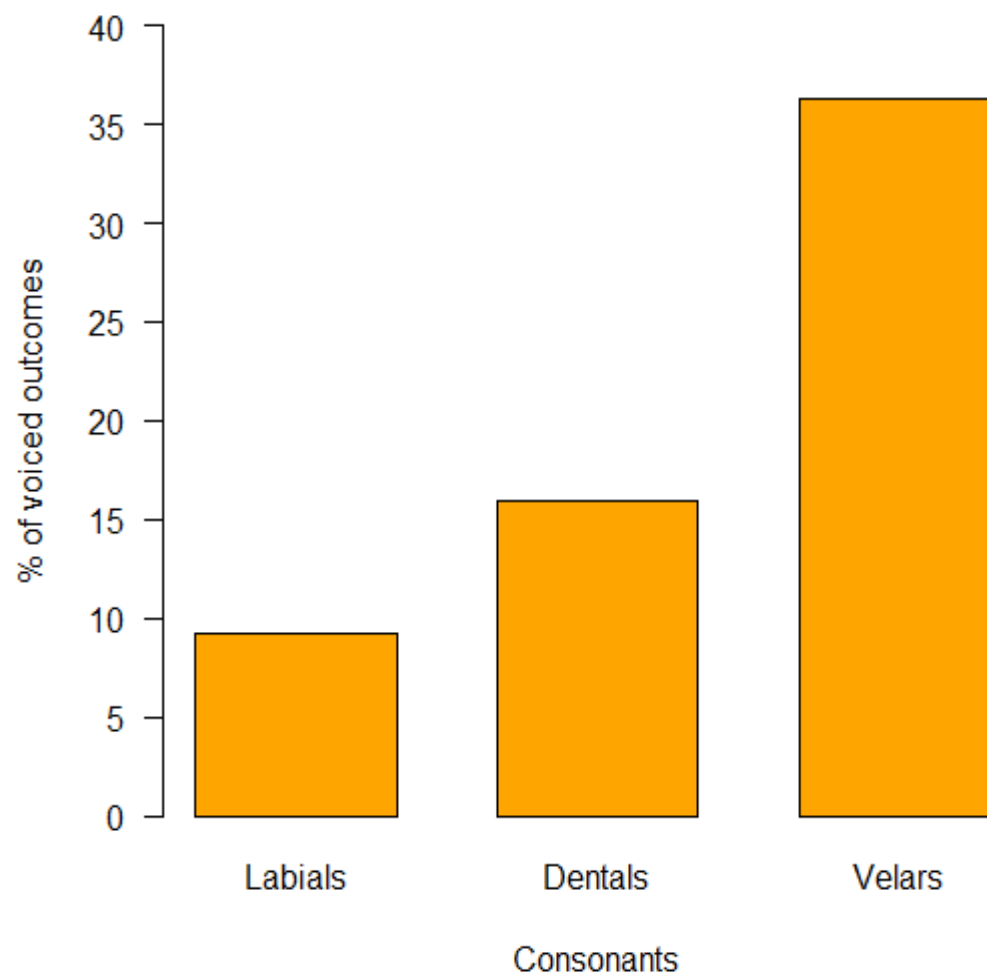
Results

- 72 words (20.6%) have a voiced outcome in half or more of their occurrences (several words show variation, with about 120 having at least one occurrence with a voiced outcome: *poco/pogo, lacrima/lagrima, aprile/abrile*, etc.)
- Apparently the relative paucity of voiced outcomes is confirmed
- But their distribution is significantly correlated with several phonological parameters

Stop place of articulation

| | | Latin voiceless stops | | |
|----------------------|-------------|-----------------------|-------------|------------|
| | | -K- | -T- | -P- |
| Outcome in Tuscan | Voiced C | 37 (36.3%) | 29 (15.9%) | 6 (9.2%) |
| | Voiceless C | 65 (63.7%) | 153 (84.1%) | 59 (90.8%) |
| Total | | 102 (100%) | 182 (100%) | 65 (100%) |

