

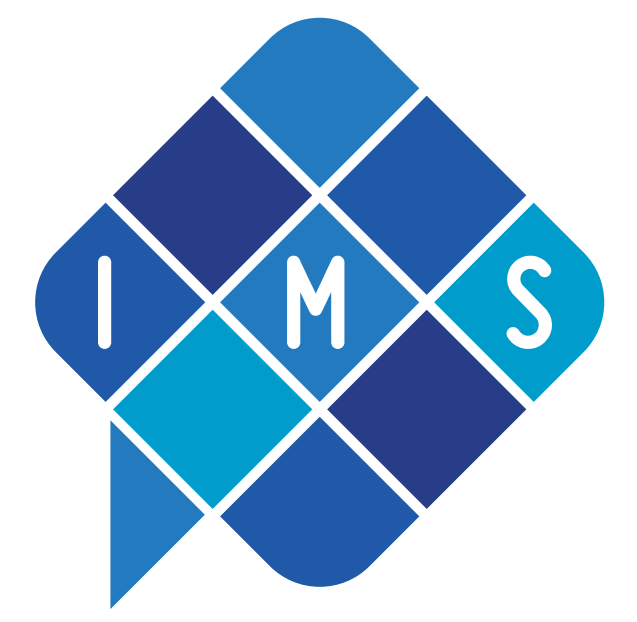
Analogies in Complex Verb Meaning Shifts: The Effect of Affect in Semantic Similarity Models

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