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Architectures and Mechanisms for Language Processing

Polysemy and acoustic duration: Different senses come with different durations

Background

Motivation

- Research on lexical ambiguity and phonetic realisation has shown that morphological differences in homophonous elements influence fine-phonetic detail
- For example, different types of word-final /s/ in English and German affect subphonemic acoustic duration [1, 2, 3]
- However, almost all studies in this area focus on homonymy, while polysemy has only recently been examined in this context
  - → In a reading task, speakers produced the word-final *-er* suffix (/ɐ/) significantly shorter when producing the gender-specific sense of a masculine role noun in German as opposed to its generic sense counterpart [4]

Aim

- The present study
  - → uses more natural speech elicited in a recall task showing that the effect is robust and not a mere artefact of the reading task, and
  - → analyses found durational differences using a lexicon-based measure from the discriminative lexicon model: semantic co-activation [5]

Generic vs. specific masculine

- Generic masculines are masculine forms with feminine counterparts used for referents irrespective of their gender / for referents of unknown gender
- Generic masculines have been shown to come with a clear male bias [6]

Method

Items

- 10 stereotypically female, 10 stereotypically male items [7]

stereotypically female

Balletttänzer ‘ballet dancer’	*Eiskunstläufer* ‘ice skater’	*Flugbegleiter* ‘flight attendant’	*Geburtshelfer* ‘obstetrician’	*Haushälter* ‘housekeeper’
Hellseher ‘clairvoyant’	*Kosmetiker* ‘beautician’	*Pfleger* ‘carer’	*Schneider* ‘tailor’	*Verkäufer* ‘salesperson’

stereotypically male

Bauarbeiter ‘construction worker’	*Elektriker* ‘electrician’	*Fußballspieler* ‘football player’	*Kranführer* ‘crane operator’	*Maurer* ‘mason’
Programmierer ‘programmer’	*Rennfahrer* ‘race driver’	*Reporter* ‘reporter’	*Schreiner* ‘carpenter’	*Wahrsager* ‘fortuneteller’

Contexts

- Each item was embedded in 3 contexts

Specific *Das ist* ***Nico****.* ***Nico*** *ist* ***Pfleger*** *im Hospiz. Was ist* ***Nico****?*
‘This is Nico. Nico is a nurse at the hospice. What is Nico?’

Generic *Das ist* ***Nina****.* ***Nina*** *ist* ***Pfleger*** *im Hospiz. Was ist* ***Nina****?*
‘This is Nina. Nina is a nurse at the hospice. What is Nina?’

Feminine *Das ist* ***Nina****.* ***Nina*** *ist* ***Pflegerin*** *im Hospiz. Was ist* ***Nina****?*
‘This is Nina. Nina is a nurse at the hospice. What is Nina?’

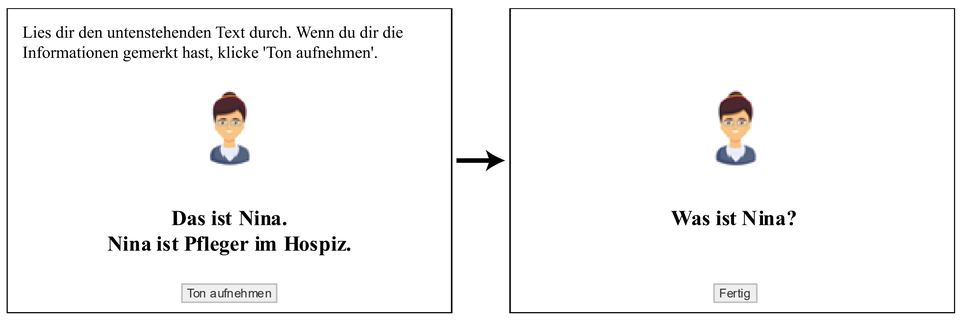
- Contexts were split into 3 lists of 20 stimuli each, randomised within participant

Participants

- 210 participants: L1 German, mean age 42.3, age range 22–64 years

Procedure

- Self-paced continuation: blank screen, context screen, question screen



Linear Discriminative Learning

- Computational implementation of the discriminative lexicon, a simple, linear model of the lexicon [6]
- Maps form C onto semantics S to simulate comprehension $CF = \hat{S}$
  - → Triphones onto context-specific embeddings created with BERT [7]
- Based on $\hat{S}$, different measures can be computed to provide insight into comprehension and the interrelations in the mental lexicon
  - → Semantic co-activation, i.e. the Euclidean norm of a vector $\hat{s}$ [8]; larger value = more/stronger semantic dimensions are activated

Analysis

- Linear mixed-effects regression models: a) generic vs. specific; b) co-activation
- Based on n = 1790 after exclusion of production errors, stuttering, and laughter

Results

Discussion

- In recalled speech – just as in read speech – the word-final *-er* suffix is produced significantly shorter in gender-specific than in generic masculines
- Goes against established theories of speech production [9, 10]
- Semantic co-activation as a measure offers an explanation for the durational difference: generic masculines show higher degrees of semantic co-activation, which in turn lead to a longer acoustic duration
- Future research in this area should investigate the non-attributive usage of the present role nouns, other polysemous items altogether, and make use of other experimental paradigms as well as of natural speech data

References

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