Stop place of articulation

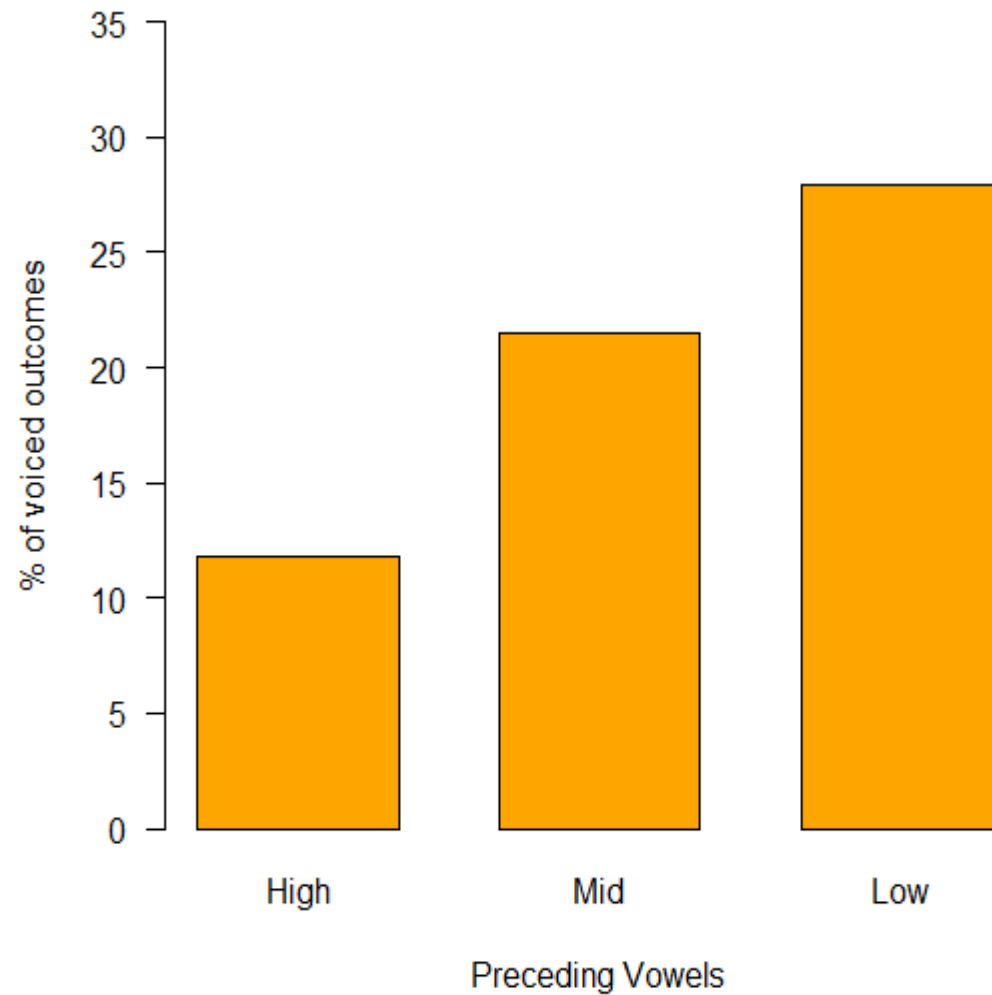


Vowel height – preceding vowel

| | | Preceding vowel | | |
|----------------------|-------------|-----------------|------------|------------|
| | | High vowels | Mid vowels | Low vowel |
| Outcome in Tuscan | Voiced C | 13 (11.8%) | 26 (21.5%) | 33 (28%) |
| | Voiceless C | 97 (88.2%) | 95 (78.5%) | 85 (72%) |
| Total | | 110 (100%) | 121 (100%) | 118 (100%) |

Note: Tuscan has 4 levels of vowel height (/a ε e i ɔ o u/), but the contrast between mid-low and mid-high is neutralized in unstressed V

