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Processing of compound constituents: position-specificity and interpretability

Jana Hasenäcker, Maria Ktori, Davide Crepaldi

International School for Advanced Studies (SISSA), Trieste



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jhasenac@sisssa.it



[@JanaHasenacker](https://twitter.com/JanaHasenacker)

watcher

watchful

reader

stopwatch

unreadable

reread

unwatchable

watchdog

rewatch

watcher

watchful

reader

stopwatch

unreadable

reread

unwatchable

watchdog

rewatch

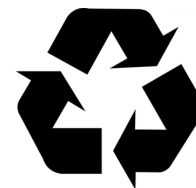
- Reading system uses morphological structure in processing

Reading is special

- not spontaneously acquired, not observed universally
- nevertheless, very efficient, very fast

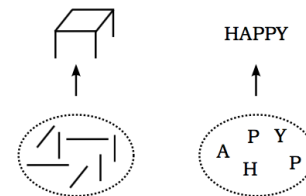
Reading is special

➤ “recycles” general structures from visual identification system



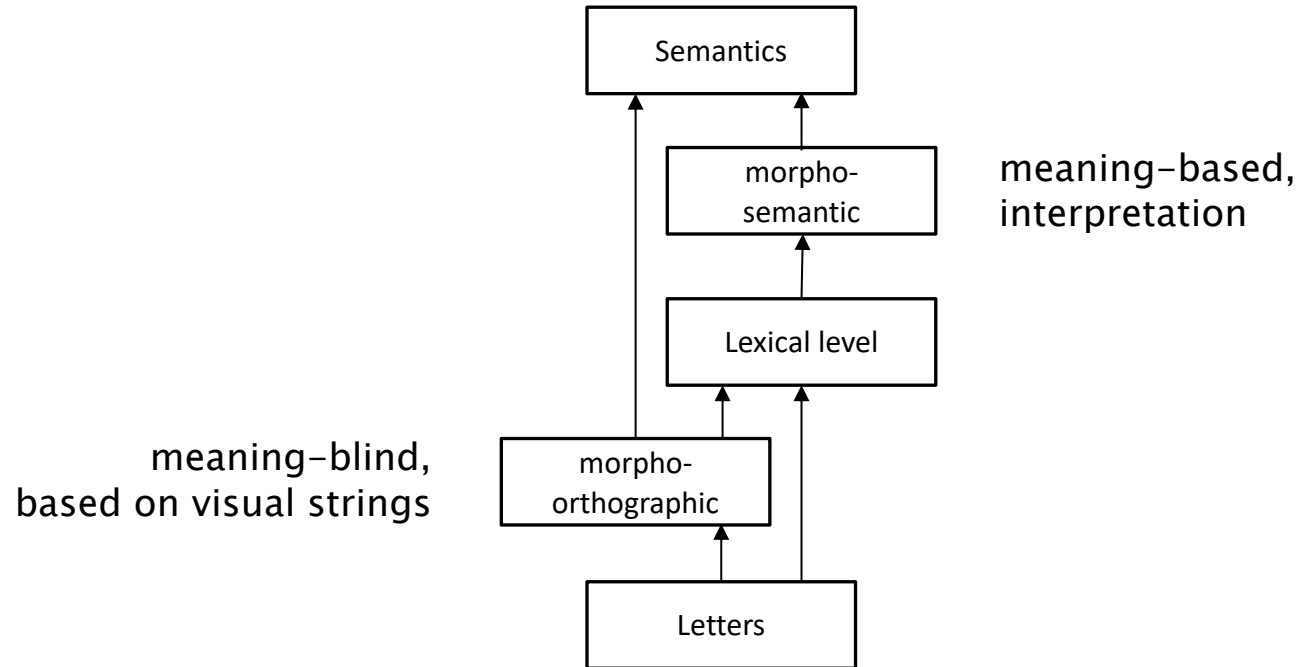
➤ uses regularities in low-level units, build higher-level units based on these

