

# A unified theory of stable variation, syntactic optionality, and syntactic change

Joel C. Wallenberg  
Newcastle University  
`joel.wallenberg@ncl.ac.uk`

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# Introduction

Variation in grammar is often described as falling into one of two categories.

## 1. Competing Grammars

- Leads to language change via the replacement of one grammatical process by another.
- Competition is parameterized in some fashion, as in competing flavors of the same functional head (Kroch, 1994).

## 2. Optionality (within a grammar?)

- Diachronically stable variation between grammatical processes.

## Introduction

**Hypothesis:** all variation, including grammatical optionality, is formally **competing grammars**, with the following consequences (Fruehwald and Wallenberg, 2013):

- We expect variation (apparent optionality) between two grammatical forms to be diachronically unstable, generally.
- True optionality = stable variation, and its difference from language change must be explained by some mechanism of language use, outside of the grammar itself.
- We argue that it depends on the mathematical character of some extragrammatical dimension with which the variation interacts.
  - Partial specialization of variants along a continuous dimension.

# Outline

## Introduction

## Blocking and Contrast

How doublets resolve, and why.

## Competing Grammars

Syntactic Optionality as Competing Grammars

A Minimalist Hypothesis for Variation/Optionality

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## Stable Variation

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Example: -m~-m

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Case Study: Relative Clause Extraposition

Within Speakers and Diachronically, PCEEC

Diachronically, Crosslinguistically

## Conclusions

## Blocking and Contrast

### “Blocking Effect” (Aronoff, 1976)

- General cognitive pressure against two forms existing for one function (“doublet”), unstable (Kroch, 1994).

{*lough*, *laughed*} (laugh-PST; Taylor 1994)

{*jimmies*, *sprinkles*} (candy topping)

### “Principle of Contrast”

- A strategy that children use in acquiring language: assume that two forms have two meanings (or uses) (Clark, 1987, 1990, *inter alia*).
- Children hypothesize that novel words also refer to novel objects (as in Markman and Wachtel, 1988, among many other replications of the effect).

## The Principle of Contrast

- A strategy that children use in acquiring language: assume that two forms have two meanings (or uses) (E. Clark 1987, *inter alia*).
  - Synonyms should only be acquired as a last resort.
- Demonstrated in experiments such as Markman and Wachtel (1988).
  1. 20 children
  2. 6 pairs of one familiar item (banana, cow, cup, plate, saw, spoon) and one unfamiliar item (cherry pitter, odd shaped wicker container, lemon wedgepress, radish rosette maker, studfinder, tongs).
  3. **Control:** “Show me one”
  4. **Test:** “Show me the X” (X = nonsense syllable)
- Control children pick the unfamiliar object at chance levels, but test children choose unfamiliar objects significantly higher than chance.

## Blocking = Contrast + Selection

- A doublet is two variants competing for finite resources, as in e.g. biological evolution.
  - Instead of competing for something like food, they are competing for use (time in the mouths/brains of speakers).
  - **Selection** operates on the number of times a variant is heard (and accurately analyzed) by an acquirer.
- Either one variant has an advantage, and so replaces the other (following a logistic function; Nowak, 2006).
- Or neither variant has an advantage (or much of one), in which case random walk and drift.
- But in linguistic doublets, random walk cannot persist indefinitely because of the acquisition pressure of the Principle of Contrast.

## Doublets = Competing Grammars (Kroch, 1994)

“**Competing Grammars**”, **general form**: 2 variants are available to a speaker, in the relevant inventory of grammatical formatives, with overlapping functions (e.g. the same meaning).

- E.g. two featural versions of the same syntactic head.
- E.g. two different output mappings for the same phonological input.
- E.g. two different Spell-outs of a morpheme.
- A fact about language use: at some point in the derivation, the speaker reaches a **decision-point**.
  - The speaker has a choice between formatives to continue the derivation, and either will result in a grammatical utterance and a meaning close enough to the speaker's intention.
  - It is speaker “choice” more in the sense of an urn problem.



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## Doublets = Competing Grammars

- Necessary for the description of **any** linguistic change in a categorical dimension.
  - E.g. word-order parameters (Pintzuk, 1991; Santorini, 1992); a phonological rule like German final stop devoicing (Fruehwald, Gress-Wright, & Wallenberg 2009).
  - In any such case, a speaker in the middle of the change in progress (code-)switches between categorical variants (Kroch, 1989).

## Summary: Blocking and Contrast

So, doublets are Competing Grammars, and the possible historical outcomes are driven by the selection and the Principle of Contrast.

**Proposal:** every case of categorical linguistic variation or optionality can be reduced to Competing Grammars, leading to one of these two outcomes.

This simplifies the grammatical architecture necessary to account for both optionality and language change (in pursuit of a Minimalist hypothesis).

## Example: English “Topicalization”

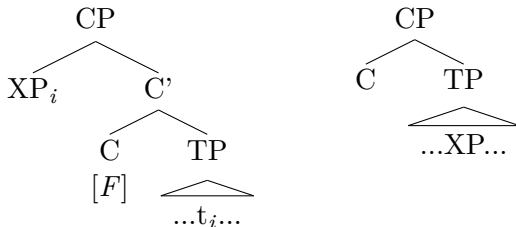
- Prince (1985, 1998, 1999): felicitous in two English discourse contexts, both of which require a certain type of contrast to appear on the fronted XP.
  - (1) She’s going to use three groups of mice. One, she’ll feed them mouse chow, just the regular stuff they make for mice. Another she’ll feed them veggies. And the third she’ll feed junk food.
  - (2) She was here two years. [checking transcript] Five semesters she was here.  
(Prince, 1999, 8,9)
- However, it is **never** obligatory.

