Beyond the textual company of words: What corpus settings tell us about lexical collocability

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1. Problem statement

Lexical collocations

• Long-standing tradition in corpus linguistic research, dating back to 50ies (amongst others, Firth 1957; Granger 1998; Hoey 2005; Sinclair 1991; Stubbs 1995, 2001; Wulff 2008, 2013; see Gries 2013 for critical methodological account)

• Use in its own right to identify lexical preference patterns, in various linguistic disciplines

• Use as explanatory variable / determinant to constrain other constructions
1. Problem statement

Corpus (1/2)

• Representative sample of **language use** of a given linguistic community in a/given **setting(s)**

• Corpus-based approaches: focus on linguistic patterns and structures in language use

• **Settings of language use:**
  • Rarely explicitly addressed in mainstream (corpus) linguistics
  • Object of peripheral linguistic disciplines (sociolinguistics, dialectology, stylistics, etc.)
1. Problem statement

Corpus (2/2)

- Settings of language use: reflection of
  - Variety of usage settings
  - Heterogeneity linguistic community
    (Heylen et al. 2008)

- Research lexical collocation: impact of language settings hardly explicitly addressed
  (exception: Stefanowitsch & Gries 2008)
2. Goal

Demonstrate that lexical collocations are subject to constraints from usage settings

1. as measures in their own right to identify lexical preference patterns

2. as explanatory variables

Procedure: case study
3. Case study

Adjectival inflection in Dutch definite NPs with singular neuter \( N_{head} \)

- Two alternating morphosyntactic realizations:
  - [inflected] -e \( \text{het vriendelijk-e kind} \) ('the friendly-INFL child')
  - [uninflected] -Ø \( \text{het vriendelijk-Ø kind} \) ('the friendly-ZERO child')

- Alternation governed by intricate network of explanatory variables (Haeseryn et al. 1997; Tummers 2005)
  - Structural: lexical collocation strength AN, Det\( _{\text{POS}} \), \( N_{\text{dim}} \), \( N_{\text{inf}} \), ...
  - Usage settings: national variety, register
  - Discourse processing: prosodic pattern AN

- Present talk: focus on
  - Lexical collocation strength AN
  - Register
  - National variety
  - Speaker
3. Case study

Corpus

- Corpus of spoken Dutch (*Corpus Gesproken Nederlands*; Oostdijk 2000)
  - 10M reference corpus of spoken Dutch
  - National variety: Belgian Dutch vs. Netherlandic Dutch
  - Register: different degrees of speaker control on situation

- **Corpus distribution** adjectival alternatives

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflected</td>
<td>3,810</td>
<td>0.7675</td>
</tr>
<tr>
<td>Uninflected</td>
<td>1,154</td>
<td>0.2325</td>
</tr>
<tr>
<td>Total</td>
<td>4,964</td>
<td>1.000</td>
</tr>
</tbody>
</table>
3. Methodology

Operationalization of variables (1/5)

- **lex.col:**
  - Lexical collocation strength between A and N (in NP)
  - Pointwise mutual information index (Church & Hanks 1990)
    - Computed based on lemmas in *Leuven News Corpus* (1.3 billion words; Ruette 2012) and *Twente News Corpus* (560 million words; Ordelman et al. 2007) for AN pairs
    - Transposed to dataset

- **nat.var:** Netherlandic vs. Belgian Dutch

- **register:**
  - high.form > mod.form > mod.inf > high.inf
  - Based on 3 binary stylistic dimensions in CGN
    - preparation: prepared vs. non-prepared
    - audience: public vs. private
    - interaction: monologue vs. dia- or multilogue
3. Methodology

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Operationalization of variables (3/5)

• **speaker:**
  • Assumption of independence of observations: often violated in corpora
  • Observations are ① grouped under speakers, ② who will (probably) be different in replication studies

• **Problems**
  • ① Grouping
    • Speakers’ idiosyncratic tendencies
    • Size of speaker’s contribution
  • ② Generalizability
3. Methodology

Operationalization of variables (4/5)

- **speaker**: overview statistics

<table>
<thead>
<tr>
<th></th>
<th>Speakers</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single contributor</td>
<td>253 (0.23)</td>
<td>253 (0.05)</td>
</tr>
<tr>
<td>Multiple contributor</td>
<td>848 (0.77)</td>
<td>4,711 (0.95)</td>
</tr>
<tr>
<td>Total</td>
<td>1,101 (1.00)</td>
<td>4,964 (1.00)</td>
</tr>
</tbody>
</table>
3. Methodology

Operationalization of variables (5/5)
4. Methodology

Modeling: mixed-effects models (1/2)

- **Fixed effect terms**: exhaust all levels of parameter; identical values in replication study
  - lex.col
  - nat.var
  - register

- **Random effect term**: sampled from larger population; different values in replication study
  - speaker

(Baayen 2008; Bates & Pinheiro 2000; Gelman & Hill 2007)
4. Methodology

Modeling: mixed-effects models (2/2)

• **Modeling lexical collocation strength:**
  
  \[
  \text{lex.col} \sim \text{register} \times \text{nat.var} \\
  + (1 \mid \text{speaker})
  \]

  [fixed] [random]

• **Modeling adjectival inflection:**

  \[
  \ln\left(\frac{A_.\text{uninf}}{A_.\text{nfl}}\right) \sim \text{lex.col} \times \text{register} \times \text{nat.var} \\
  + (1 + \text{lex.col} \mid \text{speaker})
  \]

  [fixed] [random]

• **Analyses:** R
  
  • `lme4` library (Bates 2005; Bates et al. 2013)
  • `arm` library (Gelman & Hill 2007)
  • `effects` library (Fox 2008)
  • `car` library (Fox & Weisberg 2011)
5. Results