➤ visual processes + linguistic processes



Morphological processing in reading

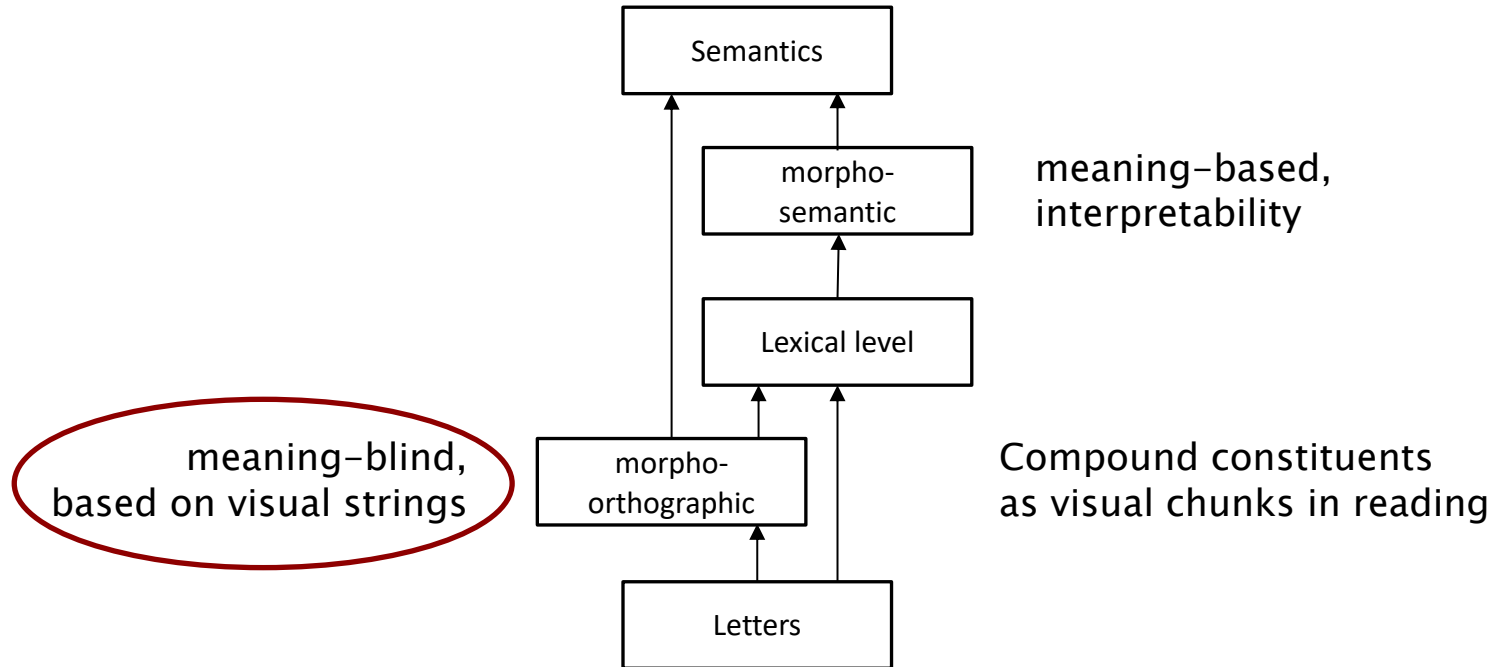
Visual + linguistic processes



(Beyersmann et al., 2012; Diependaele et al., 2009)

Morphological processing in reading

Visual + linguistic processes



(Beyersmann et al., 2012; Diependaele et al., 2009)

Morphological processing in reading

- Morpheme advantage:

sunrise < racoon

LDT



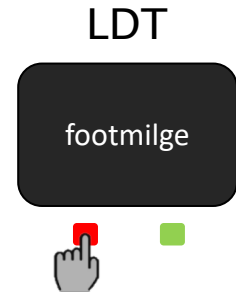
(e.g., Fiorentino & Poeppel, 2007; Quémart et al., 2012)

Morphological processing in reading

- Morpheme interference:

footmilge > mowdflick

(e.g., Burani et al., 2002; Taft & Forster, 1976)



Morphological processing in reading

- Morpheme interference:

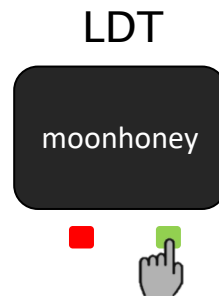
footmilge > mowdflick

(e.g., Burani et al., 2002; Taft & Forster, 1976)

stronger for reversed real compounds:

moonhoney > moonbasin

(Crepaldi et al., 2013)



Morphological processing in reading

- Morpheme interference:

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(Crepaldi et al., 2013)

Position-independent identification of stems

Position independent stems throughout language

houseboat



boathouse



Position independent stems throughout language

houseboat



boathouse



But position-specific suffixes:

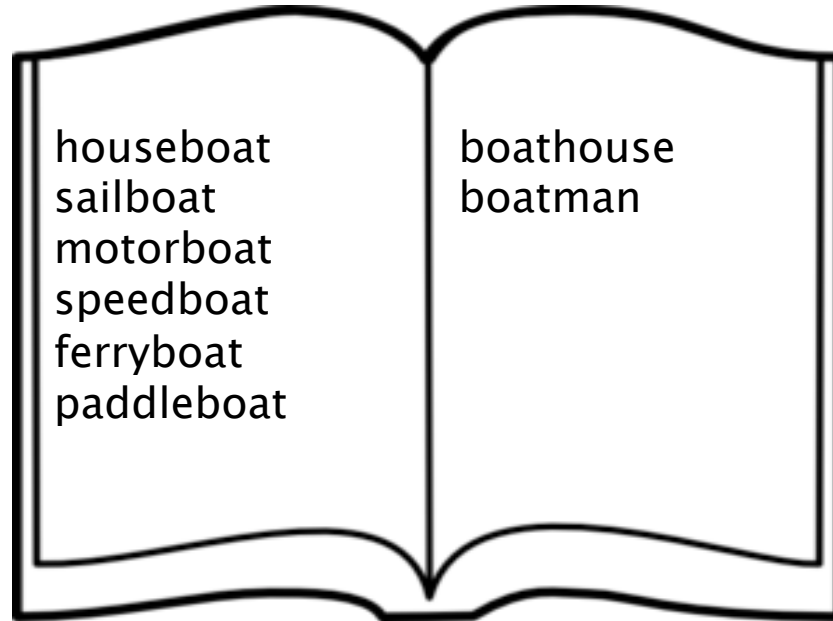
reader *erread

fulgas = filgas

no reversed morpheme interference effect (Crepaldi et al., 2010)

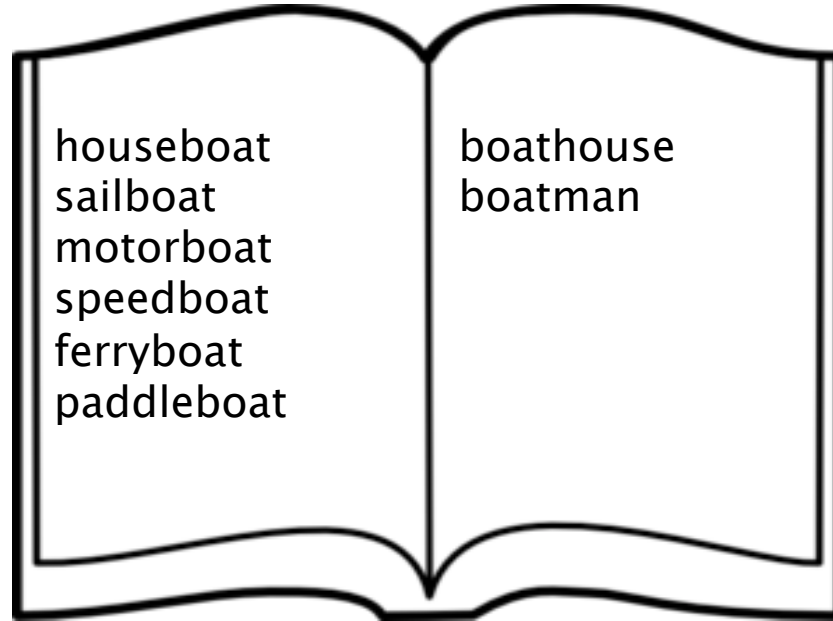
[-boat]

[boat-]



[-boat]

[boat-]



