

IMAGE: SEASEASYD/SHUTTERSTOCK

They across space and time: Capturing the nature of a multifaceted pronoun

Dominic Schmitz (he/him)

English Language and Linguistics, Heinrich Heine University Düsseldorf

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Why study singular *they*?

1. **Sociopolitical lightning rod** (e.g. Baron 2021)

- in recent years, pronouns have become a highly visible and politicised topic, not only in academia, but in public discourse, education, and legislation
- the choice or imposition of pronouns often functions as a proxy debate for broader anxieties about gender diversity, normativity, and identity politics

2. **site of queer visibility** (e.g. Zimman 2019)

- singular *they* challenges binary language structures, thereby unsettling hegemonic expectations of gendered language
- it is frequently used by nonbinary and gender-diverse individuals, becoming a form of linguistic self-determination

Why study singular *they*?

3. **socially loaded words** (e.g. Saguy & Williams 2022)

- as closed-class function words, pronouns often escape conscious scrutiny, yet they do a lot of social work
- changes in pronoun use signal shifting ideologies and normative resistance

4. **the grammar-politics interface** (e.g. Bodine 1975)

- it raises crucial questions about how language change intersects with social justice and normativity
- who gets to determine what is “grammatical”? who is erased or legitimised by pronoun systems?

5. **methodological importance** (e.g. Foertsch & Gernsbacher 1997)

- studying *they* from a cognitive perspective allows us to see how socially significant linguistic items are represented and handled in real-time language use

Types of singular *they*

- in contemporary English, one can differentiate at least four types of singular *they* (Conrod 2020)

- **generic indefinite**

*Someone ran out of the classroom, but **they** forgot their backpack.*

- **generic definite**

*The ideal student completes the homework, but not if **they** have an emergency.*

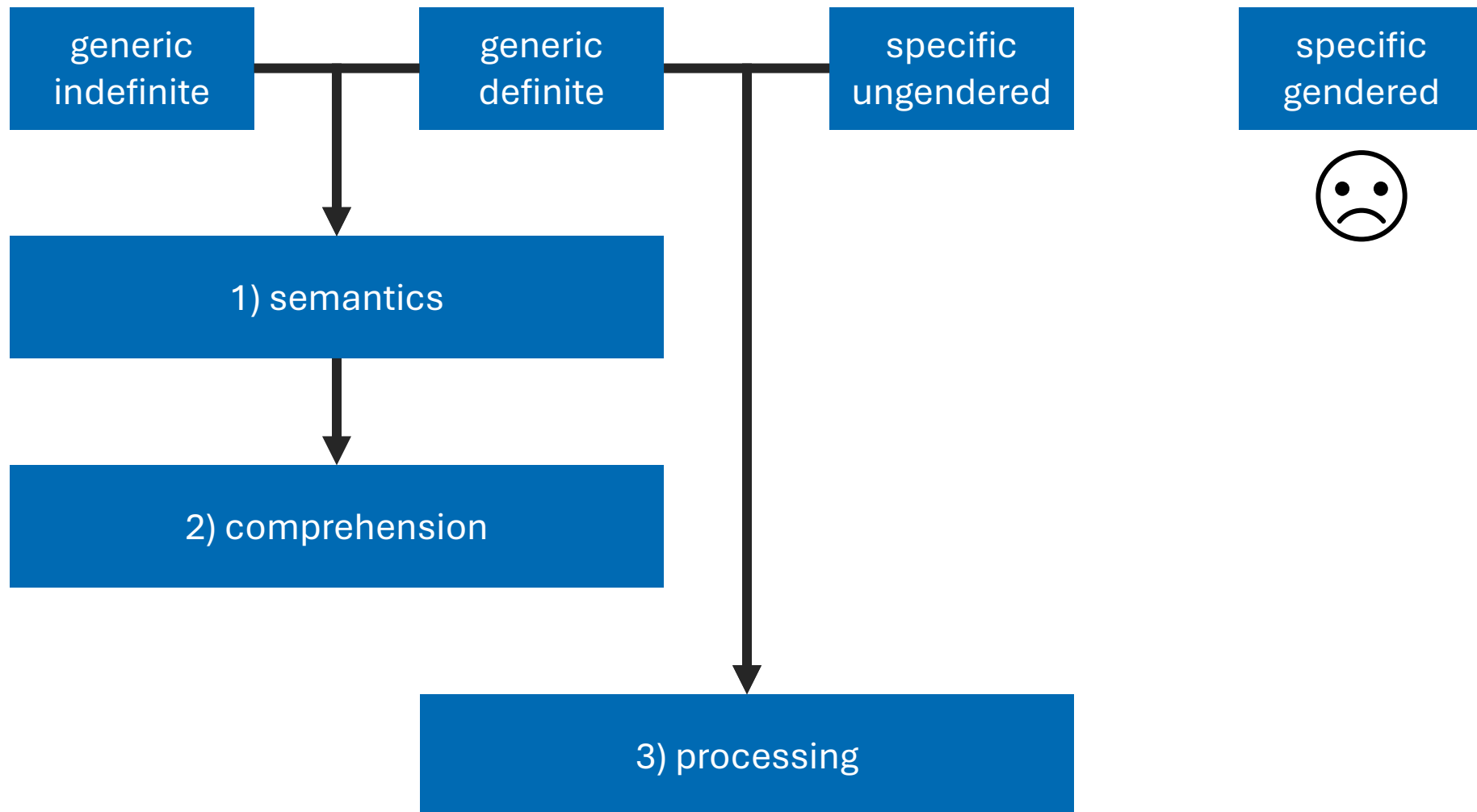
- **specific ungendered**

*The math teacher is talented, but **they** hand back grades late.*

- **specific gendered**

*James is great at laundry, but **they** never wash **their** dishes.*

Unpacking singular *they* in three studies



Semantics

What does generic *they* mean?
Is it semantically more similar to *he*,
she, or plural *they*?

Schmitz, D. (2025). Pronoun comprehension from a discriminative perspective: A proof of concept. In D. Schmitz, S. D. Stein, & V. Schneider (Eds.), *Linguistic intersections of language and gender: Of gender bias and gender fairness* (pp. 95–110). düsseldorf university press. doi: 10.1515/9783111388694-006/html

Distributional semantics

- to capture the semantics of pronouns, the idea of **distributional semantics** is used
- 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

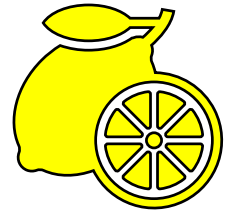
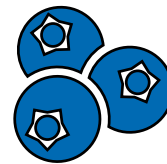
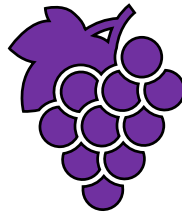
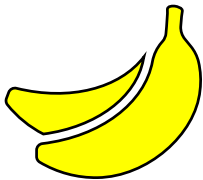
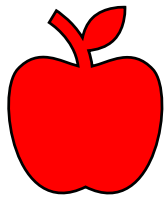
- different algorithms, e.g. naive discriminative learning (Baayen et al., 2011) and instance vectors (Lapesa et al., 2018)

Naive discriminative learning

- NDL 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

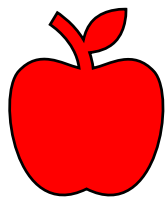
Naive discriminative learning

Toy example: different types of fruit

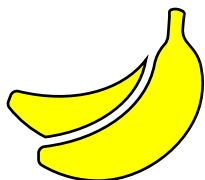


Naive discriminative learning

Toy example: different types of fruit



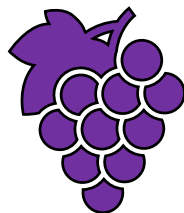
red
sweet
round



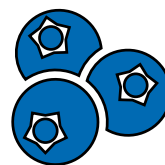
yellow
sweet
long



orange
sour
round



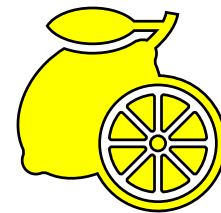
purple
sweet
round



blue
sweet
round



red
sweet
round
long



yellow
sharp
round
long

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

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

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

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

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

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

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

Naive discriminative learning

- however: 1 vector per word = 1 vector per pronoun
- potentially very different semantics of pronoun attestations are conflated into one vector representation
- this is an issue!
 - pronouns are assumed to inherit the semantics of their referents

