

Generic and specific masculines in German: Semantic and phonetic differences and similarities

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- in German, masculine role nouns with feminine counterparts can be used generically, i.e. independent of a referent's gender (e.g. Kotthoff & Nübling 2024)

*Tim ist **Lehrer** von Beruf.*

'Tim is a teacher by profession.'

specific

*Anna ist **Lehrer** von Beruf.*

'Anna is a teacher by profession.'

generic

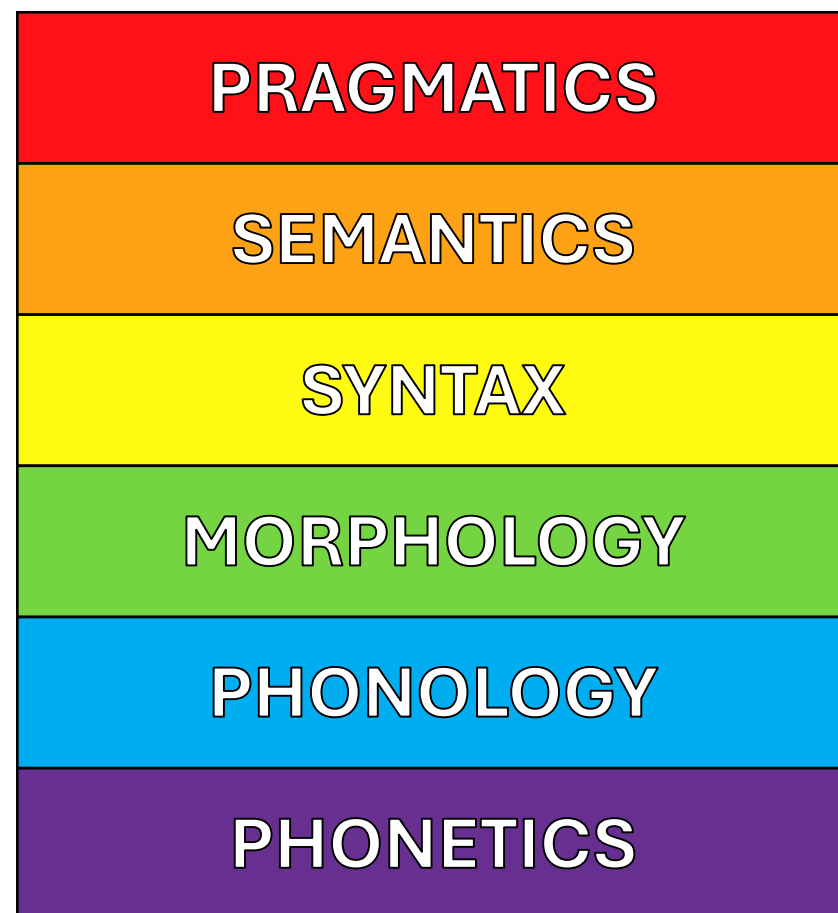
- the term 'generic' here is to be understood as 'gender-neutral' or 'regardless of gender'

Generic and specific masculines in German: Semantic and phonetic differences and similarities

Generic and specific masculines in German:

Semantic and phonetic differences and similarities

- according to prominent linguistic theories, semantics and phonetics are **strangers** (e.g. Levelt et al. 1999, Chomsky & Halle 1968)
- nonetheless, I decided to talk about both in today's talk
- not without reason: I will provide evidence that they are not only familiar with each other but that there is a direct connection between them



Semantics

Schmitz, D. (forthcoming). In German, all professors are male.

Schmitz, D., Schneider, V., & Esser, J. (2023). No genericity in sight: An exploration of the semantics of masculine generics in German.

Schmitz, D. (2024). Instances of bias: The gendered semantics of generic masculines in German revealed by instance vectors.

Schmitz, D., Müller-Spitzer, Carolin, Ochs, Samira, & Rüdiger, Jan Oliver (2025). Context doesn't matter: The male bias of generic masculines in German remains stable across different context windows.

Background & Motivation

- previous research has cast doubt on the gender-neutral use of generic masculines
- most (if not all) behavioural studies on the subject find one overall result:
generic masculines are not gender-neutral but show a clear bias towards the explicit
masculine reading (e.g. Demarmels 2017; Garnham et al. 2012; Gygax et al. 2008; Irmen & Kurovskaja 2010; Irmen & Linner 2005; Koch 2021; Misersky et al. 2019; Stahlberg & Sczesny, 2001)
- even though a generic masculine may be used with the intention of considering all genders...
- ...this intention is not fully translated by the receiver's comprehension system
- instead, a reading favouring male individuals is received

Background & Motivation

- however, previous research does not come without its own issues

Issue 1: Data

Studies make use of data elicited for the respective study, not of natural language data.

Issue 2: Semantics

Most studies provide evidence for a masculine bias but do not deliver further insight into the semantics of role nouns.

General method

- to capture semantics, the concept of **distributional semantics** is applied
- distributional semantics assumes that “you shall know a word by the company it keeps” (Firth 1957)
 - words which occur in similar contexts have similar meanings
 - words which occur in non-similar contexts have non-similar meanings
- judging from the counts of co-occurring words, *dog* and *cat* are somewhat similar (*tail*, *pet*) but not identical (*bark*, *meow*) in meaning

	<i>bark</i>	<i>meow</i>	<i>tail</i>	<i>pet</i>
<i>dog</i>	15	0	12	20
<i>cat</i>	0	18	10	22

General method

	<i>bark</i>	<i>meow</i>	<i>tail</i>	<i>pet</i>
<i>dog</i>	15	0	12	20
<i>cat</i>	0	18	10	22

General method

	<i>bark</i>	<i>meow</i>	<i>tail</i>	<i>pet</i>
<i>dog</i>	15	0	12	20
<i>cat</i>	0	18	10	22

- once the applied algorithm is finished, each row represents the semantics of the word it belongs to, e.g. *dog* or *cat*
- such a row, i.e. such an array of numbers, constitutes a semantic vector
- finally, vectors may be compared using correlation or cosine similarity as measures: the higher the value, the more similar two compared vectors are and, with that, the semantics they represent

General method

- three studies that make use of different approaches to vector computation

1. naive discriminative learning (Baayen et al. 2011)
2. fastText & instance vectors (Bojanowski et al. 2013, Lapesa et al. 2018)
3. BERT, a large language model (Devlin et al. 2018)

Semantics 1

Schmitz, D. (forthcoming). In German, all professors are male.