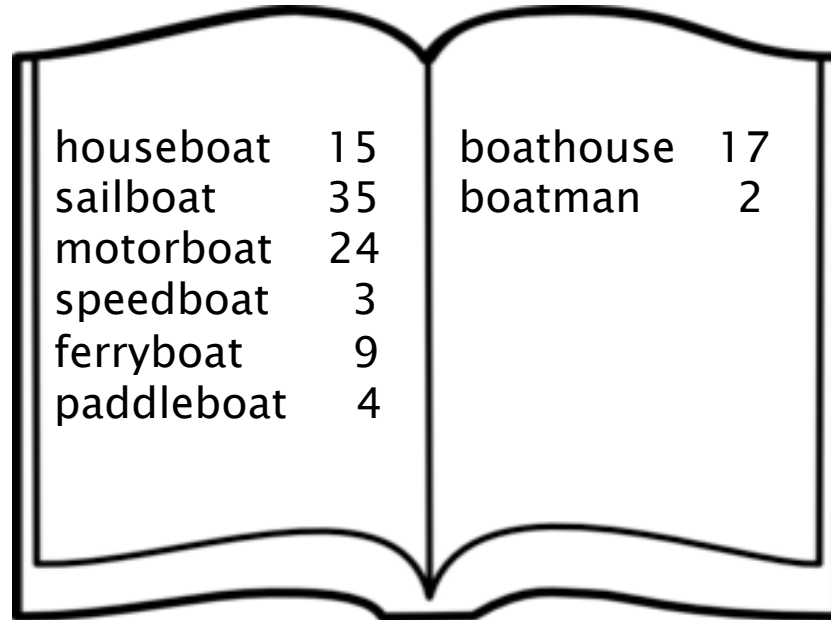
6

2

Position-specific
family size:

[-boat]

[boat-]



houseboat	15	boathouse	17
sailboat	35	boatman	2
motorboat	24		
speedboat	3		
ferryboat	9		
paddleboat	4		

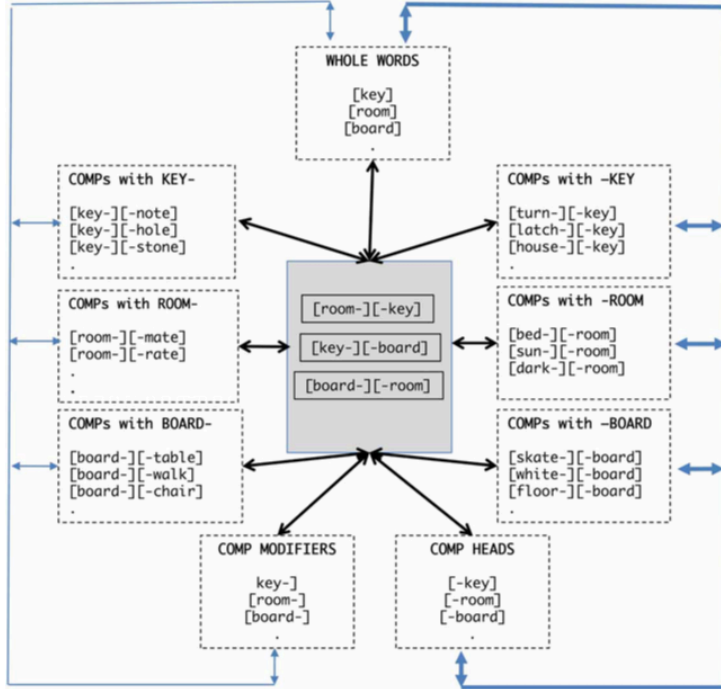
[-boat]		[boat-]	
houseboat	15	boathouse	17
sailboat	35	boatman	2
motorboat	24		
speedboat	3		
ferryboat	9		
paddleboat	4		
90		19	

Position-specific
family frequency:

Does the reading system just make a general distinction between stems (always completely position-independent) and affixes (always position-bound)?

Or is it sensitive to this distributional information of position of stems in language?

Position-specificity based on distribution in language

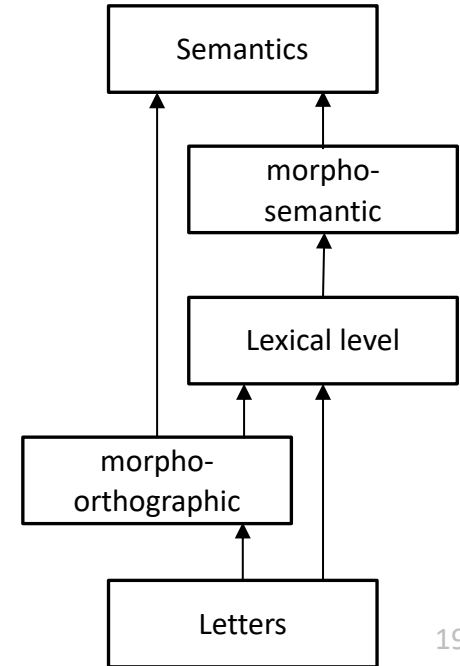


(Libben, 2014)