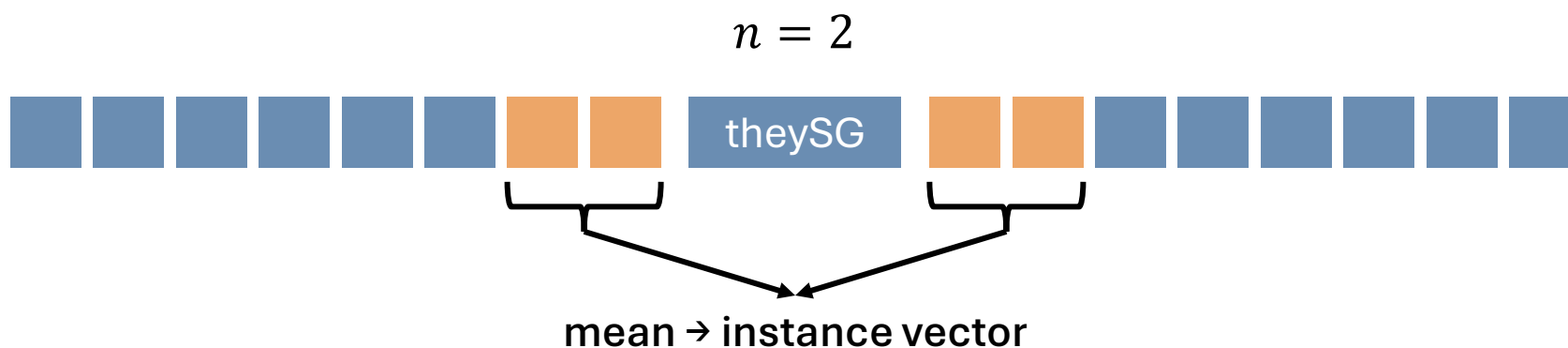
Instance vectors

- the solution: instance vectors
 - take n preceding and following words
 - get the semantic vectors of these words
 - compute the mean of these vectors
= instance vector



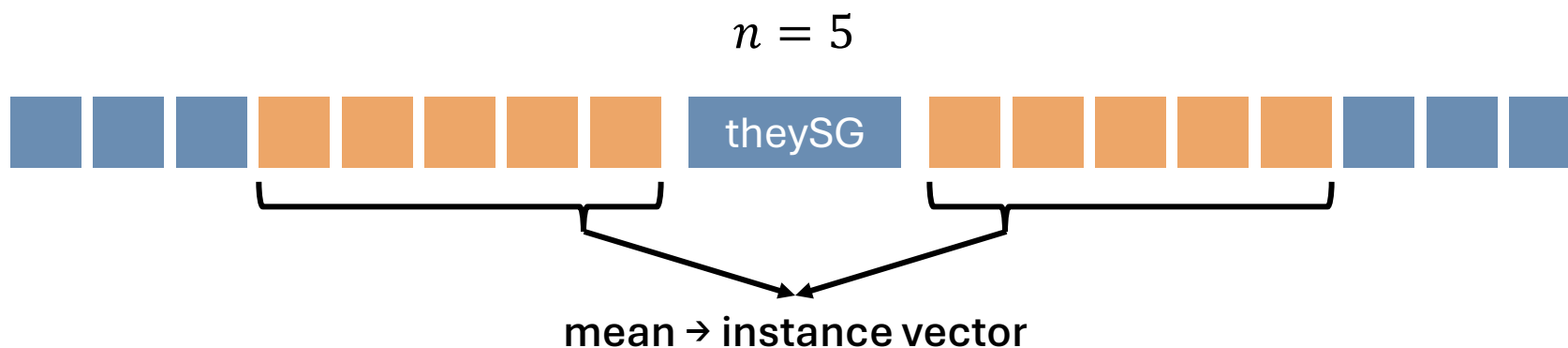
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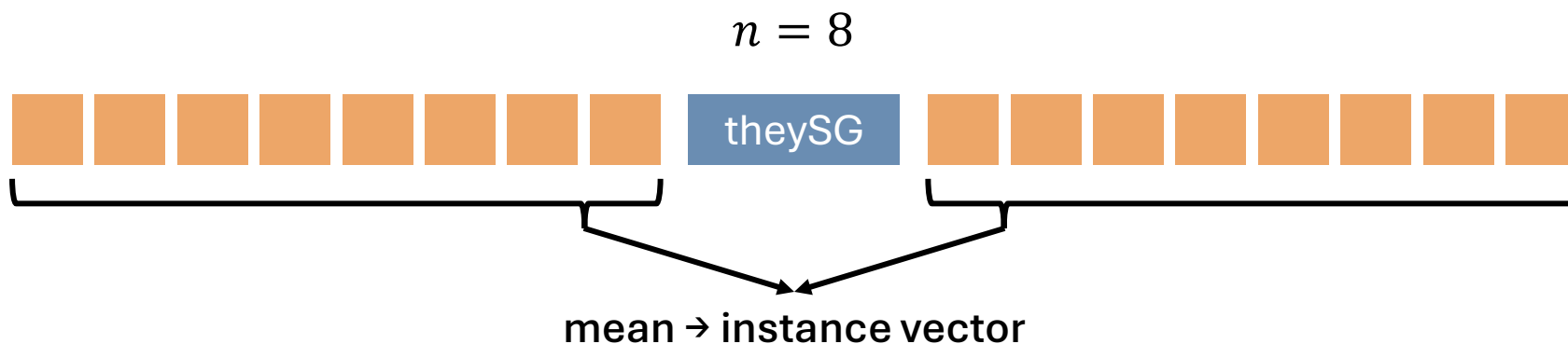
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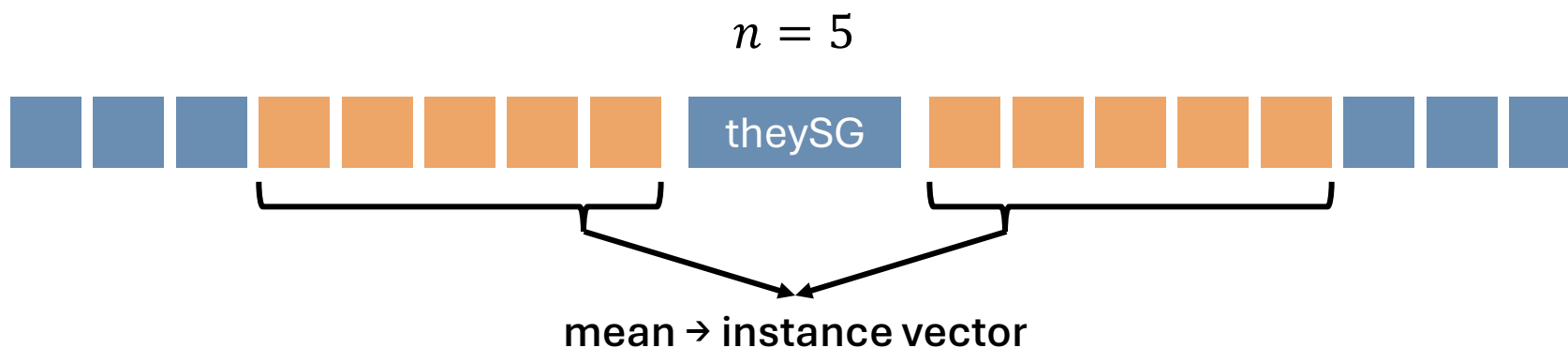
Instance vectors

- the solution: instance vectors
 - take n preceding and following words
 - get the semantic vectors of these words
 - compute the mean of these vectors
= instance vector



Instance vectors

- for the present study
 - $n = 5$
 - preceding and following semantic vectors: via NDL



Corpus

- small corpus based on COCA (Davies, 2008-)
 - 17,805 word form tokens
 - 1,000 sentences
 - 50 + attestations of each target pronoun
he, she, generic they, plural they
- pronoun attestations were manually checked for number and genericity

Semantic similarity

- to check how similar the four pronouns are, their vectors' mean correlations are computed: higher correlation → higher semantic similarity

	<i>she</i>	generic <i>they</i>	plural <i>they</i>
<i>he</i>	0.94	0.53	0.60
<i>she</i>		0.57	0.59
generic <i>they</i>			0.58

- he* and *she* are, unsurprisingly, very similar
- he* is as similar to generic *they* as *she* is
- he* is as similar to plural *they* as *she* is
- but: generic *they* and plural *they* are not as similar as *he* and *she* are
→ the two types of *they* are clearly semantically distinct

Discussion

What does generic *they* mean?

