Literal vs. figurative language use affects the frequency of syntactic patterns

Elise Stickles & Ellen Dodge
University of California, Berkeley & International Computer Science Institute
elstickles@berkeley.edu & edodge@icsi.berkeley.edu

Linguistic Society of America
Washington, D.C.
January 7, 2016
Background: Use frequency in corpora

- Frequency of syntactic patterns varies between corpora
  - Models of sentence processing ease rely on relative usage frequencies (Brysbaert & Mitchell, 2006; Ellis, 2002)
  - Models using corpora must take into account variations in syntactic patterns between corpora (Roland et al., 2007)
Background: Use frequency in corpora

- Lexical usage varies in metaphoric and non-metaphoric contexts
  - When considering frequency at the word level, there are certain word collocations that are much more likely to either be used metaphorically or non-metaphorically (Deignan, 2005)
  - Examples:
    - *pay a sale price* (non-metaphoric)
    - *pay a heavy price* (metaphoric and frequent)
    - *pay a weighty price* (metaphoric and infrequent)
Question

• Does syntactic usage vary in figurative and non-figurative contexts?
Goals

• Develop corpus annotated for frame semantic and metaphoric information
• Evaluate relative frequencies of syntactic constructions in metaphoric and non-metaphoric usages
Road map

• Background
  • Previous metaphor research in corpus linguistics
  • MetaNet NLP metaphor identification system

• Building the corpus
  • Target domain
  • Human judgments

• Results

• Implications
Background: Defining “figurative”

• Focus on linguistic realizations of conceptual metaphor (Lakoff & Johnson, 1980)
  • Abstract concept (‘target domain’) described in terms of concrete concept (‘source domain’)

  a nation afflicted by poverty
  poverty plagues the nation
  search for a poverty cure

POVERTY IS A DISEASE;
ADDRESSING POVERTY IS CURING A DISEASE
SOCIAL PROBLEMS ARE PHYSICAL PROBLEMS
Background: Corpus approaches

- Corpus linguistic approaches to metaphor
  - Hand annotation (Pragglejaz Group, 2007)
  - Corpus searches (Stefanovich & Gries, 2006)
  - Search for target domain terms (*poverty, homelessness, impoverished...*)
  - Search for source domain terms (*cure, treat, ailment, disease, cancer...*)
  - Search for target and source domain terms (*cure homelessness, plagued by poverty...*)
Background: MetaNet System

- MetaNet metaphor identification system (Dodge, Hong, & Stickles 2015)
- 3 major components
  - Repository of frames and metaphors in an ontological network
  - Constructional/syntactic patterns
  - Metaphoricity scoring system
- Output
  - Corpus annotated for frame semantic and metaphoric information, automatically rated for metaphoricity
  - Expressions rated by analysts for metaphoricity
MetaNet System Repository

- Conceptual metaphors are represented as mappings from Source frames to Target frames (Fillmore, 1976; Ruppenhofer et al., 2010)
- Network of semantic frames and metaphors:

  Social Problems Are Physical Afflictions
  
  Social Problem
  Crime
  Poverty
  Physical Affliction
  Disease
  Poverty Is A Disease
Metaphor extraction process

1. Term search
2. Constructional pattern matching
3. Metaphor likelihood estimation
4. Corpus of annotated expressions

Filter by terms in the corpus:

- English Gigaword corpus (Graff & Cieri 2003)
- Target term(s) for a given semantic domain, e.g. poverty, impoverishment, destitute, ...
Metaphor extraction process

1. Term search
2. Constructional pattern matching
3. Metaphor likelihood estimation
4. Corpus of annotated expressions

- Conceptual metaphors are typically expressed in particular syntactic patterns
  - Target and source lexemes reliably occupy certain grammatical slots (Croft 2002; Sullivan 2013)
  - Make use of syntactic patterns to identify potentially metaphorical language
Potentially metaphoric syntactic patterns

<table>
<thead>
<tr>
<th>Syntactic pattern</th>
<th>Metaphoric examples</th>
<th>Literal examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-noun S-noun</td>
<td><em>poverty trap</em></td>
<td><em>poverty problem</em></td>
</tr>
<tr>
<td>S-noun prep T-noun</td>
<td><em>path to poverty</em></td>
<td><em>question of poverty</em></td>
</tr>
<tr>
<td>S-noun of T-noun</td>
<td><em>trap of poverty</em></td>
<td><em>issues of poverty</em></td>
</tr>
<tr>
<td>T-noun poss S-noun</td>
<td><em>poverty's undertow</em></td>
<td><em>poverty's effect</em></td>
</tr>
<tr>
<td>S-adj T-noun</td>
<td><em>burdensome poverty</em></td>
<td><em>worrisome poverty</em></td>
</tr>
<tr>
<td>T-noun is S-noun/adj</td>
<td><em>poverty is a disease</em></td>
<td><em>poverty is problematic</em></td>
</tr>
<tr>
<td>S-verb prep T-noun</td>
<td><em>slide into poverty</em></td>
<td><em>blamed for poverty</em></td>
</tr>
<tr>
<td>S-verb T-dobj</td>
<td><em>escape poverty</em></td>
<td><em>address poverty</em></td>
</tr>
<tr>
<td>T-subj S-verb</td>
<td><em>poverty infected</em></td>
<td><em>poverty increased</em></td>
</tr>
<tr>
<td>S-verb by T-noun</td>
<td><em>attacked by poverty</em></td>
<td><em>bothered by poverty</em></td>
</tr>
</tbody>
</table>
Conceptual metaphors are typically expressed in particular syntactic patterns