impacts on



morphological processing in reading



19

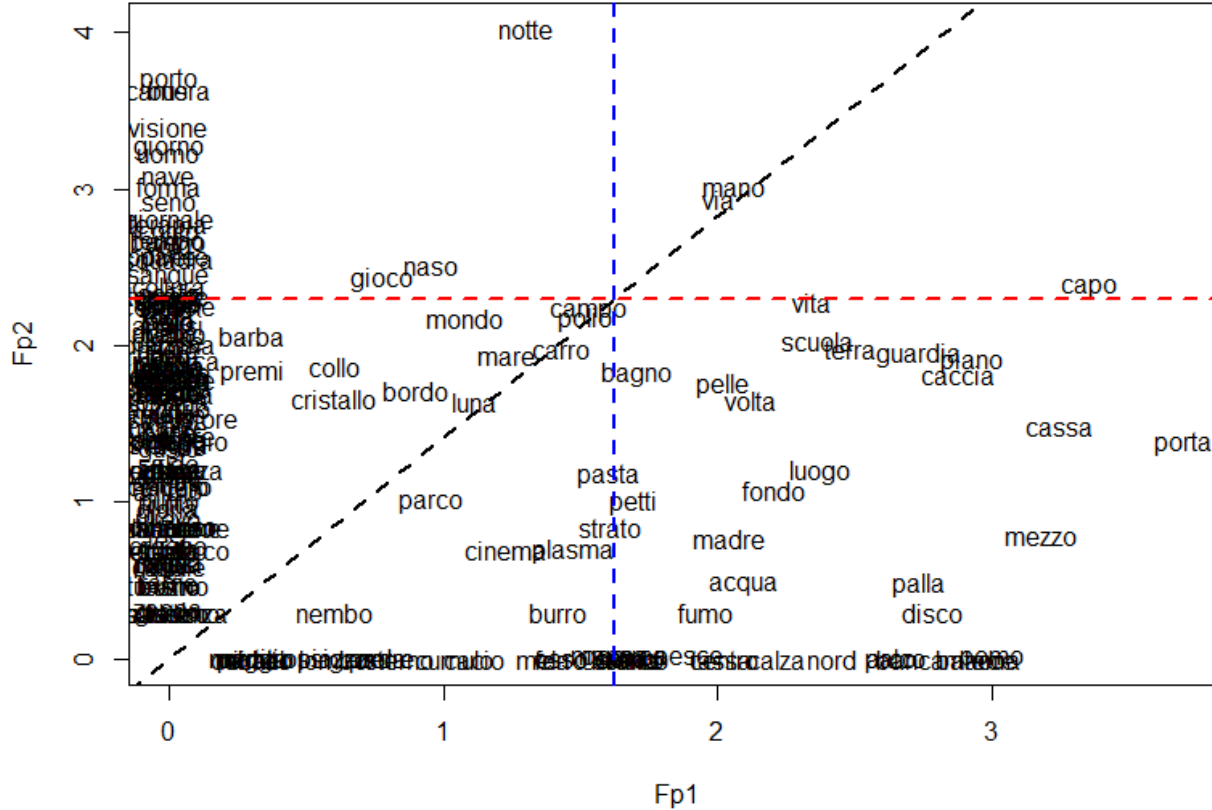
(Beyersmann et al., 2012; Diependaele et al., 2009)

Does the reading system just make a general distinction between stems (always completely position-independent) and affixes (always position-bound)?