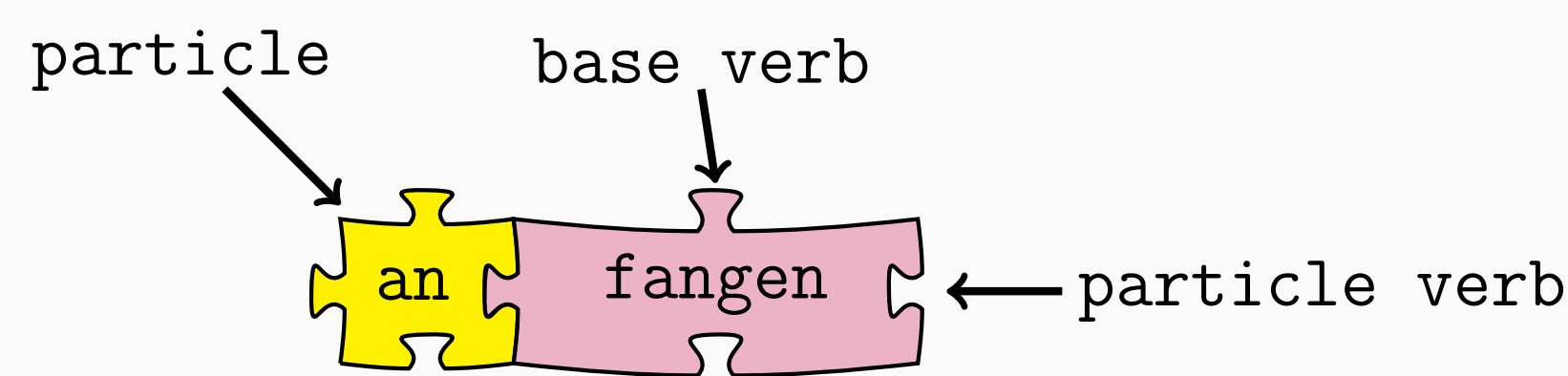
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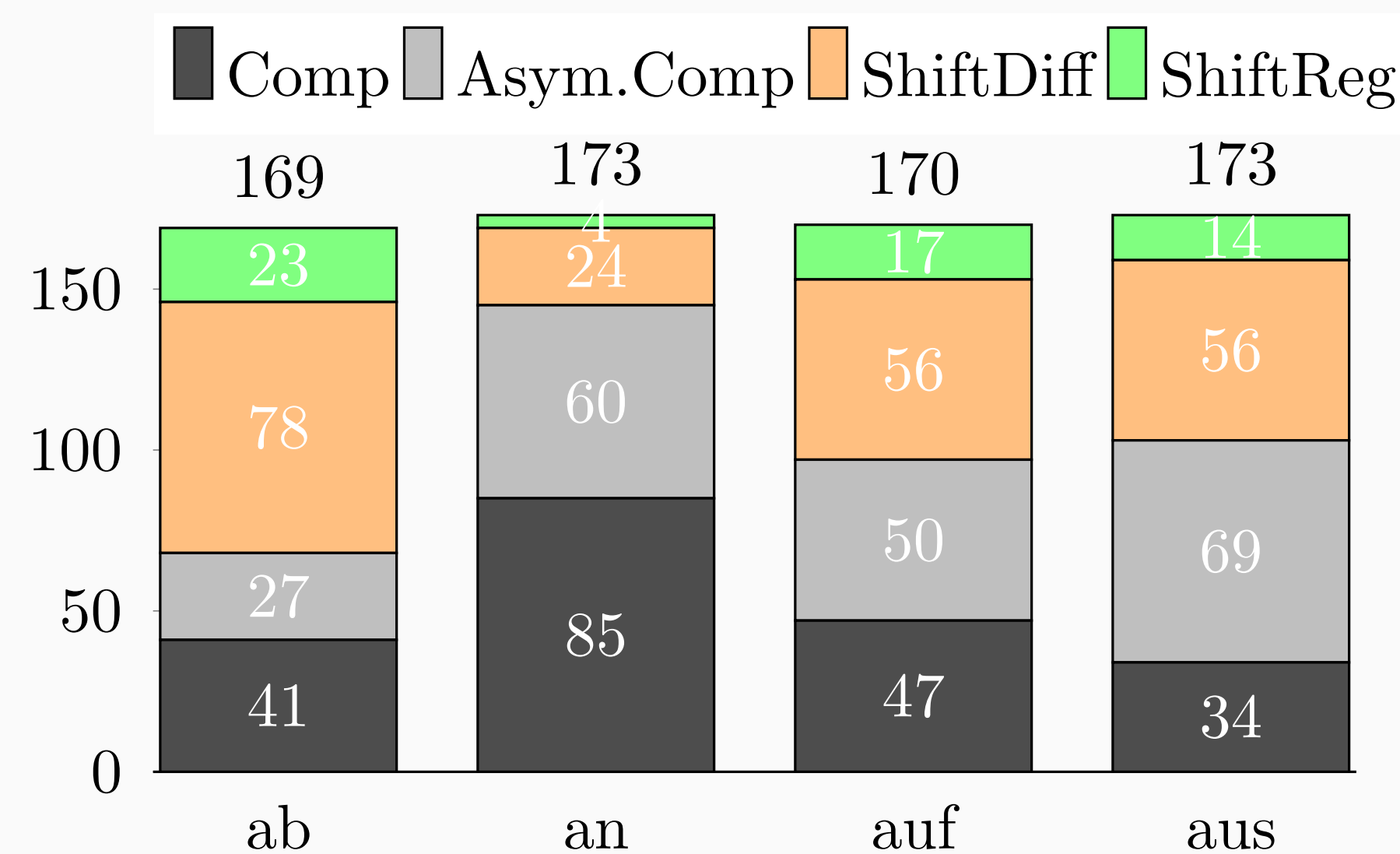
Phenomena