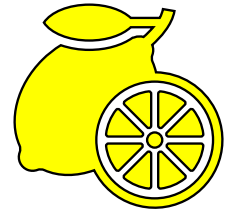
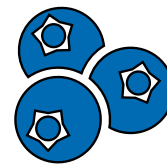
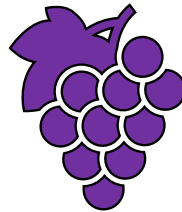
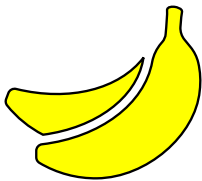
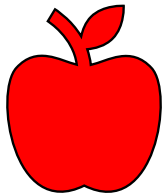
Schmitz, D., Schneider, V., & Esser, J. (2023). No genericity in sight: An exploration of the semantics of masculine generics in German.

1 Naive discriminative learning

- follows the Rescorla-Wagner rules (Rescorla & Wagner, 1972; Wagner & Rescorla, 1972)
- most importantly, these rules state that
 - outcomes are predicted by cues
 - the associative strength between an outcome and a cue is represented by a single number
- in the present study cues and outcomes are
 - content words in their base form
 - grammatical information: number and grammatical gender
 - type: generic masculine, specific masculine, specific feminine
- we used each sentence to predict each individual word within the sentence by the other words in that sentence

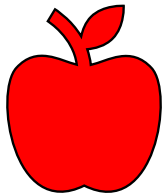
1 Naive discriminative learning

Toy example: different types of fruit

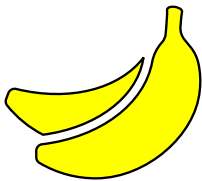


1 Naive discriminative learning

Toy example: different types of fruit



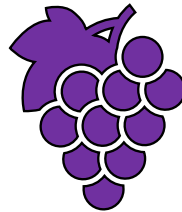
red
sweet
round



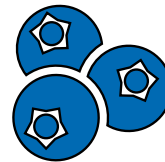
yellow
sweet
long



orange
sour
round



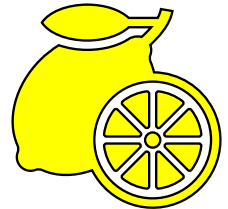
purple
sweet
round



blue
sweet
round



red
sweet
round
long



yellow
sharp
round
long

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour	round	long
	1					1		1	
		1				1			1
			1				1	1	
				1		1		1	
					1	1		1	
	1					1			1
		1					1	1	1

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour	round	long
	30					30		30	
		15				15			15
			18				18	18	
				10		10		10	
					5	5		5	
	45					45		45	45
		20					20	20	20

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour	round	long
	29	1				30		30	
		15				15			15
			18				18	18	
				10		10		10	
					5	5		5	
	45					45		45	45
		20					20	20	20

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour	round	long
	29	1				29	1	30	
		15				15			15
			18				18	18	
				10		10		10	
					5	5		5	
	45					45		45	45
		20					20	20	20

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour	round	long
	29	1	-1	-3	-2	29	1	30	-1
	-10	15	-10	-8	-6	15	-11	-5	15
	-6	-7	18	-14	-15	3	15	18	-2
	-5	-1	-6	10	-9	5	5	10	-7
	-6	-9	-19	2	3	4	1	5	-5
	45	-6	-9	-14	-1	25	20	45	45
	-1	20	-5	-6	-8	-4	20	20	20

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour	round	long
	29	1	-1	-3	-2	29	1	30	-1
	-10	15	-10	-8	-6	15	-11	-5	15
	-6	-7	18	-14	-15	3	15	18	-2
	-5	-1	-6	10	-9	5	5	10	-7
	-6	-9	-19	2	3	4	1	5	-5
	45	-6	-9	-14	-1	25	20	45	45
	-1	20	-5	-6	-8	-4	20	20	20

1 Naive discriminative learning

Toy example: different types of fruit

	red	yellow	orange	purple	blue	sweet	sour
apple	29	1	-1	-3	-2	29	1
banana	-10	15	-10	-8	-6	15	-11
orange	-6	-7	18	-14	-15	3	15
grape	-5	-1	-6	10	-9	5	5
blueberry	-6	-9	-19	2	3	4	1
strawberry	45	-6	-9	-14	-1	25	20
lemon	-1	20	-5	-6	-8	-4	20

1 Naive discriminative learning

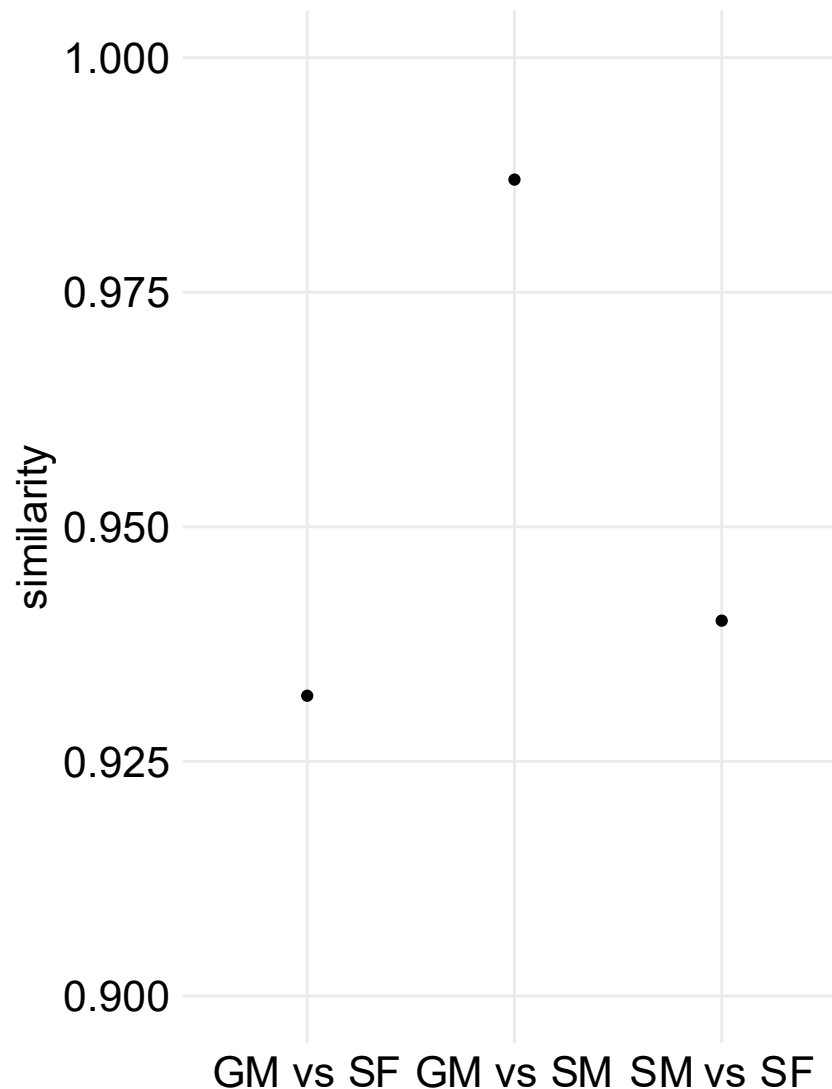
- naive discriminative learning was applied to 830,000 sentences
 - 30,000 sentences with manually annotated target words, i.e. generic masculines, specific masculines, and specific feminines
 - 800,000 further sentences
- based on the resulting semantic vectors, the representation of target words was assembled, for example

target form	base		number		gram. gender		type
Anwalt	Anwalt	+	singular	+	masculine	+	generic
Anwalt	Anwalt	+	singular	+	masculine	+	specific
Anwältin	Anwalt	+	singular	+	feminine	+	specific