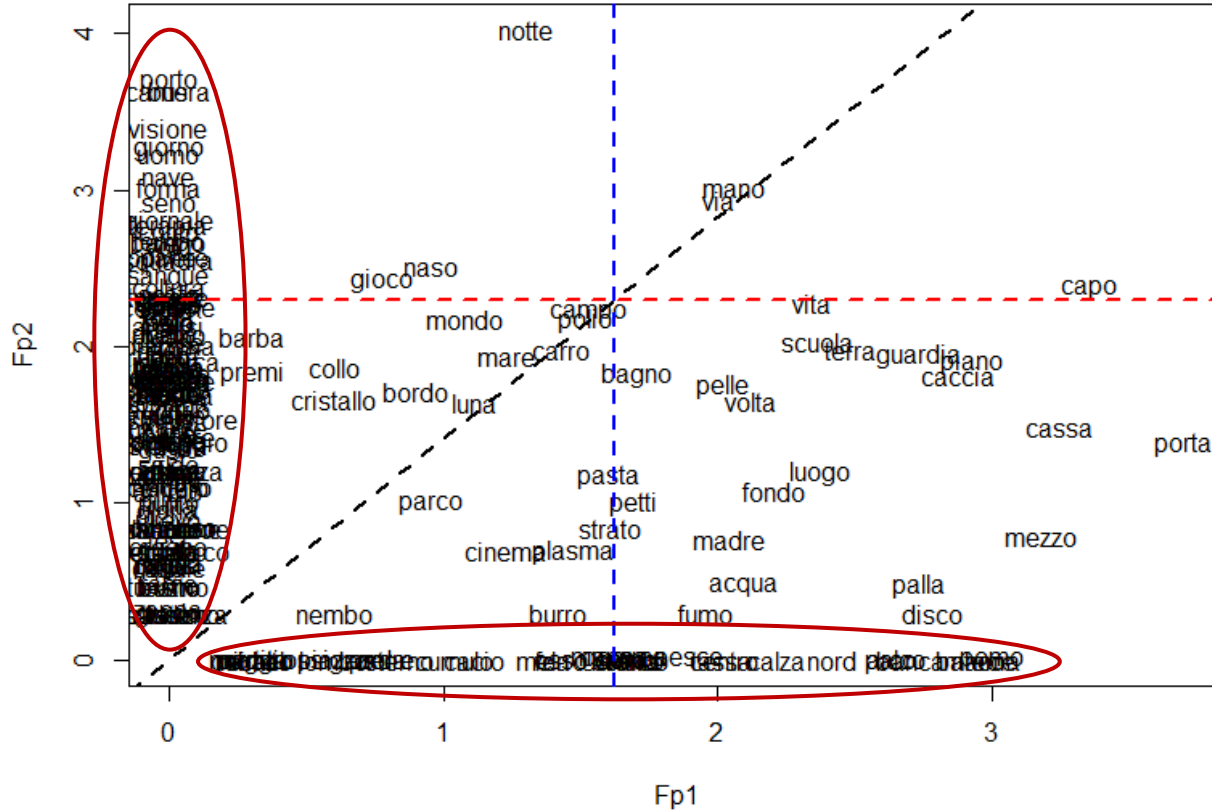
Or is it sensitive to this distributional information of position of stems in language?

Are stems more easily identified in the position where they typically occur?

Position-specific family frequency



Position-specific family frequency



Are stems more easily identified in the position where they typically occur?

P1	P1 carta
P2	P2 nave

Are stems more easily identified in the position where they typically occur?

P1	P1 - N carta paese
P2	N - P2 pace nave

Are stems more easily identified in the position where they typically occur?

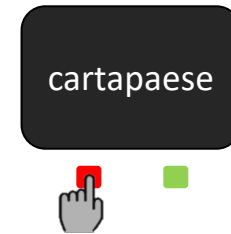
	Typical position	Atypical position
P1	P1 – N carta paese	N – P1 paese carta
P2	N – P2 pace nave	P2 – N nave pace

Are stems more easily identified in the position where they typically occur?

	Typical position	Atypical position
P1	P1 – N cartapae se	N – P1 paese carta
P2	N – P2 pae nave	P2 – N nave pace

- + Real compounds
- + Simple words and pseudowords

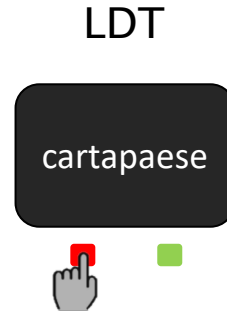
LDT



35 Participants

Are stems more easily identified in the position where they typically occur?

	Typical position	Atypical position
P1	P1 – N cartapae se	N – P1 paese carta
P2	N – P2 pae nave	P2 – N nave pace

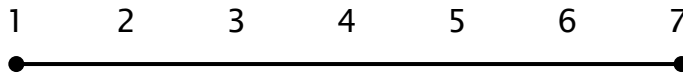


Prediction:

If participants are sensitive to distributional position information, the rejection of pseudocompounds should be harder if a stem occurs in its typical position (position-specific morpheme interference)