## Example: English Topicalization

- As long as the accent pattern is kept constant, both orders are felicitous:
  - (3) She's going to use three groups of mice. One, she'll feed them mouse chow, just the regular stuff they make for mice. Another she'll feed them veggies. And **the third** she'll feed **junk food**.
  - (4) She's going to use three groups of mice. One, she'll feed them mouse chow, just the regular stuff they make for mice. Another she'll feed them veggies. And she'll feed **the third junk food**.

## Topicalization in Minimalism

- Move is triggered by the feature content of some head.
- Given “Merge...preempts Move” (Chomsky, 2000), a feature cannot encode optional movement.
- Therefore, optional movement must involve a choice (for the **Numeration**) between two variants of a functional head, out of an inventory of possible heads:



- This is the core case of morphosyntactic doublet (i.e. competing heads) described in Kroch (1994).

## A Minimalist Hypothesis

Given that:

- these mechanics are necessary to encode syntactic optionality in a Minimalist system,
- the same mechanics are necessary to describe a change in progress,

Then, the system is simplest if no more machinery is added to deal with optionality/variation.

- Note: syntactic optionality represented as multiple formal (featural) versions of a functional head, competing for the speaker's choice in the speaker's inventory, is a logical consequence of the “Borer-Chomsky Conjecture” (Borer 1984, so named in Baker 2008).

## Minimalist Theory of Variation

- **Prediction:** every case of syntactic optionality or variation is one of the following:
  1. A replacement change in progress (outright competition going to completion).
  2. A specialization change in progress (specialization for different functions going to completion).
  3. **“Stable” variation, or optionality:** variants have partially specialized along a continuous (or ordinal) dimension, e.g. style, prosodic weight.
- If categorical variants specialize along a categorical dimension, complete specialization should eventually result.
- If categorical variants specialize along a continuous or ordinal dimension, then complete specialization can **never** result (but replacement can still be arrested).

## Example: Embedded Polar Questions

A quantitative study of embedded *yes/no*-questions in English and Icelandic, comparing the use of *whether* vs. *if*, and *hvort* vs *ef* found **specialization** in English, and **replacement** in Icelandic (Bailey, Wallenberg, & van der Wurff 2012).

- (5) John wondered whether Mary was coming to the party.
- (6) John wondered if Mary was coming to the party.

Bailey et al. (2012) suggest the Proto-Gmc dual pronoun cognate with *whether* is reanalyzed as a polarity wh-word in clauses containing a disjunction.

I asked *whether* (“which of two”) he wants, A or B.



## Example: Embedded Polar Questions

In all stages of English and in historical Icelandic, a disjunction favors *whether*.

### English

#### Disjunction:

- (7) I wonder {**whether**,if} John or Bill is bringing coffee.
- (8) I wonder {**whether**,if} John is bringing tea or coffee.

#### Simple:

- (9) I wonder {whether, **if**} Bill is bringing coffee.

## Example: Embedded Polar Questions

### Disjunction:

- (10) eftir því **hvort** maður vill heitt eða  
 according it-DAT whether man wants hot or  
 kalt  
 cold

“According to whether one wants hot or cold”  
 (*Sagan Öll*, date: 1985, from IcePaHC)

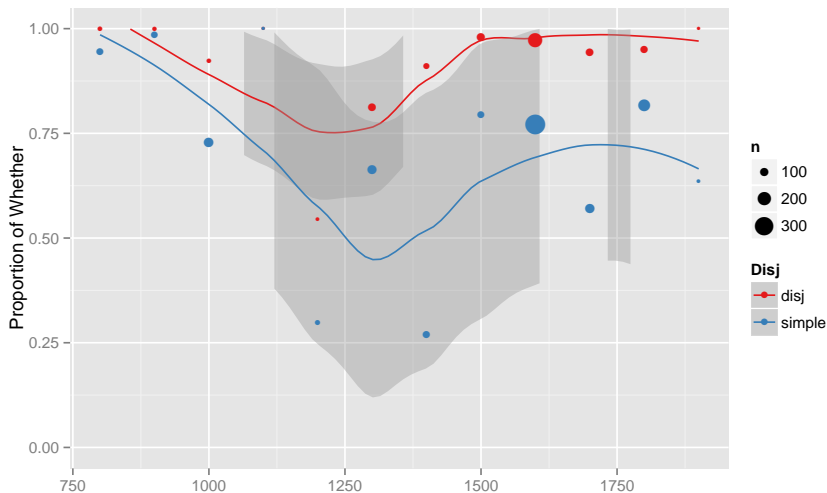
### Simple, (older) Icelandic:

- (11) vér vitum eigi, **hvort** vér tökum öndina  
 We know not whether we take soul-the

- (12) og spurðu, **ef** hann væri Kristur  
 and asked if he were Christ  
 (*Icelandic Homilies*, date: 1150, from IcePaHC)