1 Naive discriminative learning

Results

- generic masculines are specific
masculines are most similar
- generic masculines and specific
feminines are least similar



1 Naive discriminative learning

Issues

1. generic as a cue only ever co-occurs with grammatically masculine words, never with feminine ones – this results in a strong correlation of generic and masculine, pushing constructed vectors of generic masculines further towards the masculine
2. generic is treated as an exponent, i.e. as a grammatical function or marker, even though it is not

Semantics 2

Schmitz, D. (2024). Instances of bias: The gendered semantics of generic masculines in German revealed by instance vectors.

2 fastText & instance vectors

- fastText is a widely used implementation of distributional semantics (Bojanowski et al. 2016)
- it was trained on the same sentences that were used with naive discriminative learning
- however, as generic masculines and specific masculines come with identical forms, fastText will compute only one general masculine vector for each target word
- solution: instance vectors (Lapasa et al., 2018)
 - instance vectors are vectors computed for each instance, i.e. attestation, of a given target word within a given corpus
 - each instance vector is the average of n context words preceding and following the target word in a pertinent attestation

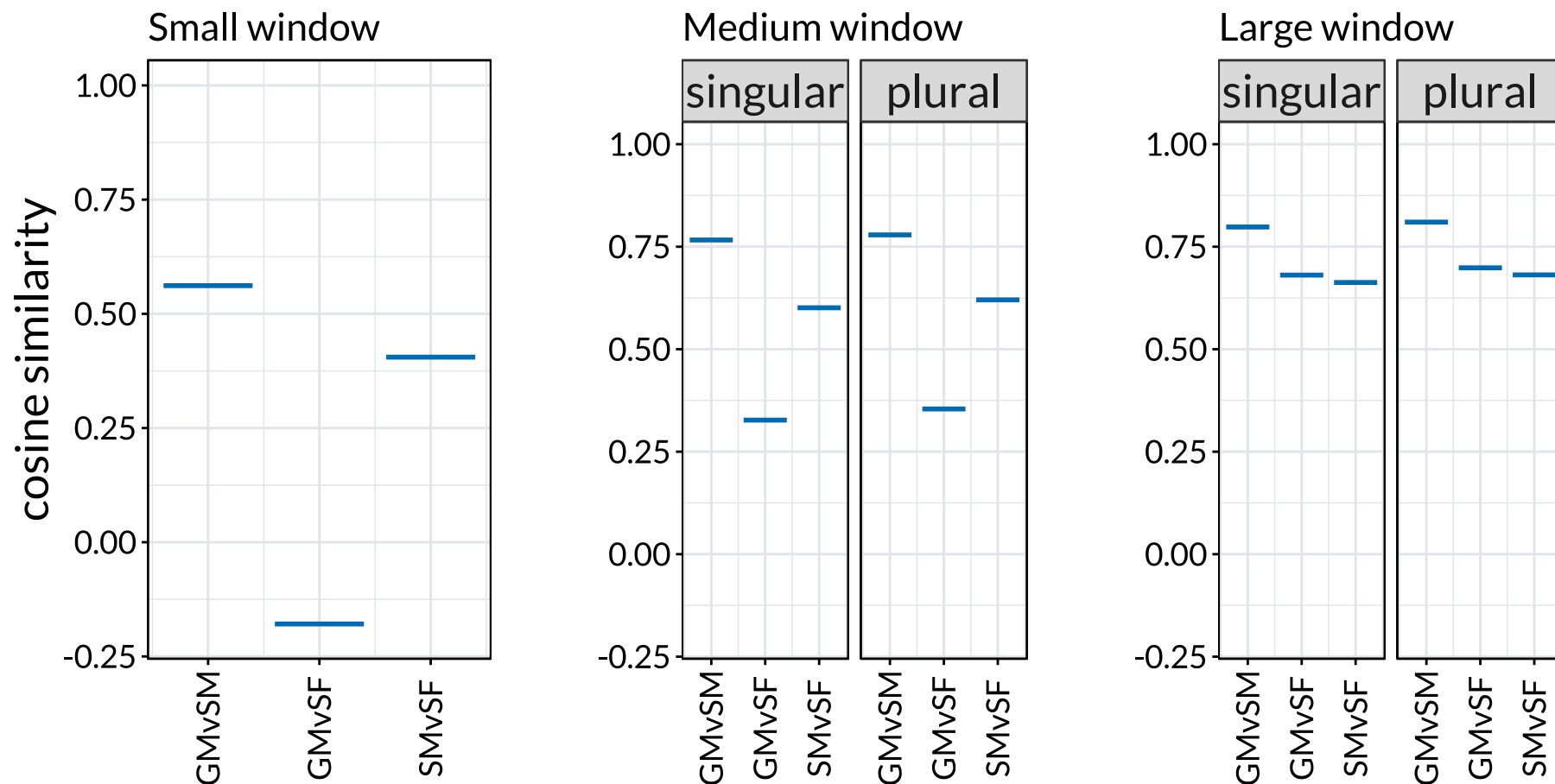
2 fastText & instance vectors

- following Lapesa et al. (2018), the following sizes were used
 - $n = 2$ assumed to reflect true semantic similarity
 - $n = 8$ assumed to reflect topical similarity
- additionally
 - $n = 5$



2 fastText & instance vectors

Results



2 fastText & instance vectors

Issues

- context is taken into account only for target words, not for the words making up the context
- this is purely based on computational effort, not on theoretical arguments

Semantics 3

Schmitz, D., Müller-Spitzer, Carolin, Ochs, Samira, & Rüdiger, Jan Oliver (2025). Context doesn't matter: The male bias of generic masculines in German remains stable across different context windows.

