Judging Paradigmatic Relations:
a New Collection of English Ratings

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The Collection

Semantically related English word pairs, rated for the strength of the semantic relation holding between them

Part of a **larger project**, whose goal is to characterize paradigmatic relations **cross-linguistically**

- ➡ **German:** (Scheible and Schulte im Walde, 2014), IMS Stuttgart
- ➡ **Italian**: Computational Linguistics Lab, University of Pisa (collection ongoing)

paradigmatic relations: synonymy, antonymy, hypernymy

3 parts of speech: nouns, verbs, adjectives

degrees of relatedness
Target: *artist*
Relation: synonymy
painter (strongly related)
creator (weakly related)
scientist (negatively related).

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directionality
For every ⟨*target,relation,relatum*⟩ triple, we collected forward and backward ratings (e.g., *artist-synonym-painter* vs. *painter-synonym-artist*)

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target selection based on a two-step process

Step 1: Generation Experiment

On Amazon Mechanical Turk, native speakers have been asked to **generate related words for 99 English targets per part-of-speech**

Random selection of targets from WordNet (Miller, 1995) with a **stratified sampling technique** (Scheible and Schulte im Walde, 2014). Criteria:

- **polysemy class**: I) one sense; II) two senses; III) > 3 senses
- **frequency classes**: I) low (200–2,999); II) mid (3,000–9,999); III) high (≥10,000)
- **size of the WordNet semantic class**

Some Examples

- **Target: "aircraft"**
  - **SYN:** plane (4), airplane (3), airship (1), balloon (1) helicopter (1)
  - **ANT:** car (3), watercraft (2), submarine (1), ship (1), landcraft (1), boat (1), _ (1)
  - **HYP:** vehicle (4), machine (2), transportation (2), plane (1), flyer (1)
- **Target: "uplift"**
  - **SYN:** raise (3), encourage (3), inspire (2), rise (1), support (1), elevate (1)
  - **ANT:** depress (4), put down (2), bring down (1), sink (1), defile (1), discourage (1)
  - **HYP:** raise (5), help (3), move (1), encourage (1) movement (1)
- **Target: "able"**
  - **SYN:** capable (5), competent (2), skilled (1), deft (1), apt (1)
  - **ANT:** unable (8), incapable (2)
  - **HYP:** capable (3), can (3), competent (1), functional (1), willing (1), qualifications (1)

Experiment conducted by Giulia Benotto and Alessandro Lenci (Computational Linguistics Lab, University of Pisa).

Step 2: Rating Experiment

⟨**Target, relation**⟩ pairs selected from the generated data
Goal: find pairs for which a full ⟨**target,weakly related, strongly related, not related**⟩ **tuple** was available. Criteria:

- at least 2 different relata had been generated
- a **strongly related** word (e.g, *painter*) was produced at least 4 times
- a **weakly related** word (e.g., *creator*) was produced twice or once
- a **negatively related** word was produced at least twice for the opposing relation: ANT for SYN and HYP, SYN for ANT (e.g., ⟨*painter, antonym, scientist*⟩)

286 ⟨target,relation⟩ pairs, 1,716 target / relation / related word / direction combinations ➡

	NOUN	ADJ	VERB
SYNONYMS	40	22	40
ANTONYMS	21	40	40
HYPERNYMS	27	20	36

Ratings collected with AMT:

- ✓ **"Do you think that the following two words are synonyms?"**
- ✓ 6 points scale (0-5)
- ✓ 10 workers per ⟨target,relation,relatum⟩ triple, per each direction

The Resource

Target	P.Cl	Freq	WN.Class	Relatum	Rel	Degree	Fw	Bw
goodbye	1	mid	communication	farewell	SYN	STRONG	4.6	4.9
goodbye	1	mid	communication	departure	SYN	WEAK	3.0	3.6
goodbye	1	mid	communication	hello	SYN	NOT	0.0	0.0
humble	3	max	all	proud	ANT	STRONG	5.0	4.3
humble	3	max	all	boastful	ANT	WEAK	4.9	4.9
humble	3	max	all	modest	ANT	NOT	0.6	0.4
to bill	3	mid	possession	to charge	HYP	STRONG	4.3	3.5
to bill	3	mid	possession	to notify	HYP	WEAK	3.1	2.9
to bill	3	mid	possession	to pay	HYP	NOT	0.8	0.8