- Complex verbs
- Very productive
- Separable
- Highly ambiguous
- Highly frequent
- Pain in the Neck for NLP [Sag et al. \(2002\)](#)

A Collection of BV-PV Analogies

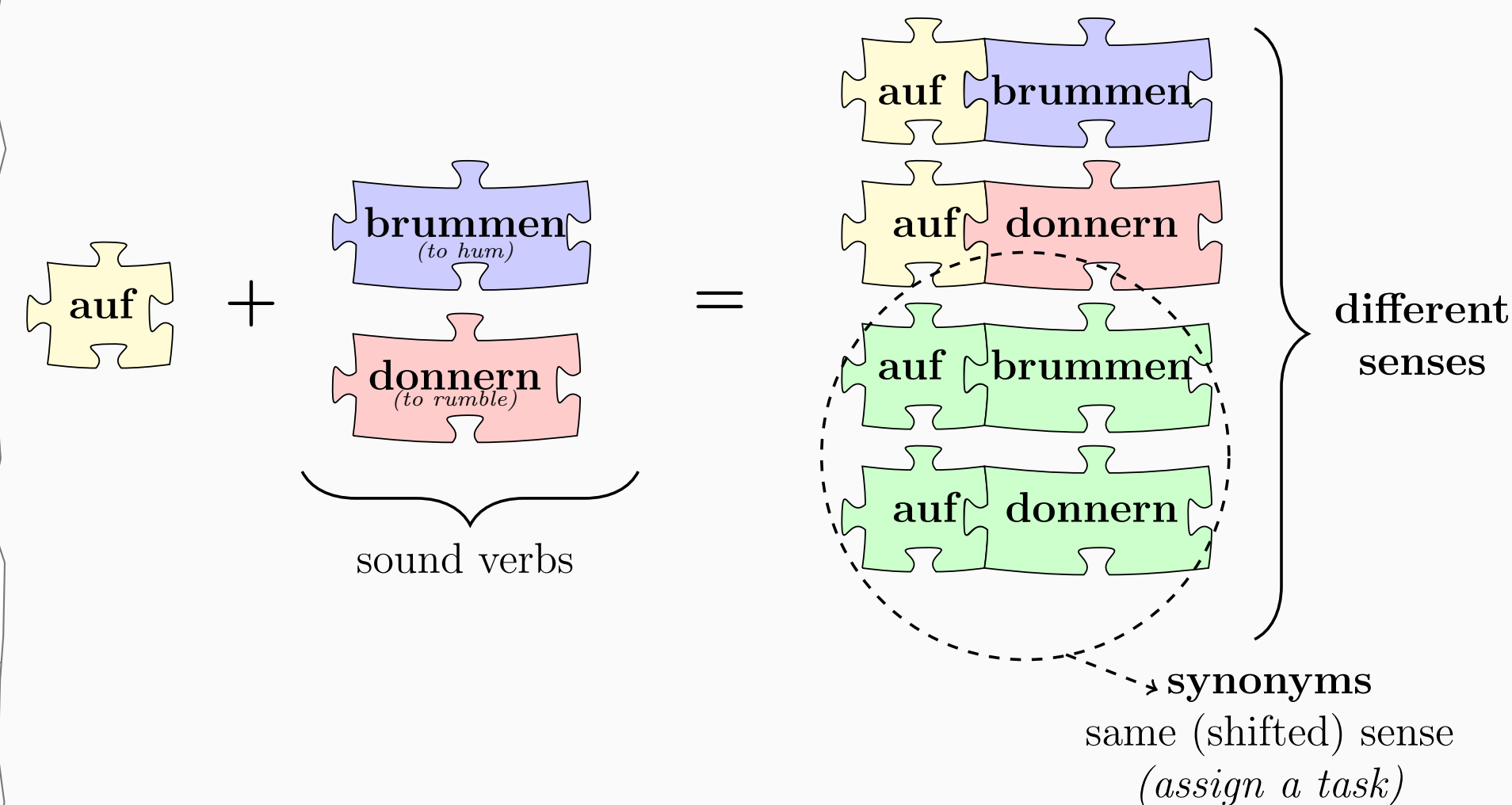
- Collect judgements for analogie combinations: $BV_1 : PV_1 :: BV_2 : PV_2$ by looking for PV_1/PV_2 (near-)synonyms according to a German dictionary. We collected 794 analogy questions across four particle types *ab*, *an*, *auf*, *aus*.
- Five German native speakers with a background in linguistics were asked to classify the analogies into four categories (Fleiss' κ agreement of 0.43).
- **COMP**: no BV-PV pair has a meaning shift, i.e., both PVs are **compositional** regarding their BVs, and therefore all four verbs are (near-)synonyms; example: *(ab)feilen::(ab)schleifen* 'to grind (off)'
- **ASYMCOMP**: **only one** of the BV-PV pairs undergoes a meaning shift; in this case, the annotators also indicated that pair; example: *(auf)wühlen::(auf)graben* lit. 'to churn::dig (up)', where *aufwühlen* includes a strong emotion component
- **SHIFTDIFF**: **both** BV-PV pairs show a meaning shift, but the BVs are not semantically similar; example: *(aus)baden::(aus)bügeln* 'to take a bath' and *bügeln* 'to iron'
- **SHIFTREG**: **both** BV-PV pairs undergo a meaning shift, and the BVs are **semantically similar**; example: *(an)graben::(an)baggern* 'to hit on so.' with both *graben* and *baggern* 'to dig'



COMP	ASYMCOMP	SHIFTDIFF	SHIFTREG
abfeilen::abschleifen	abbauen::abmontieren	abschreiben::abkupfern	abstottern::abratern
abkuppeln::abhängen	abchecken::abprüfen	abschweifen::abdriften	abraschen::abzischen
aneignen::anlernen	anfeuern::anbrennen	ankreiden::anlasten	anheizen::anfeuern
anbrüllen::anschreien	anhängen::anheften	anfechten::angreifen	anwerfen::anschmeißen
auf tupfen::auf tropfen	aufdrehen::aufzwirbeln	auf treiben::aufspüren	auf wirbeln::aufrühren
auffüttern::aufessen	aufmotzen::aufstylen	aufkreuzen::auf tauchen	aufbrummen::aufdonnern
aufritzen::aufschlitzen	aufwühlen::aufgraben	auflegen::aufbrummen	aufkeimen::aufblühen
ausrufen::ausjäten	ausposaunen::ausplaudern	ausfeilen::ausbrüten	ausweinen::ausheulen
ausschnaufen::ausatmen	aussaugen::auspumpen	ausstechen::ausbremsen	auskochen::ausbrüten