- its meaning is between the semantics of *he/she* and plural *they*
- i.e. it has its own meaning

Is it semantically more similar to *he*, *she*, or plural *they*?

- both *he* and *she* are equally similar to generic *they*
- generic *they* and plural *they* are clearly not identical semantically

Comprehension

Do the four pronouns show differences in how they are comprehended?

Schmitz, D. (2025). Pronoun comprehension from a discriminative perspective: A proof of concept. In D. Schmitz, S. D. Stein, & V. Schneider (Eds.), *Linguistic intersections of language and gender: Of gender bias and gender fairness* (pp. 95–110). düsseldorf university press. doi: 10.1515/9783111388694-006/html

The mental lexicon

- where we store all the words we know, along with their **meanings**, **forms**, and their **usage**

- example: 

- forms

/kæt/, <cat>

- meaning

a small, furry animal with a big personality

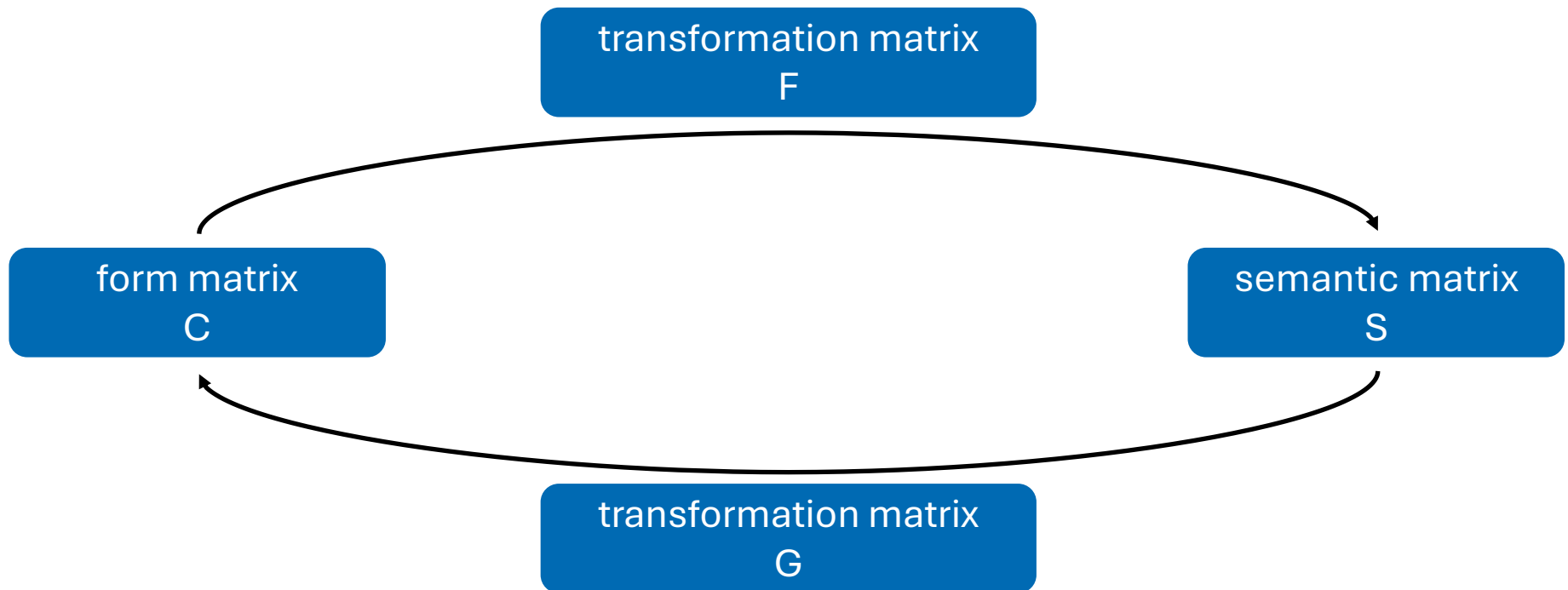
- usage

cat:kitten :: dog:puppy

- highly organised and constantly active when we listen, speak, read, write, sign

The discriminative lexicon

- a **model of the mental lexicon** which assumes mappings between meanings and forms which are based on the usage of words (Chuang & Baayen 2021)
- its computational implementation is called **linear discriminative learning** (Baayen et al. 2019)



Form matrix

- form is represented based on orthography via so-called **trigraphs**
- trigraphs are strings of 3 letters
- the start and end of a word are marked by a hashmark
- hashmarks are also counted

target form	#ca	cat	at#	cap	ap#	#ba	bat
cat	1	1	1	0	0	0	0
cap	1	0	0	1	1	0	0
bat	0	0	1	0	0	1	1

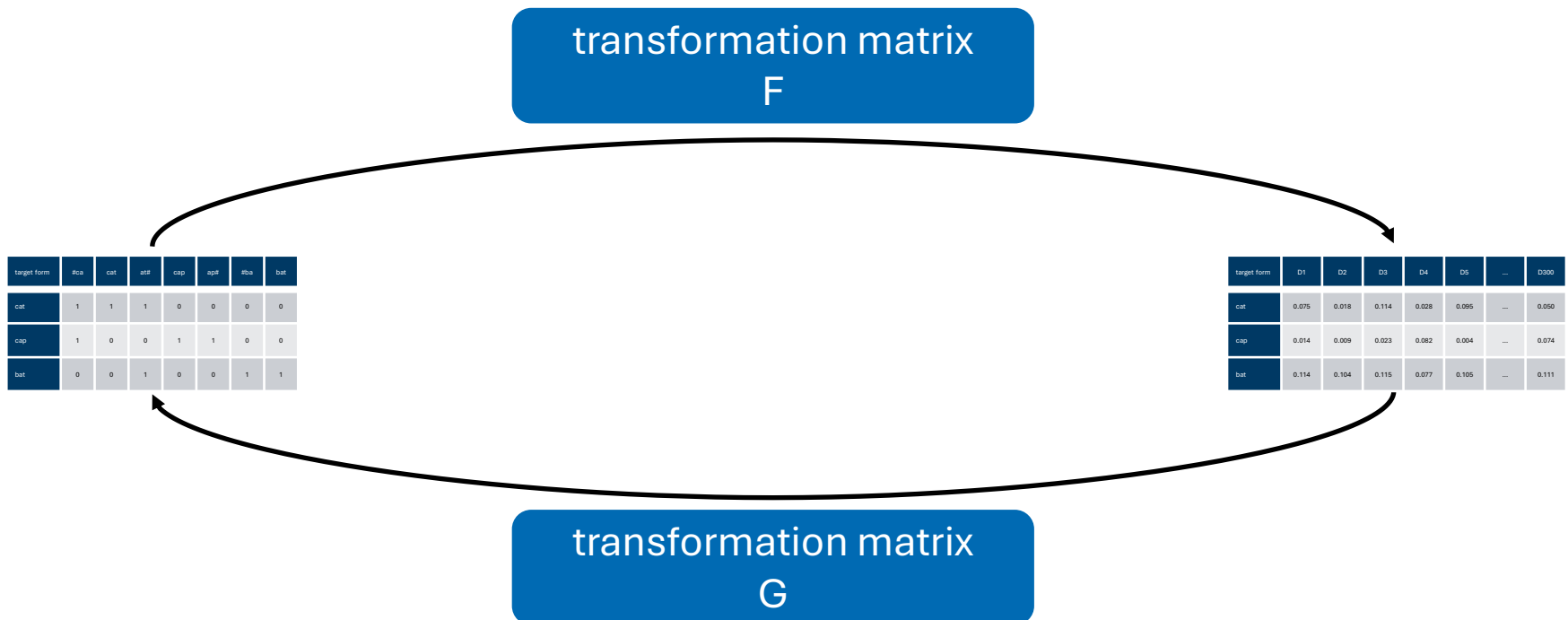
Semantic matrix

- meaning is represented based on the vectors computed via distributional semantic methods, e.g. instance vectors
- in the present study, vectors have 300 dimensions

target form	D1	D2	D3	D4	D5	...	D300
cat	0.075	0.018	0.114	0.028	0.095	...	0.050
cap	0.014	0.009	0.023	0.082	0.004	...	0.074
bat	0.114	0.104	0.115	0.077	0.105	...	0.111