Further information available with the resource:
- Z-score transformed ratings
- Full data per subject (e.g., for linear mixed effect analysis)
- Work Time in Seconds from AMT. Future work: work time as RT

Case Study: Directionality

Are some relations/parts-of-speech more asymmetric than others?
Method: item-based prediction with linear regression models

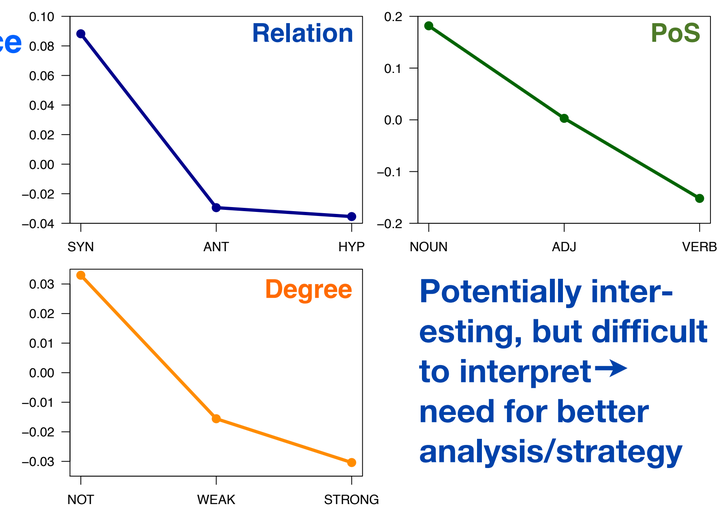
Dependent variable
Difference in Mean Ratings (Forward - Backward)

Predictors
Relation, Part of Speech, Degree of Relatedness (+ 2-way interactions), Target

Model 1: signed difference

Parameter	R^2	p
Relation	1.53	**
PoS	1.49	**
Degree	0.35	
Relation * Degree	1.61	**
Relation * PoS	0.58	
Degree * PoS	0.66	
Target	16.82	

Main effects & int., R^2 (23%)

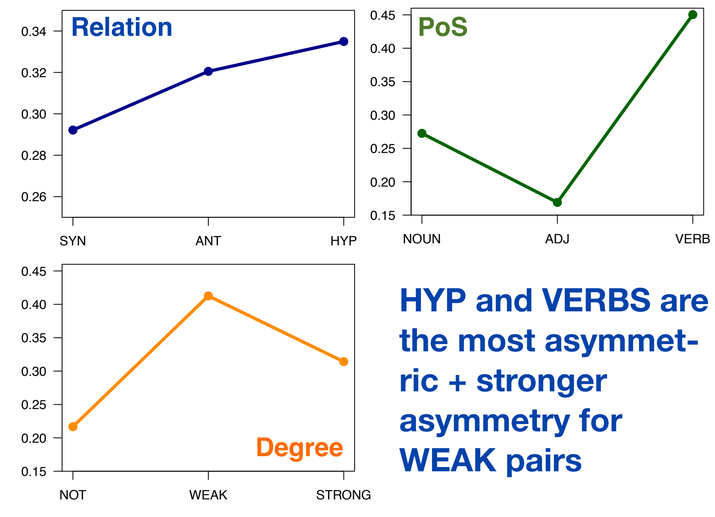


Potentially interesting, but difficult to interpret➔ need for better analysis/strategy

Model 2: abs. difference

Parameter	R^2	p
Relation	0.68	*
PoS	0.79	*
Degree	5.55	***
Relation * Degree	0.94	
Relation * PoS	0.35	
Degree * PoS	0.11	.
Target	21.29	

Main effects & int., R^2 (29.7%)



HYP and VERBS are the most asymmetric + stronger asymmetry for WEAK pairs

References & Acknowledgments

Silke Scheible and Sabine Schulte im Walde (2014). A Database of Paradigmatic Semantic Relation Pairs for German Nouns, Verbs, and Adjectives In: Proceedings of th COLING Workshop on Lexical and Grammatical Resources for Language Processing.
George A. Miller (1995). WordNet: A Lexical Database for English. Communications of the ACM Vol. 38, No. 11: 39-41.
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