Phonological Rule Change: The Constant Rate Effect

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Why we're doing this...

- Diachronic Linguistic Theory
  - Rule loss/replacement occurs gradually, and at the same rate in all environments (Constant Rate Effect).
  - Occurs in the same way in different components of the grammar (syntactic and phonological).
- Synchronic Phonological Theory
  - Abstract generalizations must be more primitive grammatical objects than surface distributions to accomodate this data.
- (Implicit Methodological Point)
  - We show that historical data can be used to decide between alternative theories of synchronic grammar.

Outline

1. The Constant Rate Effect
   a. Grammar Competition in Syntactic Change
   b. Does Phonological change look this way?
2. Early New High German Loss of Devoicing
   (NOT to be confused with modern German devoicing)
   a. Quantitative analysis of the Glaser (1985) Study
   b. Quantitative analysis of our original study of the Bonn Corpus of Early New High German
3. Implications for Language Change
4. Implications for Phonological Theory

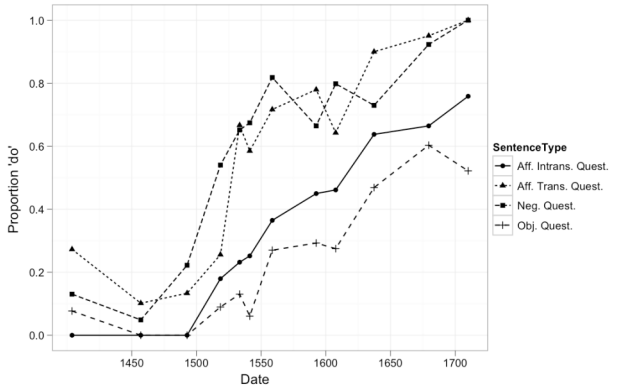
Constant Rate Effect

- CRE has been demonstrated for various syntactic changes.
  - Loss of V-to-T movement in English: Kroch (1989)
  - Change in the position of Tense in Yiddish (Santorini 1992, 1993)
  - Change in the position of Tense and OV-to-VO in Old English: Pintzuk (1991)
- The new variant replaces the old variant at the same **rate** in all contexts, even though the variant's **frequency** in each context might be different.

Constant Rate Effect: *do*-Support

- Loss of V-to-T movement
  1. He **understands** not the nature of the war.
  2. Fellows that did not **understand** them...
     (*The Diary of Samuel Pepys 1666-7*)
- Kroch (1989) demonstrated that the increasing rate of *do*-support was the same in all contexts.
- Despite contextual biases, this was a single change in a single rule.
  - A context independent, abstract rule (V-to-T) must be grammatically expressed in the synchronic grammar.

Constant Rate Effect: *do*-Support



CRE in Phonological Change

- What would it look like?
  - A process which could be described as a single generalization or abstract rule.
  - It undergoes some change (either loss or replacement) in all of the environments in which it originally applied.
  - Despite any potential contextual biases in the various environments, the rate of rule change is the same in all contexts.

Middle/Early New High German

- Data
  - Study 1 (Glaser 1985): 4 manuscripts of a single text
  - Study 2 (us): The Bonn Corpus
    - Texts from between 1325 to 1700
    - 10 dialects
- Results
  - Change progressed as the gradual loss of a single, abstract rule, which is neither segment nor word specific.
  - Constant Rate Effect in phonological change

Middle/Early New High German

- Rule: Word Final Consonant Devoicing
- Change: Originally surface true, it was lost between c.1300-1700, triggered by loss of final schwa (Mihm 2004).
  - Opacity:
    - *tage* > *tagø* 'days' (cf *tac* 'day')
    - *gebe* > *gebø* 'gift'
    - *ich gebe* > *ich gebø* 'I give' (cf. *ich gap* 'I gave')
  - Final devoicing begins to be lost (variation):
    - *tac* ~ *tag*
    - *ich gap* ~ *ich gab*