3 BERT, a large language model

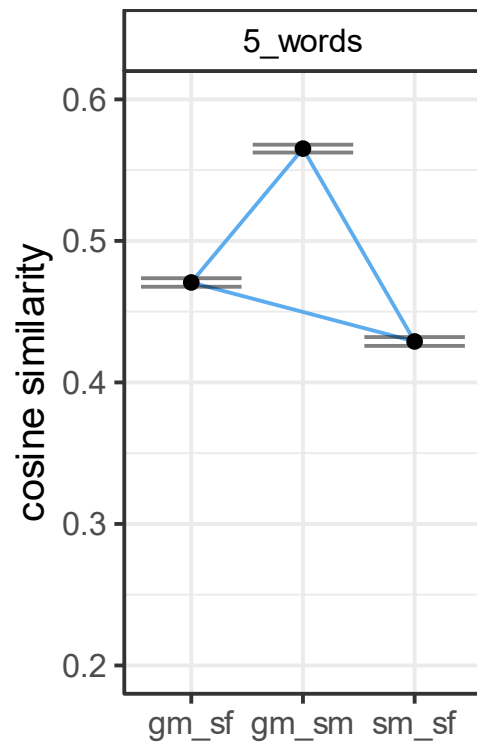
- unlike static vectors based on general word co-occurrences, LLMs can incorporate the word sequence in the immediate context of a target word, producing token-level vectors that reflect context-specific meanings
- thus, different occurrences of the same word type have similar but distinct vectors
- to capture context-specific meanings, the present study uses vectors generated via the pre-trained bidirectional language model ‘bert-base-german-cased’ (Devlin et al. 2018)

3 BERT, a large language model

- to gain insights into the potentially disambiguating properties of differently sized context windows, we used different amounts of preceding and following context
 - 5 words before and after the target
 - 10 words before and after the target
 - the entire sentence
 - and the sentence plus the sentence before and after
- for each inputted target attestation and its specified context window, we obtained one context-specific vector