# Specialization in English (N = 1929 clauses)

Parsed Corpora: YCOE, PPCME2, PPCEME, PPCMBE

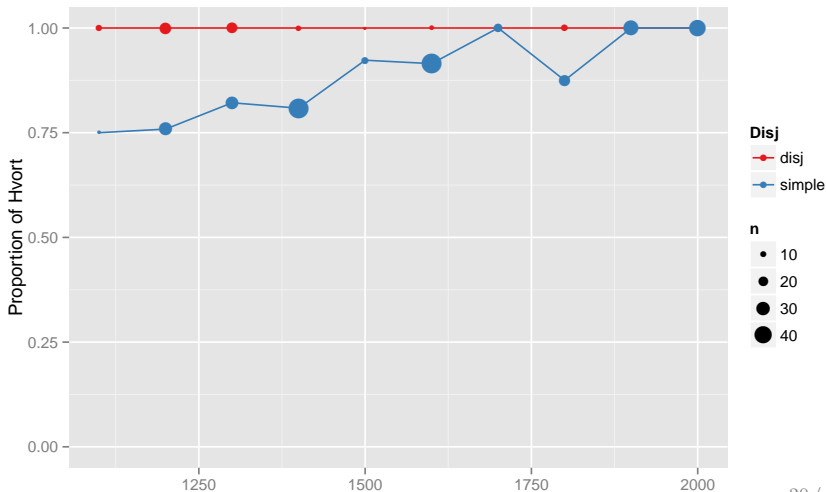


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# Replacement in Icelandic (N = 397 clauses)

IcePaHC (Wallenberg et al., 2011)



## Stable Variation

**Hypothesis:** Stable variation, i.e. optionality, results from categorical variants specializing along a continuous dimension.

There are many possible continuous dimensions, including language internal dimensions like

- weight (word length)
- prosodic accent (number of aligned prosodic peaks, degree of stress clash between two positions)

and language external dimensions like

- style
- speech rate

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## Example: English Topicalization

- Is the frequency stable over time? Possibly since Late Middle English (Speyer, 2010). (Though this is subject to revision).
- Is it specialized for different speech styles (registers)? Not that we know of.
- Is it sensitive to prosody? Definitely (Speyer, 2008, 2010).

## Prosodic Sensitivity

- Speyer (2008, 2010) shows experimentally that prosodically ill-formed topicalization is subject to prosodic repair.

- (13) **The first group** she'll feed mouse chow, **the second** she'll feed veggies, and **the third** she'll feed junk food.
- (14) ? **The first** Caitlin will feed, **the second** Joe will feed, and **the third** Maggie will feed.
- (15) ?? **Joel<sub>i</sub>** Caitlin will pay  $t_i$ , **Bob<sub>j</sub>** Joe will pay  $t_j$ , and **Ann<sub>k</sub>** Maggie will pay  $t_k$ .
- (16) ??? **Joel<sub>i</sub>** Caitlin will pay  $t_i$  10 dollars, **Bob<sub>j</sub>** Joe will pay  $t_j$  15 dollars, and **Ann<sub>k</sub>** Maggie will pay  $t_k$  20 dollars.

## Example: -ɪn ~ -ɪŋ

(17) John has been {singing/singin'}.

(18) {Dunking/Dunkin'} Donuts.

- Is the frequency stable over time? Probably, as the variation has its roots in OE morphology (Houston 1985), and both variants were present in Middle English texts (Labov, 1989).
- Is it specialized for different grammatical contexts? Yes, in part, along a nominal ↔ verbal dimension (Labov, 1989).
- Is it specialized for different speech styles? Yes, in part, along a continuous dimension of formality.



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## Example: $-m \sim -m$

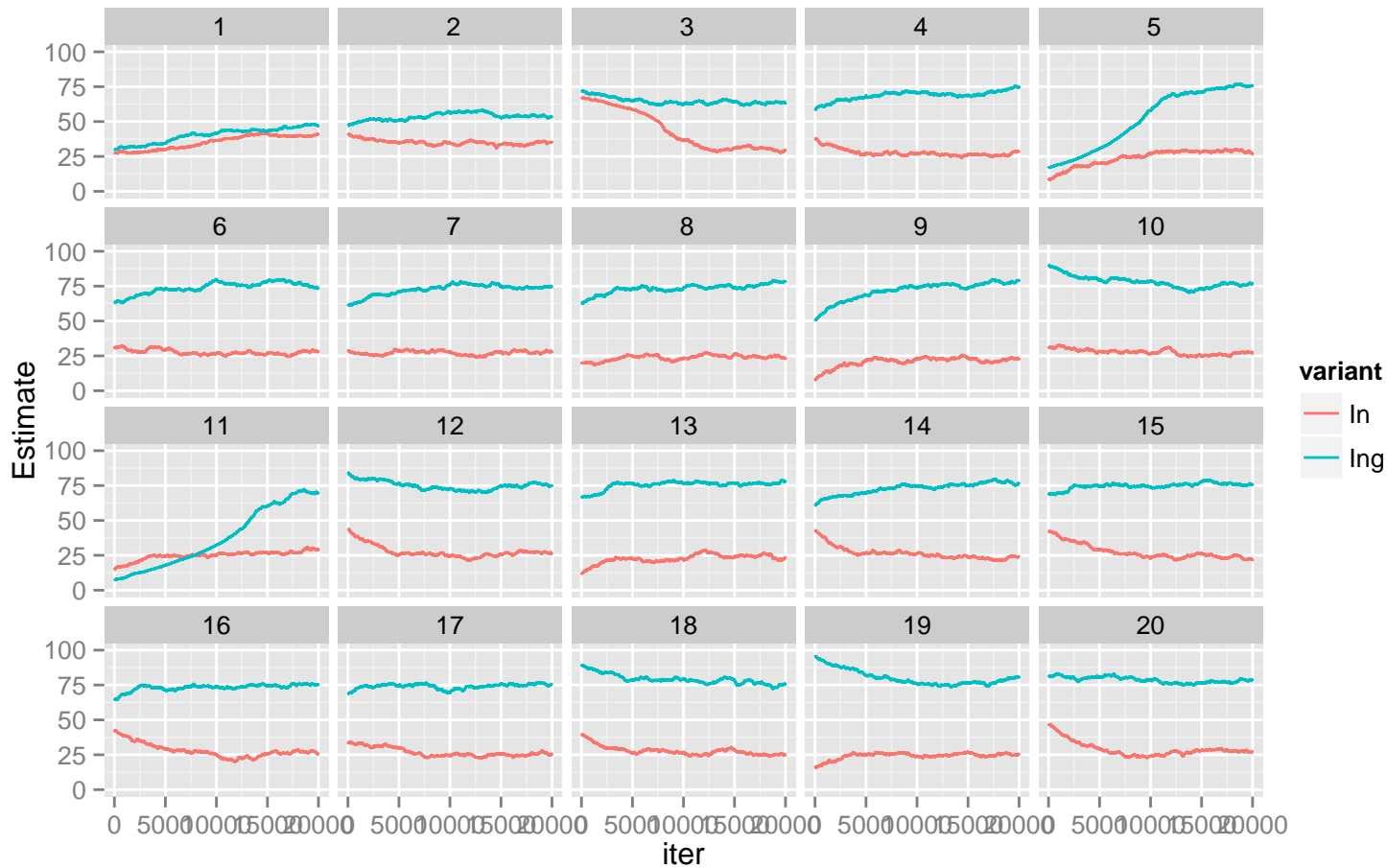
A proof of concept simulation shows that plausibly, under minimal acquisition assumptions:

- Variants specialize along a continuous dimension like style.
- For a continuous dimension, the process will stabilize at **partial** specialization.

**Gen 0:**  $-m \sim -m$  doublet is innovated, with no stylistic conditioning. **Gen 0** picks a style to speak in, and produces a variant, repeats.

**Gen 1:** **Gen 1** learns an estimate for the style value of  $-m$ ,  $m$ , as soon as she hears the first tokens of each from **Gen 0**. She adjusts this estimate as she gets more data from **Gen 0**.

**Gen 2:** **Gen 1** picks a style, produces one of the variants with a probability weighted by how far her style estimates are from the current style, repeats. **Gen 2** learns style estimates for variants as above.



## Instructive Observations from Simulation

1. We did not build the Principle of Contrast into the model. We just left the learner the possibility of contrasting the variants.
2. There is no default style value for the variants. Their initial values are the first styles the learner hears from the last generation.
3. The variants do specialize, but not all the way to the limits – they stabilize at the quartiles.
4. Given 20000 tokens in each generation to learn from, the specialization stabilizes in about 4 generations.

**Open Question:** can we predict when specialization will occur successfully (or when replacement will happen instead)?

## When Specialization vs. Replacement?

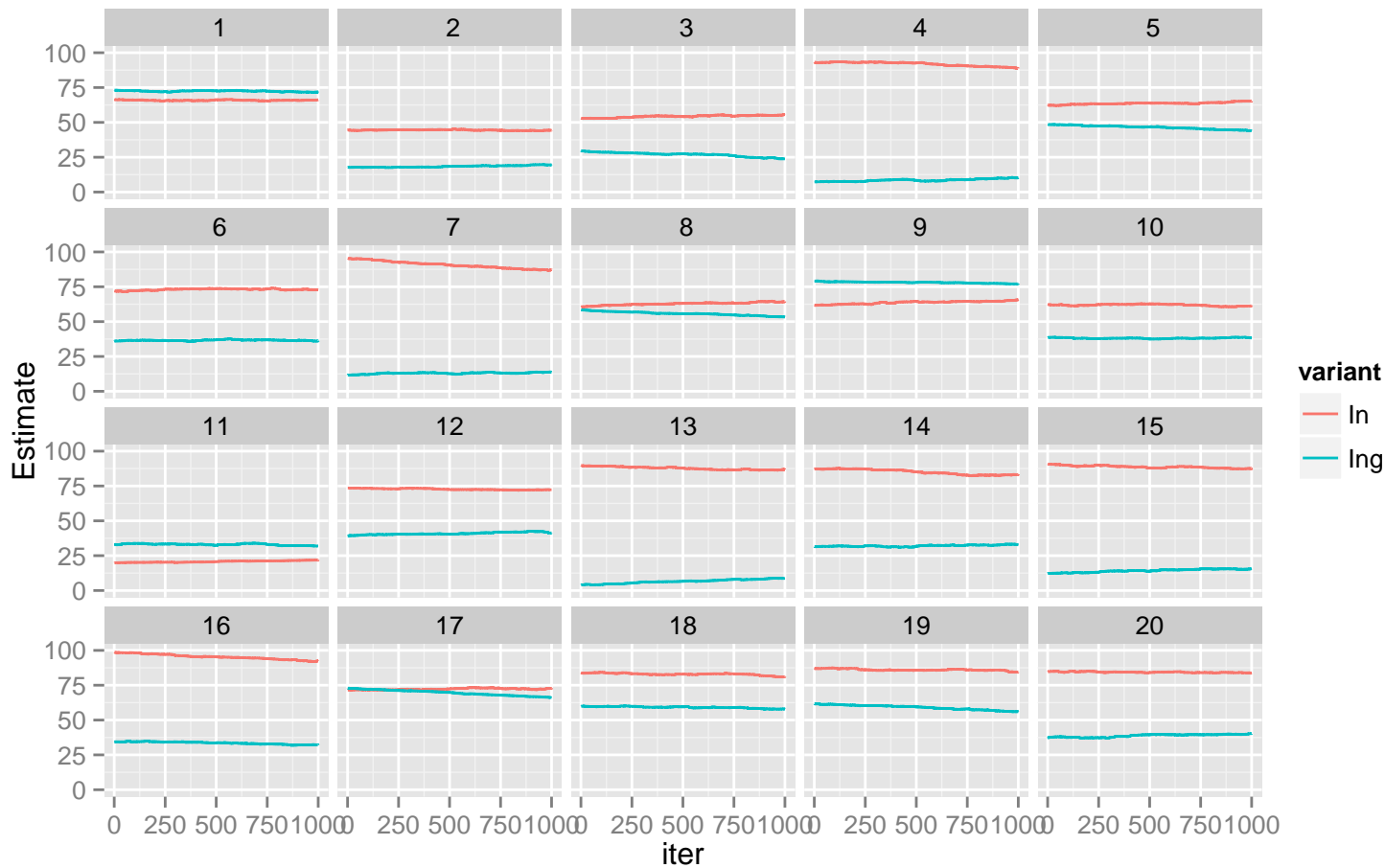
- If neither variant has a selectional advantage, then specialization should occur (modulo **drift**).
- But if there is an advantage, then we have a race; who wins?
- First, the speaker must identify some **salient domain of specialization**.
- Specialization is driven by the Principle of Contrast, which is a fact about child cognition (i.e. should be as stable as the human brain).