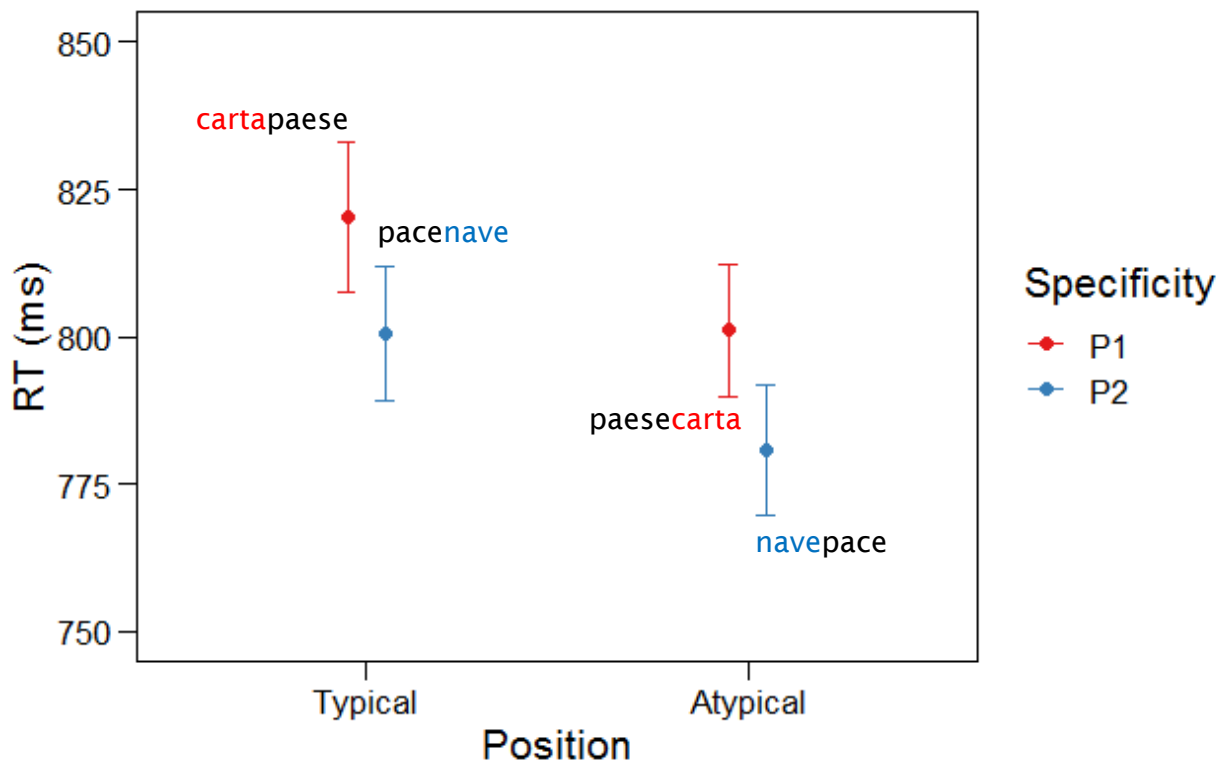
	Typical position	Atypical position
P1	P1 – N cartapaese	N – P1 paese carta
P2	N – P2 pace nave	P2 – N nave pace

Interpretability ratings:



Response Times

$1/rt \sim \text{Specificity} * \text{Position} + \text{Interpretability} + (1 | \text{Subject}) + (1 | \text{Combination})$