3 BERT, a large language model

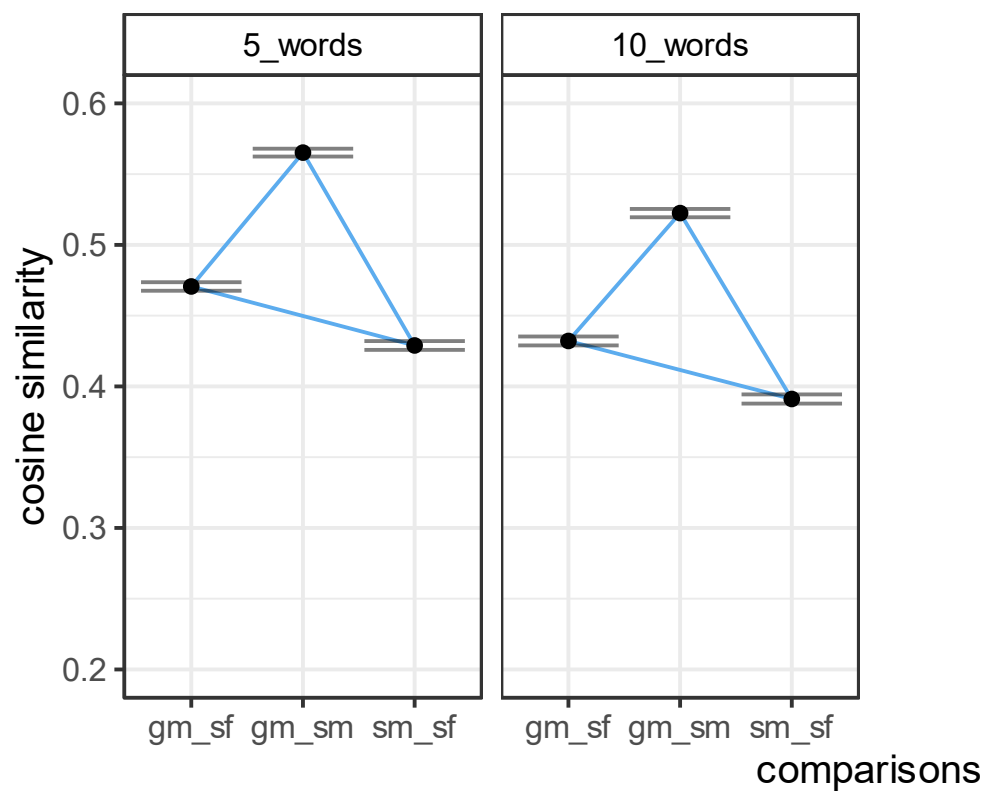
Results



comparisons

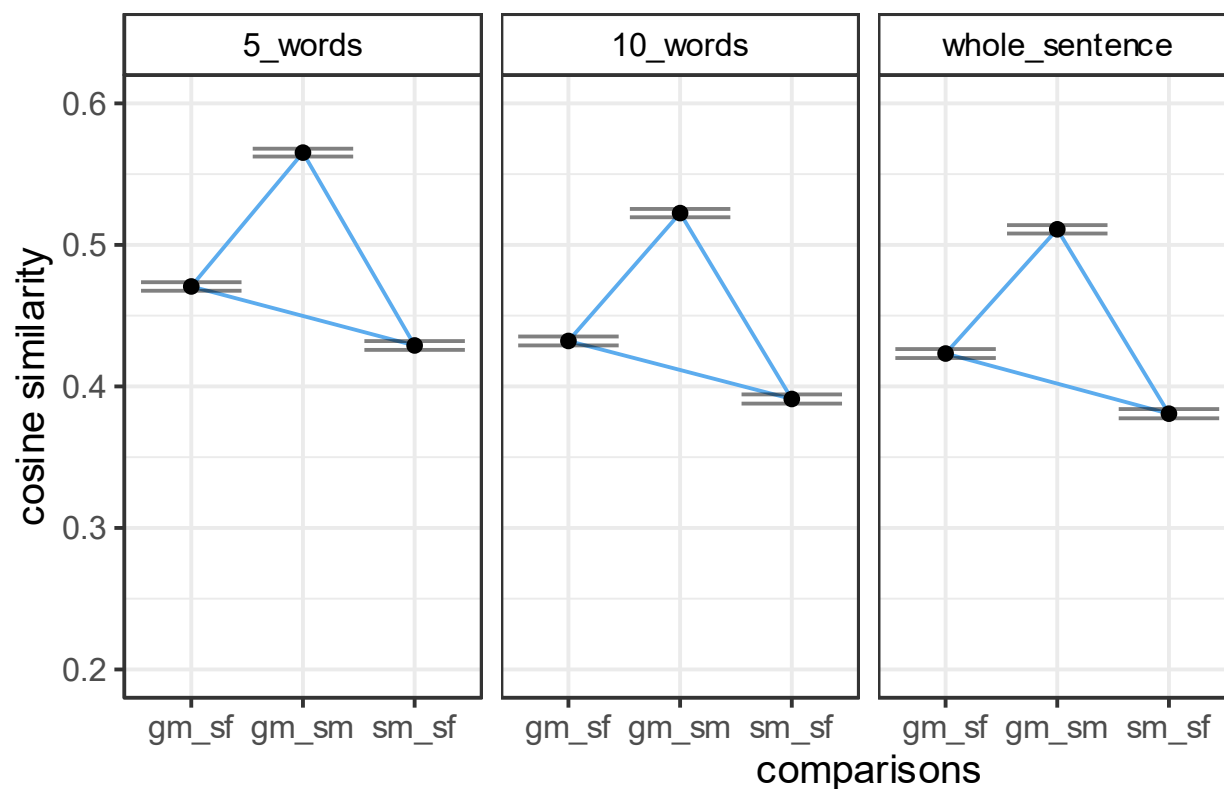
3 BERT, a large language model

Results



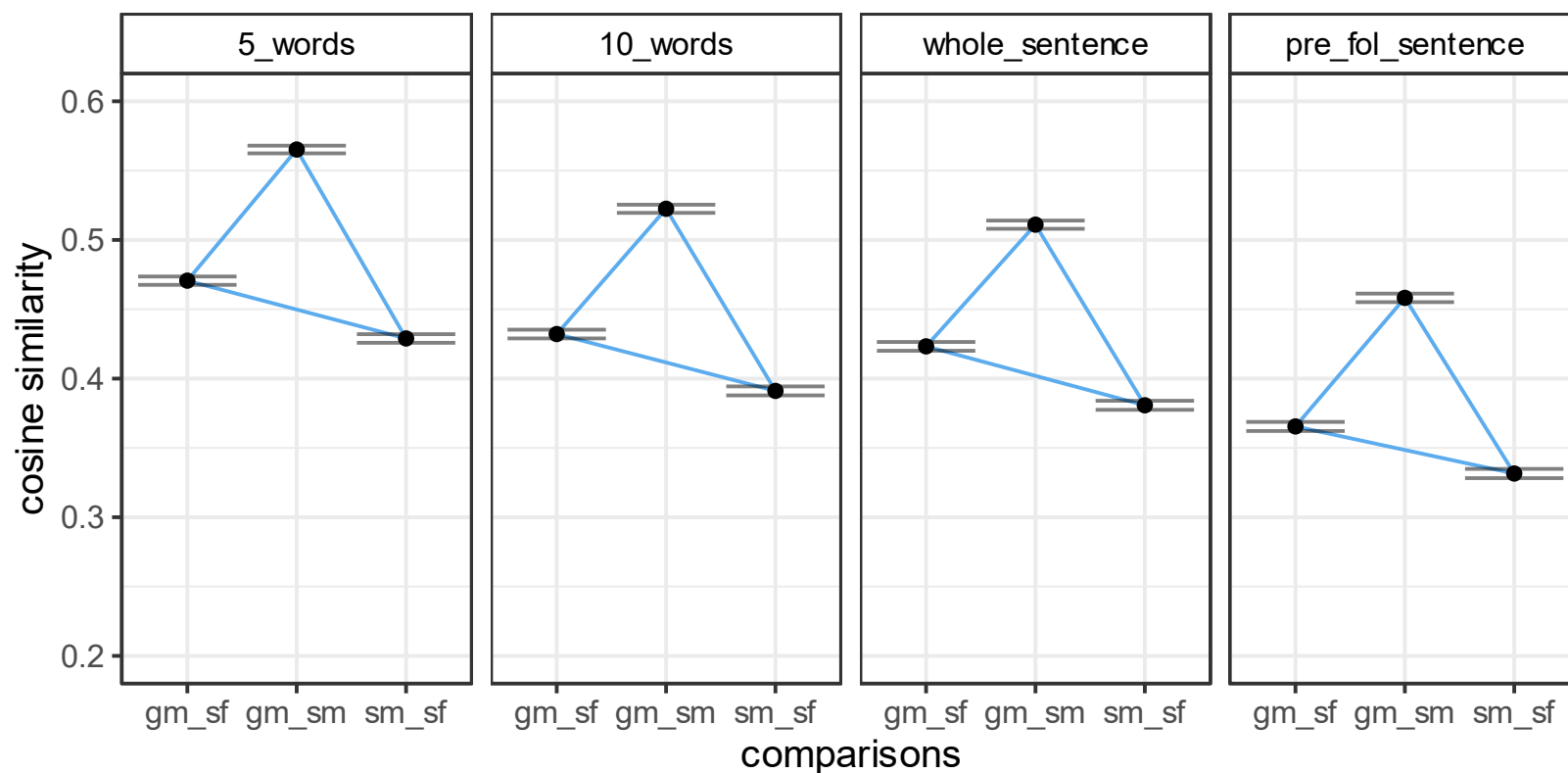
3 BERT, a large language model

Results



3 BERT, a large language model

Results



Summary

- no matter the approach – naive discriminative learning, fastText & instance vectors, BERT – generic masculines and specific masculines are always semantically most closely related
- importantly, generic masculines are always semantically closer to specific masculines than to specific feminines
- this is another piece of evidence for the male bias of generic masculines
- and in line with previous studies making use of other methods (e.g. Demarmels 2017; Garnham et al. 2012; Gygax et al. 2008; Irmen & Kurovskaja 2010; Irmen & Linner 2005; Koch 2021; Misersky et al. 2019; Stahlberg & Sczesny, 2001)

Phonetics

Schmitz, D. (forthcoming). Homophonous semantic minimal pairs differ in their subphonemic acoustic durations: The case of generic and specific masculines in German.

Schmitz, D. (in prep). Polysemy and the phonetic signal: The acoustics of word-final -er in German.

Schmitz, D. & Keller, J. (2025). Polysemes have no common sense duration.