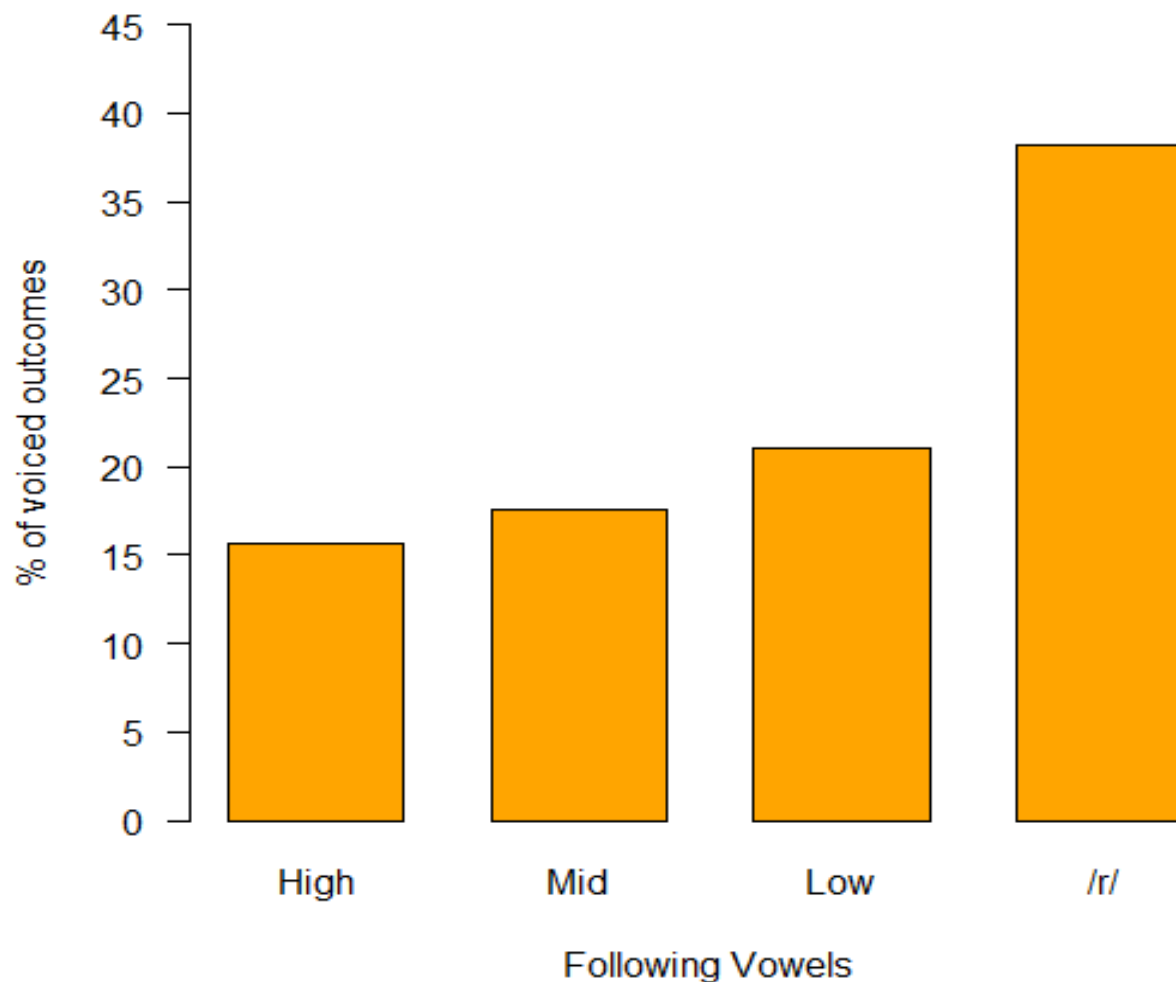
Vowel height – preceding vowel



Vowel height – following vowel

| | | Following vowel | | | |
|-------------------------|-------------|-----------------|----------------|---------------|------------|
| | | High vowels | Mid vowels | Low vowel | Rhotic |
| Outcome in Tuscan | Voiced C | 5 (15.6%) | 30 (17.6%) | 21 (21%) | 13 (38.2%) |
| | Voiceless C | 27 (84.4%) | 152 (82.4%) | 79 (79%) | 21 (61.8%) |
| Total | | 32 (100%) | 182 (100%) | 100 (100%) | 34 (100%) |

