Avoiding phonological markedness via word ordering in French and Italian

Katherine Blake

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Overview

I present evidence that shows that phonologically marked structures like vowel hiatus are avoided using word ordering.

Outline

- **Background**: languages and previous work
- **Methodology**: corpora, semantic clustering, statistical analysis
- **French**: phonology and results
- **Italian**: phonology and results
- **Discussion**: why some structures may be avoided but not others
- **Conclusion**: summary and key takeaways

Background

Variations in {noun, adjective} ordering

- Default ordering of modified noun phrases in French and Italian is POSTNOMINAL [noun adjective]
- PRENOMINAL [adjective noun] is also available for some adjectives
- Adjectives of interest: those that can occur in **both** positions

Type	French	Italian
(1) Strictly prenominal	??*une maison* ***belle*** ∼ *une* ***belle*** *maison* 'a nice house'	**uno ritardo* ***mero*** ∼ *un* ***mero*** *ritardo* 'a mere delay'
(2) Strictly postnominal	*l'industrie* ***chimique*** ∼ **la* ***chimique*** *industrie* 'chemical industry'	*un ingegnere* ***elettronico*** ∼ **un* ***elettronico*** *ingegnere* 'an electrical engineer'
(3) Flexible	*une maison* ***magnifique*** ∼ *une* ***magnifique*** *maison* 'a beautiful house'	*il contributo* ***prezioso*** ∼ *il* ***prezioso*** *contributo* 'precious contribution'

Knittel (2005); Cinque (2010)

Previous related work

Binomials: Stress clash, word length, vowel quality, sonorancy affect binomial ordering in English (Bolinger, 1962; Pinker & Birdsong, 1979; Morgan, 2016; Ryan, 2019a)

Sentence formation: Stress clash, long consonant clusters, sibilant clash, geminates, vowel hiatus, bad sonority, and nasal-voiceless consonant clusters all affect syntactic structure of sentences in English (Breiss & Hayes, 2019)

Topicalization: NPs can be shifted for topicalization only if they are at least two phonological phrases (Serbo-Croatian; Zec & Inkelas, 1990)

Noun-adjective ordering: Nasal-nasal and nasal-voiceless consonant sequences avoided in {noun, adjective} ordering (Tagalog; Shih & Zuraw, 2017)

Research question

Do we see similar evidence for phonological markedness avoidance effects on {noun, adjective} ordering in French and Italian, with adjectives that are flexible?

- If so, are only those phonologically-marked phenomena that are avoided with phonological repairs also avoided with syntactic repairs? (Shih & Zuraw, 2017)

Methodology

Corpora

- Common Voice (Mozilla) speech corpora

French	Italian
747 hours	288 hours
130,000 {noun, adjective} pairs	73,000 {noun, adjective} pairs

- Sentences tagged for POS using `spaCy`
- Phonological information provided by Lexique 3 (New et al., 2004) and PhonItalia (Goslin et al., 2014)

Semantic clustering

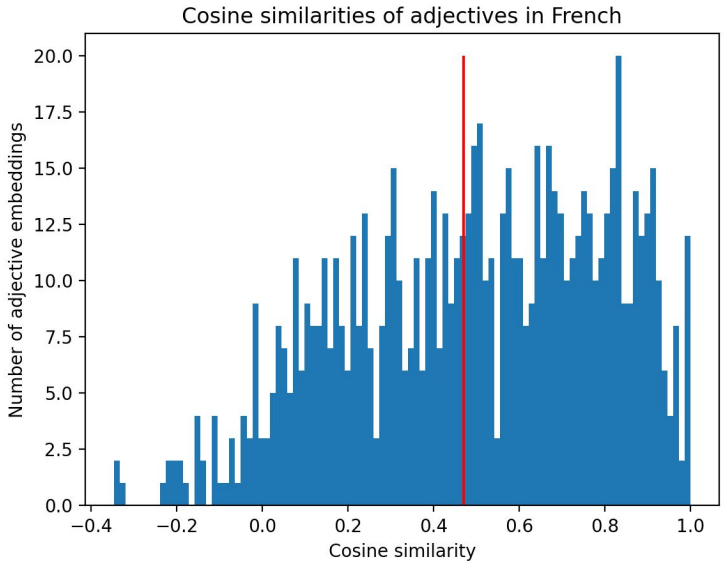
- Adjectives may have a difference in meaning depending on their position relative to the noun (Cinque, 2010)