Background & Motivation

- previous research found durational differences conditioned by morphologically different but phonologically identical elements

- homophonous free and bound (pseudo-)stems (e.g. Seyfarth et al. 2017)

frees vs. *freeze*

- homophonous prefixes (e.g. Ben Hedia & Plag 2017)

impossible vs. *implant* (negative vs. locative)

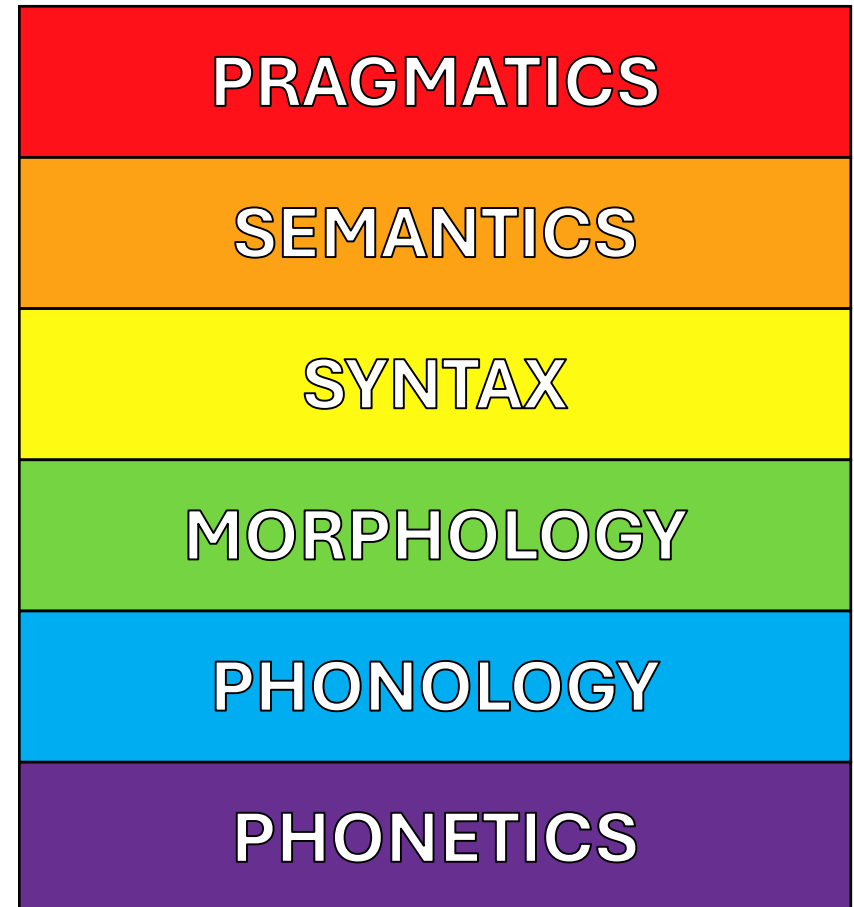
- types of /s/ (e.g. Plag et al. 2017, Schmitz et al. 2021)

bus vs. *cats* vs. *cat's* (non-morphemic vs. suffix vs. clitic)

- homophonous forms show differences in their phonetic realisation

Background & Motivation

- according to prominent linguistic theories, morphology and phonetics are strangers (e.g. Levelt et al. 1999, Chomsky & Halle 1968)
 - just as semantics and phonetics are
- but: we just heard of counterevidence for the connection of morphology and phonetics via homophonous elements
- so, what about another type of lexical ambiguity: polysemy?
- we may assume that specific and generic masculines are senses of a polyseme (cf. semantics part)



Studies

1. Pilot study
reading task & real words
2. Follow-up study
recall task & real words
3. Follow-up study
recall task & real words

Phonetics 1

Schmitz, D. (forthcoming). Homophonous semantic minimal pairs differ in their subphonemic acoustic durations: The case of generic and specific masculines in German.

1 Materials

Items

- **targets:** 20 role nouns ending in the -er suffix, i.e. /ɐ/

stereotypically female (Misersky et al., 2014)

<i>Balletttänzer</i> 'ballet dancer'	<i>Eiskunstläufer</i> 'ice skater'	<i>Flugbegleiter</i> 'flight attendant'	<i>Geburtshelfer</i> 'obstetrician'	<i>Haushälter</i> 'housekeeper'
<i>Hellseher</i> 'clairvoyant'	<i>Kosmetiker</i> 'beautician'	<i>Pfleger</i> 'carer'	<i>Schneider</i> 'tailor'	<i>Verkäufer</i> 'salesperson'

stereotypically male

<i>Bauarbeiter</i> 'construction worker'	<i>Elektriker</i> 'electrician'	<i>Fußballspieler</i> 'football player'	<i>Kranführer</i> 'crane operator'	<i>Maurer</i> 'mason'
<i>Programmierer</i> 'programmer'	<i>Rennfahrer</i> 'race driver'	<i>Reporter</i> 'reporter'	<i>Schreiner</i> 'carpenter'	<i>Wahrsager</i> 'fortuneteller'

- **fillers**
 - feminine forms of target items, e.g. *Balletttänzerin*, *Bauarbeiterin*
 - used with female referents only

1 Materials

Contexts

1. phrase or sentence introducing the referent
2. phrase or sentence containing the target item

specific

Matteos Vater kann richtig gut nähen. **Er** ist **Schneider** von Beruf.

‘**Matteo's father** is really good at sewing. **He** is a **tailor** by profession.’

generic,

Mein Kind kann richtig gut nähen. **Es** ist **Schneider** von Beruf.

gender unspecified

‘**My child** is really good at sewing. **It** is a **tailor** by profession.’

generic,

Marias Mutter kann richtig gut nähen. **Sie** ist **Schneider** von Beruf.

gender specified

‘**Maria's mother** is really good at sewing. **She** is a **tailor** by profession.’

1 Materials

Lists

- 4 lists with 40 items, i.e. 30 targets + 10 fillers

- per list:

		type	number
15	5	SM	singular
	5	GM, unspec.	
	5	GM, spec.	
15	5	SM	plural
	5	GM, unspec.	
	5	GM, spec.	
10	5	SF	singular
	5	SF	plural

- pseudo-randomised: trials with the same item did not directly follow each other

1 Participants & procedure

Participants

- 40 participants
- L1 German
- age: mean 29.1 years, range: 20 – 64 years

Procedure

- 1 set of context and target phrase/sentence per trial
- instructions: read quietly before reading aloud
- self-paced