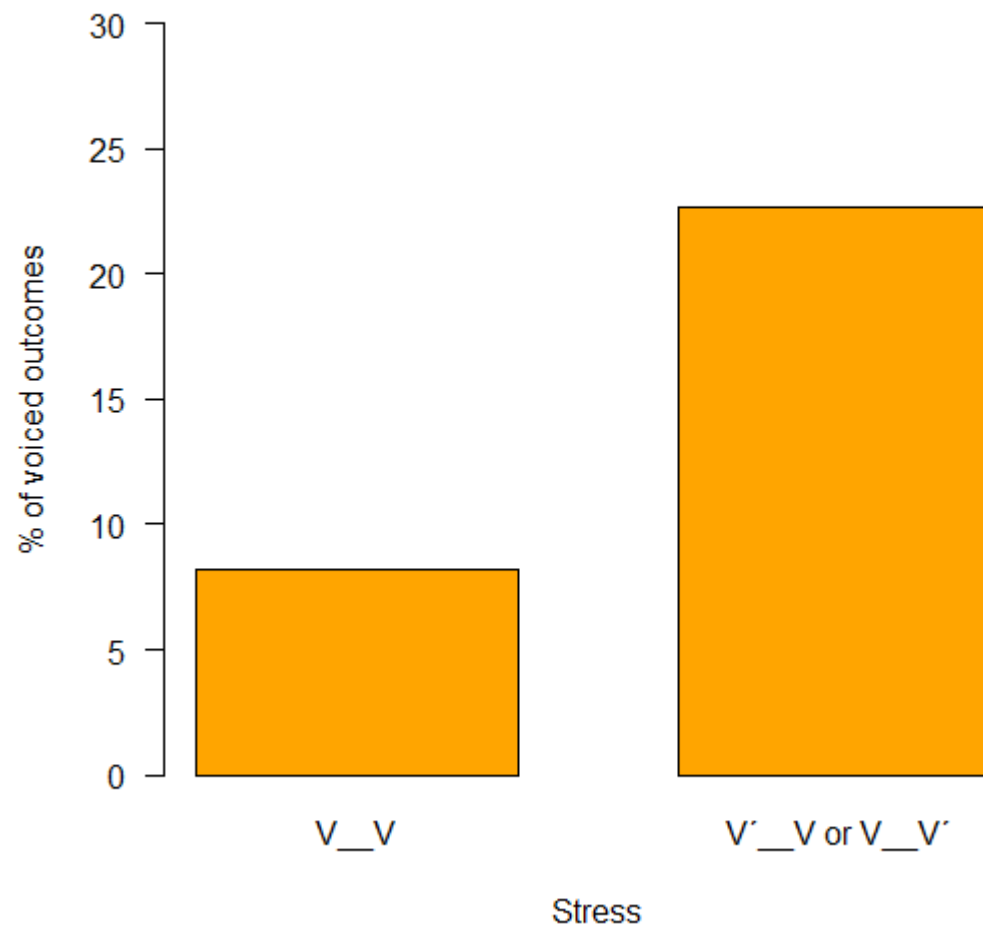
Vowel height – following vowel (or /r/)



Stress

| | | Presence of stress | |
|----------------------|-------------|--------------------|-------------|
| | | V__V̂ or V̂__V | V__V |
| Outcome in Tuscan | Voiced C | 4 (22.7%) | 68 (8.2%) |
| | Voiceless C | 45 (77.3%) | 232 (91.8%) |
| Total | | 49 (100%) | 300 (100%) |

