

# Characterizing the pragmatic component of distributional vectors in terms of polarity: Experiments on German *über* verbs

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# The phenomenon: *über* (“over”) prefix verbs

- Very productive derivational pattern in German
- The prefix has the same form of a directional/locational preposition



*über etwas fahren*  
“drive over something”



*etwas überfahren*  
“run something over”

- Some *über-* verbs (e.g., *überrollen*, “invade”, *überfluten*, “overflow”) exhibit a negative evaluative meaning component  
→ **can we capture it with a distributional semantic approach?**

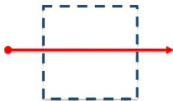
# Characterizing the *über* shift: dataset

- 83 base verbs paired with the corresponding *über*- derivation:
  - *rollen* – *überrollen* (“roll” – “invade”)
  - *bringen* – *überbringen* (“bring” – “deliver”)
- All derived words transparent with respect to their bases (at least in their main reading)
- Annotation as a basis for analysis:
  - Base: WordNet topnodes, number of synsets
  - Derived: manual **classification based on lexical-semantic properties** of the *über* derivation

# Characterizing the *über* shift: four classes

## ACROSS

Movement across some obstacle, region as a patient (in some cases undergoes change of state)



*überfahren*, “run something over”

## MORE



Exceeding of a threshold on a scale provided by the base verb

*überbewerten*, “overvalue”

## TRANSFER

Displacement of an object from a source region to a goal region



*überbringen*, “deliver”

## APPLICATION

An object is applied to another object and it fully covers it



*überkleben*, “paste over”

## Lexical-semantic properties and predictions<sup>1</sup>:

- ACROSS: motion event has negative consequences (*überrollen*, “invade, infest”)
- APPLICATION: some base verbs have a -CONTROL component which gets emphasized by telicity (*überfluten*, “overflow”)
- MORE verbs can be positive or negative (scale and thresholds are contextually supplied)

## Context set subspace (Herbelot and Copestake, 2013)

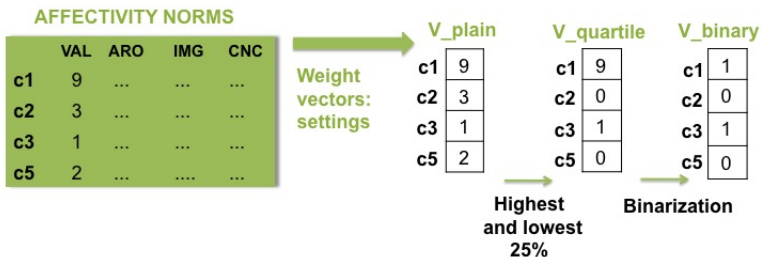
DSMs as *ideal distribution*: a language model built by accumulating all the contexts in which a target lexeme occurs; **context set subspace** as a conceptual tool for “zooming in” on theoretically motivated portions of the ideal distribution.

Focus on the **pragmatic context set subspace**:

- Evaluative considerations systematically affect text planning
- Evaluative considerations that are frequent enough become *part of the meaning* of the target word.

- **Count DSM** (interpretable dimensions):
  - SdeWaC web corpus: 800 mln words (Faaß and Eckart, 2013)
  - Large target and context vocabulary: 280k lemmatized words (DERivBase, Zeller et al. 2013)
  - Symmetric context window, 5 words
  - PPMI
- **German Affectivity Norms** (Köper and Schulte Im Walde, 2016):
  - 350k target words
  - Semi-automatically generated ratings (scale 0-10)
    - ① **Valency: is the emotion associated with the referent positive or negative?**
    - ② **Concreteness: can the referent be perceived?**
    - ③ **Imageability: can the referent be perceived visually?**
    - ④ **Arousal: how intense is the emotion associated with the referent?**

# Distributional methodology: affective score computation





- **Valency score:** inner product between target vector and weight vector:
  - High  $\uparrow$ : if most contexts have positive valency
  - Low  $\downarrow$ : if most contexts have negative valency
- We calculated:
  - A valency score for each item in the dataset (base and derived)
  - Imageability, concreteness and arousal scores
  - The corresponding **shift scores** (derived - base)

## Questions

**Q1:** Do the annotated *über* classes differ with respect to their added evaluative load?

**Q2:** Does the literal/metaphorical divide modulate the evaluative component?

Linear regression analysis:

- **Predicted value: valency score**
- **Predictors:**
  - **Q1:** Class labels (reference level: TRANSFER)
  - **Q1:** Arousal
  - **Q2:** Imageability
  - **Q1/Q2:** Interactions between class and imageability/arousal
  - **Covariates:** frequency base (\*\*\*), frequency derived (\*\*\*), base WordNet topnode (n.s.), base nr of synsets (n.s.)

# Study 1: the evaluative component of *über* verbs

Predictor	Effect
APPLICATION	
ACROSS	
MORE	
Imageability	* ↓
Arousal	
ACROSS:arousal	*** ↓
APPLICATION:arousal	
MORE:arousal	
<i>Model fit (Adj.R<sup>2</sup>)</i>	56% (***)

↓ = negative valency; ↑ = positive valency

# Study 1: summing up and further steps

- **Q1: evaluative load of über classes:**
  - Strong negative effect of arousal on **ACROSS verbs**
- **Q2: interaction with literal/metaphorical uses:**
  - Negative effect of imageability on valency:
    - Literal uses more negative – work in progress: qualitative analysis of actual instances
- **Q3: are the tendencies we identified common to other derivational patterns?**
- **Q4: can we characterize the *über* shift in terms of more fine-grained emotions?**

## Study 2: comparison to other derivational patterns

- We compare the whole *über* class to six derivational patterns (Kisselew et al. 2015):
  - N→N: FEMALE (*-in*), SMALL (*-chen*)
  - A→A: ADVERSATIVE (*anti-*), NEGATIVE (*un-*)
  - V→V: THROUGH (*durch-*), INCHOATIVE (*an-*)
- Linear regression<sup>2</sup> as in Study 1:
  - *über*-wise: no main effect, no interactions  
→ it makes sense to approach *über* per subclasses
  - Strong overall negative effect of concreteness on valency (\*\* ↓)
  - Strong interactions between concreteness and non *über* patterns, no interactions with arousal (specific feature of *über*)
  - Interesting non *über* result: significant **positive** (\* ↑) effect for the FEMALE pattern: female forms are used in more positive contexts than their male counterparts

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<sup>2</sup>Adj.R<sup>2</sup>=36% (\*\*\*)

## Study 3: the emotional component of the *über* shift

- Resource: **German Emotion Dictionary** (Klinger et al. 2016)
- Approx 4000 words in total, unweighted
- Seven emotions: joy, anger, fear, surprise, contempt, disgust, and sorrow
- Linear regression<sup>3</sup>: **emotional shift** as predicted value, emotions (joy, fear, etc.) and class (ACROSS, MORE, etc.) as predictors
- Results:
  - Less joy (\*) for ACROSS verbs than the respective bases
  - More surprise (\*) for MORE verbs
  - More anger (\*\*) for APPLICATION verbs

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<sup>3</sup>Adj.R<sup>2</sup>=7% (\*\*)

# Summing up & ongoing work

- We presented a strategy for the characterization of the pragmatic component encoded in distributional vectors
- We employed the notion of pragmatic context set subspace to detect **evaluative shifts and their interaction with other meaning dimensions** (imageability, arousal)
- Ongoing work:
  - Improving the method for the detection of emotional shifts
  - Bringing more derivational patterns into the picture (also pos-changing ones)

Thank you!