Interpretation of Indefinites – Information Structure and Modification

Klaus von Heusinger, University of Cologne

(joint work with Frederike Weeber, Jet Hoek, and Andreas Brocher)

Workshop on the Semantics of Indefinites

Syntax and Semantics group of the

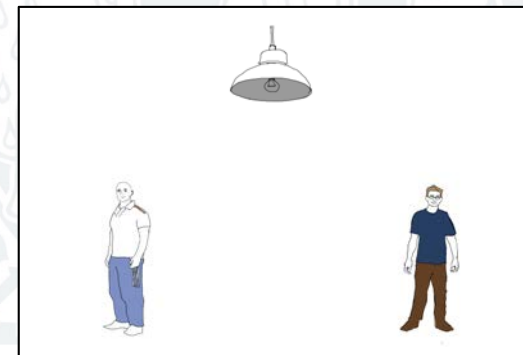*UMR 7023 Structures Formelles du Langage*

Paris, 21-22 Sept 2023

Alexander Walter – Klaus von Heusinger – Andreas Brocher – – Jet Hoek
Frederike Weeber   Hae-Eun Cho

SFB 1252
PROMINENCE IN LANGUAGE

Introduction – the puzzle

Measurement of the discourse dynamics of indefinites

Philipp stared at **a trainer**.

When the lights went out, **he** used his cell phone as a flashlight. $\longrightarrow$ *individual of type e*

Introduction – the puzzle

Measurement of the discourse dynamics of indefinites
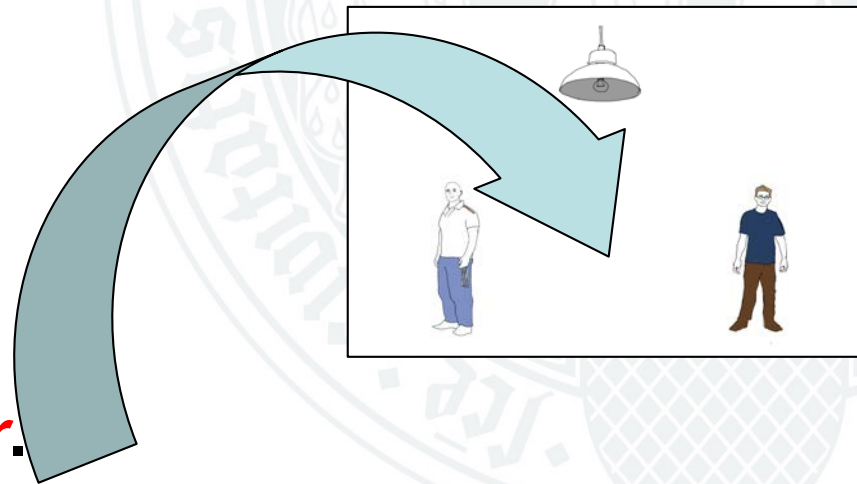

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Introduction – the puzzle

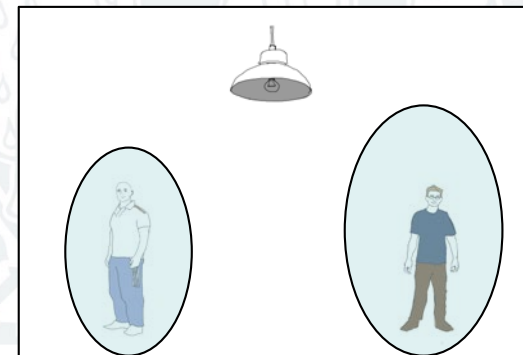Measurement of the discourse dynamics of indefinites

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Introduction – the puzzle

Measurement of the discourse
dynamics of indefinites
   informativity

Philipp stared at *a trainer* *next to the window*

When the lights went out, *he* used his cell
phone as a flashlight.

Introduction – the puzzle

Measurement of the discourse
dynamics of indefinites
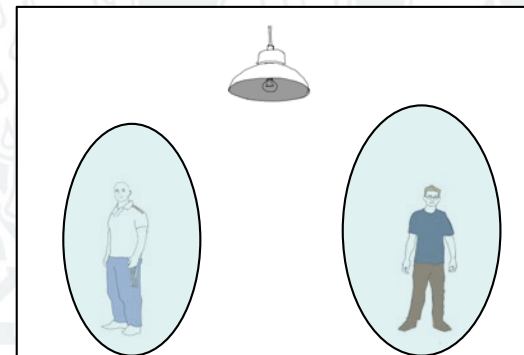information status

Gym class was crowded like always

Philipp stared at *a trainer*.

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Introduction – the puzzle

Measurement of the discourse
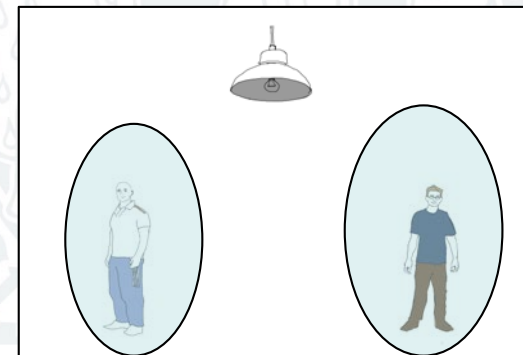dynamics of indefinites

informativity *and*
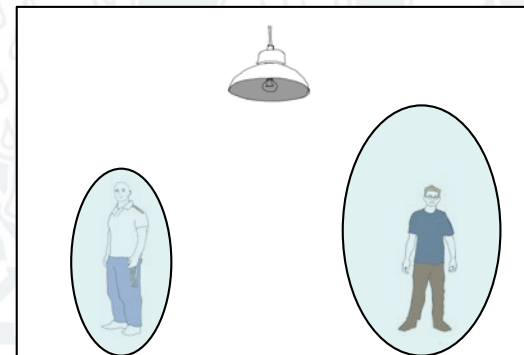
information status

Gym class was crowded like always

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Introduction – the puzzle

informativity

information status

    each enhance prominence,

    but together they reduce prominence

Introduction – the puzzle

informativity

information status

      each enhance prominence,

      but together they reduce prominence

interaction

- semantic composition
- lexical information
- discourse structure

Structure

1. **Denotational types of indefinites**
2. **Discourse prominence of indefinites**
3. **Informativeness**
4. **Information status**

   Exp. indef. DPs vs. indef. dem. DPs

   Exp. indef. DPs vs. def. DPs

5. **Exp. Informativeness x information status**
6. **Discussion**
7. **Conclusion**

1. Denotational types of indefinites

Indefinites as quantifiers

Every student saw a teacher.

semantic type: <<e,t>,t>

1. Denotational types of indefinites

Indefinites as referential expressions

Kim have met a teacher. He…

semantic type: e
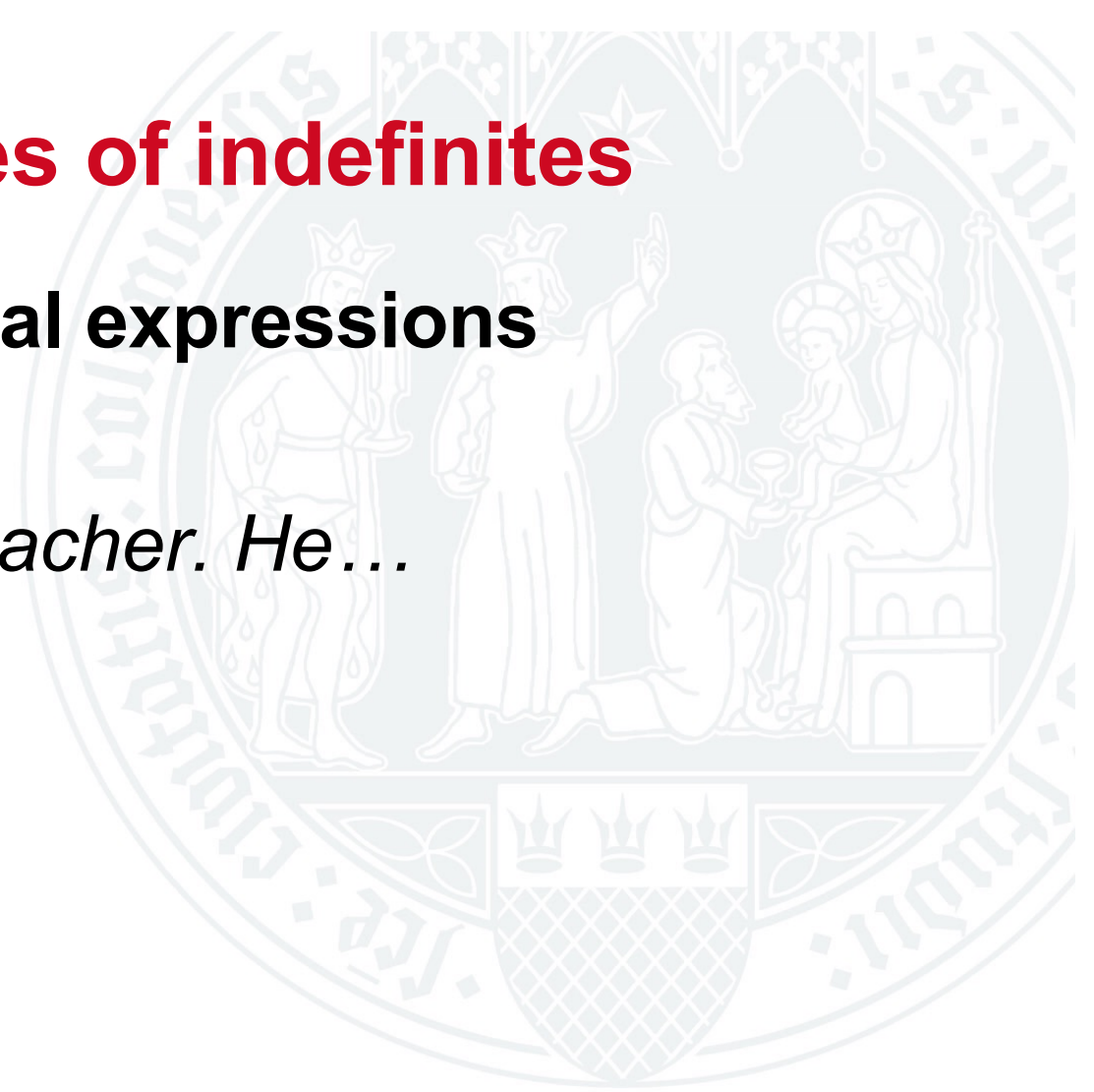
1. Denotational types of indefinites

Indefinites as predicates

Kim is a teacher.

semantic type: $\langle e,t \rangle$

1. Denotational types of indefinites

Indefinites as denoting roles

A teacher must grade the student exams.