The discriminative lexicon

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Transformation matrix F

- with the form matrix C and semantic matrix S available, we can compute a transformation matrix F
- this transformation matrix F is used to map the form matrix C onto the semantic matrix S = to simulate the comprehension process
- what does that mean?
 - for a simple multiplication like $2 * x = 6$, we can find the value of x
 - for a matrix multiplication like $C * F = S$, we also first need to find F
- matrix multiplication comes with a crucial characteristic
 - $C * F = S$ will never result in S , but in an approximated version $\hat{S}$
 - this approximated version reflects the outcome of the comprehension process

Comprehended semantic matrix $\hat{S}$

- with the comprehended semantics, one can compute different measures

1. **degree of semantic co-activation**

reflects how strongly semantic dimensions are co-activated when a given word is retrieved from the lexicon

2. **degree of comprehension uncertainty**

reflects how well the original and approximated semantics of a word align; a better alignment indicates better comprehension

3. **semantic neighbourhood density**

reflects how many words are comprehended to have a very similar meaning

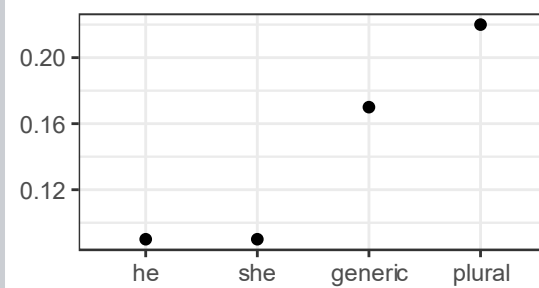
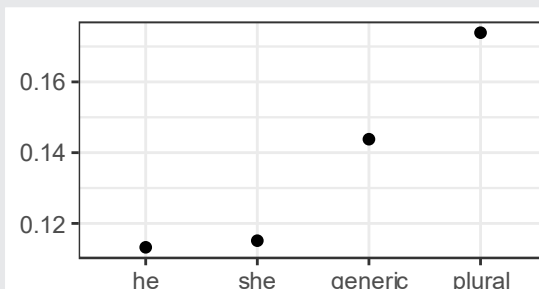
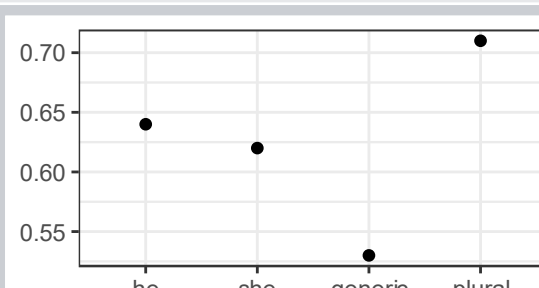
Results

	<i>he</i>	<i>she</i>	generic <i>they</i>	plural <i>they</i>	
Degree of semantic co-activation	0.09	0.09	0.17	0.22	

Results

	<i>he</i>	<i>she</i>	generic <i>they</i>	plural <i>they</i>	
Degree of semantic co-activation	0.09	0.09	0.17	0.22	
Degree of comprehension uncertainty	0.11	0.12	0.14	0.17	

Results

	<i>he</i>	<i>she</i>	generic <i>they</i>	plural <i>they</i>	
Degree of semantic co-activation	0.09	0.09	0.17	0.22	
Degree of comprehension uncertainty	0.11	0.12	0.14	0.17	
Semantic neighbourhood density	0.64	0.62	0.53	0.71	

Discussion

Do the four pronouns show differences in how they are comprehended?

- the comprehension of generic *they* is different than that of *he*, *she*, plural *they*
- **degree of semantic co-activation** & **comprehension uncertainty**
generic *they* is found between *he* and *she* at the lower and plural *they* at the higher end
- **semantic neighbourhood density**
generic *they* shows a less dense neighbourhood than *he*, *she*, and plural *they*

Processing

Do differences in the comprehension of *they*, *he*, and *she* show an effect in processing?

Schmitz, D. (in prep). New insights into the processing of generic definite and specific ungendered singular *they*.

Background

Foertsch & Gernsbacher (1997)

- two self-paced reading studies

1. generic *they*

***A truck driver** should never drive when sleepy, even if **he/she/they** may be struggling to make a delivery on time, because many accidents are caused by drivers who fall asleep at the wheel.*

2. specific *they*

***That truck driver** shouldn't drive when sleepy, even if **he/she/they** may be trying to make a delivery on time, because many accidents are caused by drivers who fall asleep at the wheel.*

- the antecedent was either a “masculine”, “feminine”, or “neutral” common noun

Background

Foertsch & Gernsbacher (1997)

- issues
 - common nouns were not tested for STEREOTYPICALITY
 - potential confounds were not taken into account
 - AGE OF PARTICIPANT
 - GENDER OF PARTICIPANT
 - ITEM
 - TRIAL
- additional point: almost 30 years of language use have passed since their data was elicited

Method

Items

- 20 items: 10 stereotypically female, 10 stereotypically male (cf. Misersky et al. 2014)

male	female
<i>drummer</i>	<i>babysitter</i>
<i>electrician</i>	<i>caregiver</i>
<i>farmer</i>	<i>cheerleader</i>
<i>firefighter</i>	<i>florist</i>
<i>groundskeeper</i>	<i>housekeeper</i>
<i>guard</i>	<i>manicurist</i>
<i>hunter</i>	<i>nanny</i>
<i>magician</i>	<i>nurse</i>
<i>mechanic</i>	<i>receptionist</i>
<i>pilot</i>	<i>secretary</i>

Method

Sentences

- each item was embedded in 6 sentences

1. generic with *he*
2. generic with *she*
3. generic with *they*
4. specific with *he*
5. specific with *she*
6. specific with *they*

- example

A/The drummer has to keep a steady rhythm, even if **he/she/they** may be nervous, because timing is crucial in music.

Method

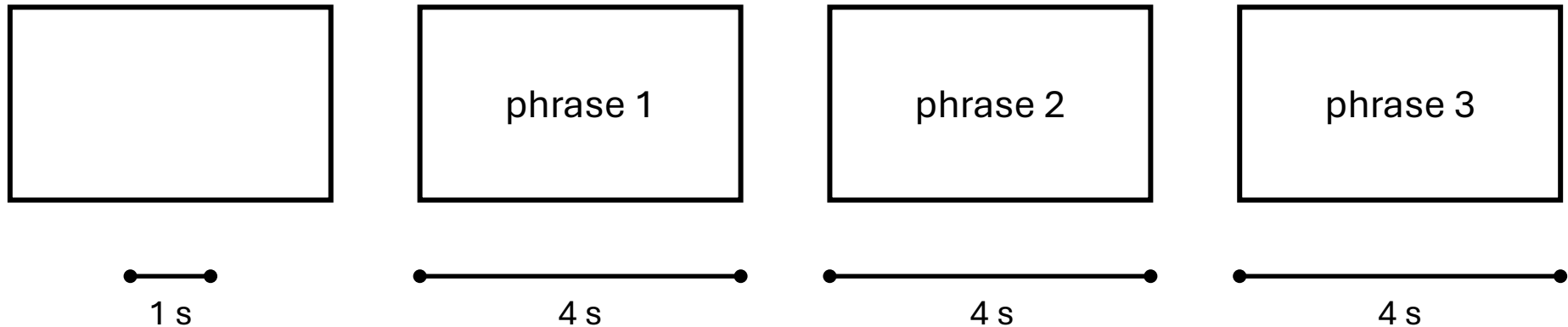
Groups

- materials were split into 4 groups to
 - keep the number of trials per participant reasonable
 - ensure that participants did not encounter the same target with multiple pronouns
- number of trials per participant: 30
- the order of trials was randomised within participant