1 Participants & procedure

**Matteos Vater kann richtig gut nähen.
Er ist Schneider von Beruf.**

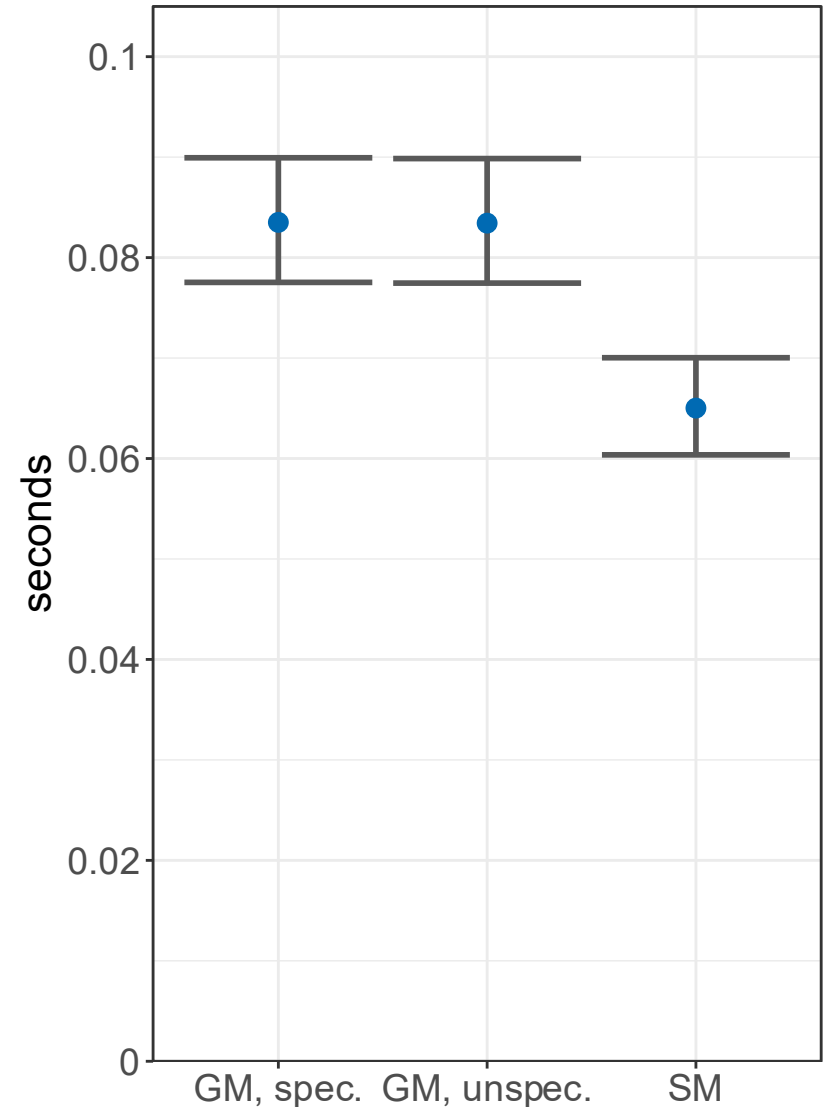
Ton aufnehmen

1 Results

- the type of masculine shows a clearly significant effect, i.e. $GM = GM > SM$

	GM, unspec	GM, spec	SM
mean (sd)	0.0869 (0.0262)	0.0871 (0.0258)	0.0682 (0.0217)

- the effect size is large with $\eta^2 = 0.2$, with 95% CI of [0.48, 1.00]



Phonetics 2

Schmitz, D. (in prep). Polysemy and the phonetic signal: The acoustics of word-final -er in German.
Schmitz, D. & Keller, J. (2025). Polysemes have no common sense duration.

2 Materials

Items

- **targets:** 20 role nouns ending in the -er suffix, i.e. /ɐ/

stereotypically **female** (Misersky et al., 2014)

<i>Balletttänzer</i> 'ballet dancer'	<i>Eiskunstläufer</i> 'ice skater'	<i>Flugbegleiter</i> 'flight attendant'	<i>Geburtshelfer</i> 'obstetrician'	<i>Haushälter</i> 'housekeeper'
<i>Hellseher</i> 'clairvoyant'	<i>Kosmetiker</i> 'beautician'	<i>Pfleger</i> 'carer'	<i>Schneider</i> 'tailor'	<i>Verkäufer</i> 'salesperson'

stereotypically **male**

<i>Bauarbeiter</i> 'construction worker'	<i>Elektriker</i> 'electrician'	<i>Fußballspieler</i> 'football player'	<i>Kranführer</i> 'crane operator'	<i>Maurer</i> 'mason'
<i>Programmierer</i> 'programmer'	<i>Rennfahrer</i> 'race driver'	<i>Reporter</i> 'reporter'	<i>Schreiner</i> 'carpenter'	<i>Wahrsager</i> 'fortuneteller'

- **fillers**
 - feminine forms of target items, e.g. *Balletttänzerin*, *Bauarbeiterin*
 - used with female referents only

2 Materials

Contexts

1. sentence introducing the referent
2. sentence introducing the referent's occupation
3. question about the referent's occupation

specific

*Das ist **Lasse**. **Lasse** ist **Pfleger** im Hospiz. Was ist **Lasse**?*

‘This is **Lasse**. **Lasse** is a **nurse** at the hospice. What is **Lasse**?’

generic

*Das ist **Lisa**. **Lisa** ist **Pfleger** im Hospiz. Was ist **Lisa**?*

‘This is **Lisa**. **Lisa** is a **nurse** at the hospice. What is **Lisa**?’

feminine

*Das ist **Lisa**. **Lisa** ist **Pflegerin** im Hospiz. Was ist **Lisa**?*

‘This is **Lisa**. **Lisa** is a **nurse** at the hospice. What is **Lisa**?’

2 Materials

Lists

- 3 lists with 20 items
 - A: 6 generic masculine + 6 specific feminine + 8 specific masculine
 - B: 6 generic masculine + 8 specific feminine + 6 specific masculine
 - B: 8 generic masculine + 6 specific feminine + 6 specific masculine
- randomised within participant

2 Participants & procedure

Participants

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

Procedure

- 1 context per trial
- instructions: read quietly, then answer the question
- self-paced