semantic type: e_{role}
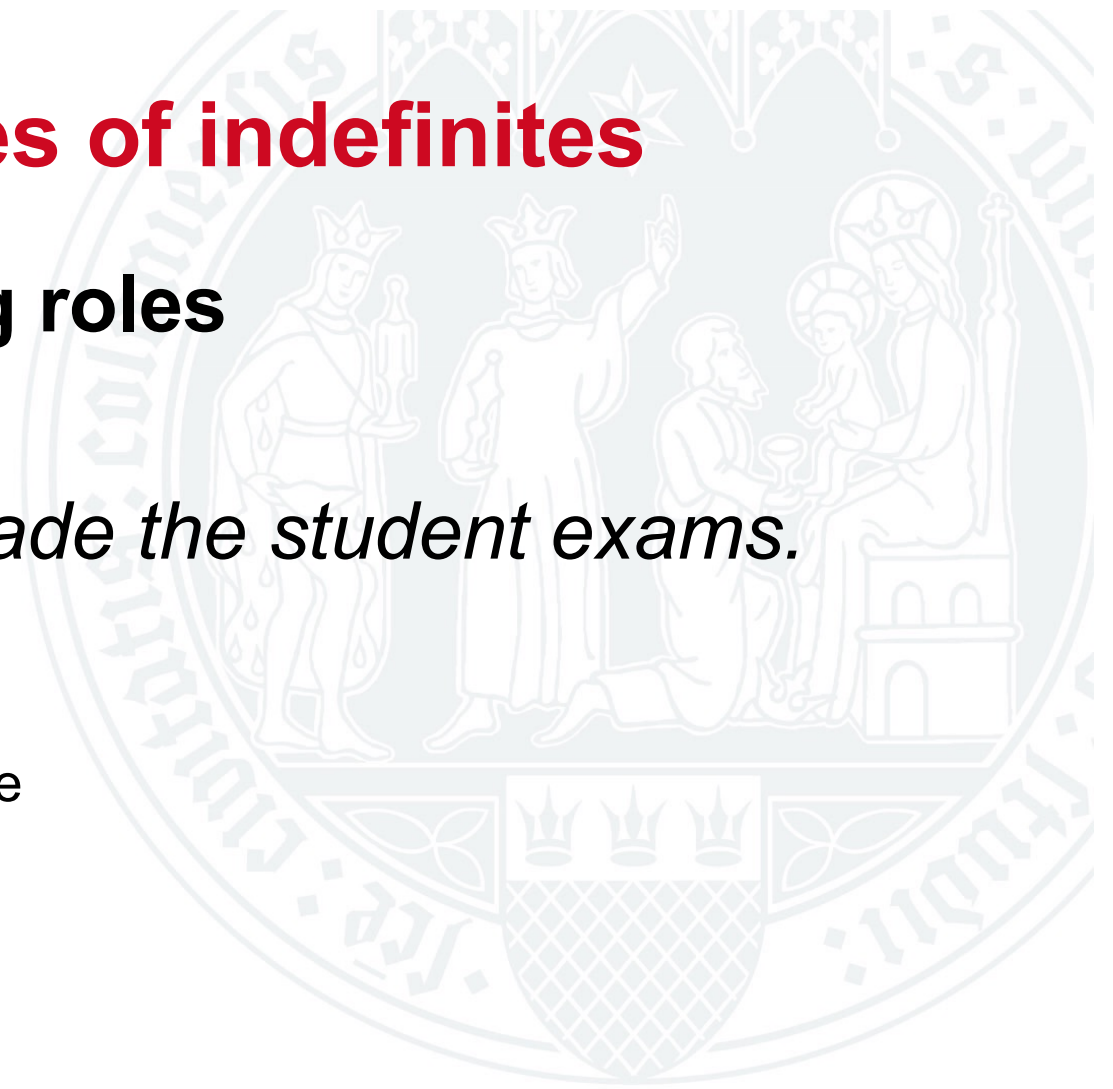
1. Denotational types of indefinites

Prince (1981: 231)

a   A body was found in the river yesterday. specific

b   A tiger has stripes.   generic

c   John is a plumber.   predicative

d   I never saw a two-headed man.   attributive

e   He won´t say a word.   negative
                                            polarity idiom piece

1. Denotational types of indefinites

quantifier $<<e,t>,t>$

referential e

generic / role e_{role}

predicate $<e,t>$

1. Denotational types of indefinites

Type shifting (Partee 1987: 121)
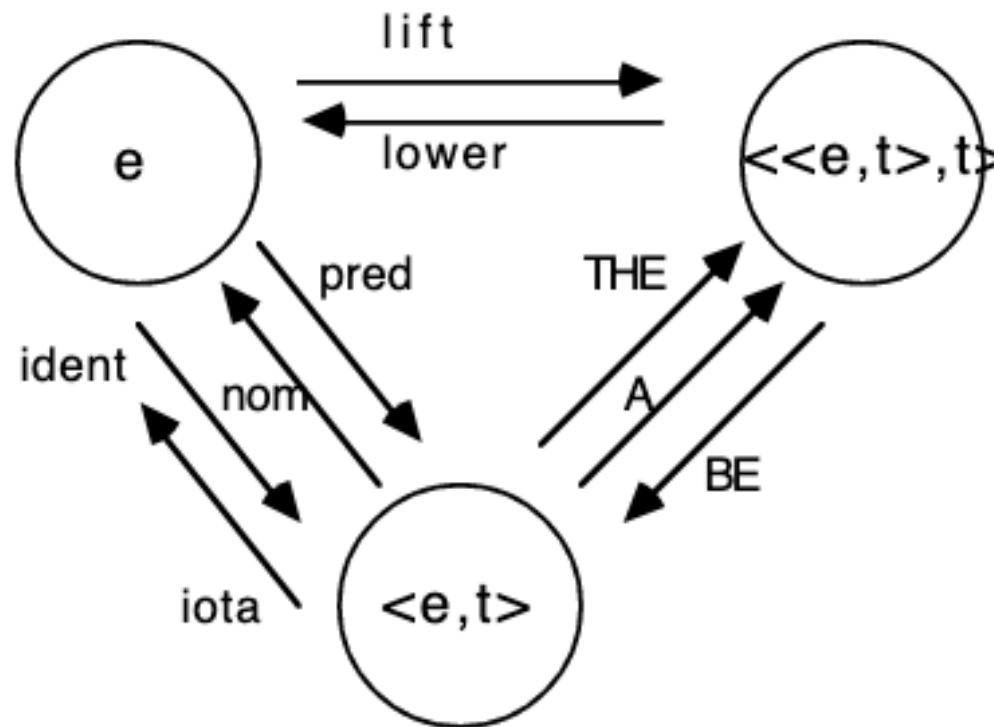
2. Discourse prominence of indefinites

discourse referents introduced by indefinite DPs

- compete with other discourse referents in prominence

- are more or less easy to access for subsequent pronouns

(1) Sue met a teacher. She …

(2) We are looking for a teacher. ?She…

(3) We did not find a teacher. #She …

2. Discourse prominence of indefinites

- unfamiliarity
- indirect anaphoric linkage /d-linking
  - partitivity
  - inferrability

(1) Kim read a book. Ann read a book.   (not the same)

(2) Kim met her friends. One of them was from Cologne.

(3) Kim bought a book. The cover was missing.

(4) Kim bought a book. A page was missing.

2. Discourse prominence of indefinites

discourse contribution / communicative goal

- "introductionary function" (Christophersen 1939)

- "pragmatically important function" (Wright and Givón 1987)

- "opening of a new file with an *a*-form mention tends to raise the expectation that the file will continue to be used, as more information is added to it." (de Bois 1980)

- opening an new QUD (question under discussion, Onea 1996)

- see also the function of indefinite *this DPs* in English (Prince 1981, Ionin 2006)

2. Discourse prominence of indefinites

Parameters for accessibility of discourse referents

- **grammatical role** (Fukumura & van Gompel 2010; Rohde and Kehler 2014)

- **thematic role** (Stevenson et al. 1994; Ferretti et al. 2009)

- **order** (Givón 1983; Gordon et al. 1993)

- **topicalitiy** (Kaiser 2011)

- **focus** (Crawley 2001; Kaiser 2011)

- **implicit causality** (Stevenson et al. 1994; Arnold 2001; Kehler et al. 2008; Fukumura & van Gompel 2010; Hartshorne & Snedeker 2013)

- **aspect** (Kehler et al. 2008; Kehler & Rohde 2013)

2. Discourse prominence of indefinites

DP-type as parameter
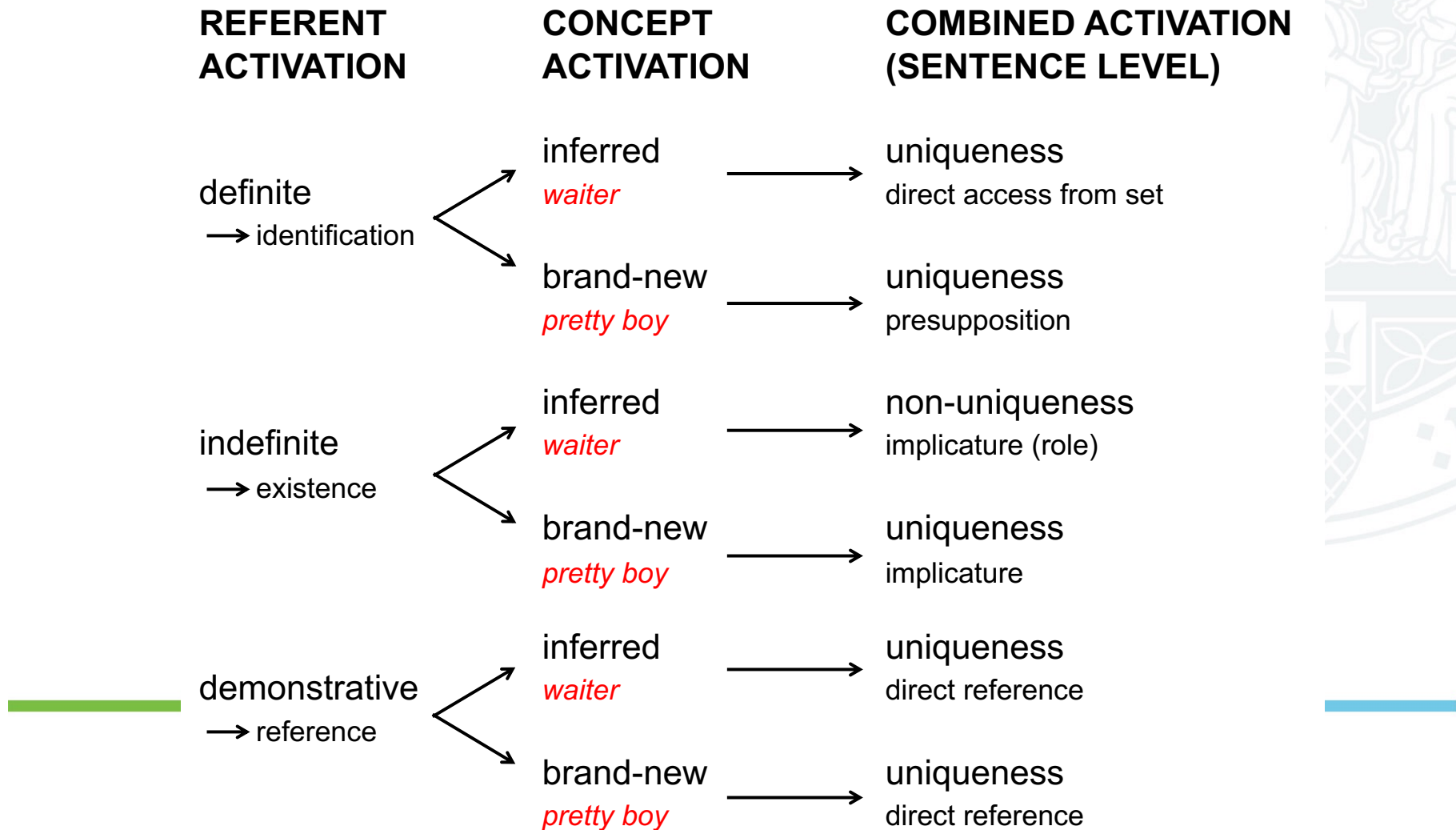
- proper names   Kim
- definite DPs   the donkey
- demonstrative DPs   this donkey
- indefinite DPs   a donkey
- weak indefinites DPs   (collecting) stamps
- weak definite DPs   (take) the train
- bare nouns   (go to) hospital

2. Discourse prominence of indefinites

DP Type and information status

REFERENT ACTIVATION	CONCEPT ACTIVATION	COMBINED ACTIVATION (SENTENCE LEVEL)
definite → identification	inferred *waiter*	uniqueness direct access from set
	brand-new *pretty boy*	uniqueness presupposition
indefinite → existence	inferred *waiter*	non-uniqueness implicature (role)
	brand-new *pretty boy*	uniqueness implicature
demonstrative → reference	inferred *waiter*	uniqueness direct reference
	brand-new *pretty boy*	uniqueness direct reference

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2. Discourse prominence of indefinites

Informativity
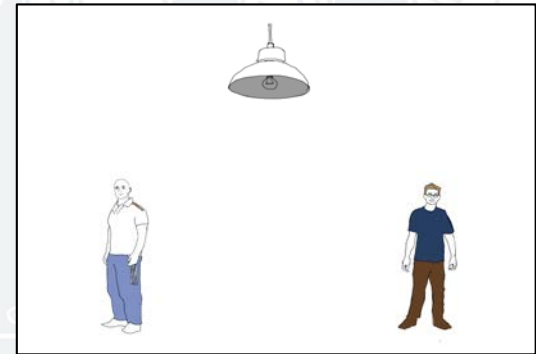
- how much (overt lexical) material a DP contains

    - simple DP   the donkey

    - modified DP   the donkey in the Zoo

Information status

- whether or not a DP is discourse dependent

    - familiar

    - inferrable /inferred

    - brand-new

2. Discourse prominence of indefinites

Measurement of accessibility by ambiguous pronoun

Philipp stared at **REFERENTIAL EXPR**.