Method

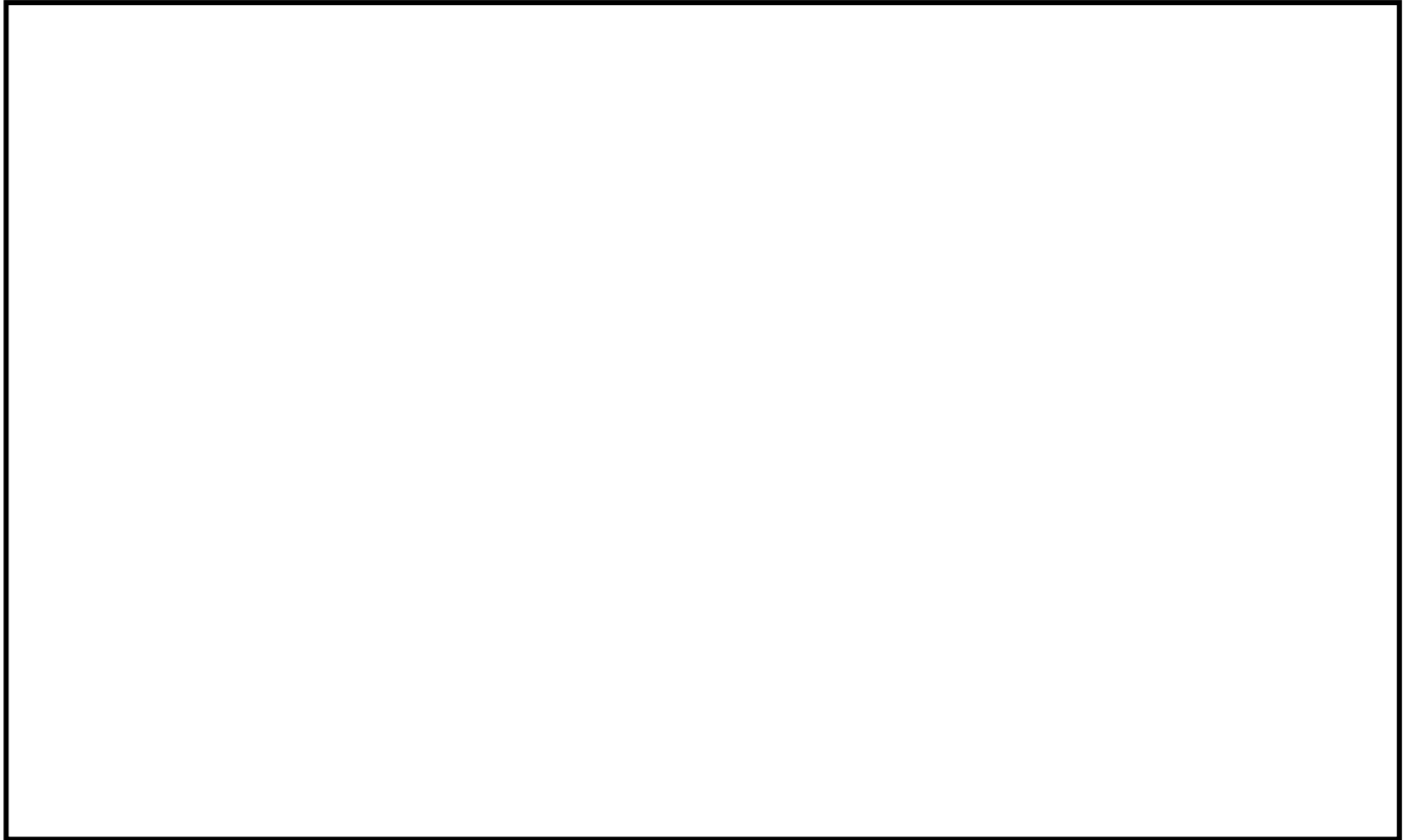
Procedure

- blank screen at the start of each trial for 1 second
- individual screens for each of the three phrases per trial
- time-out after 4 seconds
- self-paced: spacebar to continue between phrases



Method

Procedure



Method

Procedure

The drummer has to keep a steady rhythm,

Method

Procedure

even if she may be nervous,

Method

Procedure

because timing is crucial in music.

Method

Procedure

- to ensure that participants actually read and parsed all sentences, each trial was followed by a simple question: “True or False?”
- participants were told that this was about their opinion, i.e. that there were no wrong answers

Method

Participants

- 80 participants recruited via Prolific, i.e. 20 per group
- L1: British English
- age: mean 42.7, sd 14.2, min 18, max 84
- no gender information, instead: preferred pronoun
 - *he/him*: 50
 - *she/her*: 30

Data pre-processing

- RTs ≥ 4000 ms and RTs ≤ 400 ms were excluded (cf. Kutas and Federmeier 2010, Hohnfeld et al. 2015, Evans and Curtis-Holmes 2005), if they were present for the
 - second phrase, i.e. the one with the pronoun
 - first phrase, i.e. the one with the common noun antecedent
- remaining RTs were log-transformed for a more normal distribution

Statistical analysis

- linear mixed-effects regression models for both types of *they* (generic, specific)
- both initial full models included the same variable setup
- then, stepwise reduction to find the best model

Generic they

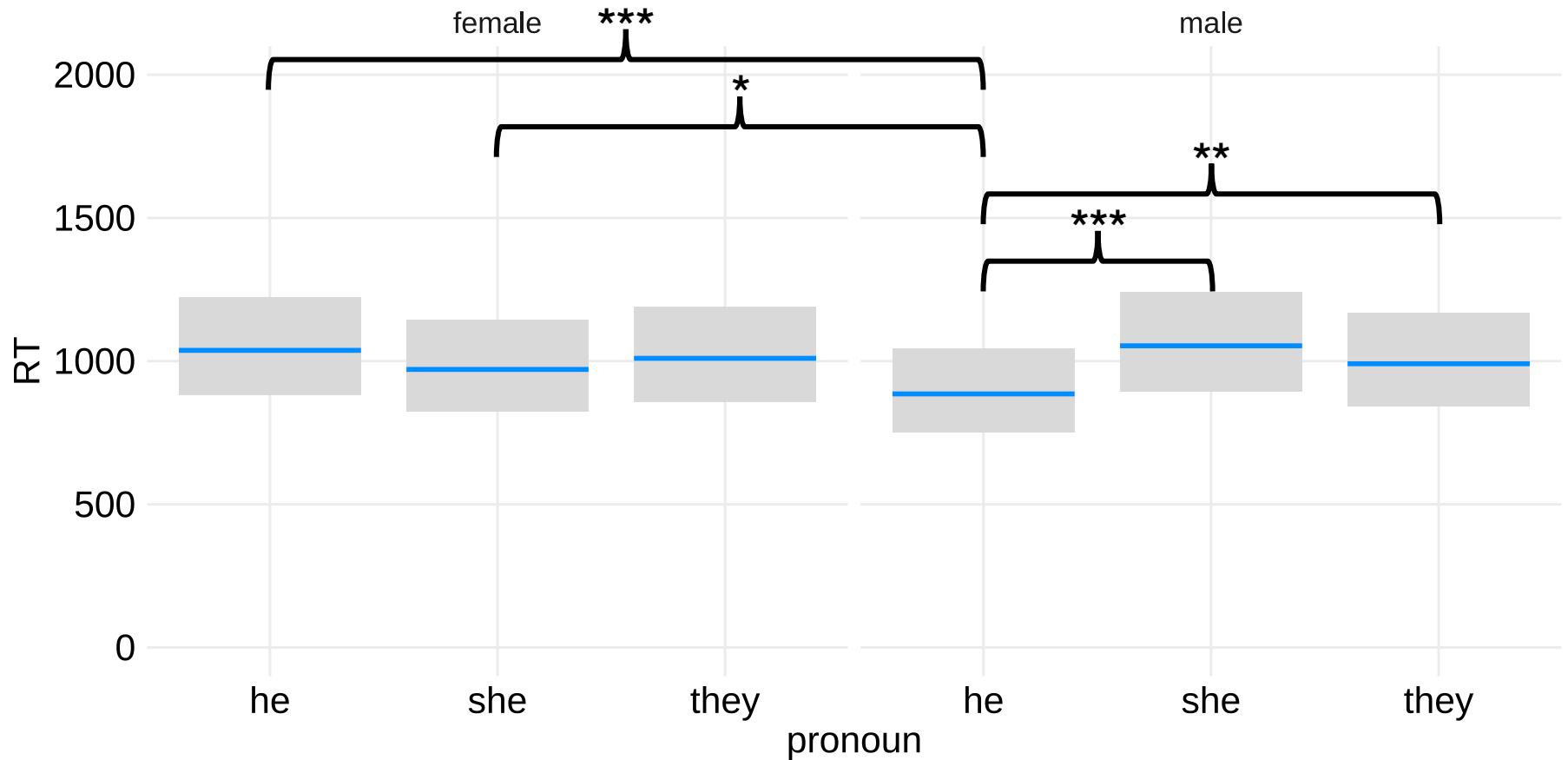
- effects found for
 - interaction of **PRONOUN** and STEREotypicality
 - AGE
 - NCHAR

Specific they

- effects found for
 - STEREO
 - AGE
 - TRIAL
 - NCHAR
- **but not for PRONOUN!**

Generic *they* – Results

pronoun * stereo



A drummer has to keep a steady rhythm...