Study One

- Data Source:
  - Four manuscripts of the same text (*Augsburger Stadtbuch*), made at different times.
- Data collected by Glaser (1985):
  - Found orthographic variation reflects phonological variation and change.
  - Devoicing never applies in words that lost final schwa.
    - *tage* ~ *tagø* (**tac)* 'days'
    - *tac* ~ *tag* 'day'

Study One: Analysis

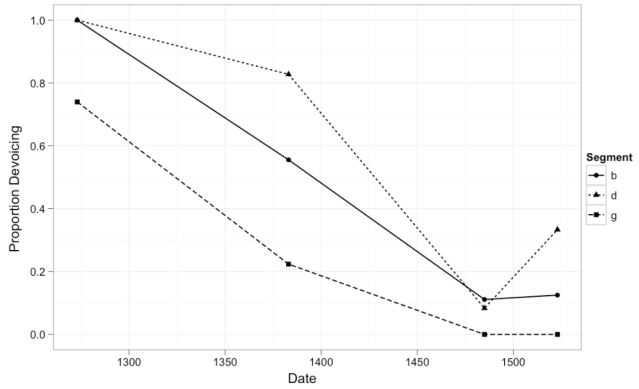
- Logistic Regression
  - p(Devoicing) ~ Segment+Date+Segment:Date
    - Segment = Contextual Biases
    - Date = Rate of Change
    - Segment:Date = Modulation of Rate by Segment
- The Segment:Date term is diagnostic of the Constant Rate Effect.
  - Significant Interaction = Significantly different rates per segment.
  - Non-Significant Interaction = Difference in rates probably due to chance.

Study 1: Results

Analysis of Deviance

	DF	Deviance	p
Segment	2	52.5	< 0.001
Date	1	261.9	< 0.001
Segment:Date	2	0.5	0.76

Study 1: Results



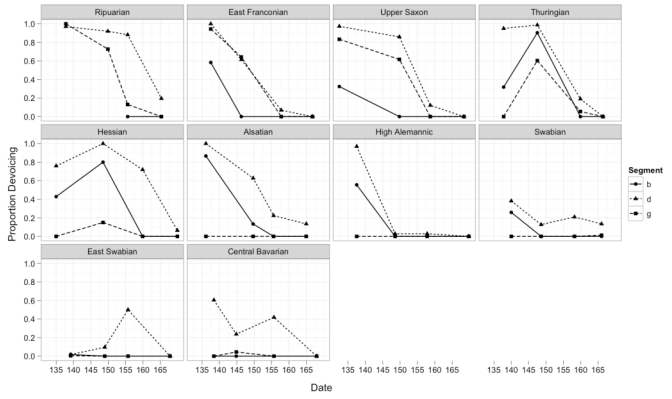
Study 1: Results

- The Constant Rate Effect is strongly supported by the data from Glaser.
- There is no detectable interaction between Segment and Date.
- Conclusion: the rate of the change for each segment is the same.

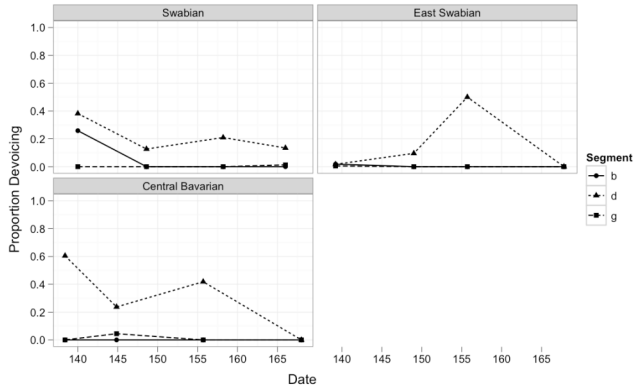
Study 2

- Data
  - Drawn from the Bonn Early New High German Corpus (*Das Bonner Frühneuhochdeutschkorpus*)
  - 40 texts total from between 1350 and 1700, drawn from 10 dialect areas
- Collection
  - Sample of 6,070 tokens with final <p,t,k> or <b,d,g> and lemmas with final /b/,/d/,/g/ (annotated in the corpus)
  - Compared final segment of the token to the final segment of its underlying form