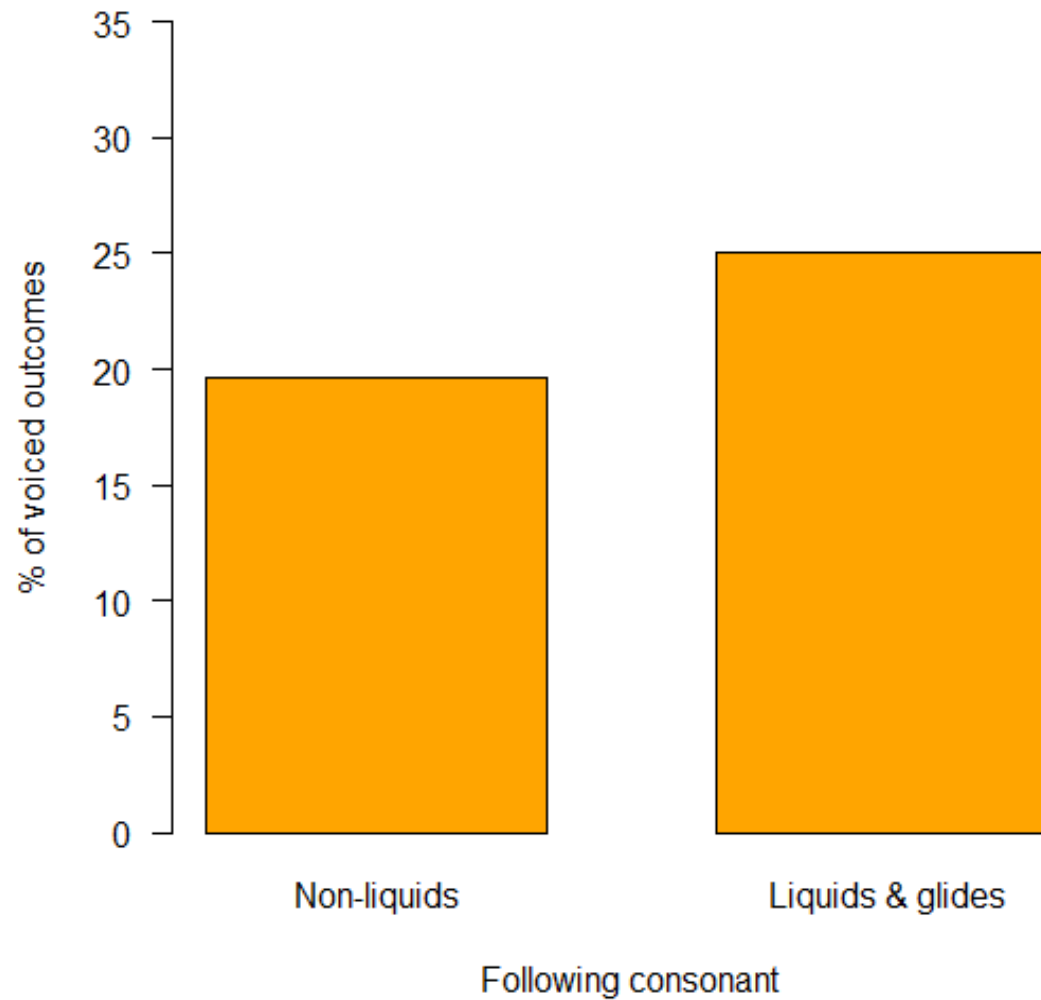
Stress



Following consonant

| | | Following consonant | |
|----------------------|-------------|---------------------|-----------|
| | | Non-liquid | Liquid |
| Outcome in Tuscan | Voiced C | 56 (19.6%) | 16 (25%) |
| | Voiceless C | 229 (80.4%) | 48 (75%) |
| Total | | 285 (100%) | 64 (100%) |