Discussion

Do differences in the comprehension of *they*, *he*, and *she* show an effect in processing?

1. generic *they*

- male antecedent: $he < they = she$
- female antecedent: $she = they = he$
- additionally, AGE and NCHAR show effects

Answer
YES

2. specific *they*

- male antecedent: $he = she = they$
- female antecedent: $he = she = they$
- additionally, AGE, NCHAR, TRIAL, and STEREO show effects

Answer
NO

Concluding remarks

Concluding remarks

Today's main findings

1. singular *they* is semantically different to *he*, *she*, and plural *they*
2. singular *they* is represented differently in the lexicon, i.e. it is comprehended differently than *he*, *she*, and plural *they*
3. different types of singular *they* are processed differently
 - a) generic *they* is processed differently than *he* and *she*
 - b) specific *they* is processed similarly to *he* and *she*

Outlook

- future research should
 - apply similar methodological approaches (distributional semantics, discriminative learning) to different types of singular *they* without conflating them into one category
 - apply other variants of self-paced reading and other methods (from psycholinguistics, neurolinguistics, etc.)
 - consider adding specific definite gendered singular *they*, as this is the most heatedly debated type of singular *they*
 - consider adding neopronouns to the picture, even though this will ultimately require more effort in creating study materials and may be complicated by data availability issues

References 1/2

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Thank you!

Statistical analysis

- linear mixed-effects regression models for both types of *they* (generic, specific)
- both initial full models included the same variable setup

```
rt_log ~  
  pronoun * pro +      # pronoun in sentence * preferred pronoun  
  pronoun * stereo +   # pronoun in sentence * stereotypicality  
  pronoun * age +      # pronoun in sentence * age of participant  
  pro * stereo +       # preferred pronoun * stereotypicality  
  trial +  
  nchar +              # number of characters in the phrase  
  (1 | id) +  
  (1 | item) +  
  (1 | group)
```

Generic *they* – Best model

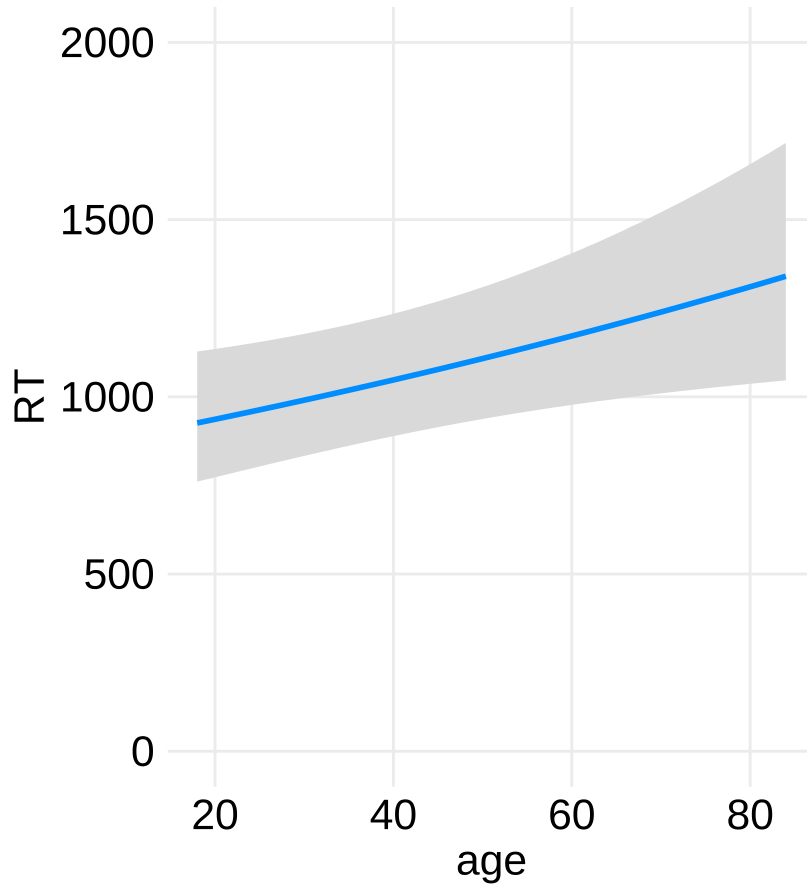
```
rt_log ~  
  pronoun * stereo +  
  age +  
  nchar +  
  (1 | id) +  
  (1 | group)
```