Italian	**French**
a. un uomo povero a man poor 'a poor man' (not rich)	a. un homme grand a man big 'a tall man'
b. un povero uomo a poor man 'a pitiful man'	b. un grand homme a big man 'a great man'

- Corpus data was split into two datasets to help control for this

Semantic clustering

- Separate prenominal and postnominal word embeddings were computed
  - Bag of words → PPMI → PCA (128 dimensions)
- Cosine similarity was measured between each prenominal and postnominal embedding of the same adjective (e.g., *grand* N and N *grand*)
- Gaussian mixture model with k=2 fit to the cosine similarities to determine a cutoff threshold for *similar* and *dissimilar* adjectives



Mixed-effects logistic regression models

- Predict the ordering of all {noun, adjective} pairs in the corpus that contain a flexible adjective (token-level)
- Fixed effects: phonological constraints, and relative frequency
    - Phonological constraints:
      1=well-formed in prenominal, -1=well-formed in postnominal, 0=no preference
    - **Relative frequency**: a number between 0.0 and 0.5 that corresponds to how flexible a pair is
- Full random effects structure, with random slopes
- Separate models for *similar* and *dissimilar* adjectives

Hypotheses and predictions

- **HYPOTHESIS 1**: Only those phonologically-marked phenomena that are avoided with phonological repairs may also be avoided with syntactic repairs.
  - *Prediction*: Only those effects will be significantly positive in a model predicting ordering of {noun, adjective} pairs

- **HYPOTHESIS 2**: Phonological effects on ordering are stronger if semantic differences between orders are minimal.
  - *Prediction*: In the semantically-similar model, phonological effects will have a larger positive coefficient or be significant compared to the semantically-dissimilar model

Phonological constraints

Vowel hiatus vowel-vowel sequences across a syllable boundary

Stress clash: two adjacent prominent syllables

Stress lapse: three adjacent unstressed syllables

Clusters with mismatching voicing: voiced-voiceless or voiceless-voiced

Clusters with matching place of articulation: labial-labial, coronal-coronal, etc.

Long before short sequences: word 1 greater syllable count than word 2

French

Phonological constraints: French

Vowel hiatus

- Liaison repairs hiatus after certain words, under certain conditions (Tranel, 1995)

a. grands hommes
[gʁɑ̃ **z**ɔm]
'big men'

b. avions américains
[avjɔ̃ **z**amɛʁikɛ̃]
'American planes'

Phonological constraints: French

Clusters with mismatching voicing

- Regressive voicing assimilation occurs between obstruents of different voicing specifications (Snoeren & Segui, 2003)

a. une jupe droite
[yn ʒy**b** dʁwat]
'a straight skirt'

b. une robe claire
[yn ʁɔ**p** klɛʁ]
'a light dress'

Phonological constraints: French

Length

- Preference for shorter words before longer words in noun-adjective ordering (Forsgren, 1978; Thuilier, 2012)

a. un air avide
   a air greedy
   'a greedy air'

b. un avide hippopotame
   a greedy hippopotamus
   'a greedy hippopotamus'

Phonological constraints: French

OCP-Place

- Dispreference for obstruent sequences at the same place of articulation, but no strong evidence in Standard French

Stress constraints

- Not possible in French, no word-level stress

Phonological constraints: French

CONSTRAINT	ACTIVE STATUS
CLASH	Not possible.
LAPSE	Not possible.
HIATUS	Active across word boundaries (*liaison*; (Tranel, 1995))
VOICE	Active across word boundaries (*regressive assimilation*;, (Snoeren and Segui, 2003))
OCP-PLACE	Not active.
LENGTH	Active for noun-adjective pairs (Forsgren, 1978; Thuilier, 2012)

