

# Judging Paradigmatic Relations: a Collection of Ratings for English

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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).



directionality

For every  $\langle \text{target}, \text{relation}, \text{relatum} \rangle$  triple, we collected forward and backward ratings (e.g., *artist-synonym-painter* vs. *painter-synonym-artist*)



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 ( $\geq 10,000$ )
- **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).

## 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 the 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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## Step 2: Rating Experiment

$\langle \text{Target}, \text{relation} \rangle$  pairs selected from the generated data

**Goal:** find pairs for which a full  $\langle \text{target}, \text{weakly related}, \text{strongly related}, \text{not related} \rangle$  tuple was available. Criteria:

- at least 2 different relations 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.,  $\langle \text{painter}, \text{antonym}, \text{scientist} \rangle$ )

285  $\langle \text{target}, \text{relation} \rangle$  pairs,  
 1,710 target / relation / related word / direction combinations

	NOUN	ADJ	VERB
SYNONYMS	40	22	40
ANTONYMS	21	40	40
HYPERNYMS	27	20	35

Ratings collected with AMT:

- ✓ "Do you think that the following two words are synonyms?"
- ✓ 6 points scale (0-5)
- ✓ 10 workers per  $\langle \text{target}, \text{relation}, \text{relatum} \rangle$  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

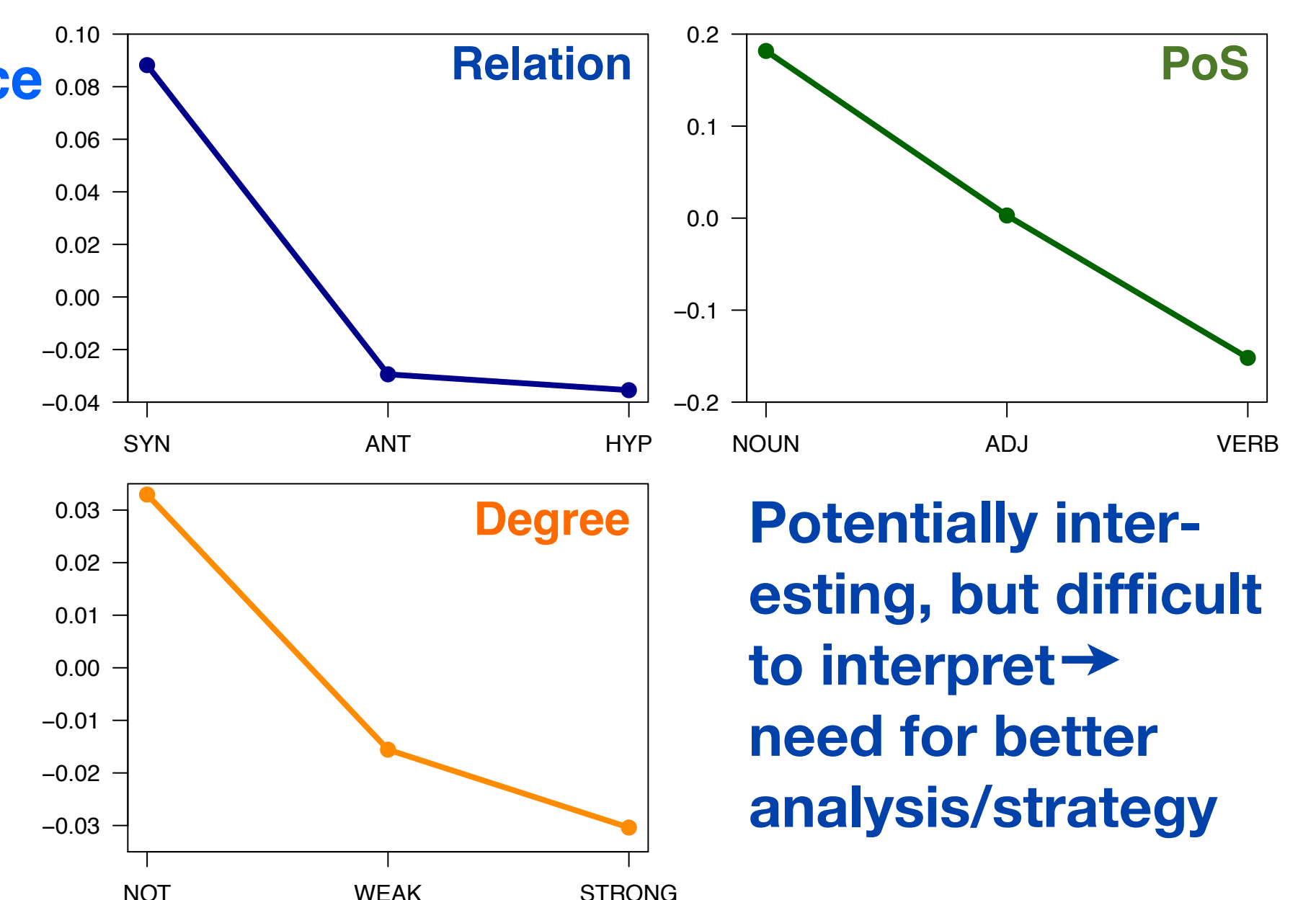
Dependent variable  
 Difference in Mean Ratings  
 (Forward - Backward)

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

Model 1: signed difference

Parameter	R <sup>2</sup>	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<sup>2</sup> (23%)



Model 2: abs. difference

Parameter	R <sup>2</sup>	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<sup>2</sup> (29.7%)