Effects found for

- interaction of PRONOUN and STEREOTypicality
- AGE
- NCHAR

Generic *they* – Results

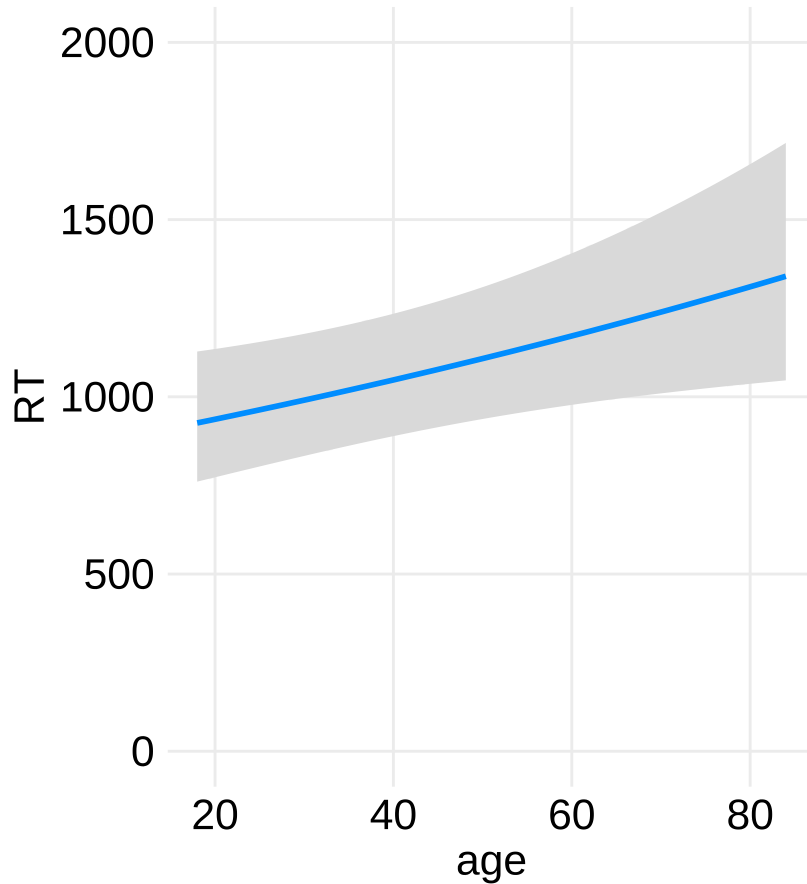
age



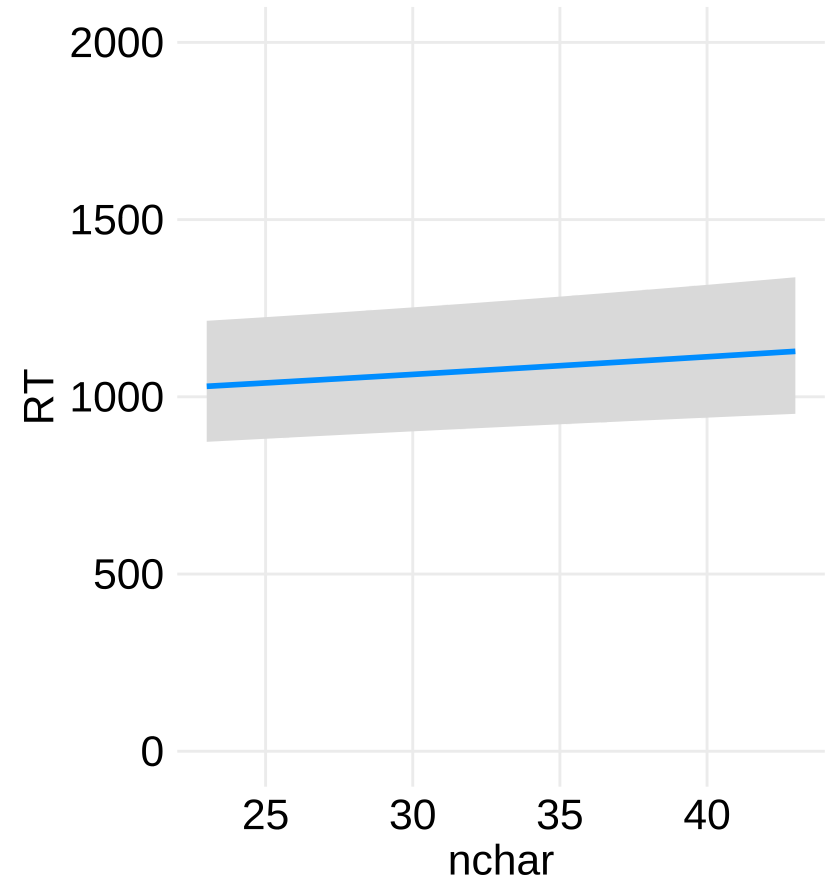
A drummer has to keep a steady rhythm...

Generic *they* – Results

age



nchar



A drummer has to keep a steady rhythm...

Specific *they* – Best model

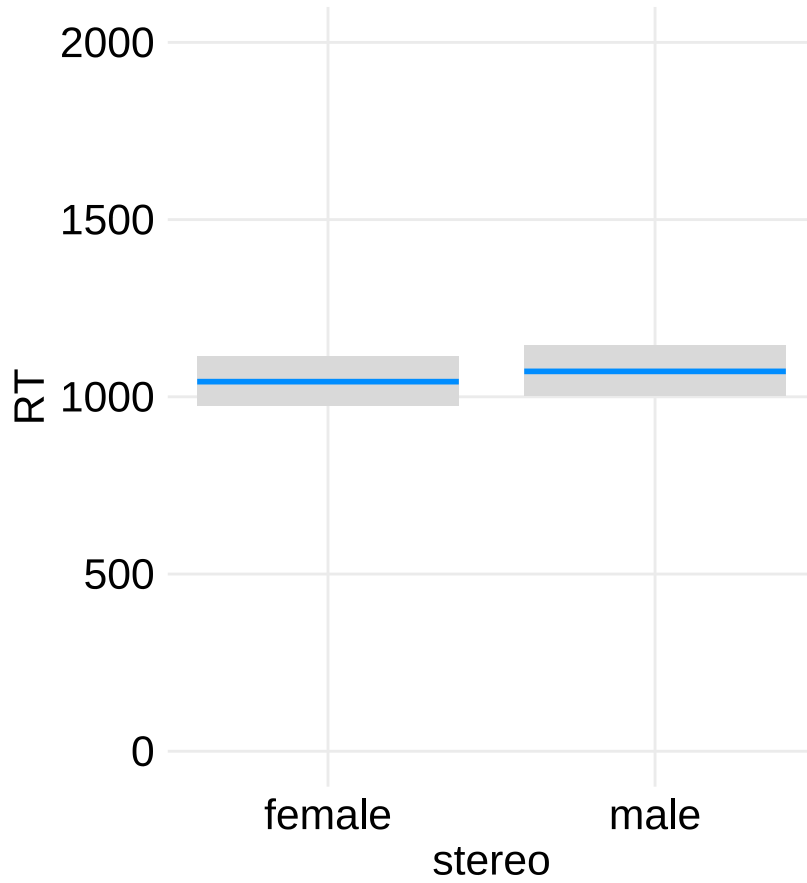
```
rt_log ~  
  stereo +  
  age +  
  trial +  
  nchar +  
  (1 | id)
```

Effects found for

- STEREO
- AGE
- TRIAL
- NCHAR
- but not for PRONOUN!

Specific *they* – Results

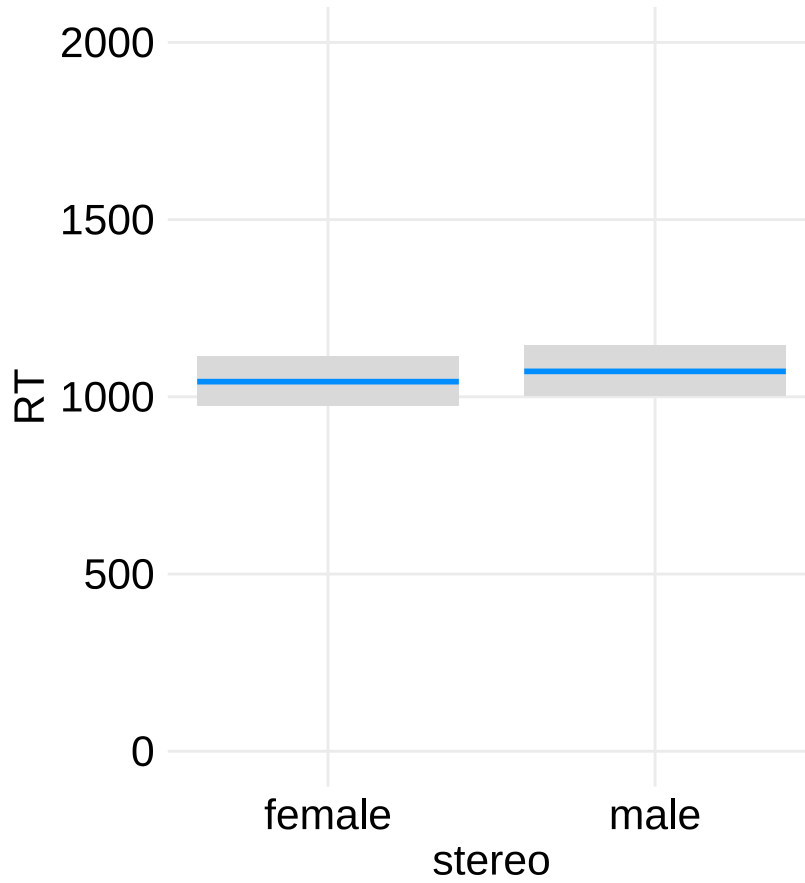
stereo



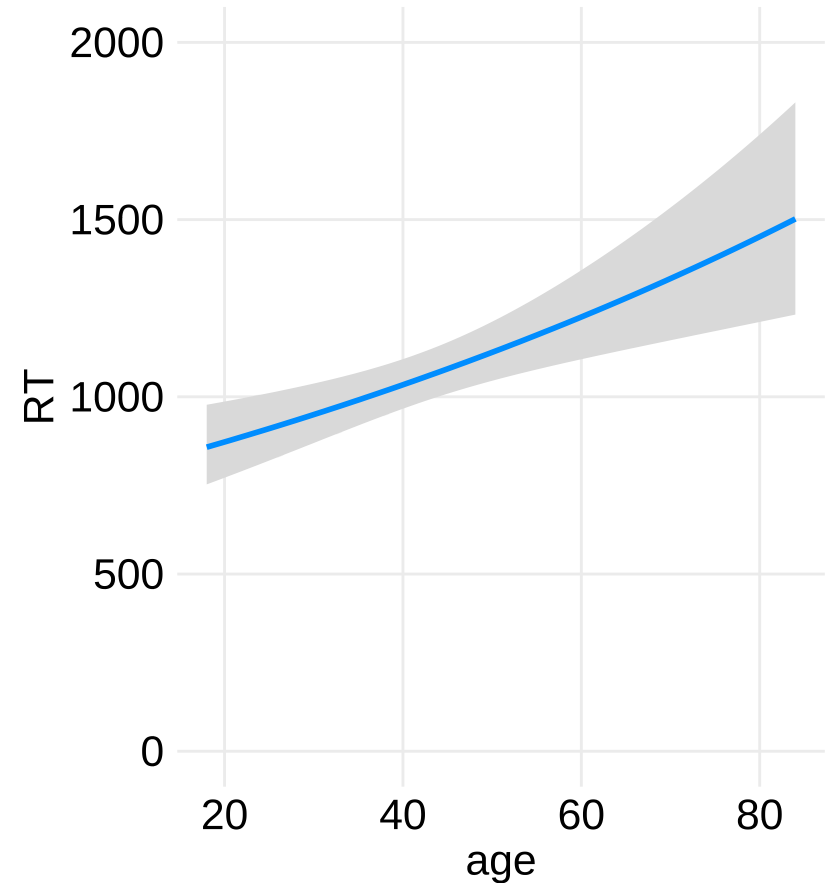
The drummer has to keep a steady rhythm...