Results & Discussion: French

French

Dataset with semantically *dissimilar* adjectives

	Estimate	Std. Error	z value	p value
Intercept	-6.16104	0.29052	-21.207	< 2e-16 ***
Constraint: Hiatus	0.97032	0.28915	3.356	0.000791 ***
Constraint: Voice	0.21504	0.08444	2.547	0.010879 *
Constraint: OCP	0.17366	0.11287	1.539	0.123911
Constraint: Length	0.01622	0.07945	0.204	0.838232
Relative frequency	3.90285	0.23226	16.804	< 2e-16 ***

Dataset with semantically *similar* adjectives

	Estimate	Std. Error	z value	p value
Intercept	0.7418	0.5281	1.405	0.1601
Constraint: Hiatus	1.5249	0.3807	4.005	6.19e-05 ***
Constraint: Voice	0.2456	0.1468	1.672	0.0945 .
Constraint: OCP	0.1316	0.1688	0.780	0.4355
Constraint: Length	0.2973	0.1165	2.551	0.0107 *
Relative frequency	-2.6553	0.5080	-5.227	1.73e-07 ***

Predictions

- Significant positive coefficients for HIATUS, VOICE, and LENGTH
- No effect of OCP

- Stronger/present effects in the *similar* model

French

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Hiatus

- Significantly positive coefficient in both models, larger in the *similar* model

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Length

- Significantly positive coefficient only in the *similar* model

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Voice

- Significantly positive only in the *dissimilar* model

?

French

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OCP

- Insignificant in both models

French

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Relative frequency

- Significant in both models: positive in *dissimilar* model and negative in *similar* model

French

As predicted

- HIATUS: avoiding hiatus is correlated with the order that avoids it in both models, more strongly in the *similar* model
- LENGTH: preference for short before long only significant in the *similar* model
- OCP: no effect

Not as predicted

- VOICE effect only in the *dissimilar* model

French

VOICE is able to be repaired without word-order manipulation,

whereas HIATUS and LENGTH are not

Regressive voicing assimilation

a. une jupe droite
[yn ʒy**b** dʁwat]
'a straight skirt'

b. une robe claire
[yn ʁɔ**p** klɛʁ]
'a light dress'

***h aspiré* words**

a. grands haricot
[gʁɑ̃ Øaʁiko]
'big beans'

b. grandes haches
[gʁɑ̃d Øaʃ]
'big axes'

Epenthesis not possible

a. oiseau artificiel
[wazo aʁtifisjɛl]
'artifical bird'

Italian

Phonological constraints: Italian

Stress clash

- Clash may be repaired with stress retraction or initial-consonant doubling (Nespor & Vogel, 1979)

a. **cit**tà vecchia
city old

b. città **vv**ecchia
city old
'old city'

Phonological constraints: Italian

Stress lapse

- Lapse may be repaired with beat addition (Nespor & Vogel, 1989)

a. vecchia **al**leanza
   old alliance
   'old alliance'

Phonological constraints: Italian

Length

- Restrictions on sentence structure based on length of constituents (Cardinaletti, 2010)

a. Il partito di maggioranza fece poi la stessa proposta.
the party of majority made then the same proposal

b. **La stessa proposta** fece poi il partito di maggioranza.
the same proposal made then the party of majority
'The majority party then made the same proposal (not a similar one)'

c. ***La stessa proposta** fece poi Gianni/lui.

Phonological constraints: Italian

Vowel hiatus

- No strong evidence for phonological repairs of vowel-vowel sequences in Standard Italian

Voice and OCP

- Not possible in Italian, final consonants are extremely marginal

Phonological constraints: Italian

CONSTRAINT	ACTIVE STATUS
CLASH	Active across word boundaries (*retraction or doubling*; (Nespor and Vogel, 1979))
LAPSE	Active across word boundaries (*beat addition*; (Nespor and Vogel, 1989))
HIATUS	Not active.
VOICE	Not possible.
OCP-PLACE	Not possible.
LENGTH	Active for larger constituents (*object-verb-subject order*; (Cardinaletti, 2010))

Results & Discussion: Italian

Italian

Dataset with semantically *dissimilar* adjectives

	Estimate	Std. Error	z value	p value
Intercept	-2.10476	0.23881	-8.814	< 2e-16 ***
Constraint: Clash	0.26362	0.31272	0.843	0.39924
Constraint: Lapse	-0.29341	0.09038	-3.247	0.00117 **
Constraint: Hiatus	-0.89913	0.13404	-6.708	1.98e-11 ***
Constraint: Length	0.39835	0.07318	5.444	5.22e-08 ***
Relative frequency	1.56574	0.20247	7.733	1.05e-14 ***