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## When Specialization vs. Replacement?

- Suppose, then, that specialization always occurs at the same rate per token of the linguistic variable that the child encounters.
  - **Factor 1:** the size of selectional advantage for one variant vs. another, compared with the fixed rate of specialization.
  - **Factor 2:** the frequency, in speech, of the context for the linguistic variable in question.
  - Even if Factor 1 is small compared with rate of specialization, replacement could still occur if Factor 2 is small enough.
- The specialization stabilizes at 20000 tokens, but with 1000 tokens it never does – implies that the frequency of the variant could be a determining factor.



## Case Study: Relative Clause Extraposition

### French

- (19) mais l'heure vient que je ne parleray plus a  
but the time comes that I NEG speak-FUT more to  
vous en proverbes  
you in proverbs  
“The time approaches when I will no longer speak to  
you in parables”  
(MCVF, 1523-NEW-TESTAMENT-P, A5V.2491)

### English

- (20) none lives that more loves you  
(PCEEC, TIXALL, 53.019.369, date: 1619)

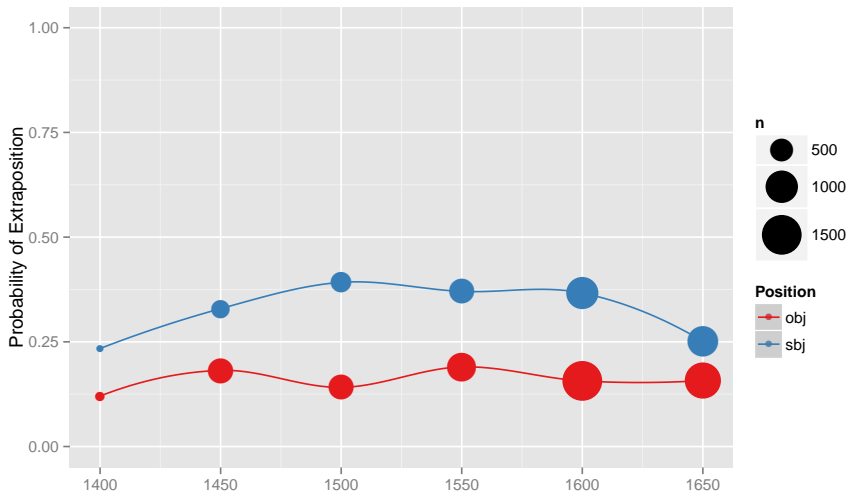
## Within Speakers, and Diachronically

- Relative clause extraposition in the Parsed Corpus of Early English Correspondence (PCEEC; Taylor et al. 2006).
- Allows us to look at reasonable samples from individual speakers (letter-writers), as well as an historical sample from 1400–1700.
- Coded for prosodic weight of the relative clause, in number of words, from 0–50.
- Also coded for extraposition from Subject vs. Object.