Specific *they* – Results

stereo



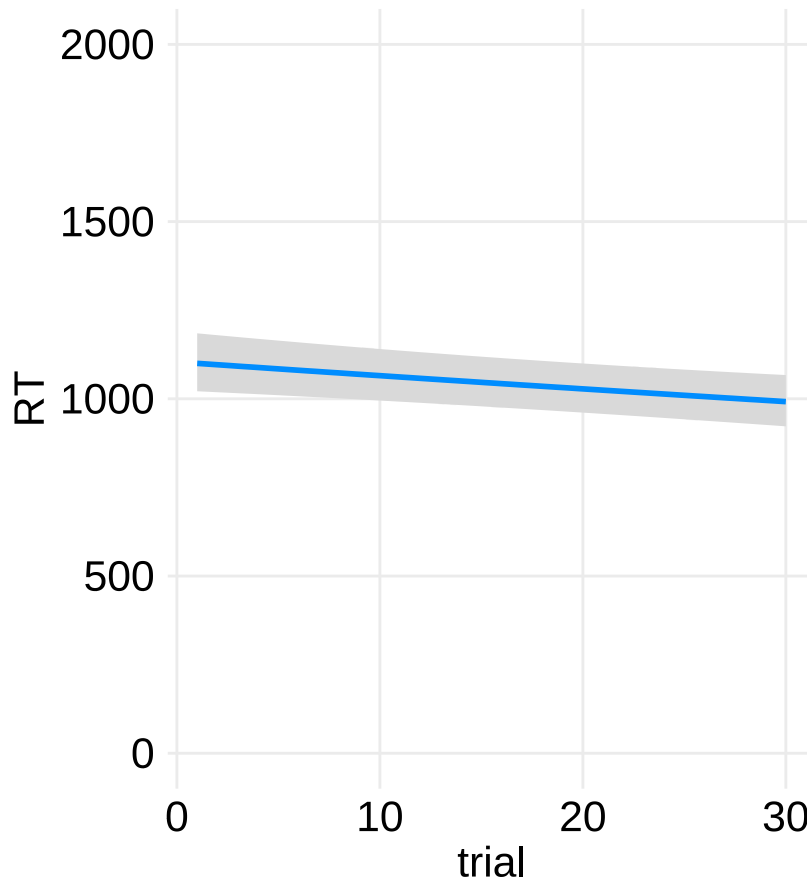
age



The drummer has to keep a steady rhythm...

Specific *they* – Results

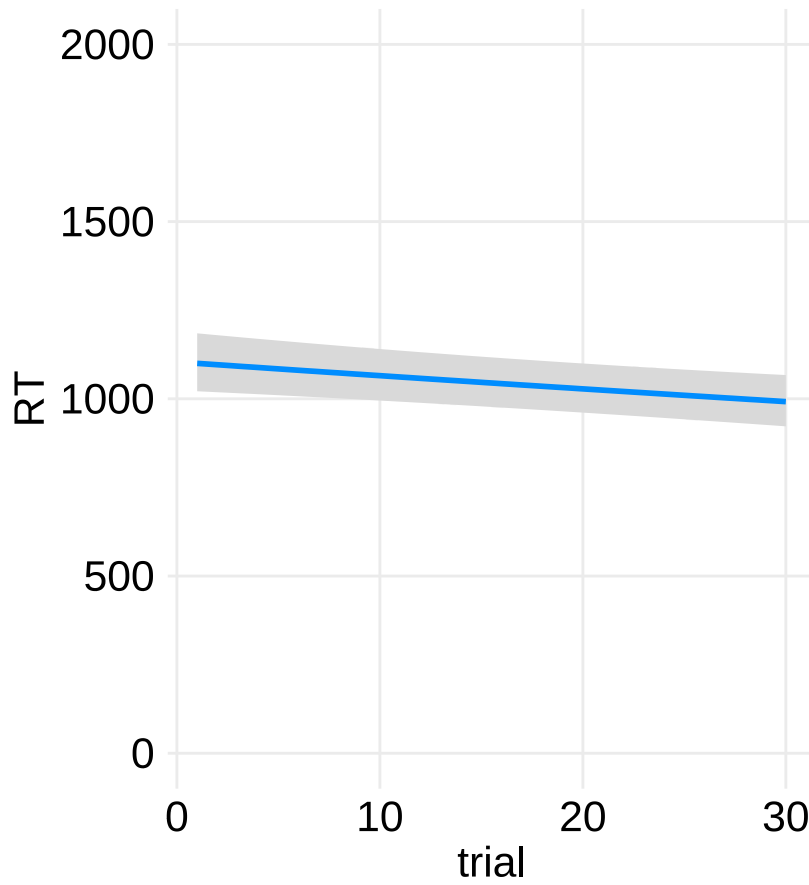
trial



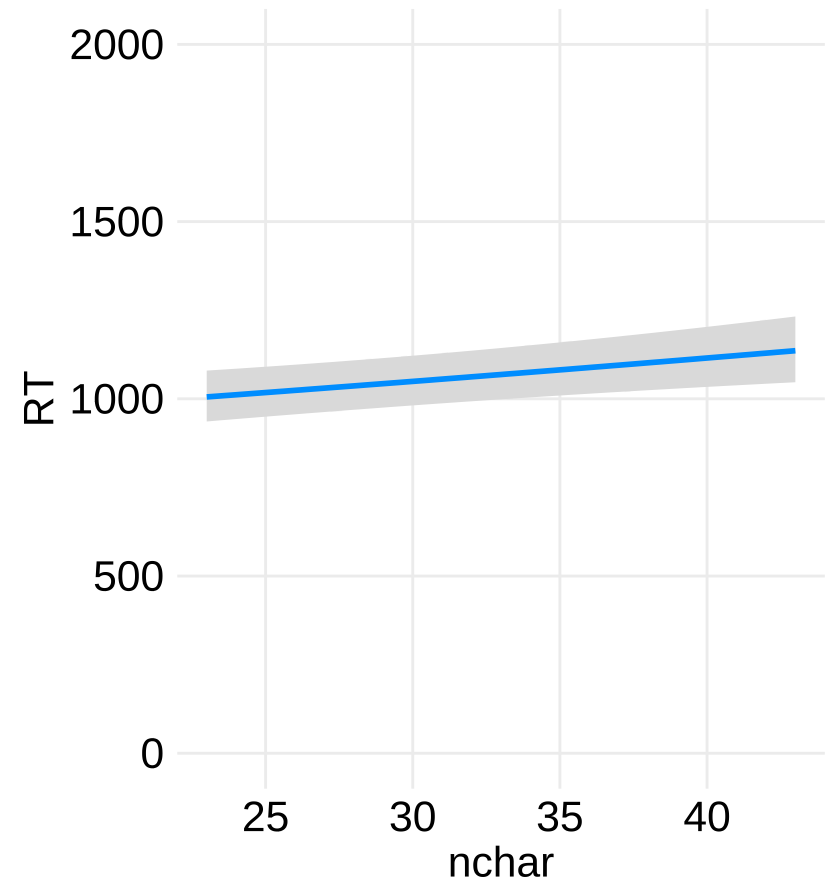
The drummer has to keep a steady rhythm...

Specific *they* – Results

trial



nchar



The drummer has to keep a steady rhythm...