

The relationship between semantics and verb argument structure is highly regular

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QUESTION & METHOD

Background

Variation in argument structure

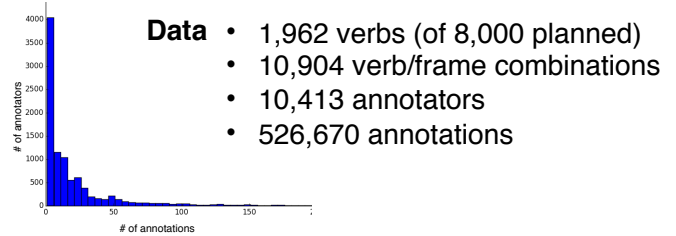
| | | | | | | | | | | |
|--------------------|-------|-------|------|-----|------|------|------|------|------|-----|
| | break | crack | chip | hit | bump | beat | like | know | walk | ... |
| NP V | + | + | + | + | + | + | + | + | + | + |
| NP V NP | + | + | + | + | + | + | + | + | + | + |
| NP V at NP | + | + | + | + | + | + | + | + | + | + |
| NP V NP Adj | + | + | + | + | + | + | + | + | + | + |
| NP V NP against NP | + | + | + | + | + | + | + | + | + | + |
| ... | | | | | | | | | | |

The Semantic Consistency Hypothesis
Verb argument structure is reliable function of described event (e.g., Levin, 1993).

Limitation:

- Little systematic data.
- 10,000ish verbs X 100ish frames X 10ish event features => massive coding project

FINDINGS & RESULTS



Effect of Animacy

Does it matter whether arguments are animate?

- *Abigail hit Beatrice vs. The ball hit the wall.*
- Calculated K-L Divergence between animacy variants.
- Bipolar distribution => subset of items care about animacy.

- All seven datasets are clearly unipolar. Little effect of animacy.

Solution: Crowdsourcing with Citizen Scientists

User Home Page **The "Equilibrium" Task**

social networking gamification elements

Calculating Semantic Consistency

- Restrict to 'completed' items
 - Verb-frame combinations with low entropy annotations (ask for details)
- Exclude items labeled 'ambiguous' or 'ungrammatical'.
- Analyzed in terms of Levin/VerbNet verb classes (classes of verbs with identical argument realizations).

Example: A Good World (data modified for illustration)

| class | frame | num. verbs | modal label | % modal |
|--------------|--------------|------------|-------------|---------|
| 10.1 | NP V NP | 29 | 'Bad' | 67% |
| | NP V NP PP | 32 | 'Good' | 74% |
| | <i>total</i> | | | 71% |
| 10.2 | NP V NP | 7 | 'Bad' | 78% |
| | NP V NP PP | 5 | 'Good' | 56% |
| | NP V NP PP | 7 | 'Bad' | 78% |
| <i>total</i> | | | 71% | |

Tasks

Design

- Each verb presented in each licensed frame (cf. VerbNet)
- Subset of items "over-sampled"
- Novel NPs and additional VPs (avoids world knowledge)
- Fanciful backstory to prime intuitions and focus on entailment

Tasks (semantic predicate explored)

- A Good World (positive/negative valence)
- Entropy (change of physical state)
- Equilibrium (application of force)
- Explode on Contact (contact)
- Fickle Folk (change of mental state)
- Philosophical Zombie Hunter (mental state)
- Simon Says Freeze (change of location)

control

| Feature | Total items | Coded items | Uncodable items | Consistency |
|---------------|-------------|-------------|-----------------|-------------|
| Phys. change | 9571 | 5152 | 716 | 99% |
| Force | 10902 | 4143 | 1179 | 95% |
| Phys. contact | 9696 | 4250 | 1009 | 98% |
| Change mind | 6532 | 2976 | 1172 | 98% |
| Mental state | 9793 | 2421 | 1425 | 95% |
| Change loc. | 9061 | 4381 | 945 | 99% |
| Valence | 10904 | 8106 | 785 | 74% |