Theories and Models of Language Change

Session 10: Priming

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Mechanisms of universal evolution:

1. *variation*: continuing abundance of different elements
2. *selection*: number/probability of copies of elements - depending on interaction between element features and environmental features
3. *replication*: reproduction/copying of elements
Priming is a well-known psycholinguistic mechanism that refers to the (usually) increased likelihood of linguistic elements to be repeated in the sense that either speakers are more likely to repeat what they’ve previously said (...) or that hearers may better parse what they’ve previously heard (...).

Annette Rosenbach (2008): Language Change as Cultural Evolution
Priming Example

- **identity priming**
  a. At what time do you close? *at six*
  b. What time do you close? *six o’clock*

- **similarity priming**
  a. The 747 was alerted by the airport’s control tower.}
  b. The 747 was landing by the airport’s control tower. } *passive*

- **unidirectional priming**
  a.i The dark widget is on front of the light widget.
  a.ii Next Wednesday’s meeting has been moved forward two days. When did the meeting take place? *Monday vs Friday*
  b.i Thursday comes before Saturday.
  b.ii Which of the two widgets is ahead? *dark vs light*

- **cross-linguistic priming (language contact)**
  a.i *il grappolo d’uva* (bunch of grapes)
  a.ii *Bündel von Trauben* vs Traubenbündel
Priming And Linguistic Replication

Questions:

1. What are the units of linguistic replication?
2. What are possible minimal steps in the process of altered replication (in terms of possible analogical extension)?

Answer(s): Whatever can be primed.
Priming and Unidirectional Language Change

Priming as a factor in language change

- connects psycholinguistic research and research on language change
- offers an explanation for non-reversible processes of grammaticalization
- solves the problem of linkage: how can performance preferences may come to be encoded in grammars?
- provides for a plausible linguistic replicating mechanism
Grammaticalization and unidirectionality

Classical example: *going to* future (Exercise 1)

- I’m going to London to visit my friend. (locative)
- I’m going to read. (locative/temporal)
- It’s going to rain. (temporal)
- It’s gonna rain.

Change in form and meaning:

- a lexical main verb (locative) becomes an auxiliary verb (temporal)
- phonetic reduction: *going to* → gonna
Grammaticalization and unidirectionality

Hypothesis of unidirectionality in grammaticalization

- agreement on the fact that the majority of observed changes are irreversible
- few have addressed the question, why there is a tendency of unidirectionality in language change
- Haspelmath (1999) argues for a user-based account of unidirectionality: the speaker’s attempt to be particularly expressive is the driving force in grammaticalization (maxim of extravagance)
- a more concrete explanation: priming
Priming...

- has been shown to operate on all linguistic levels:
  - evidence for the priming of form, on the phonological, lexical, and syntactic level
  - evidence for priming of meaning on the semantic level
- provides a plausible cognitive mechanism for both
  - faithful replication in terms of identity priming
  - non-faithful (i.e. altered) replication in terms of similarity priming
Goals of the study (Exercise 2)

What are the three disciplines the study wants to connect in a novel and original way?

- historical linguistics ✓
- sociolinguistics
- cognitive science
- evolutionary theory ✓
- psycholinguistics ✓
Case Study I: From Space to Time

Diachronic development from spatial to temporal expressions, but not the other way around.

<table>
<thead>
<tr>
<th>spatial expression</th>
<th>temporal expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>from London to Paris</td>
<td>from Monday to Friday</td>
</tr>
<tr>
<td>in England</td>
<td>in January</td>
</tr>
<tr>
<td>at the door</td>
<td>at noon</td>
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<tr>
<td>the king rode before the army</td>
<td>before the battle started</td>
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<tr>
<td>they are a mile behind us</td>
<td>they are an hour behind us</td>
</tr>
<tr>
<td>sit by the window</td>
<td>arrive by tomorrow</td>
</tr>
<tr>
<td>within the prison</td>
<td>within a year</td>
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</table>

space-time correspondences in English (Deutscher 2005)
Case Study I: From Space to Time

Priming experiment by Boroditsky (2000)

- basic idea: compare two basic conceptualizations of time
  - ego-moving metaphor: “We are coming up on Christmas.”
  - time-moving metaphor: “Christmas is coming up.”
- related to both conceptualizations, the following sentence is ambiguous: “Next Wednesday’s meeting has moved forward two days.”
  - ego-moving interpretation: to Friday
  - time-moving interpretation: to Monday
Case Study I: From Space to Time

Experiment:

1. participants get *spatial primes*:

   - ego-moving metaphor
   - space-moving metaphor

   ![Diagram of spatial priming](image)

   "The dark can is in front of me."