- Target and source lexemes reliably occupy certain grammatical slots (Croft 2002; Sullivan 2013)
- Make use of syntactic patterns to identify potentially metaphoric language
- Identify instances of potential source + target lexemes occurring in potentially metaphoric patterns
Metaphor extraction process

1. Term search
2. Constructional pattern matching
3. Metaphor likelihood estimation
4. Corpus of annotated expressions

- Assess metaphoricity of candidate expressions
  - Automatically evaluated using frame semantic annotations and networked repository
  - Scored from .1 (non metaphoric) to .9 (highly metaphoric)
Metaphor extraction process

1. Term search
2. Constructional pattern matching
3. Metaphor likelihood estimation
4. Linguistic metaphors

Assess metaphoricity of candidate expressions:

- Candidate source and target terms are associated with the frames they evoke within repository
- Repository is searched to determine the path(s) that connect these two frames
- Expressions are scored, based on the path
Metaphoric pattern: *cure poverty*

**SOCIAL PROBLEMS ARE PHYSICAL AFFLICTIONS**

- Social Problem
  - Poverty

- Physical Affliction
  - Disease
    - Cancer
    - Polio

- Treating a Physical Affliction
  - cure.v
Building the corpus: Metaphor extraction

1. Term search
2. Constructional pattern matching
3. Metaphor likelihood estimation
4. Corpus of annotated expressions

• Searched for potentially metaphoric expressions with the target lexeme *poverty*
• Retained only expressions rated highly metaphoric or highly non-metaphoric
Building the corpus: Metaphoricity rating

• Metaphoricity rating task
  • Selected 15 most frequent lexemes in each category
  • Collected attested examples from corpus
  • 3 independent metaphor analysts evaluated on 7-point Likert scale
Building the corpus: Metaphoricity rating

- Metaphoricity rating task: Metaphoric examples

1. **130 million people live in grinding poverty**
   - Key word: grinding
   - Rating: 5

2. **Colombia’s endemic poverty made the disaster even worse**
   - Key word: endemic
   - Rating: 4
Building the corpus: Metaphoricity rating

• Metaphoricity rating task: Non-metaphoric examples

**Let's be the generation that ends poverty in America**

key word: ends

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Definitely not metaphoric  ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ Definitely metaphoric

**The reason behind child labor is the increase in poverty in the country**

key word: increase

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Definitely not metaphoric  ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ Definitely metaphoric
Building the corpus: Results

• Metaphoricity rating task
  • Eliminated one lexeme ‘cause’ due to inconsistent ratings
  • Re-categorized one lexeme ‘deep’ as metaphoric

• Final corpus size
  • Highly metaphoric: 50,413 expressions
  • Unlikely to be metaphoric: 30,308 expressions
Building the corpus: Examples

Noun-Noun
• Metaphoric: poverty trap
  About 152 million young people -- 28 percent of the world's youth working population -- work but never earn enough to break out of the poverty trap.

• Non-metaphoric: poverty project
  The prosecution says Boesak deliberately raised money from Coca-Cola saying it was for a poverty project, when he had every intention of using the money to invest in a hotel.

Verb-Prep-Noun
• Metaphoric: mired in poverty
  At the same time, though, only one in 10 university graduates have found work, creating a daunting challenge for the country, which overall remains mired in poverty despite the economic successes.

• Non-metaphoric: blame for poverty
  He is the one to blame for poverty, crime and abuses of human rights and he should go," Berisha declared.
Results

Relative frequency of syntactic patterns

Nominal

Other

Verbal

Metaphoric
Non-metaphoric
All comparisons significant
Implications: Processing models

• Sentence processing models relying on corpora for use frequencies can be affected by choice of corpora
  • Previously: variation in syntactic patterns, variation in lexical usage
  • We further show that metaphoric constructions exhibit similar tendencies
• Models of sentence processing that utilize relative frequency measures should take into account the relative frequency of metaphoricity in a corpus
Implications: Metaphor analysis

• Metaphor analysis should include syntactic as well as semantic information

• Future investigations
  • Other lexemes, semantic domains, corpora/genres
  • Semantics of constructions (Stickles, Dodge, & Hong 2014)
  • Generalized usage differences in metaphoric and non-metaphoric contexts vs. differences in specific lexemes or metaphors
Selected References

• Ellis, N. C. (2002). Frequency effects in language processing. Studies in second language acquisition, 24(02), 143-188.
Acknowledgements

• The MetaNet Analysis and Repository teams: George Lakoff, Eve Sweetser, Oana David, Karie Moorman, Luca Gilardi, Jisup Hong

• Supported by the Intelligence Advanced Research Projects Activity (IARPA) via Department of Defense US Army Research Laboratory contract number W911NF-12-C-0022. The U.S. Government is authorized to reproduce and distribute reprints for Governmental purposes notwithstanding any copyright annotation thereon. Disclaimer: The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of IARPA, DoD/ARL, or the U.S. Government.
Thank you!

- https://metanet.icsi.berkeley.edu/metanet/