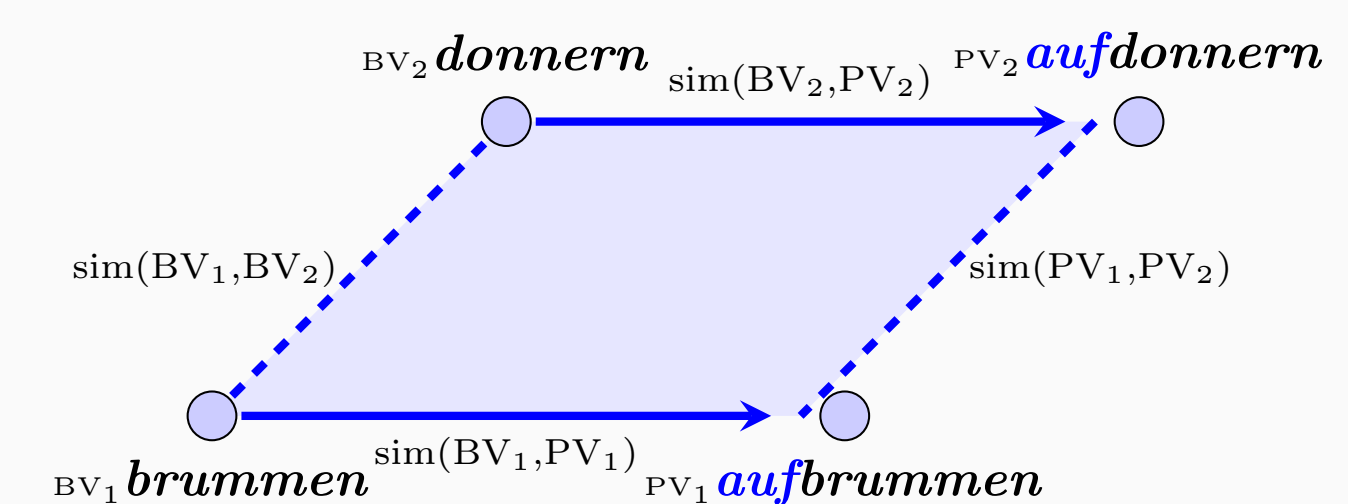
Research Question: Meaning Shifts

- Particles trigger (regular?) **meaning shifts** of the base verbs:



[Springorum et al. \(2013\)](#) presented a manual corpus exploration suggesting regular mechanisms in meaning shifts from base verbs (BVs) to particle verbs (PVs) that apply across a semantically coherent set of BVs.