   "The light widget is in front of the dark widget."

2. participants hear an *ambiguous temporal sentence*:
   
   "Next Wednesday’s meeting has moved forward two days."

3. participants are asked for the interpretation:
   
   (c) meeting is on Friday
   (d) meeting is on Monday

Results:

- (a) primes (c) (73.3%), and (b) primes (d) (69.2%)
- spatial metaphor primes temporal metaphor, but not the other way around (≈ 50%)
Case Study II: Phonological Reduction

Linguistic expressions typically become shorter under language change dynamics, whereas the reverse generally does not occur.

Examples:

- *hiu dagu* (on this day) ⇒ *hiutuu* ⇒ *hiute* ⇒ *heute* (today)
- *going to* ⇒ *gonna*
- *let us* ⇒ *let’s*
Case Study II: Phonological Reduction

Priming experiment by Shields & Balota (1991)

1. participants read certain sentences in present tense, which entail a prime and a target:
   1.1 Her cat chases our cat under the table.
   1.2 Her dog chases our cat under the table.
   1.3 Her son chases our cat under the table.

Note: prime and target are i) identical, ii) semantically related, or iii) completely unrelated

2. participants were asked to repeat the sentence in past tense

3. phonetic realization of the target was acoustically analyzed with regard to duration and amplitude
Case Study II: Phonological Reduction

Results of Shields & Balota’s Experiment (Exercise 3)

- Identity priming and semantically related priming lead to a significant reduction in duration
  1. cat...cat: 329 msec
  2. dog...cat: 340 msec
  3. son...cat: 350 msec

- Only identity priming leads to a significant reduction in amplitude, whereas semantically related and totally unrelated priming both show no significant reduction
  1. cat...cat: -1.62 dB
  2. dog...cat: -0.11 dB
  3. son...cat: 0.23 dB

- Various linguistics claim a relation between phonetic reduction and expectedness
how should priming effects account for long-term diachronic change?

- priming is regarded as
  - a very short-lived phenomenon
  - occurring in specific contexts immediately and locally

- the problem of linkage: how do preferences in language use become grammaticalized?
Implicit Learning

The account of implicit learning

► has been developed within the research paradigm of syntactic priming

► is based on the empirical observation that *structural priming* may persist over various trials, indicating that priming effects do not always immediately decay

► priming ≠ priming

  ► *mere lexical repetition* is attributed to memory effects

  ► *structural priming* is attributed to learning

► has been modeled as a *connectionist* neural network

Thesis: Via implicit learning the effects of structural priming may become entrenched in speakers’ grammars over time.

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1The central connectionist principle is that mental phenomena can be described by interconnected networks of simple and often uniform units.
Experiment

- speaker economy (brevity)
- hearer economy (informativity)
- identity/similarity priming
- structural priming
Implicit Learning (Exercise 4)

“It is not difficult to see the appeal of implicit learning for theories of language change, as it provides a usage-based model for how performance changes in the lifetime of speakers may come to have an immediate effect on their grammars (see particularly Chang et al. 2006²), thereby challenging the assumption of formal models of grammar that competence change is restricted to the process of first language acquisition only.”

²Literature: Franklin Chang, Gary S. Dell and Kathryn Bock: Becoming Syntactic, Psychological Review 113(2), pages 234–272
Implicit learning is essential to understand the connection between *asymmetric priming effects* and *unidirectional language change*, but questions remain:

- how can a very local process like **phonetic reduction** (e.g. reduced duration of *cat*) be in any sense connected to a global process like **phonological reduction** (e.g. final b-deletion like in *bomb*)?

- even is the historical pathways of **forms** might be explained, how does the theory account for **meaning change** (e.g. temporal interpretation of spatial expressions)?
Implicit Learning

How can a very local process like **phonetic reduction** (e.g. reduced duration of *cat*) be in any sense connected to a global process like **phonological reduction** (e.g. final b-deletion like in *bomb*)?

Answer: by assuming a **exemplar-based representation** of lexical items:

- tokens are stored in memory as exemplars
- memorized tokens’ strength decays over time
- exemplars are stored in a similarity space
- cognitive representation (type) represents that collection of exemplars (weighted average)
- in such a model a directed bias in language production ultimately leads to a trajectory of phonological reduction (Pierrehumbert 2001, Bybee 2002)
- this approach can probably extended to various types of unidirectional change (not only phonological reduction)
Implicit Learning

How does the theory of implicit learning account for meaning change (e.g. temporal interpretation of spatial expressions)?

