Semantic maps of causatives: Data types and methods in contrast

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Introduction

• The temptation to capture such an elusive thing as meaning by representing it as a material object is irresistible.
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• This explains, at least partly, the success of semantic maps.
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• This explains, at least partly, the success of semantic maps.

• But how do they help us to learn something new about language?

• This talk compares some popular and less well known statistical semantic maps based on different data types.
A typology of semantic maps

• What kind of data are used?

• Grammars or dictionaries

• Parallel corpora

• What kind of objects are shown?

• Semantic functions (senses, meanings, etc.)

• Semantic situations (exemplars, tokens)

• Linguistic forms

• How are the relationships between the objects represented?

• As links in a network

• As distances (Multidimensional Scaling or Correspondence Analysis)
A typology of semantic maps

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Causative constructions

• Formal variation

• Semantic variation
Causative constructions

- Formal variation
- Semantic variation
Formal variation

• Lexical, e.g. *kill, break*

• Morphological, e.g. Turkish *öldür*- "kill" from *öl-"die"

• Syntactic, e.g. *cause X to die, make X disappear*
Causative constructions

• Formal variation

• Semantic variation
Control of the Causee

• Does the Causee have control over the caused event?

• Yes: The teacher had the students read *War and Peace*.

• No: The sniper killed the terrorist.
Control of the Causee

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Factitive or permissive

• Factitive (making):

   That which does not kill us, makes us stronger.
Factitive or permissive

• Factitive (making):
  That which does not kill us, makes us stronger.

• Permissive (letting):
  Let my people go!
Direct or indirect causation

• Direct:

  A Swedish football player *broke* Rudy’s nose.
Direct or indirect causation

• Direct:

  A Swedish football player broke Rudy’s nose.

• Indirect:

  The politician had a rival poisoned with Novichok.
Implicative or not

• Are we sure that the caused event happened?

  • Implicative:

    The secret service killed the Kremlin critic (*but he was alive).

  • Non-implicative:

    She asked him to leave (but he might have stayed).
Some more types

• Non-intentional:

  Oops, I’ve broken your Ming vase!

• Forceful:

  You can’t force anyone to love you.

• Assistive:

  O God, help me to be pure, but not now! (St. Augustine)

• Involved/comitive:

  Load up your guns and bring your friends! (Nirvana)
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Database of causatives *TypoCaus*

- Levshina 2013 –
- Over 130 languages analyzed
- R Shiny User Interface
- Here: data from 50 families from all over the world
Database of causative constructions in languages of the world

Enter the name of a language:
Basque

5 causative construction(s) found!

Construction 1: Lexical

Form: Inchoative/causative alternation
Meaning: NA
Example:
hil "die/kill", sartu "go in, put in", atara "go out, take out", zabaklu 'open', jantzi 'dress'; galdu 'get lost, lose'

Construction 2: Morphological

Form: Forms with infix -ra-
Meaning: NA
Example:
erakutsi "show, make see" < ikusi "see", irakatsi 'teach, make learn' < ikasi 'learn'; eragin 'cause to make, affect' from egin 'make'; erabili 'use', from ibili 'walk'; erantzui 'undress' from jantzi 'dress'

Construction 3: Morphological/Syntactic

Form: Verb/suffix (written separately) (e)raz- added to the participle (Western dialects) or the verbal root (Eastern dialects)
Meaning: More direct causation than eus_01 and eus_02, less direct causation than eus_04
Example:
Berek etxutian nihor hil anatzeko bidererik. They not.AUX anyone die CAUSE.NOM REL power.PRTT
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Networks: Previous work

http://clics.lingpy.org/
## Networks: co-expression data

<table>
<thead>
<tr>
<th>SENSE 1</th>
<th>SENSE 2</th>
<th>Frequency of co-expression by one form</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOVE</td>
<td>PEACE</td>
<td>3</td>
</tr>
<tr>
<td>LOVE</td>
<td>APPLE PIE</td>
<td>5</td>
</tr>
<tr>
<td>APPLE PIE</td>
<td>PEACE</td>
<td>1</td>
</tr>
</tbody>
</table>
Networks: visualization
Networks of causative senses
Networks of functions: evaluation

Advantages
• One can investigate the relationships between individual semantic functions
• No loss of information
## Networks of functions: evaluation

### Advantages
- One can investigate the relationships between individual semantic functions
- No loss of information

### Disadvantages
- Very confusing when the number of nodes is large
- No common dimensions of variation
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Previous work

- Croft & Poole 2008
**Multidimensional Scaling: computing the distances**

<table>
<thead>
<tr>
<th>Sense</th>
<th>Form 1</th>
<th>Form 2</th>
<th>Form 3</th>
<th>Form 4</th>
<th>Form 5</th>
<th>Form 6</th>
<th>Form 7</th>
<th>Form 8</th>
<th>Form 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOVE</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>APPLE PIE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>PEACE</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Distance between LOVE and APPLE PIE: $1 - (5/9) = 0.44$
Distance between LOVE and PEACE: $1 - (3/9) = 0.67$
Distance between APPLE PIE and PEACE: $1 - (1/9) = 0.89$
Multidimensional Scaling: visualization of distances
MDS of causative senses
Type-based MDS maps: evaluation

Advantages
• Help to identify dimensions of semantic variation

Disadvantages
• More difficult to evaluate pairwise relationships
• Loss of information
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The main idea behind CA

- CA is based on comparison of row profiles and column profiles, e.g.