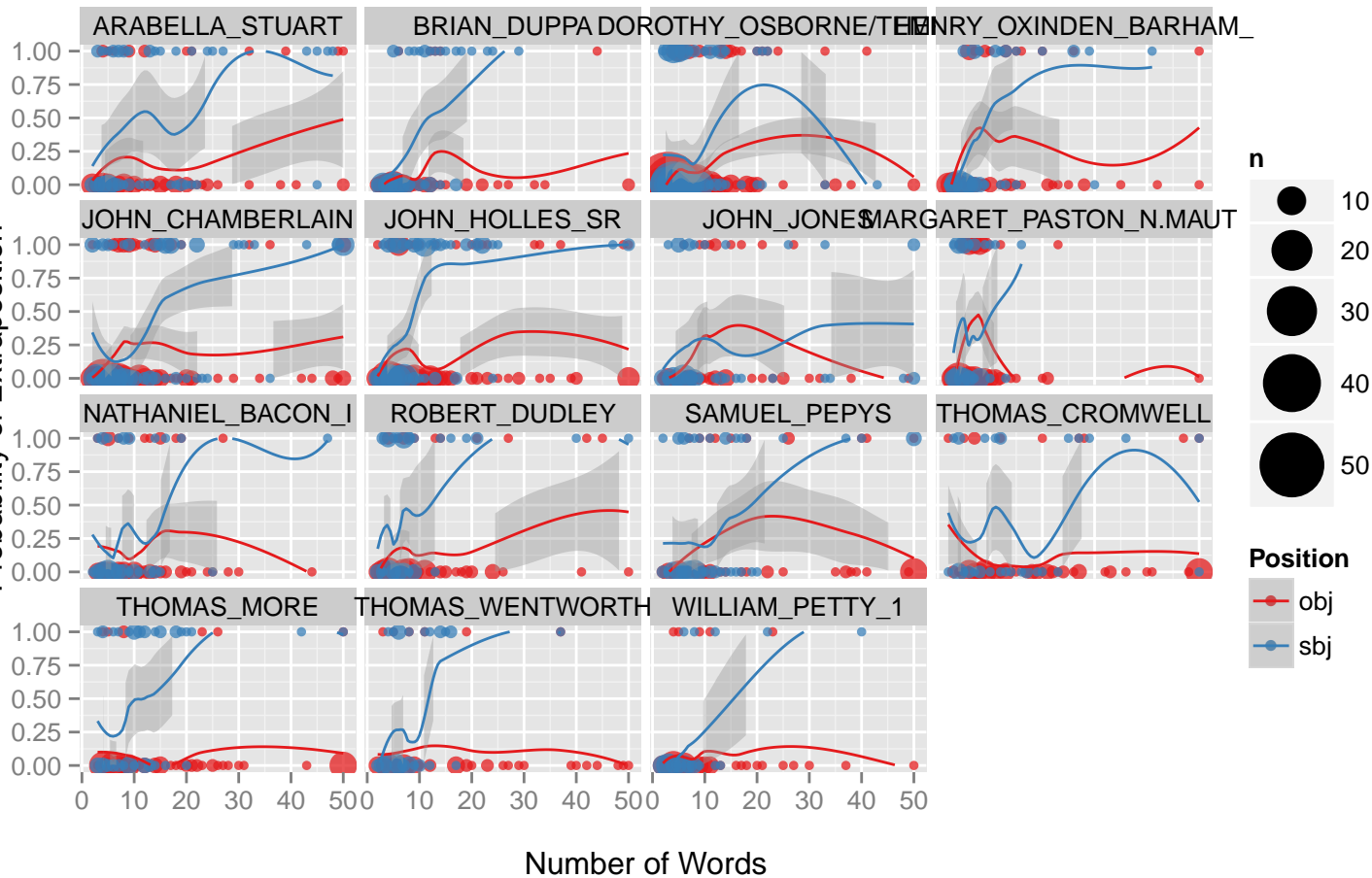
**Hypothesis:** individual speakers treat weight as a continuous variable, with extraposition specialized imperfectly along it, in roughly the way the acquisition model predicts (following on Ingason and MacKenzie, 2011).



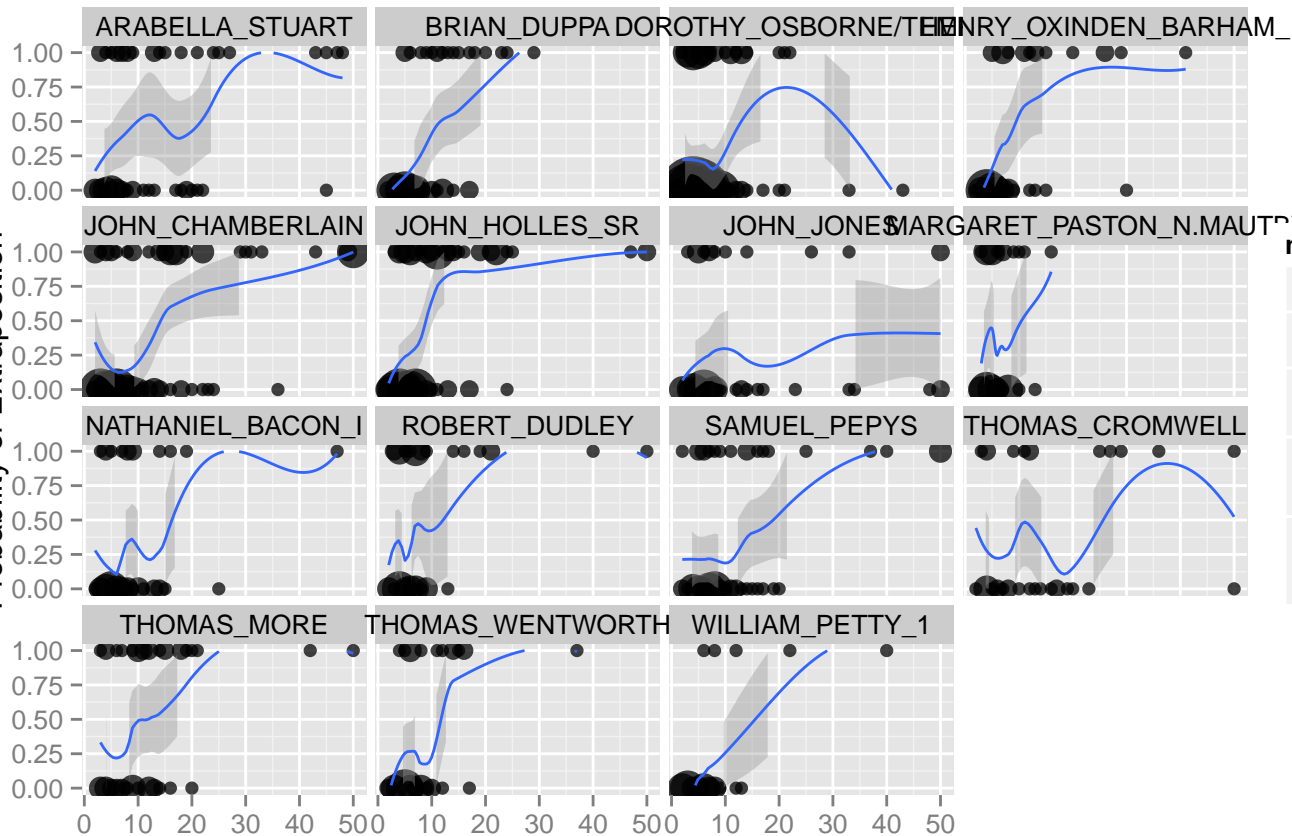
## All PCEEC, over time (N = 8073 clauses)