To answer this question two additional assumptions have to be made:

1. The stronger the activation of a concept is, the more likely this concept is to be expressed by a speaker.

2. If a concept can be expressed in more than one way, the activation level of a form is positively correlated with its likelihood to be chosen.

The two assumption lead to the prediction that semantic priming (e.g. spatial meaning primes temporal meaning) facilitates semantic change: if a concept $A$ primes a concept $B$, an expression denoting $A$ is a candidate to acquire the additional meaning $B$. 
Challenge: find linguistic analogues for the evolutionary processes of variation, selection and replication:

- the process of selection in language change is already relatively well understood (except debate of functional vs social factors)
- it is however unclear by which mechanisms linguistic elements are replicated and how variation may arise
- priming provides a natural cognitive mechanism
  - by which linguistic items are replicated in language use
  - that does not require total copying fidelity (mutation), and is therefore capable to create variation in language
Outlook

▶ under the given theory is should be possible to test any unidirectional change with respect to asymmetric priming

▶ open problems:
  ▶ not all grammaticalization pathways are well attested
  ▶ the **textual** evidence available to use will not always give us the full **picture** of the various steps involved in a change and there will be (often considerable) **gaps** (Ex. 5)

▶ priming may serve as a **complementary tool** in the reconstruction of grammaticalization **pathways** (Ex. 5)
Multifunctionality in Grammar & Semantic Maps

- grammatical morphemes (function words, affixes) have mostly multiple often related abstract meanings
- these meanings generally differ among different languages
- cross-linguistic comparison is crucial for creating a semantic map
  1. choosing the relevant functions
  2. arranging the functions on the map

![Semantic Map](image)

Fig. 1: A semantic map of typical dative functions/
The boundaries of English to
**Semantic Maps: Example Reflexives**

French reflexives: se (him/herself), me (myself), te (yourself)

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<table>
<thead>
<tr>
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<tr>
<td>(13) a.</td>
<td><em>Judas s’est tué.</em></td>
<td>‘Judas killed himself.’</td>
</tr>
<tr>
<td></td>
<td>(full reflexive)</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td><em>Bathséba s’est lavée.</em></td>
<td>‘Bathseba washed.’</td>
</tr>
<tr>
<td></td>
<td>(grooming)</td>
<td></td>
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<tr>
<td>c.</td>
<td><em>Mamoud s’est agenouillé.</em></td>
<td>‘Mamoud knelled down.’</td>
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<tr>
<td></td>
<td>(body motion)</td>
<td></td>
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<tr>
<td>d.</td>
<td><em>Elisabeth et Marie se sont rencontrées.</em></td>
<td>‘Elizabeth and Mary met.’</td>
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<td></td>
<td>(naturally reciprocal)</td>
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<tr>
<td>e.</td>
<td><em>La porte s’est ouverte.</em></td>
<td>‘The door opened.’</td>
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<td></td>
<td>(anticausative)</td>
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Russian reflexive marker: -sja/s’

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<tr>
<td>(14) a.</td>
<td><em>Batseba umyla-s’.</em></td>
<td>‘Bathseba washed.’</td>
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<tr>
<td></td>
<td>(grooming)</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td><em>Ucitel’ povernul-sja.</em></td>
<td>‘The teacher turned around.’</td>
</tr>
<tr>
<td></td>
<td>(body motion)</td>
<td></td>
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<td>c.</td>
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<td><em>Dver’ otkryla-s’.</em></td>
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<tr>
<td></td>
<td>(anticausative)</td>
<td></td>
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<tr>
<td>e.</td>
<td><em>Vopros obsuzdal-sja komissiej.</em></td>
<td>‘The question was discussed by the committee.’</td>
</tr>
<tr>
<td></td>
<td>(passive)</td>
<td></td>
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<tr>
<td>f.</td>
<td><em>Sobaka kusaet-sja.</em></td>
<td>‘The dog bites.’</td>
</tr>
<tr>
<td></td>
<td>(deobjective)</td>
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Semantic Maps: Example Reflexives

Fig. 10: The boundaries of French se and Russian -sja
Fig. 18: The boundaries of reflexive/middle grams in seven languages
Homework

- Read the article ‘The geometry of semantic meaning: Semantic maps and cross-linguistic comparison’ (Haspelmath 2000)
- solve the appropriate exercises given on ILIAS