When the lights went out, **he** used his cell phone as a flashlight.

individual of type e
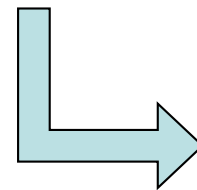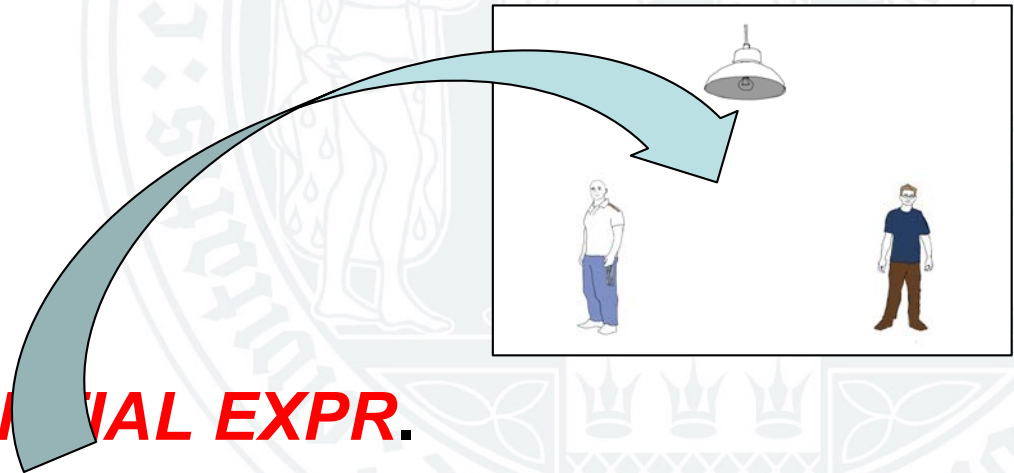
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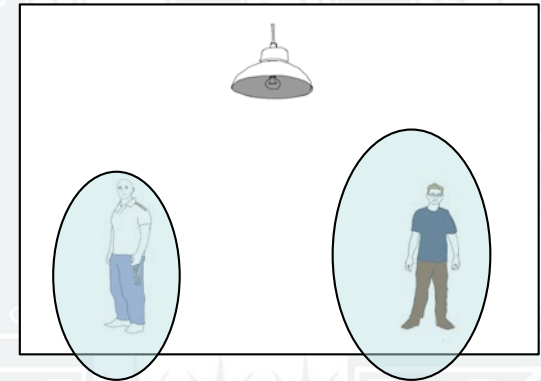
Measurement of accessibility by ambiguous pronoun

Philipp stared at *REFERENTIAL EXPR*.

When the lights went out, *he* used his cell phone as a flashlight.

2. Discourse prominence of indefinites

Section summary:

Interpretation of indefinite DP

      highly variable

      depending on many different parameters

Discourse prominence / accessibility

Is influenced by

         DP type

         informativity

         information status

3. Informativity

Karimi, Fukumura, Ferreira, and Pickering (2014), Karimi and Ferreira (2016) and Karimi, Diaz, and Ferreira (2019)

- the effect of informativity, operationalized as the length of noun phrases, on accessibility

(1)   The wizard disagreed...
(2)   The wizard who was confused disagreed …

3. Informativity

Karimi and Ferreira (2016)

- a visual-world eye-tracking experiment
- participants listened to two-sentence auditory stimuli
- visual display that contained pictures
- first sentence of the auditory input had two humans
- the second sentence started with an ambiguous pronoun; Informativity was manipulated to create three conditions

3. Informativity

|	Manip	Sentence
1	short-short long-short short-long	(a) The wizard disagreed with the knight. (b) The wizard who was confused and depressed by the irreparable situation disagreed with the knight. (c) The wizard disagreed with the knight who was confused and depressed by the irreparable situation.
2	-	He suddenly came up with a good idea to solve the problem.

3. Informativity
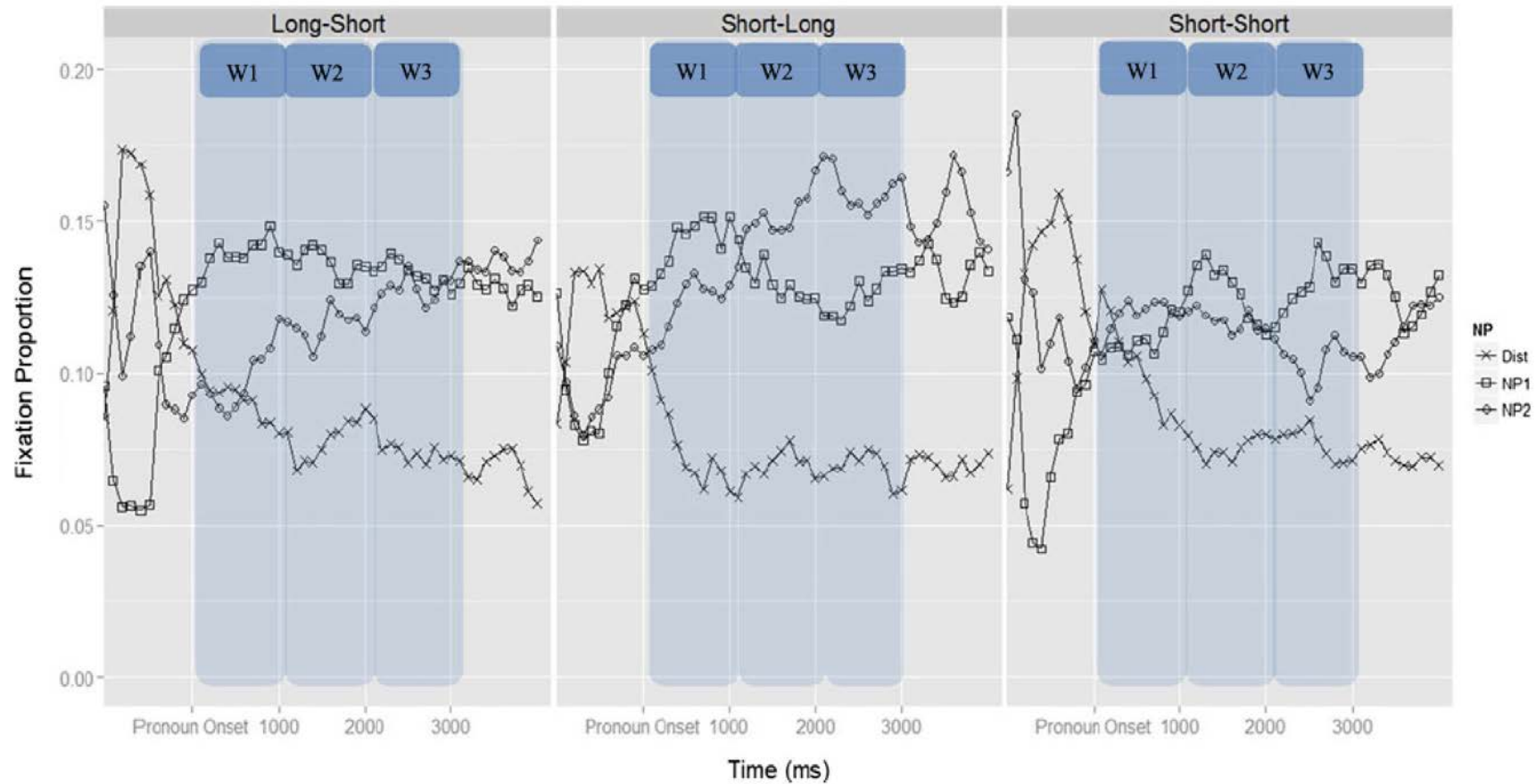
Fig. 2 Experiment 1: Fixation proportions by NP position and NP length. "W" and "Dist" stand for "Window" and "distractor," respectively
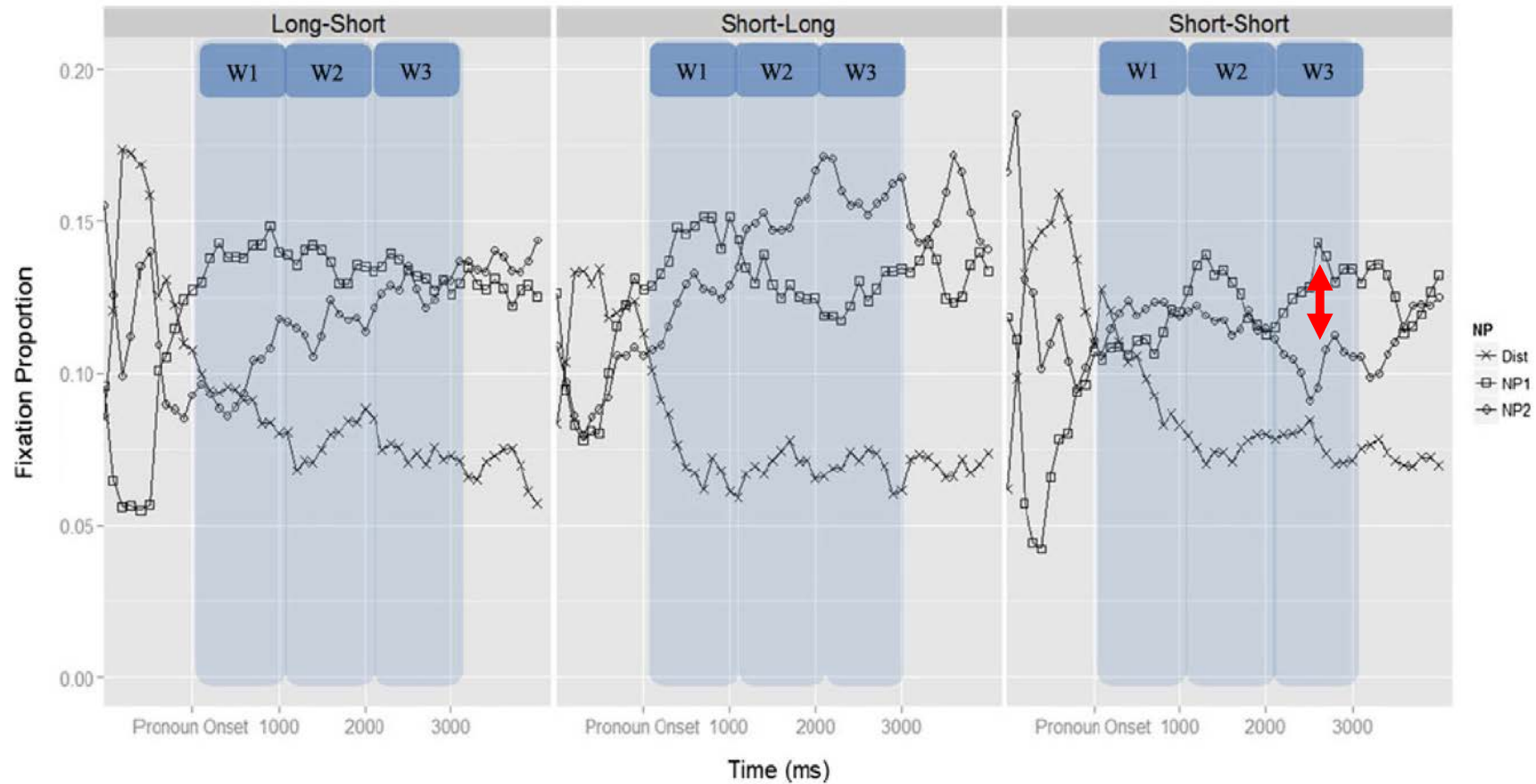
3. Informativity