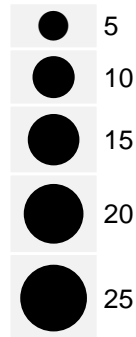
Probability of Extrapolation



Probability of Extrapolation



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Number of Words

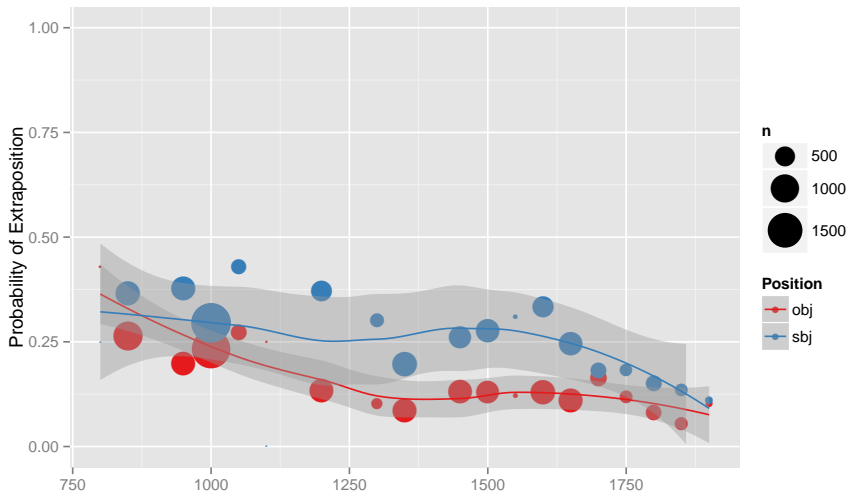
## Diachronically, Crosslinguistically

- **English:** YCOE (Taylor et al., 2003), PPCME2 (Kroch and Taylor, 2000), PPCEME (Kroch et al., 2005), PPCMBE (Kroch et al., 2010).
- **Icelandic:** IcePaHC (Wallenberg et al., 2011).
- **Old/Middle French:** MCVF Corpus (Martineau, Hirschbühler, Kroch & Charles Morin, 2010)
- **Historical Portuguese:** Tycho Brahe Corpus of Historical Portuguese (Galves and Britto, 2002/2013).

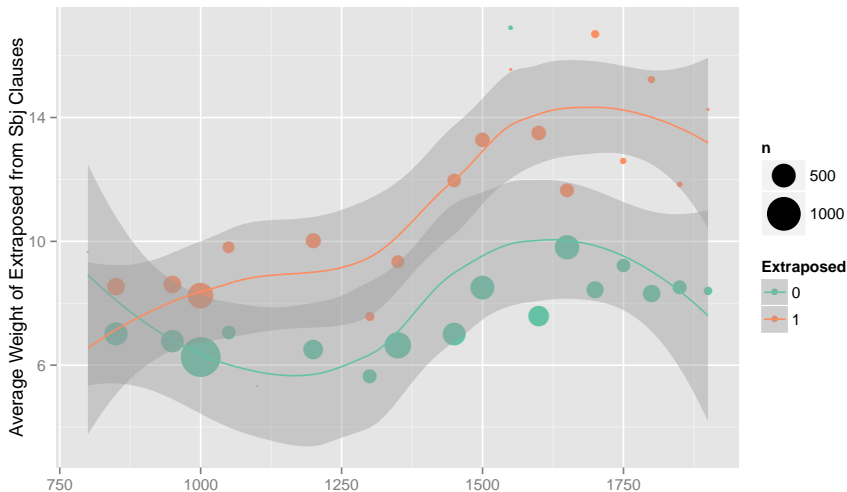
**Hypothesis 1:** the specialization for weight has stabilized, so the effect of weight will be constant over time. **(Confirmed!)**