Following consonant



Results

- All the parameters are statistically significant (generalized linear model)
- Coefficients:

| | Estimate | Std. Error | z value | Pr(> z) | |
|-------------|----------|------------|---------|----------|-----|
| (Intercept) | -6.2013 | 0.8854 | -7.004 | 2.48e-12 | *** |
| PrecV | 0.7776 | 0.2043 | 3.806 | 0.000141 | *** |
| Cons PoA | 1.3947 | 0.2665 | 5.233 | 1.67e-07 | *** |
| FollowV | 0.4804 | 0.1958 | 2.454 | 0.014131 | * |
| Stress | 1.5534 | 0.5546 | 2.801 | 0.005095 | ** |
| FollowC | 0.9070 | 0.3872 | 2.343 | 0.019151 | * |

Results

- These results rule out the borrowing hypothesis: all these phonological parameters were irrelevant in Western Romance intervocalic voicing
- They are not phonologically arbitrary:
 - scale velar > coronal > labial attested in many lenition processes, including modern Tuscan
 - interaction between vowel height and non-categorical voicing of /s/ in Ecuadorian Spanish (Chappell 2011)
 - several lenition processes are sensitive to stress

(Ir)regularity in sound change

- We have a finely conditioned process, yet even in the most favourable individual environment voicing does not reach 50%
- How to reconcile these findings with the regularity of sound change?
- First, the facts of Old Tuscan are not exceptional. Other cases of regular allophonic processes that were only partially lexicalized, for instance in Durie (1996): assimilatory lowering of Proto-Germanic high vowels in several Germanic languages was probabilistically conditioned by the quality of the intervening consonant

(Ir)regularity in sound change

- Second, there can be a mechanism
- Old Tuscan probably had an allophonic synchronic voicing process, without full (modal) voicing
- fine-grained and gradient conditioning
- no systematic sound change
- allophonic voicing present in some modern varieties of Tuscan

(Ir)regularity in sound change

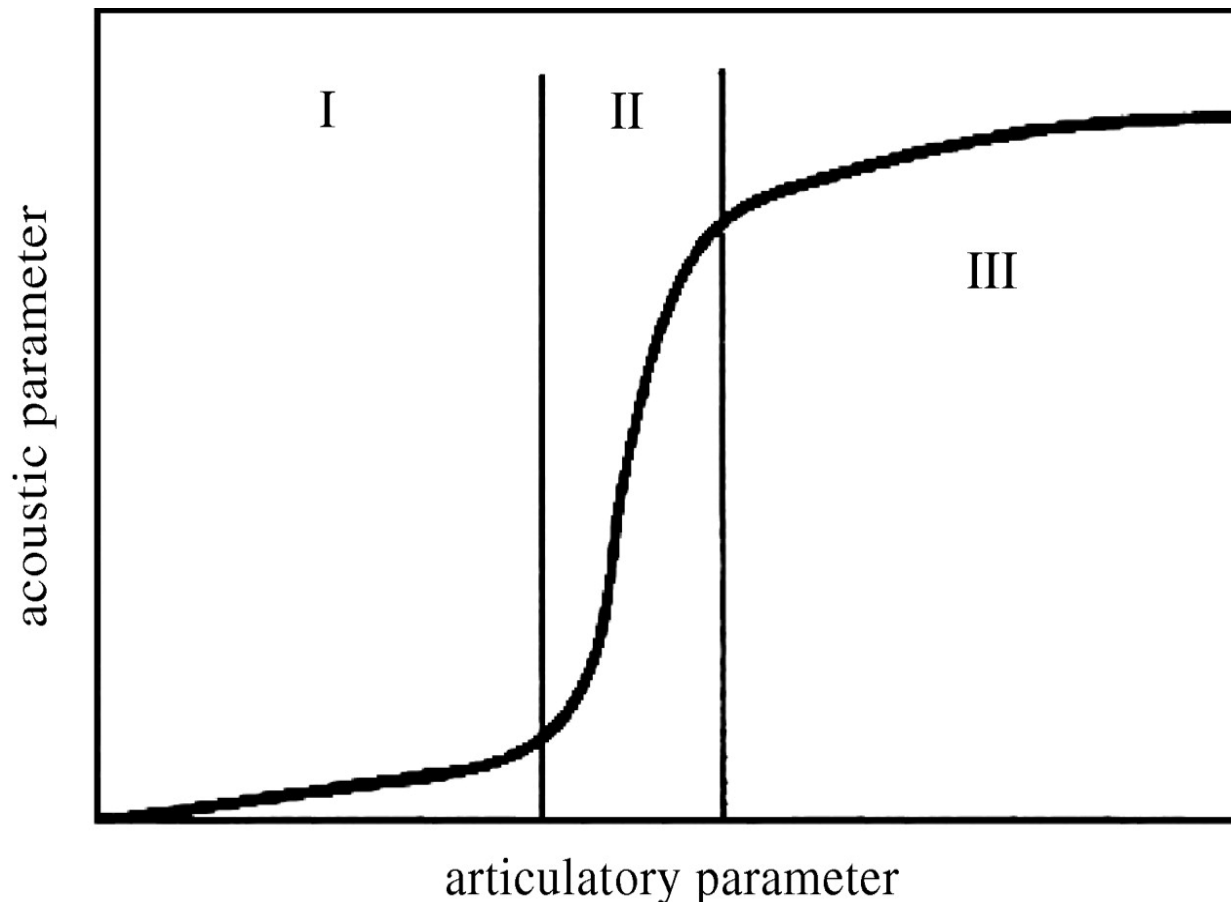
- This may explain why not all stops were voiced – they were not fully voiced, especially in some environments
- But why any recategorization at all, if voicing did not lead to neutralization?
- Possible answer: in the most favourable environments voicing was intense enough to cause perceptual ambiguity