Fig. 2 Experiment 1: Fixation proportions by NP position and NP length. "W" and "Dist" stand for "Window" and "distractor," respectively

short-short
NP1 > NP2

3. Informativity
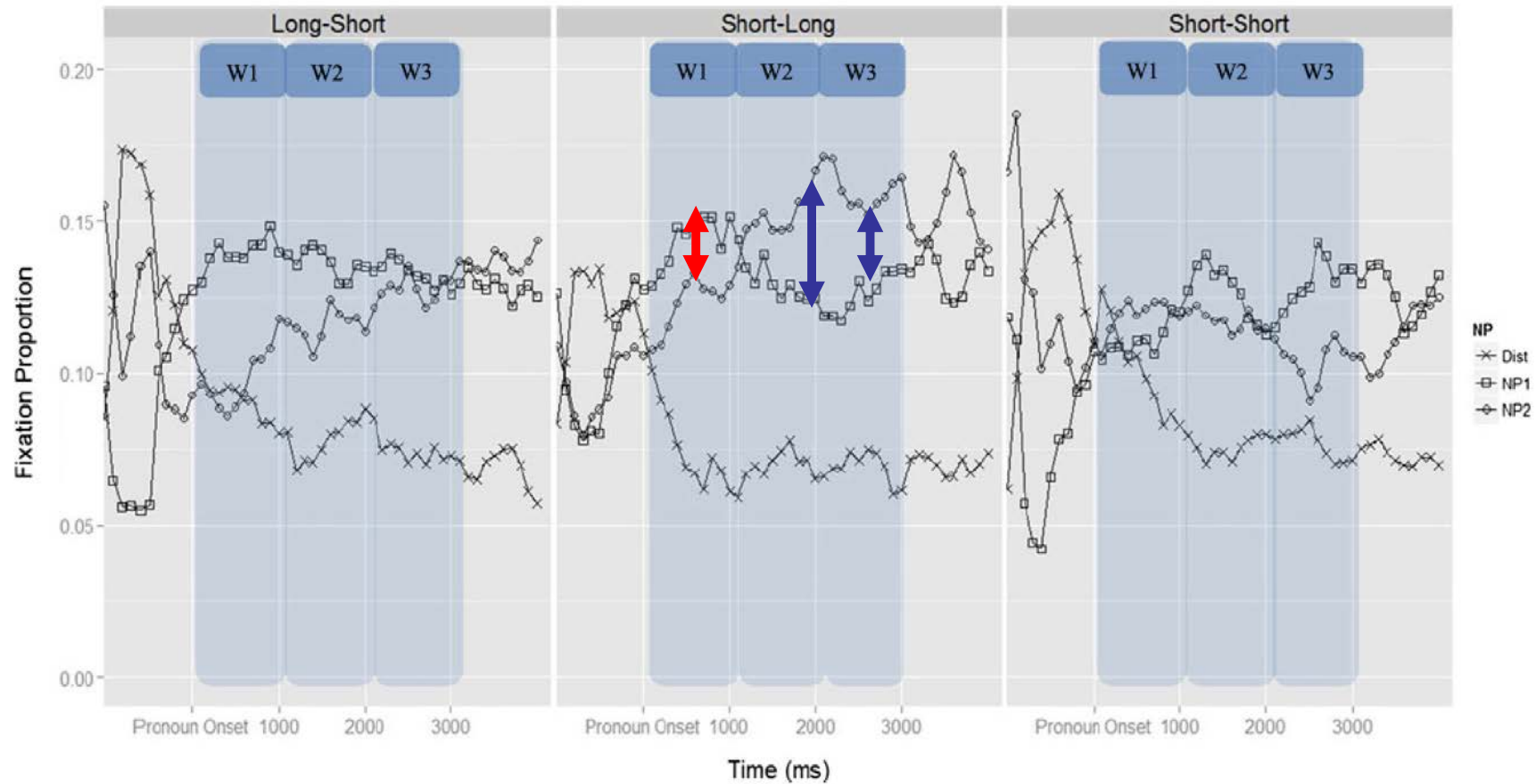
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long-short
NP1 > NP2

short-short   35
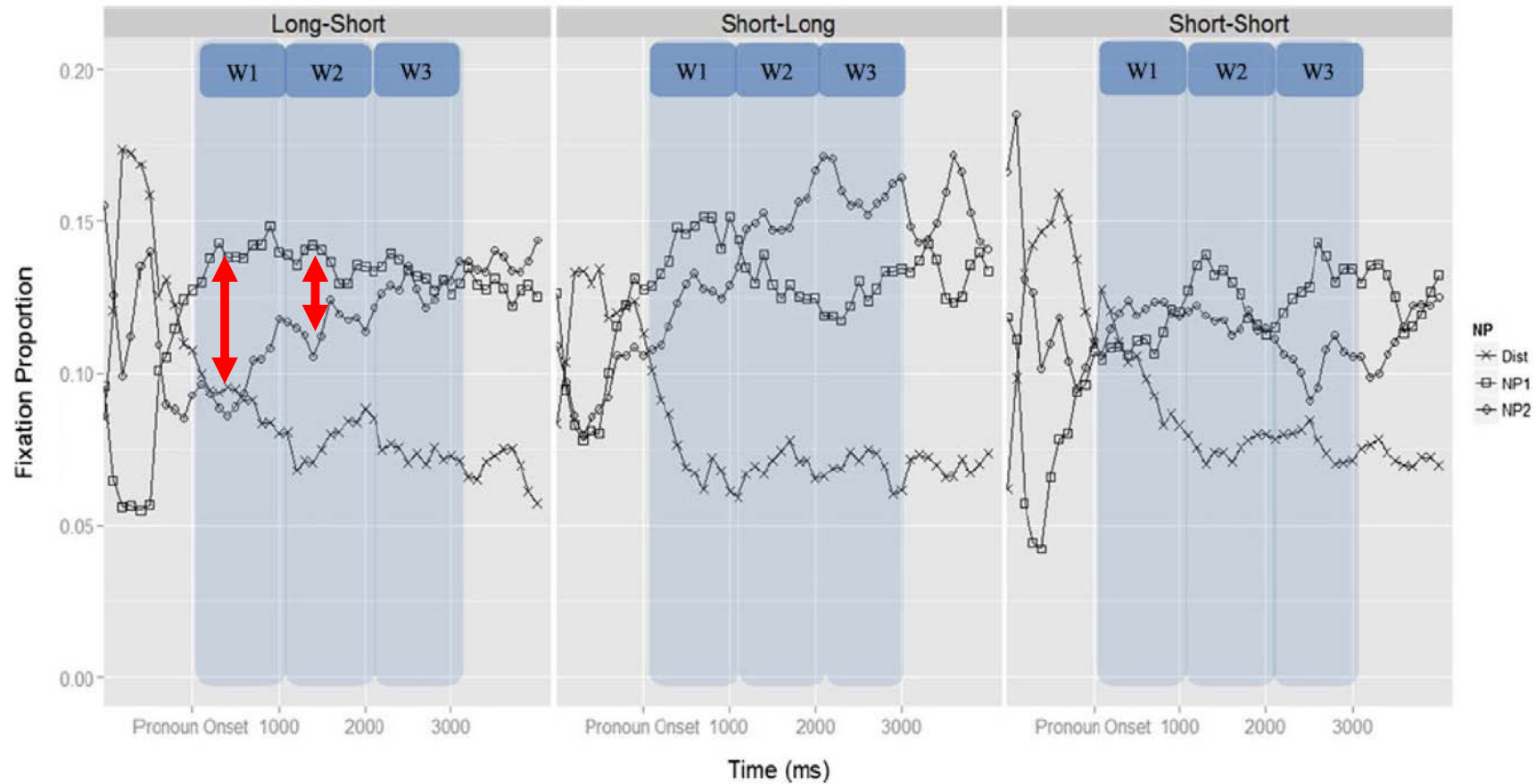NP1 > NP2

3. Informativity

Fig. 2 Experiment 1: Fixation proportions by NP position and NP length. "W" and "Dist" stand for "Window" and "distractor," respectively

long-short
NP1 > NP2

short-long
NP1 – NP2

short-short
NP1 > NP2

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3. Informativity

Summary

- informativity contributes to prominence / accessibility
- higher accessibility of discourse referents
- (exception short NP1 – long NP2 in first window - due to complexity of the sentence)
- confirming Karimi et al. (2014) and Karimi et al. (2019)
- more informative noun phrases are more accessible

4. Information status

Full or descriptive DPs (unlike pronouns and proper names)

- descriptive content activating a concept
- can be pre-activated by lexical material in preceding context; corresponds to the information status of the NP (Prince 1981)

Information status	Concept activation
brand-new	no pre-activation
inferred (inferrable)	pre-activation
given	full activation

4. Information status

Sentences with indefinite NPs can express different
implicatures depending on the information status or domain
restrictions provided by the descriptive material (Heim, 1991)

Information status	Implicature	Activation / Access
brand-new	uniqueness	individual referent
inferred	non-uniqueness	role
given	non-familiarity	individual referent

4. Information status

Brand-new indefinites (uniqueness implicature)

Gym class was crowded like always.
Philipp stared at a pretty boy.
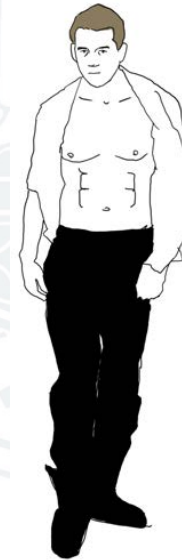
4. Information status

Brand-new indefinites (uniqueness implicature)

Gym class was crowded like always.
Philipp stared at a pretty boy.

Inferred indefinites (non-uniqueness implicature, role reading)

Gym class was crowded like always.
Philipp stared at a trainer.

4. Information status

Brand-new indefinites (uniqueness implicature)
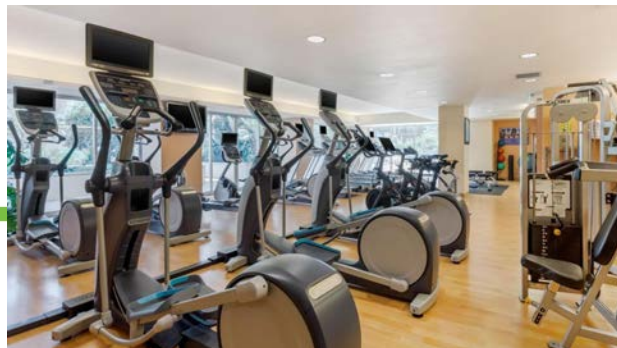
> Gym class was crowded like always.
> Philipp stared at a pretty boy.

Inferred indefinites (non-uniqueness implicature, role reading)

> Gym class was crowded like always.
> Philipp stared at a trainer.

Given indefinites (non-familiarity constraint)

> A trainer entered the room with a smile.
> Philipp stared at a trainer.

Exp1 indef. DPs vs. indef. dem. DPs

40 short stories (in German)

sentence 1:   context

sentence 2:   introduction of two human referents

sentence 3:   presentation of ambiguous pronoun

1. The gym was crowded like always.

2. The theater was crowded like always.

a Phillip observed **this trainer**.

b Phillip observed **a trainer**.

When a glass fell off the table, **he** turned around and shook his head.

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Exp1 indef. DPs vs. indef. dem. DPs

- 40 experimental items
- 80 filler items (same structure)
- four lists
- auditory input
- four pictures
- comprehension questions or "continue"
- 32 native speakers of German

Exp1 indef. DPs vs. indef. dem. DPs

– While ps listened to the short stories they looked at a computer screen displaying pictures of the two human referents (subject vs. critical object referent) together with two unrelated pictures of day-to-day objects.
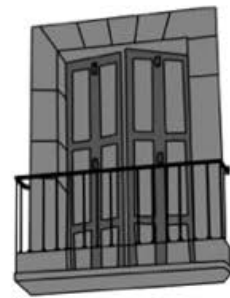
Exp1 indef. DPs vs. indef. dem. DPs

- We measured ps' eye fixations starting at 100 ms before pronoun onset up until 1400 ms post pronoun onset
- and analyzed which of the four pictures on the screen participants were fixating.
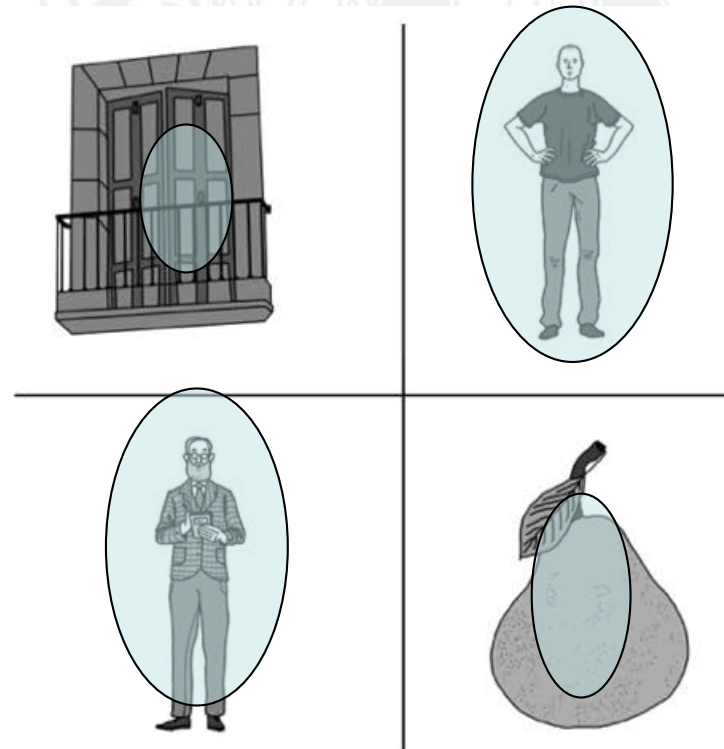
Exp1 indef. DPs vs. indef. dem. DPs