**Hypothesis 2:** the overall rate of relative extraposition will be stable over time. **(Rejected!)**

## English, over time (N = 18530 clauses)

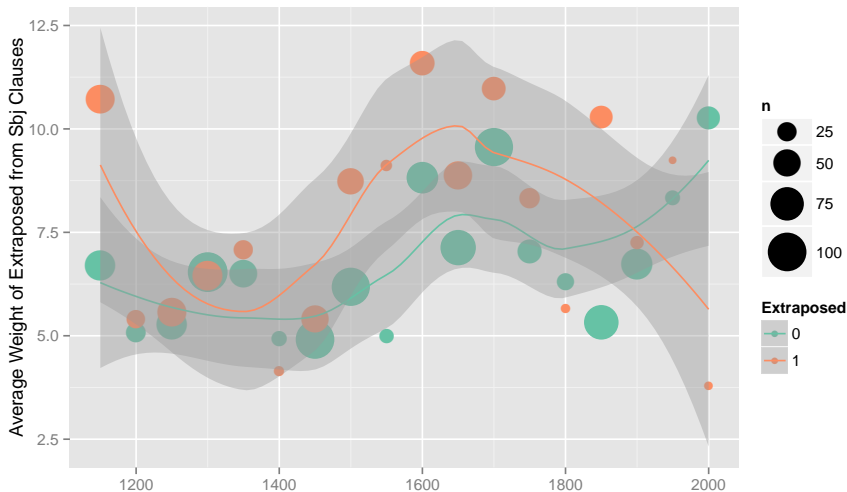


## English, average weight over time (N = 18530)



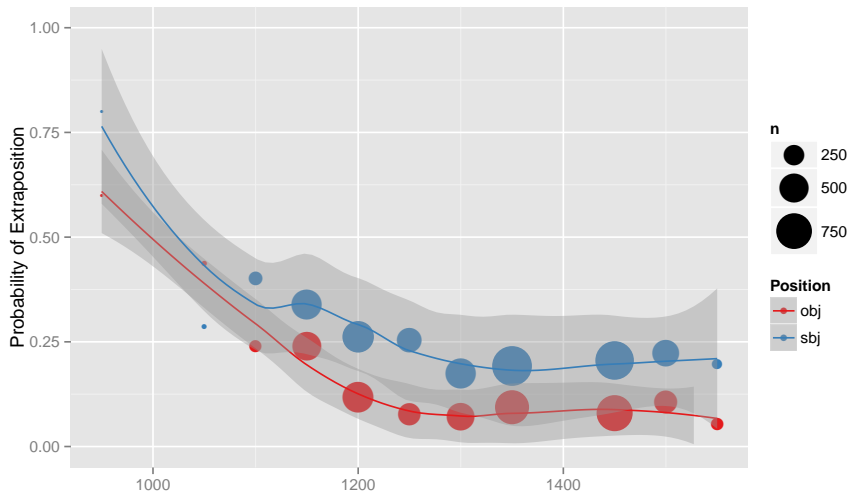


## Icelandic, average weight over time (N = 3486)

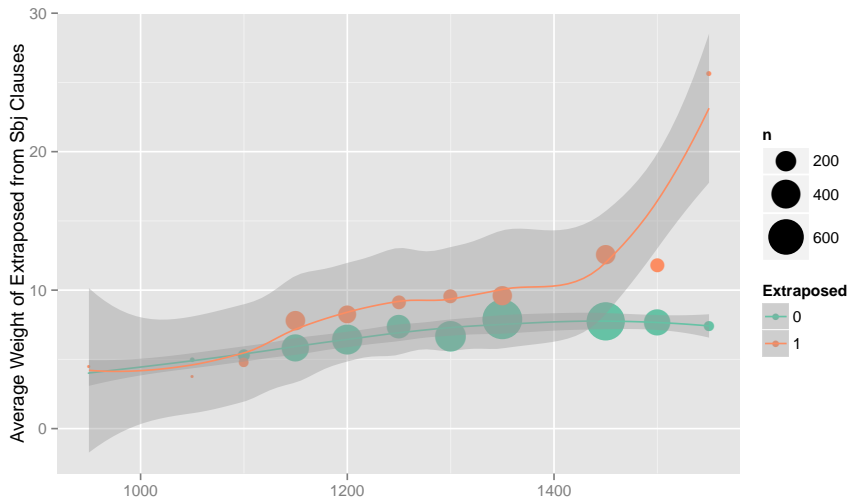




## Old/Middle French, over time (N = 8207)



## French, average weight over time (N = 8207)







## Change in Relative Clauses

- Why the change?
- Relative clause extraposition has become severely restricted in modern Portuguese (Cardoso, 2011, 2012); cause and effect?
- Perhaps a small selectional advantage has asserted itself in the usage-overlap, but can only do so slowly because the overlap is limited.
- Drift; the population (of utterances) is more likely to fixate on the majority variant over time through random death, given enough time (Moran 1958; see Nowak 2006 for an overview and references).
- **Note:** topicalization in English has slowly declined from 1750 through the 20th c. (A. Kroch, p.c.).

## Conclusions

### Conclusions

- Within syntax, only one formal account of optionality is available, the same one that accounts for language change: Competing Grammars (i.e. decision points in the selection of grammatical formatives).
- All categorical variation/optionality/change = Blocking Effect, Competing Grammars
- Blocking Effect = selection, P. of Contrast (and a domain of specialization)
- Thus, all categorical variation/optionality/change is reduced to interactions of Competing Grammars, selection, Principle of Contrast, and inherent mathematical properties of possible domains of specialization.

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## Conclusions

### Conclusions

- Competing Grammars result in replacement, specialization, or “stable variation”.
- The latter is (only) the result of mapping categorical variation onto a continuous dimension of specialization.
- An acquisition simulation shows how stable variation can emerge under a minimal assumptions about the Principle of Contrast.
- Even so, the most stable variation may not be entirely stable.
- It is possible and desirable to extend this formal account to other domains of variation, like morphology and phonology.

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## Conclusions

### Further Work

- We have a hypothesis about which factors influence specialization vs replacement, as they do not **appear** to be deterministic; find a way to test it!
- Look into other data sets for within-speaker categorical variation specialized along a continuous dimension.
- Look at the set of very slow changes in more detail (where we expected stability), to control for as many factors as possible.
- Figure out how to appropriately parameterize phonological variation.



## Acknowledgements

Thank you first to Josef Fruehwald for working out many of these ideas with me, and to Anthony Kroch for much discussion of these issues. Thanks to Anton Karl Ingason for use of his CS queries. Also Aaron Ecay, Caitlin Light, Laurel Mackenzie, Ian Roberts, Wim van der Wurff, and participants at the LSA Institute for comments on earlier versions of this work.

Simulation:

[github.com/joelcw/tyneside/blob/master/articles/sim\\_Joel.R](https://github.com/joelcw/tyneside/blob/master/articles/sim_Joel.R)

Extrapolation Study:

[github.com/joelcw/tyneside/tree/master/extrapolation](https://github.com/joelcw/tyneside/tree/master/extrapolation)

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