Dataset with semantically *similar* adjectives

	Estimate	Std. Error	z value	p value
Intercept	3.8106	1.1618	3.280	0.001039 **
Constraint: Clash	0.1924	1.1880	0.162	0.871343
Constraint: Lapse	0.2260	0.3298	0.685	0.493171
Constraint: Hiatus	-2.1790	0.5686	-3.832	0.000127 ***
Constraint: Length	0.7740	0.2259	3.427	0.000611 ***
Relative frequency	-6.7861	1.2392	-5.476	4.35e-08 ***

Predictions

- Significant positive coefficients for CLASH, LAPSE, and LENGTH
- No effect of HIATUS

- Stronger/present effects in the *similar* model

Italian

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Length

- Significantly positive coefficient in both models, larger in the *similar* model

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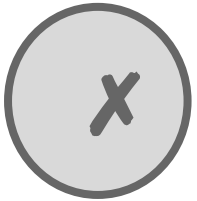
Clash

- Insignificant in both models



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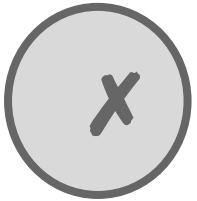
Lapse

- Significantly negative in the *dissimilar* model, insignificant in *similar*



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Hiatus

- Significantly negative in both models, larger effect in *similar* model

Italian

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Relative frequency

- Significant in both models: positive in *dissimilar* model and negative in *similar* model

Italian

As predicted

- LENGTH: preference for short before long is significant in both models, stronger in the *similar* model

Not as predicted

- CLASH and LAPSE are not avoided with word-order manipulation
- HIATUS is likelier to be tolerated than avoided

Italian

CLASH and LAPSE are also able to be repaired without word-order manipulation,

whereas LENGTH is not

Clash repairs

a. **cit**tà vecchia
city old

b. città **vv**ecchia
city old
'old city'

Lapse repair

a. vecchia **al**leanza
old alliance
'old alliance'

Italian

HIATUS may be the result of the phonological shape of words in Italian

- 73% of {noun, adjective} pairs that can violate hiatus do so
- 71% of these violations are POSTNOMINAL [noun adjective] order, meaning there is a vowel-final noun before a vowel-initial adjective
- 98% of nouns in the corpus are vowel-final, and 18% of adjectives are vowel-initial

Constraint includes penalization of high vowel-vowel sequences, which may surface as glide-vowel and not violate hiatus

Discussion

Inactive phonological constraints

- VOICE, CLASH, and LAPSE were all predicted to have a significantly positive effect on word-ordering, but did not
- For all three constraints, a phonological repair in the output order was available (compared to HIATUS and LENGTH)
- Word-order manipulation is not a preferred repair strategy to phonology

Relative frequency

Included as a control effect for degree of how fixed a pair is in one order

Positive in *dissimilar* models

- Flexible pairs are likelier to be prenominal, which is the position to which specific or special meanings of an adjective are usually attributed

Negative in *similar* models

- Flexible noun-adjective pairs are likelier to be postnominal, which is the default order

Morgan (2016); Cinque (2010)

Takeaways

Summary & key findings

Do we see evidence for phonological markedness avoidance effects on {noun, adjective} ordering in French and Italian, with adjectives that are flexible?

→ Yes, with two stipulations

(1) phonological constraints must be otherwise ACTIVE in the language

(2) phonological repair strategies may outcompete word-order manipulation

Summary & key findings

Are phonological effects stronger when semantic difference is weaker?

→ Yes

Relevant phonological effects were present only in, or had a larger coefficient in, regression models with pairs that included adjectives with a smaller semantic difference between their prenominal and postnominal positions

Thank you

Dissertation committee

- Drs. Marten van Schijndel, Helena Aparicio, Draga Zec and Abigail Cohn

Cornell lab groups

- Computational Psycholinguistics Discussions (C.Psyd)
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