Analysis

eye fixations five windows

i)   100 ms before onset of pronoun to 200 ms after

ii)   200 ms – 500 ms

iii) 500 ms – 800 ms

iv) 800 ms – 1,100 ms

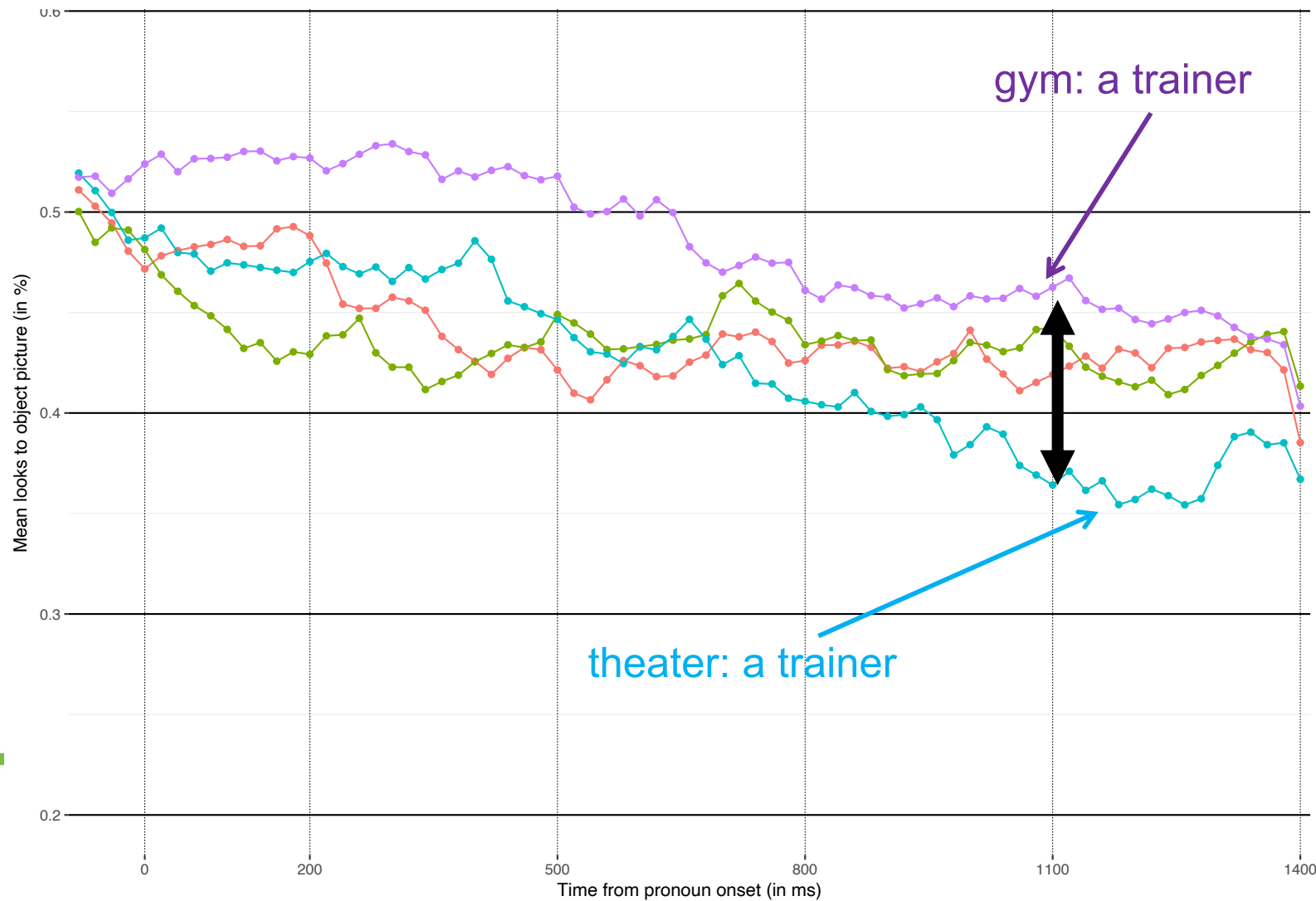v)   1,100 ms – 1,400 ms

Mean looks to the picture of the object referent (in %)

Exp1 indef. DPs vs. indef. dem. DPs

Mean looks to the picture of the subject referent (in %)

Exp1 indef. DPs vs. indef. dem. DPs

- Generalized mixed models confirm these observations: For looks to the object picture, we found a marginal Information status x article interaction for the 1100 ms – 1400 ms time frame, $t = 1.88$.
- For looks to the subject picture, we found a significant Information status x article interaction for the time frame 500 ms – 800 ms post pronoun onset, $t = 2.45$, and a marginal interaction for the 800 ms – 1100 ms time frame, $t = 1.91$.

Exp2 indef. DPs vs. def. DPs

Brocher & von Heusinger 2018

- a visual-world eye-tracking experiment
- participants listened to three-sentence auditory stimuli
- visual display that contained pictures
- first sentence of the auditory input had a frame
- second sentence included two human referents
- the third sentence contained an ambiguous pronoun
- information status and definiteness was manipulated
- four conditions

Exp2 indef. DPs vs. def. DPs

32 short stories (in German)

sentence 1:   context

sentence 2:   introduction of two human referents

sentence 3:   presentation of ambiguous pronoun

Exp2 indef. DPs vs. def. DPs

32 short stories (in German)

sentence 1:   context
sentence 2:   introduction of two human referents
sentence 3:   presentation of ambiguous pronoun

The gym was crowded like always.

Philipp stared at ___REF___*at PP* .

When the lights went out, *he* used his cell phone as a flashlight.
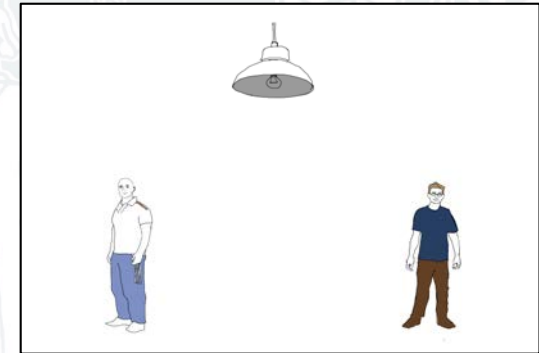
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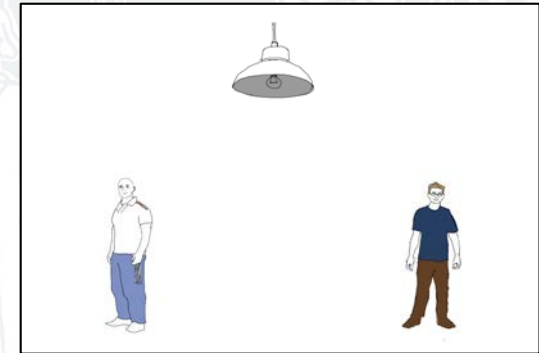
The gym was crowded like always.
Philipp stared at ___REF___ *at PP* .
When the lights went out, *he* used his cell phone as a flashlight.

indefinite / brand-new   a pretty boy next to the window
definite / brand-new   the pretty boy next to the window
indefinite / inferred   a trainer next to the window
definite / inferred   the trainer next to the window

Exp2 indef. DPs vs. def. DPs

Analysis

eye fixations five windows

i)   100 ms before onset of pronoun to 200 ms after

ii) 200 ms – 500 ms

iii) 500 ms – 800 ms

iv) 800 ms – 1,100 ms

v)   1,100 ms – 1,400 ms

vi) 1,400 ms – 1,700 ms

Exp2 indef. DPs vs. def. DPs
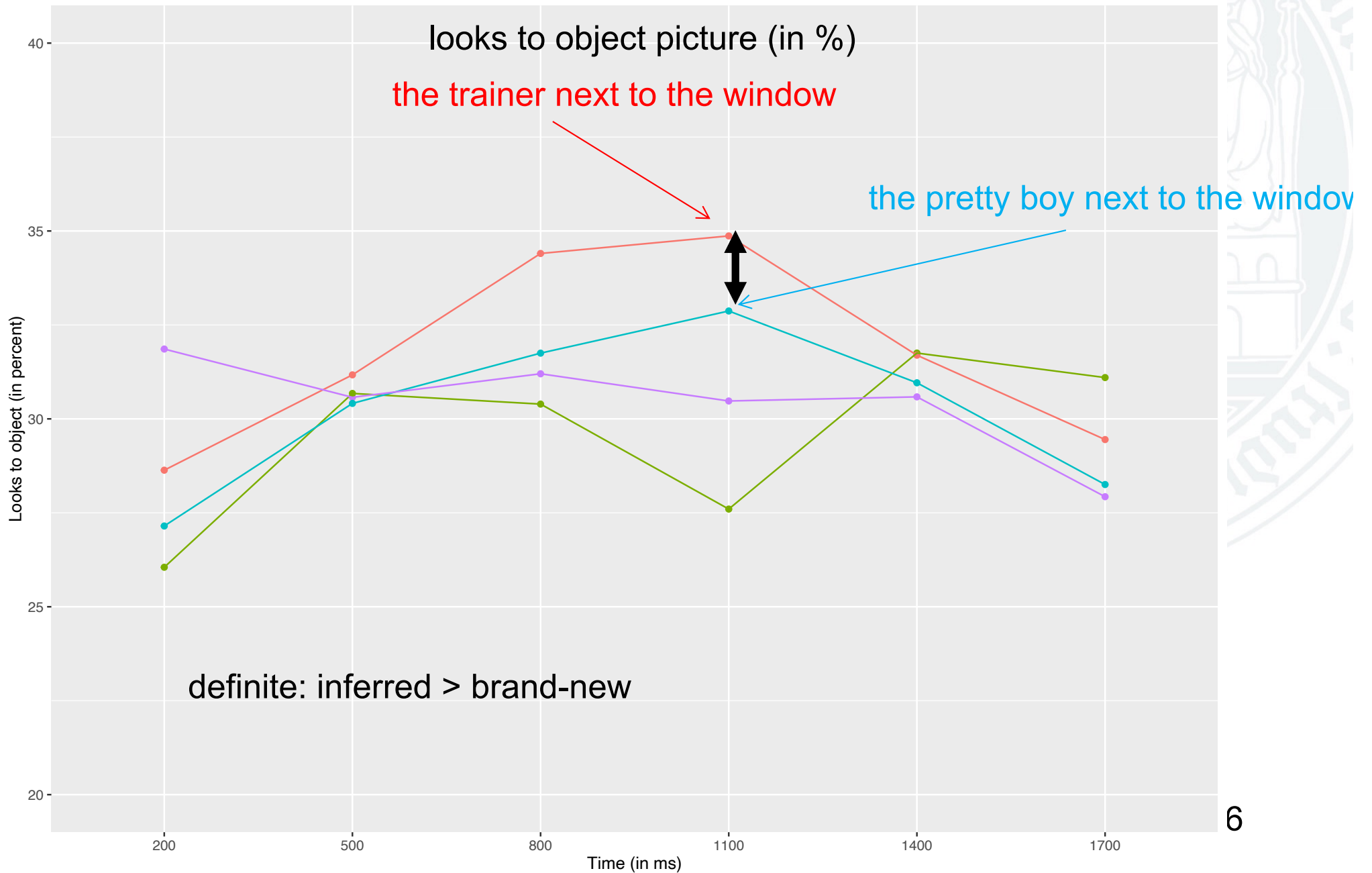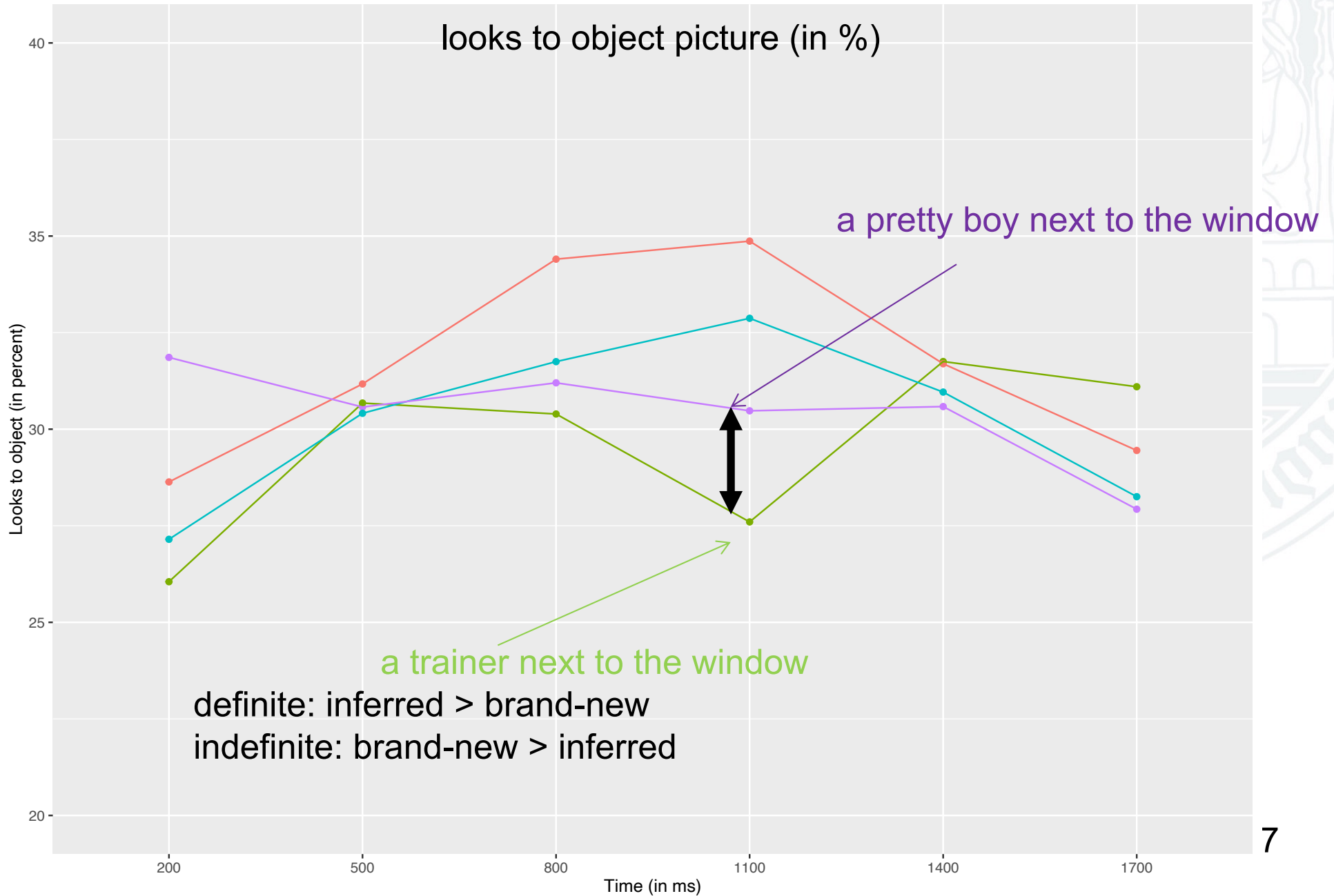
looks to object picture (in %)

