Quantifying aspects of antonym canonicity in English and Swedish: textual and experimental
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The Comparative Lexical Relations Group
Ongoing project on English, Swedish and Japanese antonyms along two lines of investigation
- Antonym canonicity
- Discourse functions of antonyms

Aim
- Propose a corpus-based method as a possible source for cross-linguistic investigations in general and investigations of canonicity in particular
- Report on corpus results and elicitation experiments

Issues
- Are there two distinct types of antonyms or is there a cline from strongly canonical pairings to weak pairings?
- Why do most people consider pairs such as good-bad and long-short as better antonyms than cold-scorching and disturbed-fine?

Direct and indirect antonyms as in WordNet

We question this view of a strict dichotomy of direct and indirect antonyms and propose a continuum from perfect through good and less good antonyms to hardly antonymic at all.
Working definition

*Canonical antonyms* are pairs of words in binary semantic opposition associated by convention as well as by semantic relatedness (e.g. *wide/narrow*). The notion of canonical antonymy is different from *semantic opposition* in which the meanings are incompatible, but the words are not necessarily conventionally paired (e.g. *cold/scorching, calm/nervous*).

Psycholinguistic investigations

- Antonyms, canonical as well as non-canonical, tend to elicit each other in psychological tests such as free word association (Deese 1965, Charles and Miller 1989).
- People are faster at recognizing canonical opposites as antonyms than non-canonical opposites (Herrmann et al. 1979, Charles et al. 1994).
- Charles, Reed & Derryberry (1994) found that canonical antonym recognition was not affected by the distance between members of the pair, while distance in non-canonical antonyms delayed reaction times.
- Canonical antonyms prime each other more strongly than non-canonical opposites (Becker 1980).

Textual investigations

- Members of canonical pairs co-occur within sentences at higher than expected rates (Justeson and Katz 1992).
- They co-occur in sentences significantly more often than other potentially antonymous word pairs (Willners 2001).
- Knowing antonym pairs is not just a matter of knowing set phrases in which they occur, like *the long and the short of it* or *neither here nor there*. Instead, the same pairs occur in a range of different contexts and functions (Muehleisen 1997, Jones 2002, Jones et al 2005).

We use both experimental and textual methods to gain insights into the nature of antonymy as an organizing lexico-semantic principle.

Design of canonicity study

- Selection of test items from sententially co-occurring antonyms in text.
- Elicitation experiments.
- Judgement experiments.
- Antonym co-occurrence patterns in fixed constructions using web-as-corpus.

Selection of test items

<table>
<thead>
<tr>
<th>Category</th>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUMINOSITY</td>
<td>light-dark</td>
<td>ljus-mörk</td>
</tr>
<tr>
<td>STRENGTH</td>
<td>weak-strong</td>
<td>svag-stark</td>
</tr>
<tr>
<td>SIZE</td>
<td>small-large</td>
<td>liten-stor</td>
</tr>
<tr>
<td>SPEED</td>
<td>slow-fast</td>
<td>långsam-snabb</td>
</tr>
<tr>
<td>WIDTH</td>
<td>narrow-wide</td>
<td>smal-bred</td>
</tr>
<tr>
<td>MERIT</td>
<td>bad-good</td>
<td>dålig-bra</td>
</tr>
<tr>
<td>THICKNESS</td>
<td>thin-thick</td>
<td>smal-ljock</td>
</tr>
</tbody>
</table>
Princeton WordNet
We collected all the synonyms of the 14 adjective antonyms from WordNet and thereby got a set of synonyms for each of the seven pairs of antonyms. We ran the seven sets of words through the BNC in all possible constellations in search for sentential co-occurrence (same method for Swedish data).

BNC searches
<table>
<thead>
<tr>
<th>Word 1</th>
<th>Word 2</th>
<th>N1</th>
<th>N2</th>
<th>Co</th>
<th>Expect Co</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>fast</td>
<td>slow</td>
<td>6707</td>
<td>5760</td>
<td>163</td>
<td>9.6609</td>
<td>0.0000</td>
</tr>
<tr>
<td>slow</td>
<td>tedious</td>
<td>5760</td>
<td>543</td>
<td>9</td>
<td>0.7821</td>
<td>0.0000</td>
</tr>
<tr>
<td>gradual</td>
<td>sudden</td>
<td>1066</td>
<td>3920</td>
<td>22</td>
<td>1.0450</td>
<td>0.0000</td>
</tr>
<tr>
<td>fast</td>
<td>rapid</td>
<td>6707</td>
<td>359</td>
<td>29</td>
<td>5.9139</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Test items from the BNC
- 7 pairs of canonical antonyms at p<10^-4 (light-dark, weak-strong etc.)
- 14 pairs of antonyms at p<10^-4 (two pairs per dimension)
- 14 pairs of synonyms at p<10^-4 (two pairs per dimension)
- 7 pairs of unrelated pairs at p<10^-4 (one pair per dimension)

SPEED dimension items
- slow – fast (canonical) antonym
- slow – sudden antonyms
- gradual – immediate antonyms
- slow – dull synonyms
- fast – rapid synonyms
- hot – smooth unrelated

Test items from Hermann et al.
Hermann et al. had 100 hundred test pairs. We used 11 of their pairs (every sixth gradable adjective pair in their list from more canonical through less strongly antonymical to not related)

Hermann et al’s
- beautiful - ugly sober – excited
- immaculate – filthy nervous – idle
- tired – alert delightful – confused
- disturbed – calm bold – civil
- hard – yielding daring - sick
- glad – irritated
Test items

- The English test set consists of 85 randomized unique words
- The Swedish test set consists of 77 randomized unique words

Participants

- 50 native English participants, 36 women and 14 men between 19 and 88 years of age
- 50 native Swedish participants, 25 women and 25 men between 20 and 70 years of age

Instructions

You are going to be given a list with 85 English words. For each word write down the word that you think is the best opposite for it in the blank line next to it.
- Don't think too hard about it - write the first opposite that you think of.
- There are no 'wrong' answers.
- Give only one answer for each word.
- Give opposites for all the words, even when the word doesn't seem to have an obvious opposite.
- Don't use the word not in order to create an opposite phrase. Your answer should be one word.