Study 2: Results



Study 2: Southern Dialects

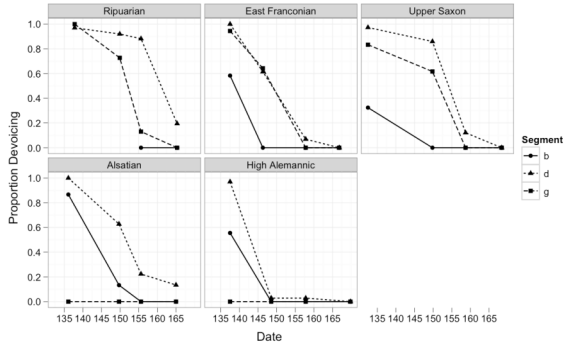


Study 2: Results

- The loss of devoicing is in progress in 7 of 10 dialects surveyed.
- Of those, the change is strictly monotonic in 5.
- Of those 5, the CRE was clear with no significant interaction between segment and date.

Study 2: Results

- Constant Rate Effect Holds

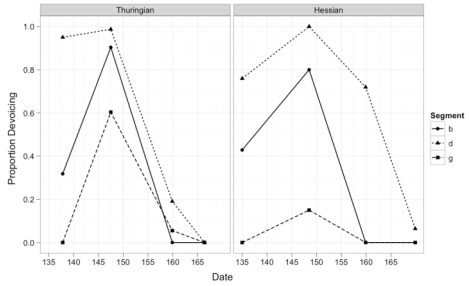


Study 2: Results

- In the remaining dialects, the shape of change was strongly non-monotonic, which means they can't be fit by the logistic.
- It is unclear why devoicing increases in these dialect regions, but their anomalous behavior does not affect the strength of the CRE in the remaining dialects.

Study 2: Results

- Even in these dialects, the segments move in lockstep with each other. This is perhaps even better confirmation of the CRE.



Study 2: Results

- We have, in a sense, 8 experiments (our 7 dialects, and Glaser's).
- Details across dialects vary.
  - Cross dialect rates vary.
  - Cross dialect segmental effects vary.
- The details within dialects don't vary.
  - The CRE holds within every dialect.
  - This invariance is predicted if phonological rules are ontologically prior to token utterances.
  - This invariance is highly improbable and unpredicted if phonological rules are secondary, analogical generalizations made at decision time. (cf Exemplar Pierrehumbert 2002, Bybee 2002)

Summary

- The loss of final devoicing in Early New High German is a clear case of the Constant Rate Effect in phonological change.
- Devoicing in Early New High German is best described as single rule which was lost.

Larger Points: Diachronic

- The Constant Rate Effect holds in both phonological and syntactic change.
- Different components of the grammar change in the **same** way: grammar or rule competition.
- One, abstract rule/grammar is gradually replaced by another in all contexts at the same time.

Larger Points: Synchronic

- There must be phonological generalizations which are not segment or word specific.
- These generalizations are the locus of change, and therefore must be more primitive grammatical objects than the surface distributions over words or segments (contra Exemplar Theory)

Larger Points: Methodological

- Diachronic data:
  - Not to be explained away with some additional stipulation.
  - Not to be forced into the synchronic grammar.
- Instead
  - Careful studies of language change restrict the space of possible synchronic theories.
  - In a dialectic way, more restrictive synchronic theories lead to more restrictive quantitative hypotheses.

Conclusions

- We described the loss of final-devoicing in German in quantitative detail, and showed that it progressed at a constant rate across all contexts.
  - This demonstrates the Constant Rate Effect in phonology.
- Consequence for diachronic theory:
  - Rule/Grammar competition and replacement is an empirical fact of both phonological and syntactic components of the grammar.
- Consequence for synchronic theory:
  - Phonological rules have a reality independent from their token applications.
- Future research plans:
  - Explore other potential contextual effects on devoicing (e.g. occurrence in consonant clusters).
  - Identify and analyze other cases of the constant rate effect in Phonological change.

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