the trainer next to the window

the pretty boy next to the window

definite: inferred > brand-new

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Exp2 indef. DPs vs. def. DPs

looks to object picture (in %)

a pretty boy next to the window

a trainer next to the window

definite: inferred > brand-new
indefinite: brand-new > inferred

Looks to object (in percent)

Time (in ms)

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4. Information status

Results

Exp1 indef. DP vs. indef. dem. DP

indef. dem.   inferred = brand-new

indefinite   inferred > brand-new

4. Information status

Results

Exp1 indef. DP vs. indef. dem. DP
indef. dem.   inferred = brand-new
indefinite   inferred > brand-new

Exp2 indef. DP vs. def. DP
definite   inferred > brand-new
indefinite   brand-new > inferred

4. Information status

Results

Exp1 indef. DP vs. indef. dem. DP

indef. dem.   inferred = brand-new

indefinite   inferred > brand-new

Exp2 indef. DP vs. def. DP

definite   inferred > brand-new

indefinite   brand-new > inferred
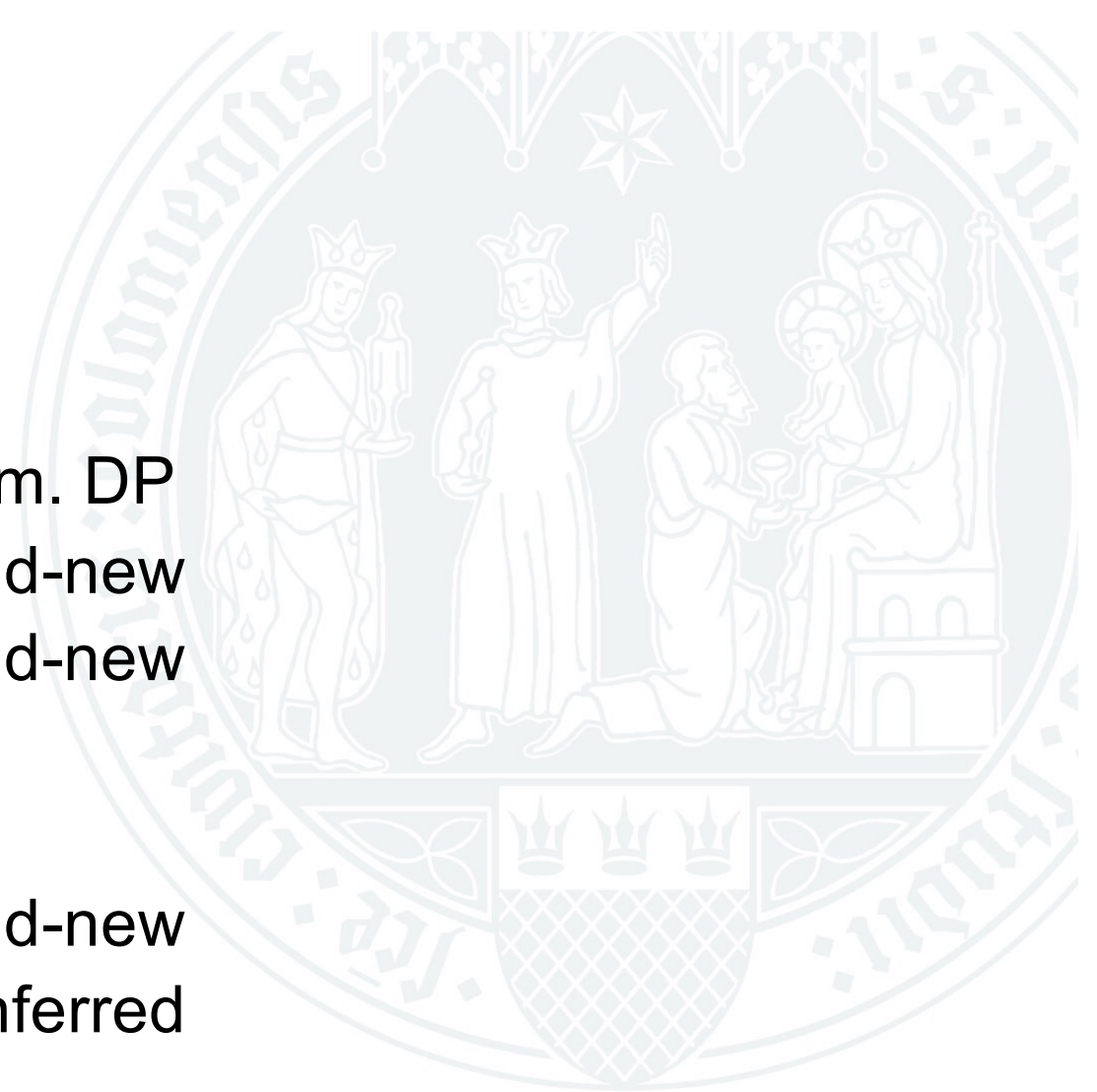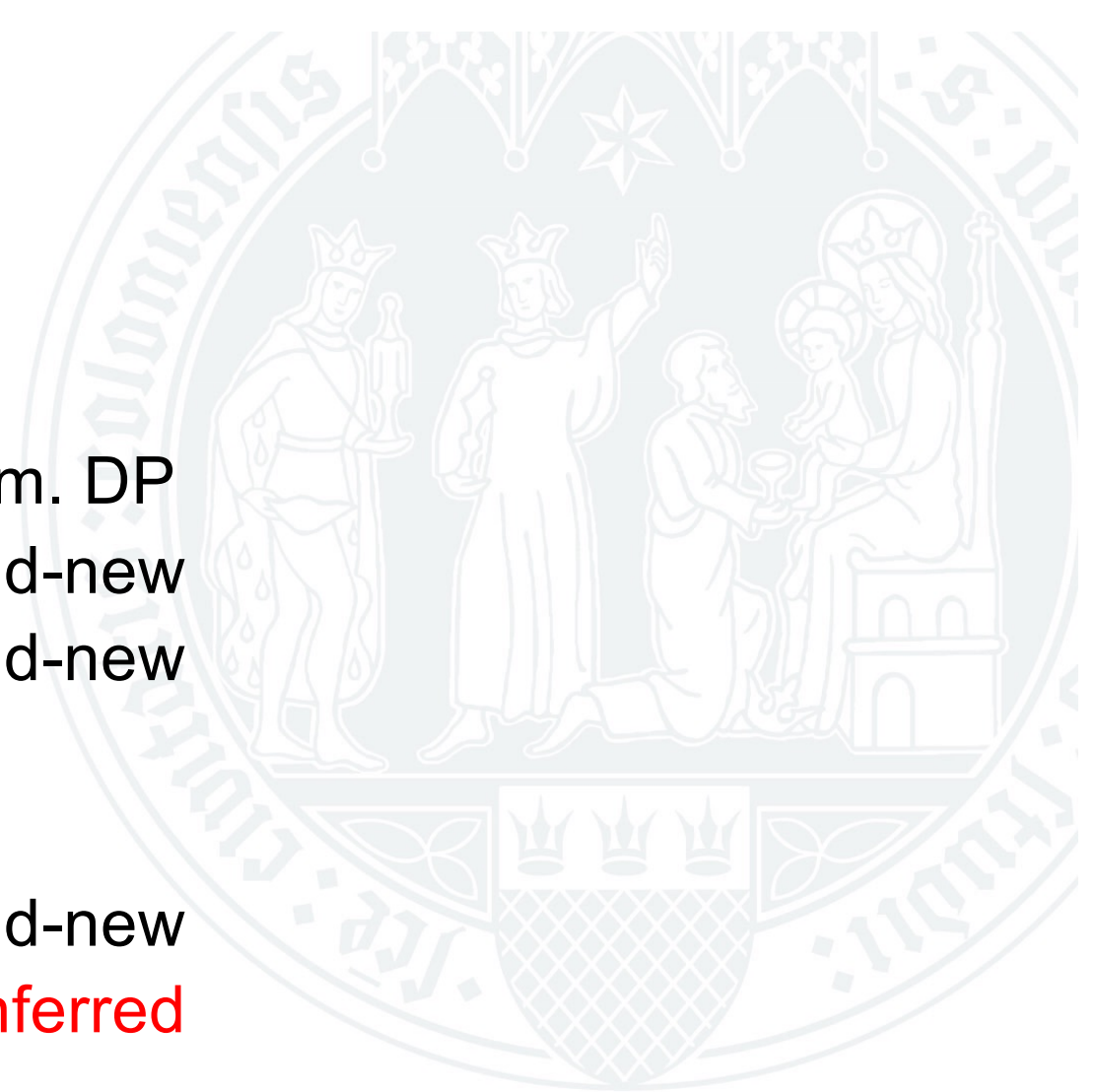
4. Information status

Results

Exp1 indef. DP vs. indef. dem. DP   no Modification

indef. dem.   inferred = brand-new

indefinite   inferred > brand-new

Exp2 indef. DP vs. def. DP   Modification

definite   inferred > brand-new

indefinite   brand-new > inferred

5. Exp. Informativeness x information status

Prominence of indefinite DPs depending on

- Informativeness
- Information status

Prediction with respect to prominence

A: more informative DPs > less informative DPs

         inferred DPs > brand new DPs

B: interaction with discourse update function (QUD)

         interaction with denotation (role vs. individual)

5. Exp. Informativeness x information status

- a visual-world eye-tracking experiment

- participants listened to three-sentence auditory stimuli

- visual display that contained pictures

- first sentence of the auditory input had a frame

- second sentence included two human referents

- the third sentence contained an ambiguous pronoun

- informativity and information status was manipulated

  - indef. DP vs. indef. DP + PP

  - inferred vs. brand-new

- four conditions

5. Exp. Informativeness x information status

40 short stories (in German)

sentence 1:   context

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5. Exp. Informativeness x information status

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The bar was crowded like always.