Example: The opposite of MASCULINE is _____________.
You might answer feminine.

Our predictions are that

- there is total agreement across speakers of a language on the pairings of the seven pairs representing the dimensions, and the other pairs will be less than total agreement in a gradient, sloping fashion
- the weaker the degree of canonicity the more responses the test items will yield

To the results...

Total agreement

Given X all participants said Y

- weak > strong (50)
- bad > good (50)
- beautiful > ugly (50)
Total agreement

Given X all participants said Y

<table>
<thead>
<tr>
<th>Word 1</th>
<th>Word 2</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>bra</td>
<td>dålig</td>
<td>50</td>
</tr>
<tr>
<td>liten</td>
<td>stor</td>
<td>50</td>
</tr>
<tr>
<td>ljus</td>
<td>mörk</td>
<td>50</td>
</tr>
<tr>
<td>svag</td>
<td>stark</td>
<td>50</td>
</tr>
</tbody>
</table>

Directionality

Are pairs of antonyms symmetrical in eliciting one another?

If they do,

it could be a sign of canonicity which may have several converging reasons frequency, monosemy, symmetry, binary intrinsicness or contextual generality.

If they don’t,

it could be a sign of lower degree of canonicity in one direction or in both directions due to infrequency, polysemy, asymmetry, non-intrinsic binarity or contextual specificity.
Directionality

- Black > white, colour
- White > black, dark

Monosemy

- Beautiful > ugly
- Ugly > beautiful, pretty, attractive

Monosemy

- slow - rapid
- slow - fast

Polysemy

- Good > bad, evil
- Evil > good, kind, angelic, pure
- Mediocre > outstanding, excellent, exceptional, brilliant, amazing, good... (19)

Polysemy

- Light – heavy
- Light – dark

Non-intrinsicness

- Abundant > rare, scarce, sparse, little, lacking, disciplined, few, limited, needed, none, meagre plentiful, sparing, threadbare
- Rare > common, commonplace, ubiquitous, frequent, plentiful, well-known
Cluster analysis: English data

- 16 antonym pairs: strong bidirectionality
- 13 antonym pairs: weaker or skewed bidirectionality
- 120 antonym pairs: more disagreement across participants or strongly skewed responses

Cluster 1: strong bidirectionality

<table>
<thead>
<tr>
<th>bad</th>
<th>good</th>
</tr>
</thead>
<tbody>
<tr>
<td>filthy</td>
<td>clean</td>
</tr>
<tr>
<td>thick</td>
<td>thin</td>
</tr>
<tr>
<td>big</td>
<td>small</td>
</tr>
<tr>
<td>large</td>
<td>small</td>
</tr>
<tr>
<td>thin</td>
<td>fat</td>
</tr>
<tr>
<td>enormous</td>
<td>tiny</td>
</tr>
<tr>
<td>narrow</td>
<td>wide</td>
</tr>
<tr>
<td>fast</td>
<td>slow</td>
</tr>
<tr>
<td>rapid</td>
<td>slow</td>
</tr>
</tbody>
</table>

Cluster 2: weaker or skewed bidirectionality

<table>
<thead>
<tr>
<th>bright</th>
<th>gloomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>gradual</td>
<td>sudden</td>
</tr>
<tr>
<td>strong</td>
<td>feeble</td>
</tr>
<tr>
<td>dark</td>
<td>pale</td>
</tr>
<tr>
<td>hard</td>
<td>easy</td>
</tr>
<tr>
<td>thick</td>
<td>fine</td>
</tr>
<tr>
<td>dull</td>
<td>bright</td>
</tr>
<tr>
<td>huge</td>
<td>tiny</td>
</tr>
<tr>
<td>tough</td>
<td>tender</td>
</tr>
<tr>
<td>fat</td>
<td>slim</td>
</tr>
<tr>
<td>narrow</td>
<td>broad</td>
</tr>
<tr>
<td>good</td>
<td>evil</td>
</tr>
<tr>
<td>sick</td>
<td>healthy</td>
</tr>
</tbody>
</table>

Cluster 3: examples of weak relations

- bold | weak |
- confused | fine |
- delicate | robust |
- enormous | slight |
- dark | pale |
- evil | pure |
Cluster analysis: Swedish data

- 8 antonym pairs: strong bidirectionality
- 15 antonym pairs: weaker or skewed bidirectionality
- 118 antonym pairs more disagreement across participants or strongly skewed responses

Dimensions

All the lexical items used for the searches are strongly bidirectional pairs. That’s not the case for Swedish where WIDTH is in Cluster 2 (instead tired/alert are in Cluster 1).

Summary

- Proposal of principled corpus-based method for the study of antonyms that can be used for cross-linguistic investigations using experiments or corpora.
- Some (inconclusive) results of antonym elicitation in English and Swedish to be matched with judgment experiments and antonym constructions in text.

Conclusions

- Are there two types of antonyms or is there a canonicity scale? Textual evidence for the seven dimensions as a distinct type.
- Psycholinguistic evidence through clusters pointing towards a cline.

Conclusions

- Why are there differences?
  The stronger pairs are frequent, symmetrical, intrinsically binary (salient dimensions), contextually general and elicit one another bidirectionally
  BUT, quite a few of the words in Cluster 1 are in fact polysemous: good, heavy, light, hard, thick

Thanks for your attention