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx1</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Cx2</td>
<td>10</td>
<td>70</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100</td>
<td>70</td>
<td>200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Cx2</td>
<td>0.1</td>
<td>0.7</td>
<td>0.2</td>
<td>1</td>
</tr>
</tbody>
</table>

Row profiles

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx1</td>
<td>0.67</td>
<td>0.3</td>
<td>0.71</td>
<td>1</td>
</tr>
<tr>
<td>Cx2</td>
<td>0.33</td>
<td>0.7</td>
<td>0.29</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
The main idea behind CA

• If two row or column profiles are similar, their labels will be closely located in a semantic map.
• If two row or column profiles are dissimilar, their labels will be located far from each other.
CA of causative formal types and senses

Database of causative constructions in languages of the world
CA maps: evaluation

Advantages

• Easy to investigate form-meaning mapping
• One can explore the semantic dimensions
CA maps: evaluation

Advantages
• Easy to investigate form-meaning mapping
• One can explore the semantic dimensions

Disadvantages
• One cannot interpret the distances between forms and functions directly.
• Loss of information
• The distances are non-Euclidean (chi-squared)
• Outliers are dangerous!
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# Languages

<table>
<thead>
<tr>
<th>Language</th>
<th>Genus</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>Chinese</td>
<td>Sino-Tibetan</td>
</tr>
<tr>
<td>Finnish</td>
<td>Finnic</td>
<td>Uralic</td>
</tr>
<tr>
<td>French</td>
<td>Romance</td>
<td>Indo-European</td>
</tr>
<tr>
<td>Hebrew</td>
<td>Semitic</td>
<td>Afro-Asiatic</td>
</tr>
<tr>
<td>Indonesian</td>
<td>Malayo-Sumbawan</td>
<td>Austronesian</td>
</tr>
<tr>
<td>Japanese</td>
<td>Japanese</td>
<td>Japanese</td>
</tr>
<tr>
<td>Russian</td>
<td>Slavic</td>
<td>Indo-European</td>
</tr>
<tr>
<td>Thai</td>
<td>Kam-Tai</td>
<td>Tai-Kadai</td>
</tr>
<tr>
<td>Turkish</td>
<td>Turkic</td>
<td>Altaic</td>
</tr>
<tr>
<td>Vietnamese</td>
<td>Viet-Muong</td>
<td>Austro-Asiatic</td>
</tr>
</tbody>
</table>
Subtitles used in the case studies

Films

TED talks

- Ken Robinson: *Do schools kill creativity?*
- Elizabeth Gilbert: *Your elusive creative genius*
- Amy Cuddy: *Your body language shapes who you are*
- Leslie Morgan Steiner: *Why domestic violence victims don’t leave*
- Dan Gilbert: *The psychology of your future self*
- Simon Sinek: *Why good leaders make you feel safe*
Data set

• 344 causative situations found in the English segment of the ParTy corpus*

• Translations in the 10 languages are found and coded into 3 types of constructions (Syntactic, Morphological or Lexical)

*http://www.natalialevshina.com/corpus.html
Example from Avatar

Original
• ENG: Don't shoot, you'll *piss* him *off*.

Translations
• FRA: *Ne tirez pas. Vous allez l'énerver.* (Lexical)
• TUR: *Ateş etme. Ateş etme. Onu kızdıracaksın.* (Morphological, from *kızmek* ‘become angry’).
• VIE: *Đừng bắn. Cậu sẽ làm nó nổi điên đó.* (Syntactic)
# Examples of constructions