5. Exp. Informativeness x information status

40 short stories (in German)

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sentence 3:   presentation of ambiguous pronoun

The bar was crowded like always.

The theater was crowded like always.

5. Exp. Informativeness x information status

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The bar was crowded like always.
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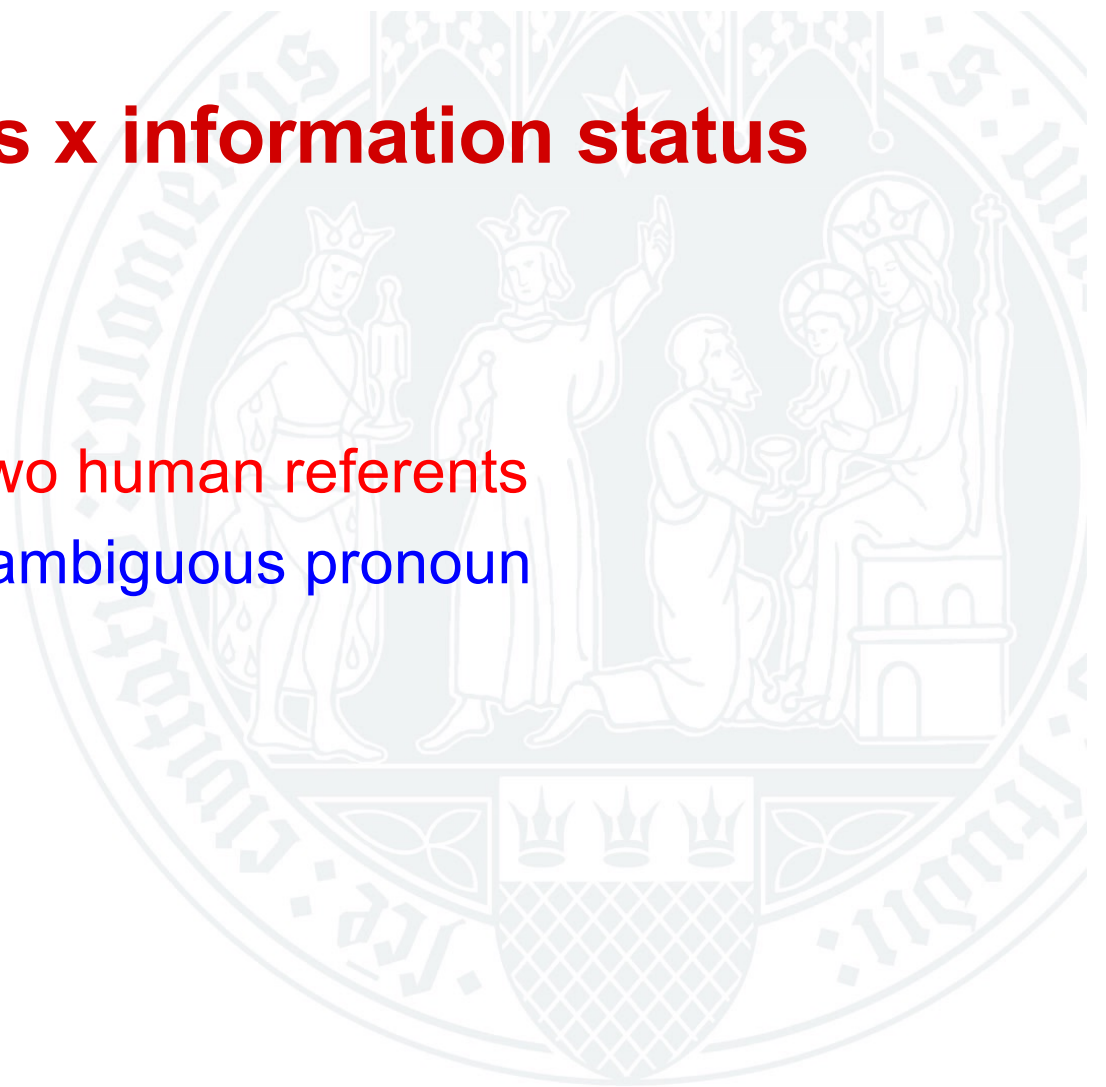Peter called a waiter at the entrance.
Peter looked a waiter.
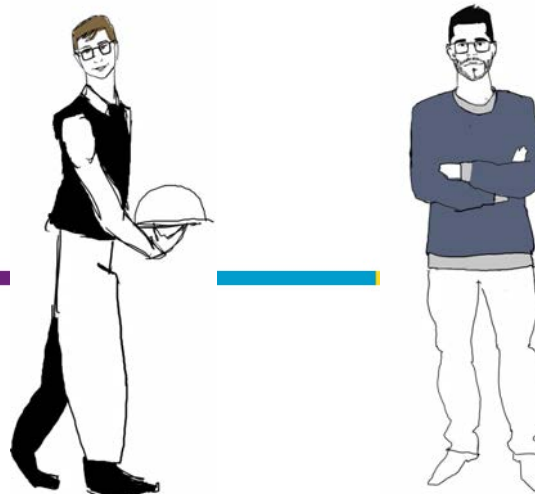
5. Exp. Informativeness x information status

40 short stories (in German)

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The bar was crowded like always.

The theater was crowded like always.

Peter called a waiter at the entrance.

Peter called a waiter.

When a glass fell off the table, **he** turned around and shook his head.
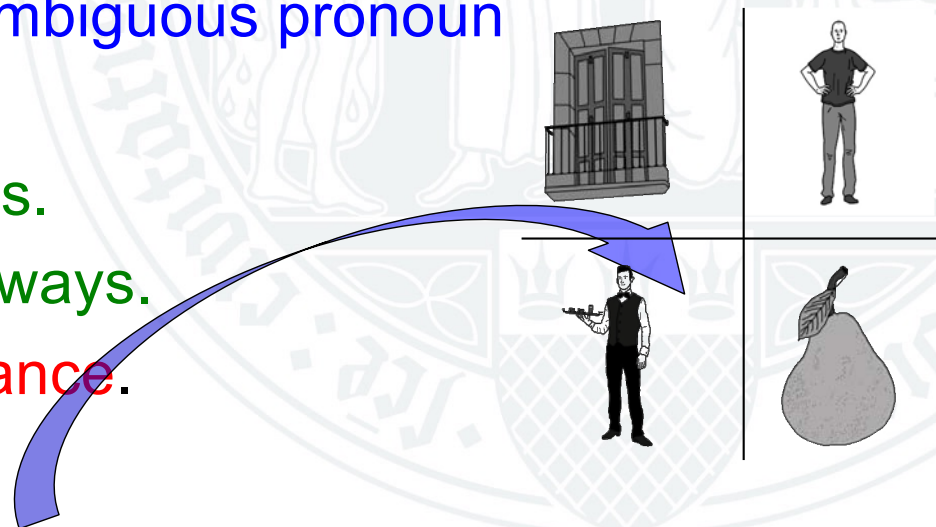
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eye fixations five windows

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ii) 200 ms – 500 ms

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iv) 800 ms – 1,100 ms

v)   1,100 ms – 1,400 ms

- 90.1% Accuracy to the comprehension
- 12.9% of the data were not included (blinks, no picture fixated)

5. Exp. Informativeness x information status
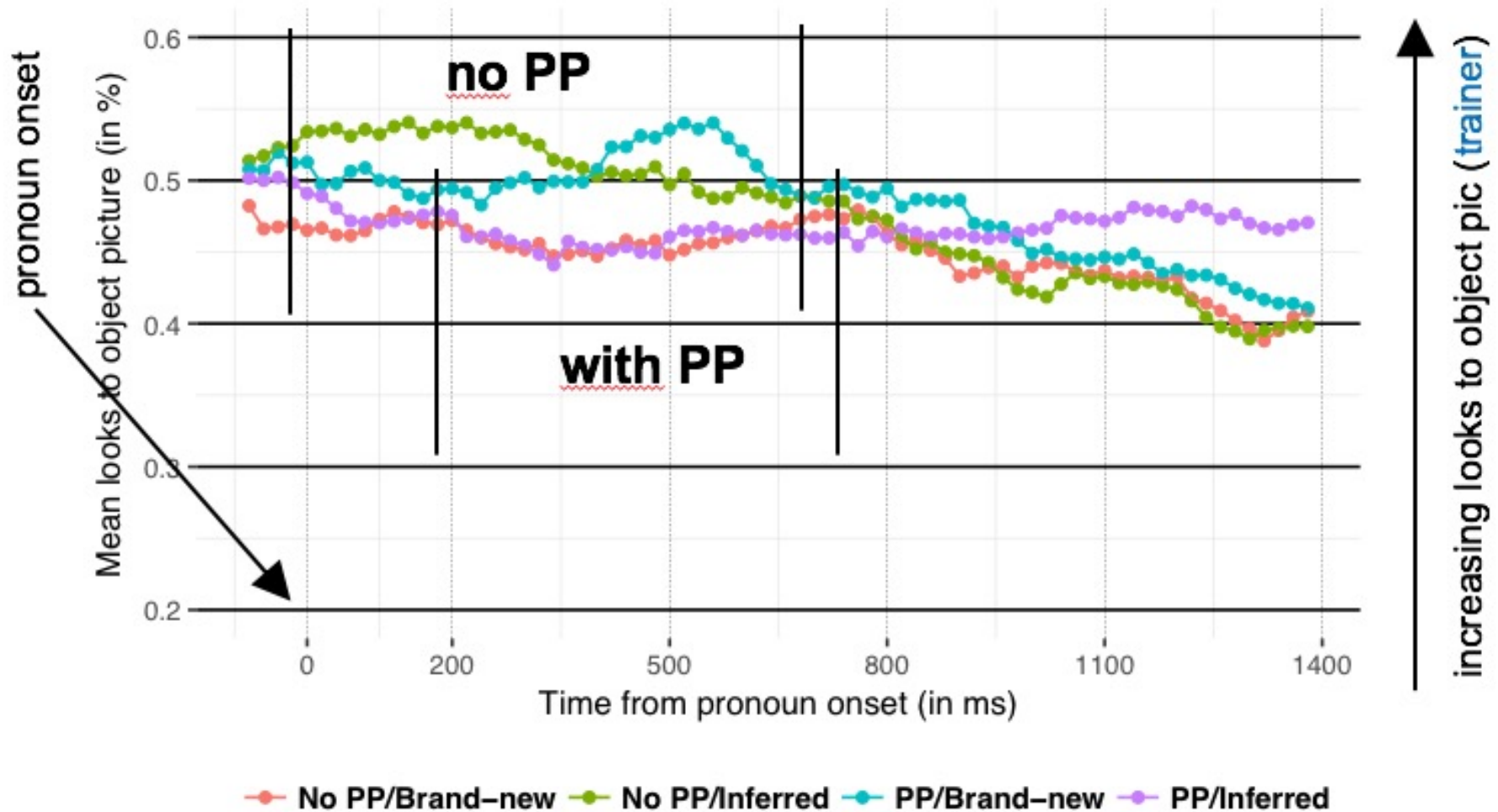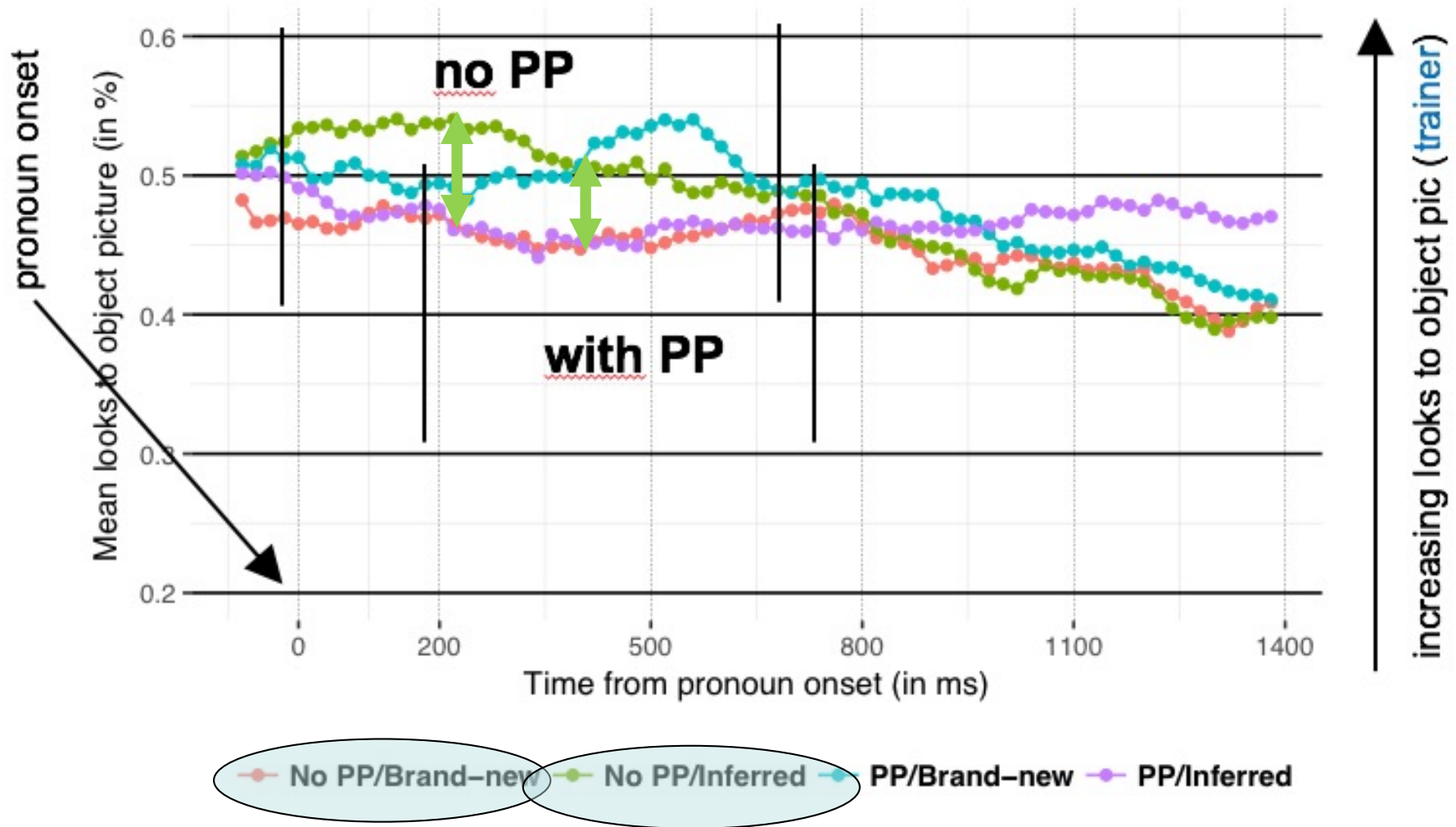
onset - 700 ms
no modification: inferred > brandnew