2 Participants & procedure



**Das ist Iva.
Iva ist Balletttänzer beim städtischen
Theater.**

Weiter

2 Participants & procedure

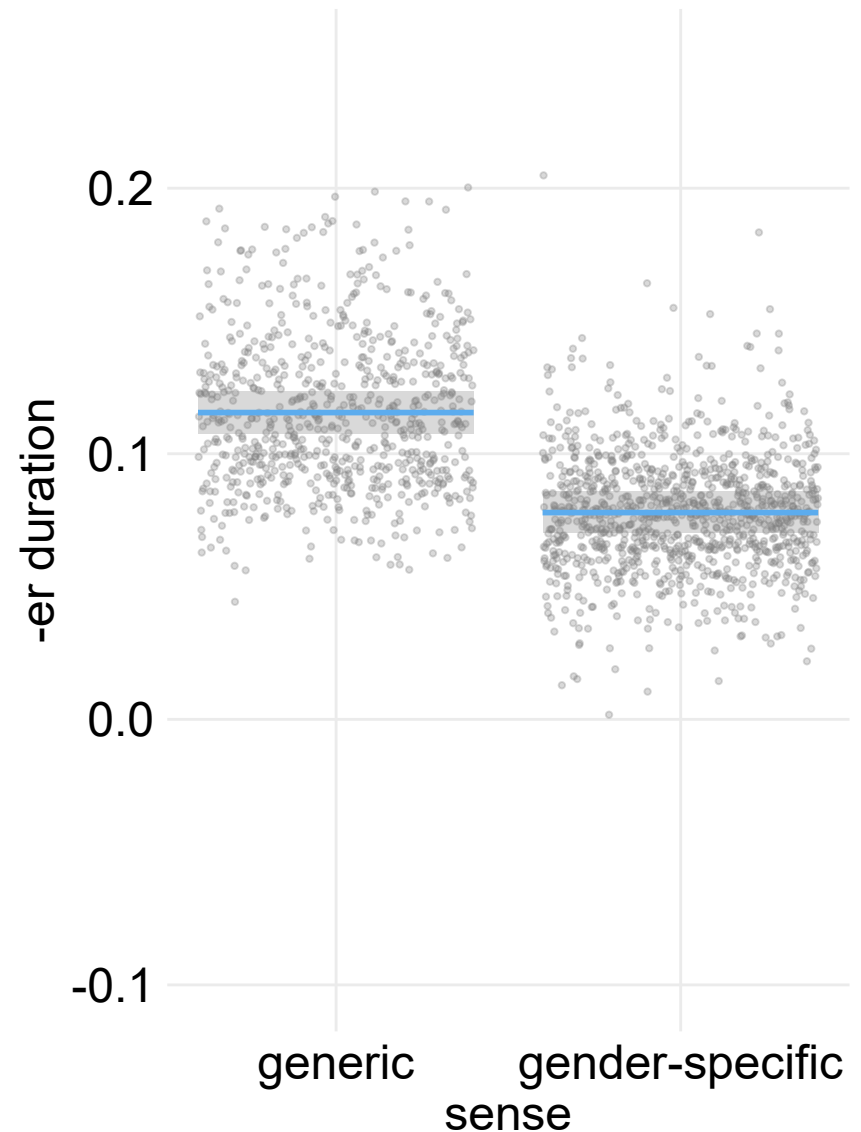


Was ist Iva?

Ton aufnehmen

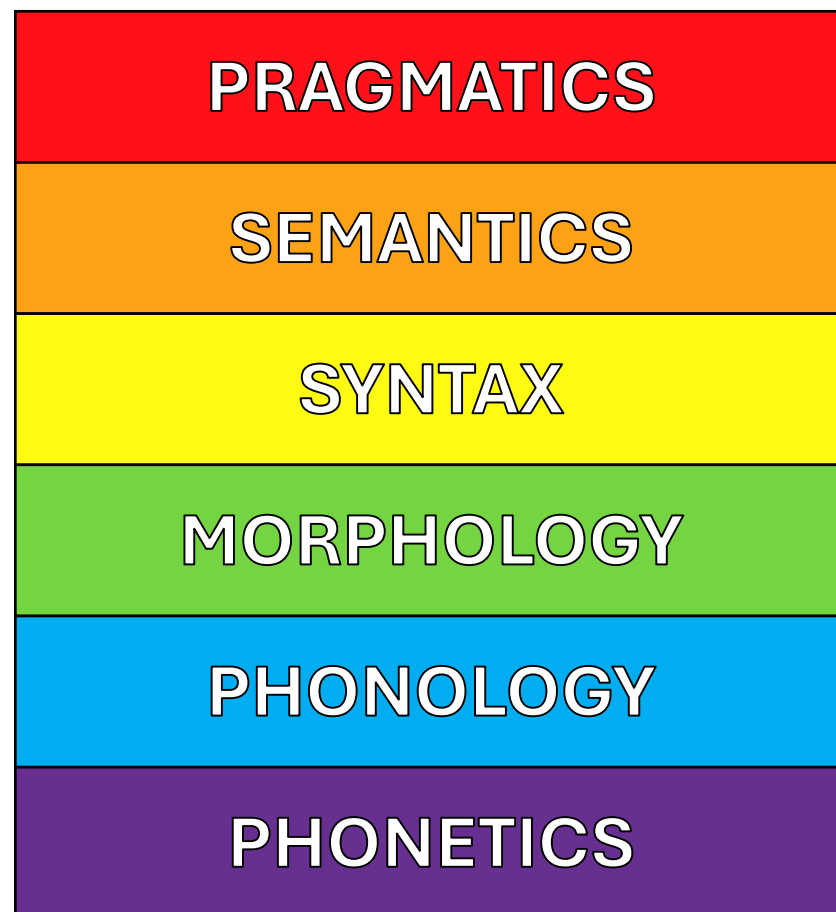
2 Results

- the type of masculine shows a clearly significant effect, i.e. GM > SM
- the effect size is large with $\eta^2 = 0.32$, with 95% CI of [0.29, 1.00]



Discussion

- according to prominent linguistic theories, semantics and phonetics are strangers (e.g. Levelt et al. 1999, Chomsky & Halle 1968)
- however, we just saw evidence that senses of a polysemous word come with distinct durational patterns
- that is, semantics must be connected to phonetics, or, in other words, phonetics must be informed or influenced by semantics



General discussion

General findings

- generic masculines and specific masculines are semantically very similar, yet phonetically distinct

What should we take away from these findings?

- it is practically impossible that generic masculines are gender-neutral, as they are so semantically close to specific masculines
- nonetheless, they are phonetically different regarding their suffix durations

Where do we go from here?

- it is likely that generic masculines are processed differently than specific masculines (cf. Schmitz et al. 2023, Schmitz 2024)
- further research in this direction is required to show why phonetic differences arise

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Generic and specific masculines in German: Semantic and phonetic differences and similarities

THANK YOU!

Pseudowords

Dahper	Tohker	Gahter	Legaper	Sutaker	Miwater
Keeper	Kuhper	Reeter	Kiteper	Temeker	Kaniter
Nieper	Bieler	Duhper	Nukiper	Nobiker	Dumeter
Lähper	Bohker	Fieter	Ranoper	Dinoker	Renoter
Nuhper	Duhker	Kuhter	Galuper	Mituker	Pimuter
Hühper	Tühker	Gähter	Togüper	Valöker	Foküter
Löhper	Böhker	Pühter	Hutöper	Ludüker	Hunöter
Gahter	Dahper	Tohker	Miwater	Legaper	Sutaker
Reeter	Keeper	Kuhper	Kaniter	Kiteper	Temeker
Duhper	Nieper	Bieler	Dumeter	Nukiper	Nobiker
Fieter	Lähper	Bohker	Renoter	Ranoper	Dinoker
Kuhter	Nuhper	Duhker	Pimuter	Galuper	Mituker
Gähter	Hühper	Tühker	Foküter	Togüper	Valöker
Pühter	Löhper	Böhker	Hunöter	Hutöper	Ludüker