Model

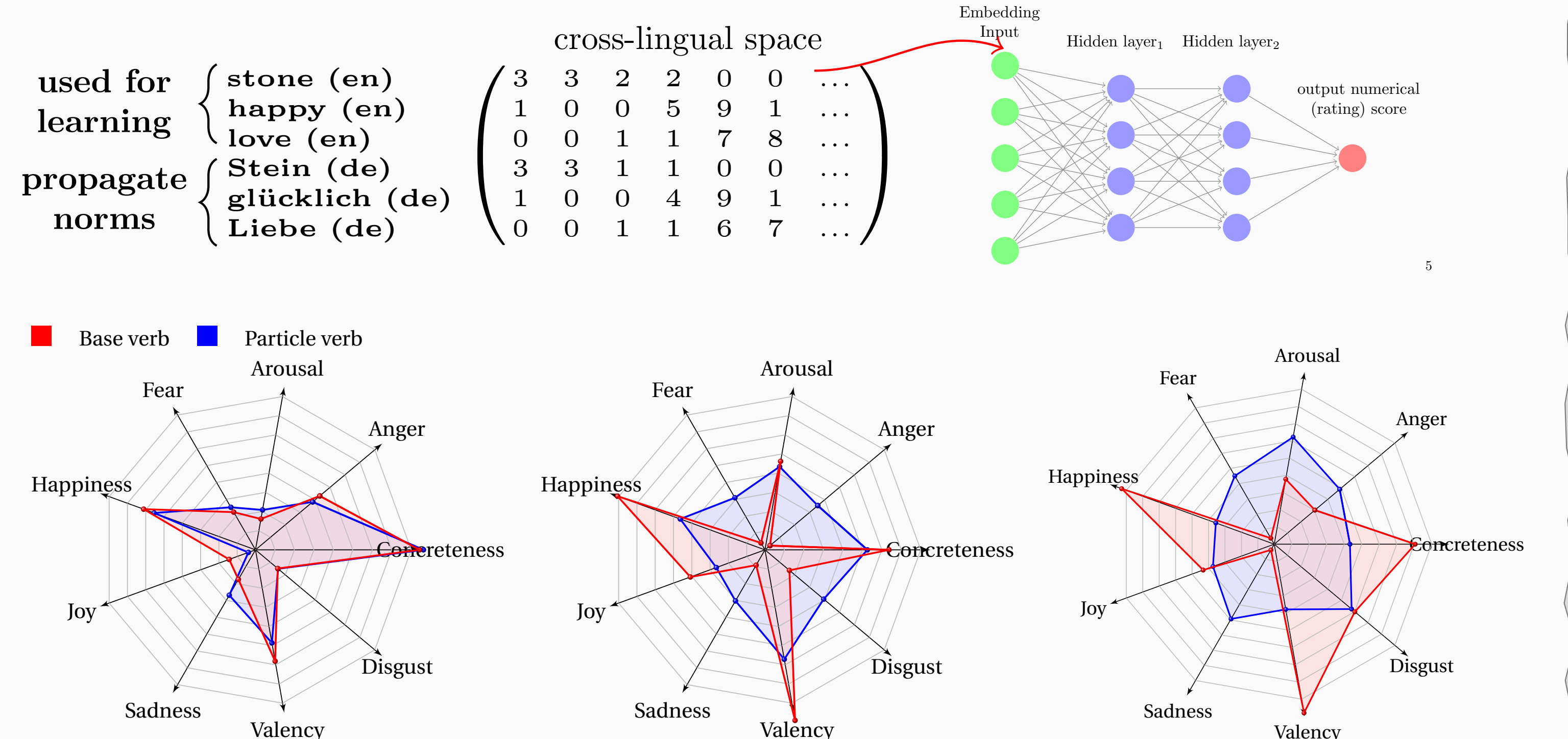


Contribution

1. We provide a computational model of meaning shifts for German particle verbs.
2. We create a collection of human-annotated complex verb meaning shifts for BV-PV analogies.
3. We present a computational model to detect and distinguish analogies in meaning shifts.

(Extending) Affective Norms Across Languages

- A BV-PV meaning shift often involves a change in emotion and/or sentiment.
- Non-literal PV usage might correlate with abstractness.
- Combine word representations with regression model.
- We extend affective norms from (EN) human-created lexicons \rightarrow 2.2m words (DE).
- Cross-lingual embeddings from [Smith et al. \(2017\)](#).
- *anger, disgust, fear, joy, and sadness* [NRC Mohammad and Kritchenko. \(2015\)](#) *valence, arousal* [Warriner et al. \(2013\)](#) *happiness* [Smith et al. \(2017\)](#) *concreteness* [Dodds et al. \(2011\)](#).



COMP: (ab)montieren (to mount \rightarrow to dismount)
 SHIFT: (ab)frühstücken (to have breakfast \rightarrow to fob sb. off)
 SHIFT: (ab)servieren (to serve \rightarrow to dump sb.)

NOTE! Resources (analogy collection and ratings) available: www.ims.uni-stuttgart.de/data/pv-meaning-shift

Experiments on BV-PV Analogies

- Two classification scenarios: 4-Classes, BV-PV include a shift vs. compositional pairs (Shift-vs-Comp)
- Features:
 - \rightarrow Cosine similarities
 - \rightarrow Cluster generalisation models
 - * Nearest centroid w. manually created seed cluster
 - * Nearest centroid w. GermaNet as seed
 - * Unsupervised (K-Means)
 - \rightarrow Affect noms
 - * Emotion/affect value of verbs (concreteness, anger,...)
 - * Mean emotion/affect value of top associated (ppmi) context words
- 10-fold cross-validation
- Support vector machines (SVMs) w. RBF kernel
- F_1 =macro-average over all classes
- Leave-one-out classification revealed following top features: 1) fear, 2) joy, 3) arousal

Results

	4-Classes		Shift-vs-Comp	
	Acc	F_1	Acc	F_1
Majority baseline	31.24	.12	60.29	.38
Basic Sim	40.73	.32	65.10	.60
Sim+GermaNet	43.36	.34	67.15	.59
Sim+ManClass	45.55	.36	69.05	.62
Sim+k-Means	52.99	.37	70.51	.66
Affect (full)	57.08	.44	76.49	.74
Affect only verbs	47.73	.37	69.05	.65
Affect only context	58.39	.45	78.54	.77
Combination	56.20	.44	77.08	.75