<table>
<thead>
<tr>
<th>Language</th>
<th>Lexical</th>
<th>Morphological</th>
<th>Syntactic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>shā sǐ “kill”</td>
<td>-</td>
<td>ràng “let, make“ + Pred</td>
</tr>
<tr>
<td>Finnish</td>
<td>tappaa “kill”</td>
<td>odotu-tt-aa “make wait”</td>
<td>antaa “give” + V1</td>
</tr>
<tr>
<td>French</td>
<td>tuer “kill”</td>
<td>-</td>
<td>faire + Vinf</td>
</tr>
<tr>
<td>Hebrew</td>
<td>harag “kill” pa’al</td>
<td>hotsi “take out” hiph’il</td>
<td>natan “give” + le-Vinf</td>
</tr>
<tr>
<td>Indonesian</td>
<td>mem-bunuh “kill”</td>
<td>meng-ingat-kan “remind”</td>
<td>membuat “make” + Pred</td>
</tr>
<tr>
<td>Japanese</td>
<td>korosu “kill”</td>
<td>ikar-ase-ru “make angry”</td>
<td>V_te + morau “get”</td>
</tr>
<tr>
<td>Russian</td>
<td>ubit’ “kill”</td>
<td>-</td>
<td>zastavit’ + Vinf</td>
</tr>
<tr>
<td>Thai</td>
<td>kaa “kill”</td>
<td>-</td>
<td>tham hai “do give” + Pred</td>
</tr>
<tr>
<td>Turkish</td>
<td>açmak &quot;open&quot;</td>
<td>öl-dür- “kill”</td>
<td>V_mA_DAT + izin ver- “allow”</td>
</tr>
<tr>
<td>Vietnamese</td>
<td>giết hại “kill”</td>
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<td>làm “do” + Pred</td>
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Previous work

Token-based MDS maps

1. Collect the data (fictitious example)

<table>
<thead>
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<th>Lang3</th>
<th>Lang4</th>
<th>Lang5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lex</td>
<td>Morph</td>
<td>Synt</td>
<td>Morph</td>
<td>Lex</td>
</tr>
<tr>
<td>Situation 2</td>
<td>Lex</td>
<td>Morph</td>
<td>Synt</td>
<td>Synt</td>
<td>Morph</td>
</tr>
<tr>
<td>Situation 3</td>
<td>Morph</td>
<td>Morph</td>
<td>Lex</td>
<td>Morph</td>
<td>Synt</td>
</tr>
</tbody>
</table>
## Token-based MDS maps

2. Compute the distances between the situations (rows)

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Situation 1</td>
<td>Lex</td>
<td>Morph</td>
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<td>Morph</td>
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<td>Morph</td>
<td>Lex</td>
<td>Morph</td>
<td>Synt</td>
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Overlap 1,2 = 3/5 = 0.6  
Overlap 1,3 = 2/5 = 0.4  
Overlap 2,3 = 1/5 = 0.2  

Distance = 1 – overlap
Token-based MDS maps

3. Perform MDS (package smacof)
Interpretation of MDS distances

• The closer two points (i.e. causative situations), the more frequently they are expressed by the same constructions across the languages.
Interactive MDS maps with googleVis

• Exemplars:
  • http://www.natalialevshina.com/plots/bubblechart1.html

• Control of the Causee:
  • http://www.natalialevshina.com/plots/bubblechart2.html

• Intentionally acting Causer:
  • http://www.natalialevshina.com/plots/bubblechart3.html

• Mapping of the constructions: FRA, RUS, FIN, TUR
Token-based MDS maps: evaluation

Advantages

• No need for semantic coding
• Dimensions of semantic variation
• Information about the relative frequencies of meanings

Disadvantages

• Often difficult to interpret linguistically
• Loss of information
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Multiple Correspondence Analysis

• Multiple Correspondence Analysis shows how different values of more than two categorical variables are associated.
  • e.g. if Finnish morphological causatives tend to be used in the same contexts as French analytic causatives, they will be located in the same region of the map.

• Package FactoMineR in R
MCA maps of forms: evaluation

Advantages
• Straightforward cross-linguistic comparison of constructional types

Disadvantages
• Loss of information
• Only the average position (no exemplar information)
• What are the underlying semantic features?
(Note: This can be fixed with additional coding and supplementary points, see Levshina 2016)
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Grammars vs. parallel corpora

Grammars

• More data for different languages are available, so one can control for genealogy and geography

Parallel corpora

• More contextual information (e.g. films)
• More realistic picture of language use
• Translationese
• Fewer languages available (exception: NT)
Grammars vs. parallel corpora

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- More realistic picture of language use
Grammars vs. parallel corpora

**Grammars**
- More data for different languages are available, so one can control for genealogy and geography
- We have to rely on the information provided by the author and the few examples
- Most frequent types (lexical causatives) are underrepresented

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Parallel corpora
• More contextual information (e.g. films)
• More realistic picture of language use
• Translationese
• Fewer languages available (exception: NT)
Some considerations

• Statistical semantic maps are exploratory methods for generating theoretically interesting hypotheses, not the end goal.
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• If one formulates a cross-linguistic generalization on the basis of a semantic map, one also needs confirmatory methods, which can control for the genealogical and geographical relationships (e.g. mixed-effects models).
Final message

• Semantic maps are almost as diverse as Belgian beers.
Final message

- Semantic maps are almost as diverse as Belgian beers.
- Choose wisely, enjoy responsibly!
• The database and the app will very soon be available at

https://github.com/levshina/TypoCaus

For questions and suggestions:

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