5. Exp. Informativeness x information status
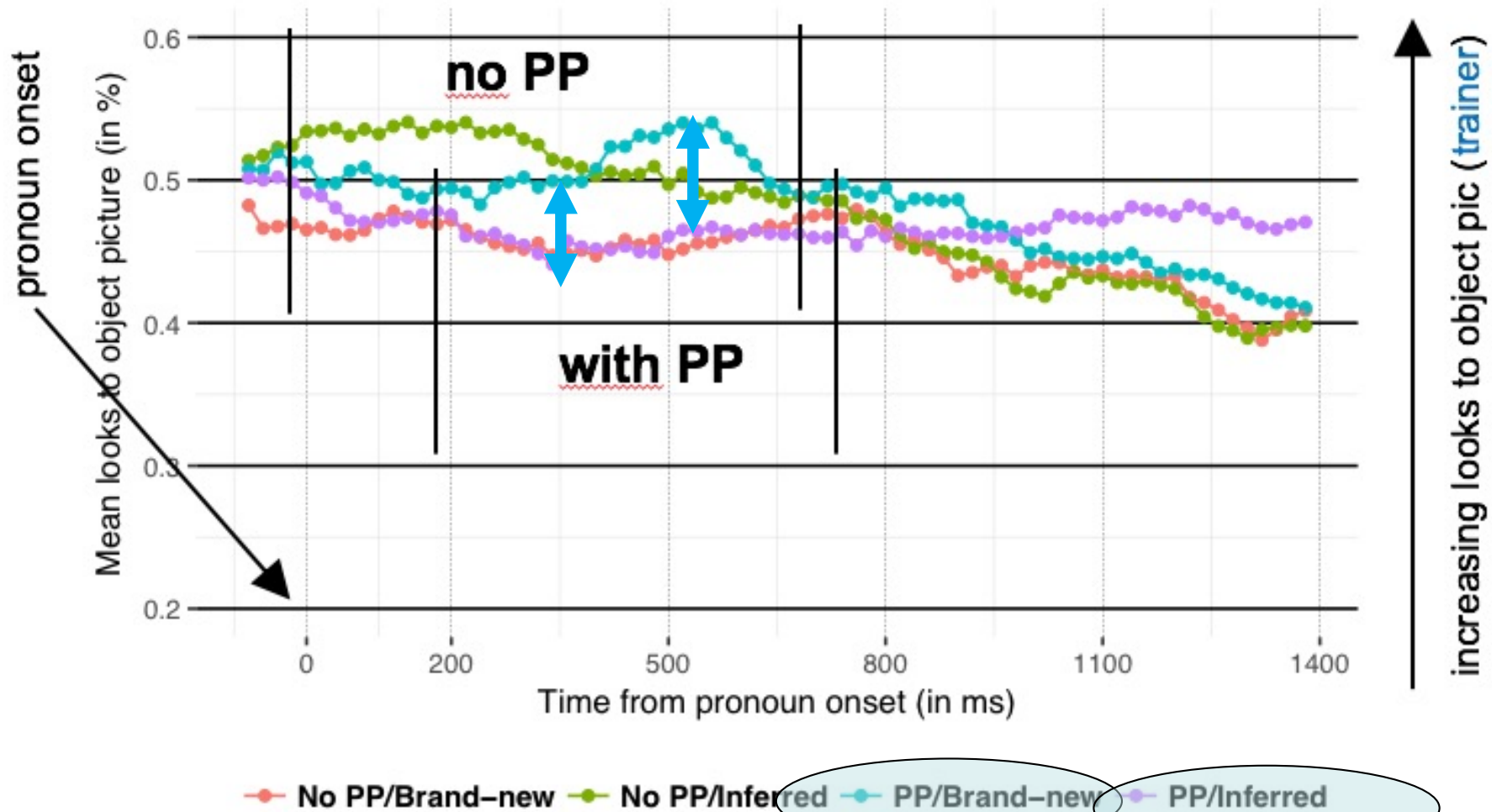
onset - 700 ms
no modification: inferred > brandnew

200 ms - 800 ms
modification: brandnew > inferred

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5. Exp. Informativeness x information status

Results

200 ms – 500 ms post pronoun

- significant Information status x informativity interaction
- resulting from opposite effects of NP complexity on referents with inferred and referents with brand-new concepts
- no other effects reached statistical reliability

6. Discussion

The results confirm

Exp1 and Exp2

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Exp1 and Exp2

They support that

- informativeness influences accessibility
- information status influences accessibility

6. Discussion

The results confirm
        Exp1 and Exp2

They support that
- informativeness influences accessibility
- information status influences accessibility

Note that they **interact**: modification causes a "reversal"
- less informative indefinites: inferred > brand new
- more informative indefinites: brand new > inferred

6. Discussion

Two potential explanations:

i) interaction with communicative goal (QUD)

-> PP modification as resolving QUD

i) interaction with denotation (role vs. individual)

-> the PP-modification mismatches with the role reading

6. Discussion

Additional assumptions

1. Indefinites denotate predicates that might be shifted to individual or role readings

2. Indefinites have the communicative goal of opening an QUD / raising an issue

3. The design with a singular pronoun as subject of an episodic predicate (*turned around)* forces an individual reading (not a role reading)

6. Discussion – Explanation QUD

interaction with discourse update function (QUD)

      -> PP modification as resolving QUD

- the indefinite introduces a QUD („tell me more about the trainer")
- the PP „at the entrance" is resolving the QUD
- thus there is less communicative pressure to use the indefinite

accessibility level:

inferred DP		brand-new DP
brand-new DP+PP	>	inferred DP+PP
theater: a trainer at the door		gym: a trainer at the door

6. Discussion – Explanation QUD

brand-new DP+PP   **>**   inferred DP+PP

theater: a trainer at the door   gym: a trainer at the door

brand new indefinites - modified

- indefinite DP introduces a new discourse referent
- the modification contributes to its identifiability
- communicative goal of an indefinite is enhanced

6. Discussion – Explanation QUD

brand-new DP+PP   **>**   inferred DP+PP
theater: a trainer at the door   gym: a trainer at the door

brand new indefinites - modified
- indefinite DP introduces a new discourse referent
- the modification contributes to its identifiability
- communicative goal of an indefinite is enhanced

inferred indefinite - modified
- referent of indefinite DP is expected
- modification does not contribute to the identifiability
- used for an independent predication
- communicative goal is saturated

6. Discussion – Explanation Role

Interpretative strategies
- indefinites denote predicates / concepts
- type shifting
    - a) role
    - b) individual
- frames enhance role reading
- PPs require individual readings
- pronouns requires individual readings, but type shifting between sentences is effortless

prominence level:

inferred $D_{<e\text{-role}>}$ brand-new $DP_{<e>}$
brand-new $DP_{<e>}$+$PP_{<e,e>}$ $>$ inferred $DP_{<e\text{-role}>}$+$PP_{<e,e>}$

6. Discussion – Explanation Role

brand-new DP+PP **>** inferred DP+PP

theater: a trainer at the door   gym: a trainer at the door

brand new indefinites - modified

- indefinite DP introduces a new discourse referent.
- the modification contributes to its identifiability
- type shifting to individuals easy

6. Discussion – Explanation Role

brand-new DP+PP   **>**   inferred DP+PP

theater: the trainer at the door   gym: the trainer at the door

brand new indefinites - modified

- indefinite DP introduces a new discourse referent.
- the modification contributes to its identifiability
- type shifting to individuals easy

inferred indefinite - modified

- referent of indefinite DP is expected
- modification enhances role reading "trainer"
- PP-modification requires individual reading - mismatch

6. Discussion – Explanation Role

inferred D$_{<e\text{-}role>}$ **>**   brand-new DP$_{<e>}$

brand-new DP$_{<e>}$+PP$_{<e,e>}$ inferred DP$_{<e\text{-}role>}$+PP$_{<e,e>}$

brand new indefinites - modified

- indefinite DP introduces a new discourse referent.
- the modification contributes to its identifiability
- type shifting to individuals easy

inferred indefinite - modified

- referent of indefinite DP is expected
- modification enhances role reading "trainer"
- PP-modification requires individual reading - mismatch

7. Conclusion

Overall

- informativity affects prominence

    - Indef. DP, def. DPs

- information status affects prominence

    - Indef. DP, def. DPs

    - But not indef. dem. DPs

- Information status (frames) and informativity (PP-modif.)

    - Add up with def. DPs

    - Block prominence for indef. DPs

8. Conclusion

Indefinites

- show high variation on denotational types

- referential indefinites have a forward discourse function

- contextual / lexical information (frames)

    - **pre-activated indefinites**

    - **trigger a role reading**

- type shifting between sentences effortless

- type shifting in sentence compositional processes (indefinite with modified PP) needs effort
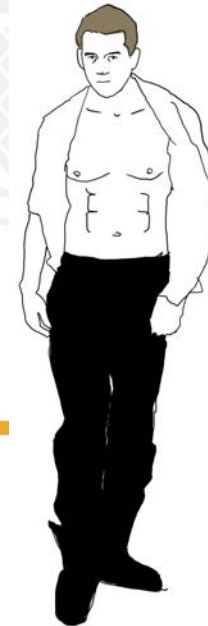
8. Conclusion

Interpretation of indefinites depends

     - referential type

     - compositional processes in the sentence

     - information in the previous discourse

     - and lead to different discourse dynamics

         for the following discourse

Thank you very much

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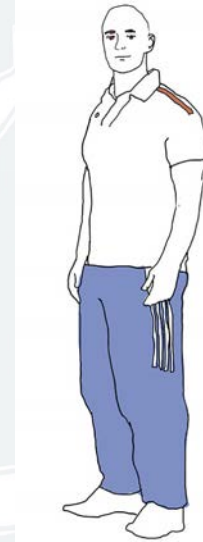
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Thank you very much