(Ir)regularity in sound change

- Circumstantial evidence for this claim: the data are consistent with the predictions of the quantal theory of speech (Stevens 1989) in case of perceptually ambiguous stimuli
- There are regions in the phonetic space where large articulatory changes produce small acoustic effects, and regions where small articulatory changes produce large acoustic effects

(Ir)regularity in sound change

- This means that in 'region II' even small differences can cause a qualitatively different perception



(Ir)regularity in sound change

- The coefficients estimated by the GLM plausibly are also an indirect estimation of the amount of allophonic voicing: the higher the contribution of a factor to the likelihood of a voiced outcome, the higher its contribution to allophonic voicing must have been

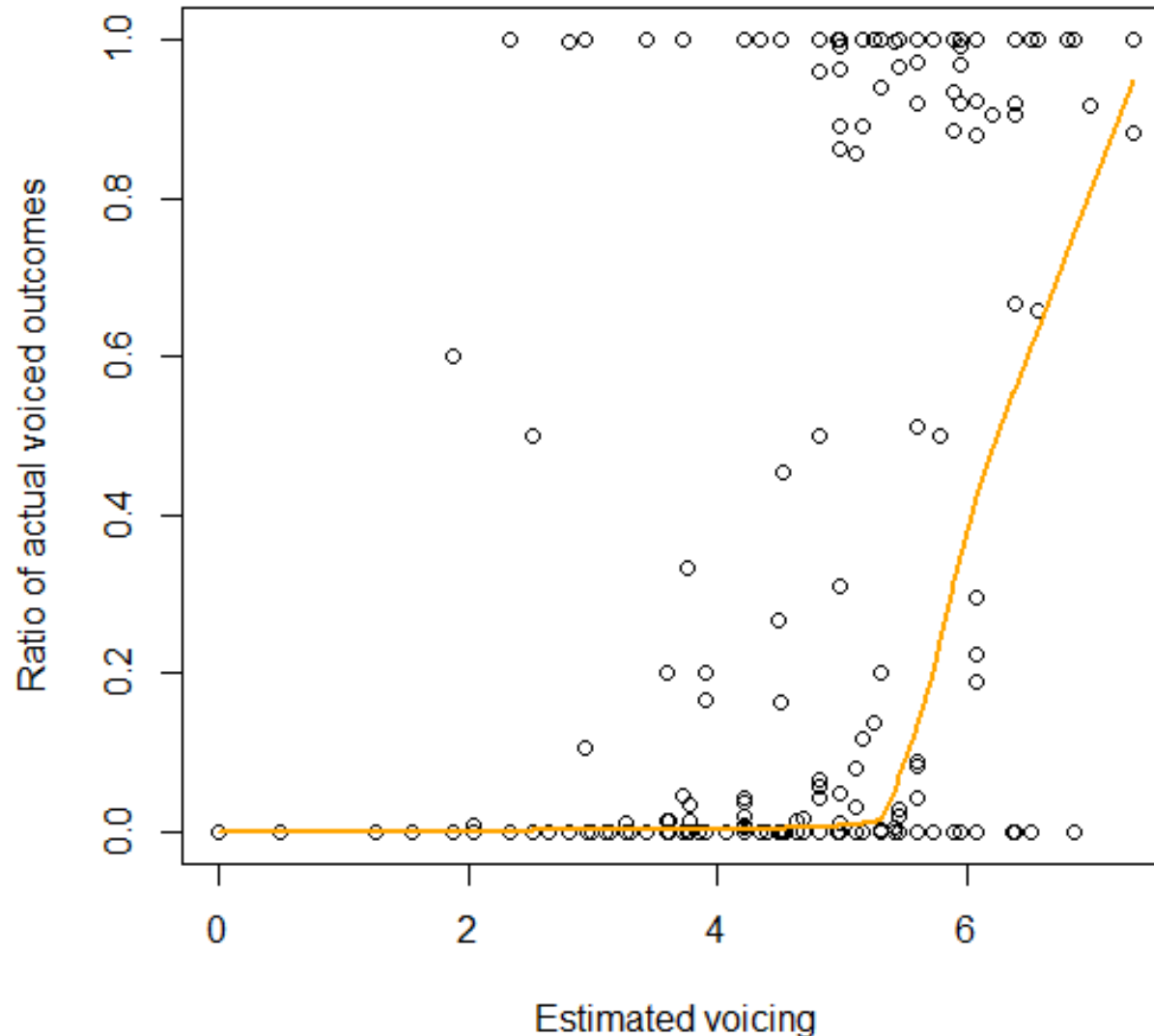
| | |
|----------------------|--------|
| Precending V Height | 0.7776 |
| Consonant PoA | 1.3947 |
| Following V Height | 0.4804 |
| Stress | 1.5534 |
| Following C sonority | 0.9070 |

(Ir)regularity in sound change

- Therefore their sum can be seen as an estimation of the total amount of allophonic voicing in each word, given the phonological environment of its intervocalic stop
- e.g. /g/ in *lago* 'lake': $0.7776*2 + 1.3947*2 + 0.4804*1 + 1.5534*1 + 0.9070*0$
- Plotting on the x-axis the amount of voicing so expected for each word, and on the y-axis their actual ratio of voiced forms, it turns out that actual voiced outcomes do not increase linearly: they are extremely rare initially and become fairly common only for quite high values, with a sharp increase in the second half of the graph

(Ir)regularity in sound change

- The superimposition of the smoothing function *lowess* (R package) shows it more clearly:



(Ir)regularity in sound change

- The result looks similar to regions I and II of ‘quantal’ contrasts
- It suggests that in Old Tuscan allophonic voicing was intense enough to produce perceptually ambiguous stops in some environments (in velars, next to low vowels, etc.), and so make recategorization of their [voice] specification by listeners possible
- Even slightly less favourable environments were much less ambiguous, and hence had a low or very low rate of recategorization

Conclusions

- Voiced outcomes in Old Tuscan cannot be due to borrowing: their phonological conditioning is not consistent with a Western Romance origin
- The non-systematicity of this sound change probably was caused by the variable and gradient nature of the process, and by the perceptual ambiguity it created

Thanks for your attention!