Collocation strength AN pair

• Model summary: sequential anova (Fox 2008)

Analysis of Deviance Table (Type II Wald chisquare tests)

Response: lex.col

<table>
<thead>
<tr>
<th></th>
<th>Chisq</th>
<th>Df</th>
<th>Pr(&gt;Chisq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>nat.var</td>
<td>28.217</td>
<td>1</td>
<td>1.085e-07 ***</td>
</tr>
<tr>
<td>register</td>
<td>37.080</td>
<td>3</td>
<td>4.426e-08 ***</td>
</tr>
<tr>
<td>nat.var:register</td>
<td>12.484</td>
<td>3</td>
<td>0.005895 **</td>
</tr>
</tbody>
</table>

• Overview fixed effects and random effect (speaker)
5. Results

Main effect national variety

Lexical collocation strength (MI)

Belgian Dutch

National variety

Netherlandic Dutch
5. Results

![Main effect register graph]

- **Lexical collocation strength (MI)**
- **Register**
  - Highly formal
  - Moderately formal
  - Moderately informal
  - Highly informal
5. Results

Interaction
national variety x register

Lexical collocation strength (MI)

Belgian Dutch
Netherlandic Dutch

highly formal
moderately formal
moderately informal
highly informal
5. Results

Collocation strength AN pair

• Random effect (speaker):
  • Random intercept model: separate intercept fitted for each speaker
  • ICC = 0.12
5. Results

Random slopes in glmer modeling MI
5. Results

Adjectival inflectional alternation

• Model summary: sequential anova (Fox 2008)

Analysis of Deviance Table (Type II Wald chisquare tests)

Response: infl

<table>
<thead>
<tr>
<th></th>
<th>Chisq</th>
<th>Df</th>
<th>Pr(&gt;Chisq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>nat.var</td>
<td>40.9291</td>
<td>1</td>
<td>1.579e-10 ***</td>
</tr>
<tr>
<td>register</td>
<td>116.8310</td>
<td>3</td>
<td>&lt; 2.2e-16 ***</td>
</tr>
<tr>
<td>lex.col</td>
<td>224.4876</td>
<td>1</td>
<td>&lt; 2.2e-16 ***</td>
</tr>
<tr>
<td>nat.var:register</td>
<td>22.0001</td>
<td>3</td>
<td>6.523e-05 ***</td>
</tr>
<tr>
<td>nat.var:lec.col</td>
<td>0.6002</td>
<td>1</td>
<td>0.43851</td>
</tr>
<tr>
<td>register:lex.col</td>
<td>21.9796</td>
<td>3</td>
<td>6.587e-05 ***</td>
</tr>
<tr>
<td>nat.var:register:lex.col</td>
<td>7.2918</td>
<td>3</td>
<td>0.06316 .</td>
</tr>
</tbody>
</table>

• Overview fixed and random effects
5. Results

Main effect national variety

Probability uninflected adjective

National variety

Belgian Dutch  
Netherlandic Dutch
5. Results

Main effect register

<table>
<thead>
<tr>
<th>Register</th>
<th>Probability uninflected adjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>highly formal</td>
<td>0.0</td>
</tr>
<tr>
<td>moderately formal</td>
<td>0.2</td>
</tr>
<tr>
<td>moderately informal</td>
<td>0.4</td>
</tr>
<tr>
<td>highly informal</td>
<td>0.6</td>
</tr>
</tbody>
</table>
5. Results
5. Results

Main effect lexical collocation strength

[Graph showing the relationship between lexical collocation strength (MI) and probability uninflected adjective]
5. Results
5. Results

Highly formal register: Interaction
lexical collocation strength x national variety

Moderately formal register: Interaction
lexical collocation strength x national variety

Moderately informal register: Interaction
lexical collocation strength x national variety

Highly informal register: Interaction
lexical collocation strength x national variety
5. Results

Belgian Dutch: Interaction
Register x lexical collocation strength

Netherlandic Dutch: Interaction
Register x lexical collocation strength
5. Results

Adjectival inflectional alternation

• Random effects:
  • Random intercept and random slope for \textit{lex.col}
  • $\text{ICC}_\text{intercept} = 0.59$
  • $\text{ICC}_\text{slope} = 0.03$
  • $r(\text{intercept}, \text{slope}) = -0.64$
5. Results

Correlation between random effects
\( r = -0.64 \)
6. Discussion

Results (1/2)

• Lexical collocation strength
  • No constant metric (as it is the case for word frequency; amongst others, Archer 2009; Baayen 2001; Brysbaert & New 2009)
  • Constrained by settings language use

• As **lexical measure**: constrained by
  • nat.var
  • register
  • nat.var x register
  • speaker’s idiosyncratic properties (cannot be reduced to nat.var)

• As **determinant of adjectival inflection**
6. Discussion

Results (2/2)

• As determinant of adjectival inflection:
  
  • Main **deflecting effect**, mainly identifying
    • lexicalizing AN: categorizing adjectives, relational adjectives
    • lexicalized AN: institutional terms, proper names
  
  • Deflecting effect on adjectival inflection **constrained** by
    • register
    • nat.var x register
    • speaker’s idiolectic properties, where lex.col mainly compensates speakers with a low disposition toward uninflected adjective
6. Discussion

Implications

• Usage settings cannot be discarded from corpus linguistic studies, since they affect basic corpus metrics

  • **Minimalist conception**: identification of usage settings to filter out potential constraints and biases induced by usage settings

  • **Maximalist conception**: full-fledged integration of settings of language use in corpus linguistic research

  (Geeraerts 2005)
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