$R^2 = 0.58$

Specificity
 $t = -1.37, p = .171$

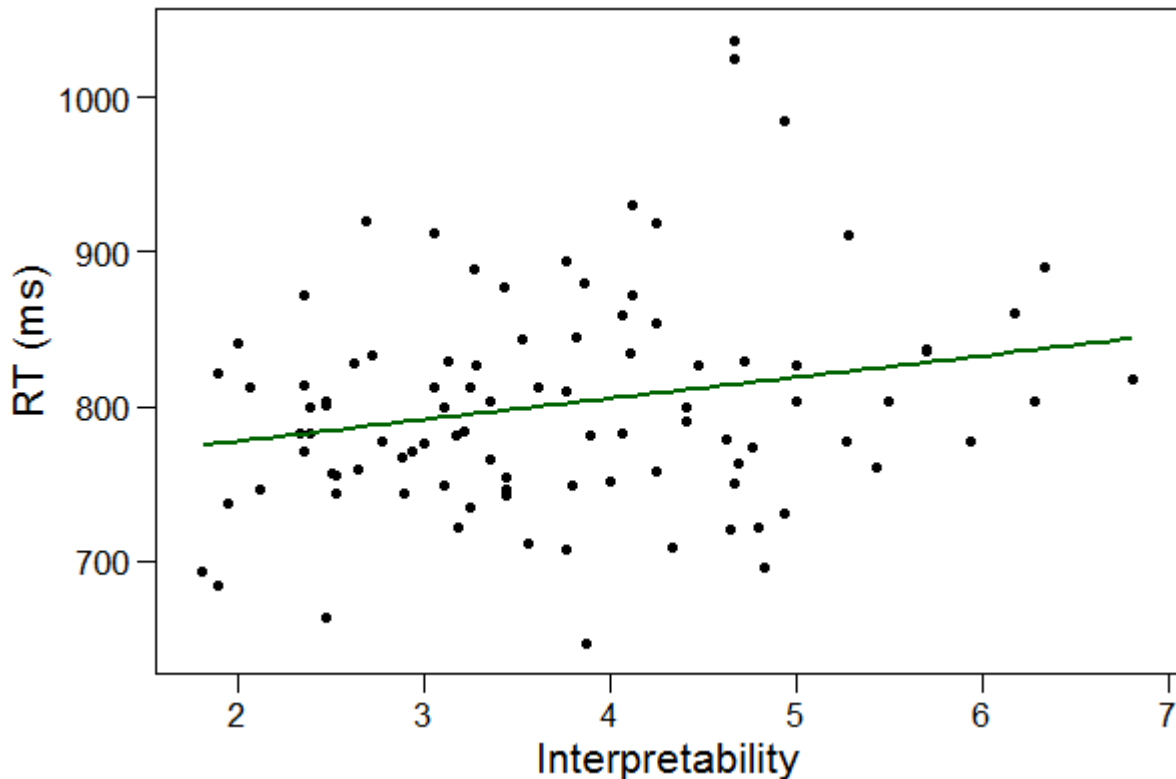
Position
 $t = 2.55, p = .011$

Spec x Pos
 $t = -0.21, p = .837$

Interpretability
 $t = -2.73, p = .006$

Response Times

$1/rt \sim \text{Specificity} * \text{Position} + \text{Interpretability} + (1 | \text{Subject}) + (1 | \text{Combination})$



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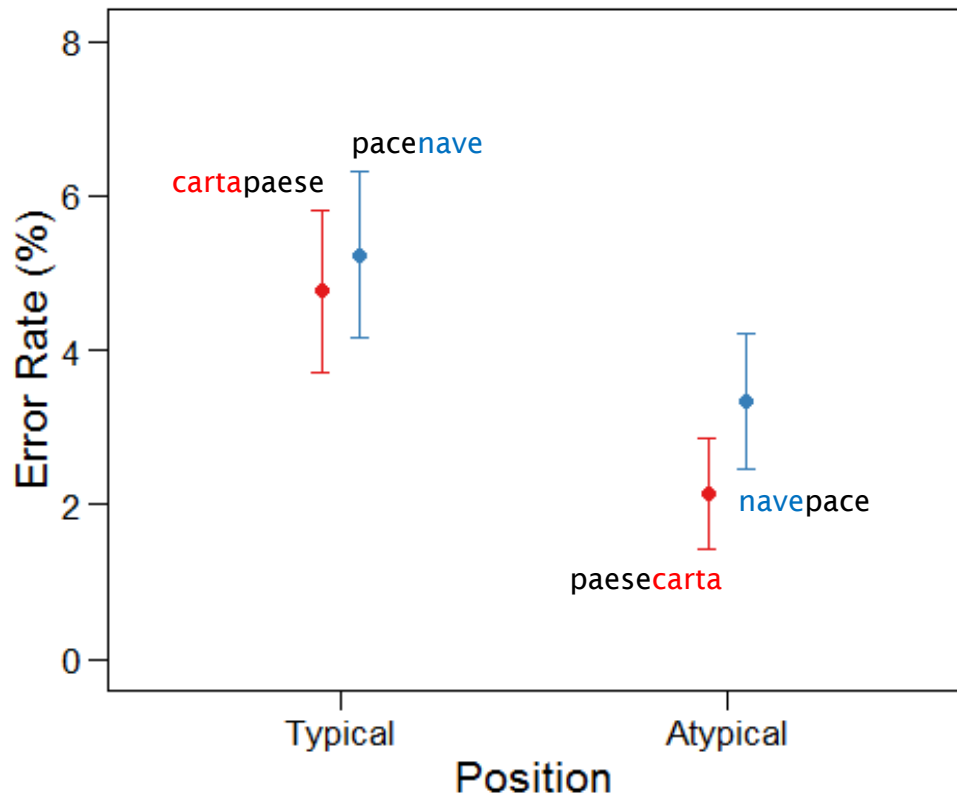
$t = -0.21, p = .837$

Interpretability

$t = -2.73, p = .006$

Error Rates

acc ~ Specificity*Position+Interpretability+(1 | Subject)+(1 | Combination)



$R^2 = 0.01$

Specificity
 $z=0.98, p=.330$

Specificity

—●— P1
—●— P2

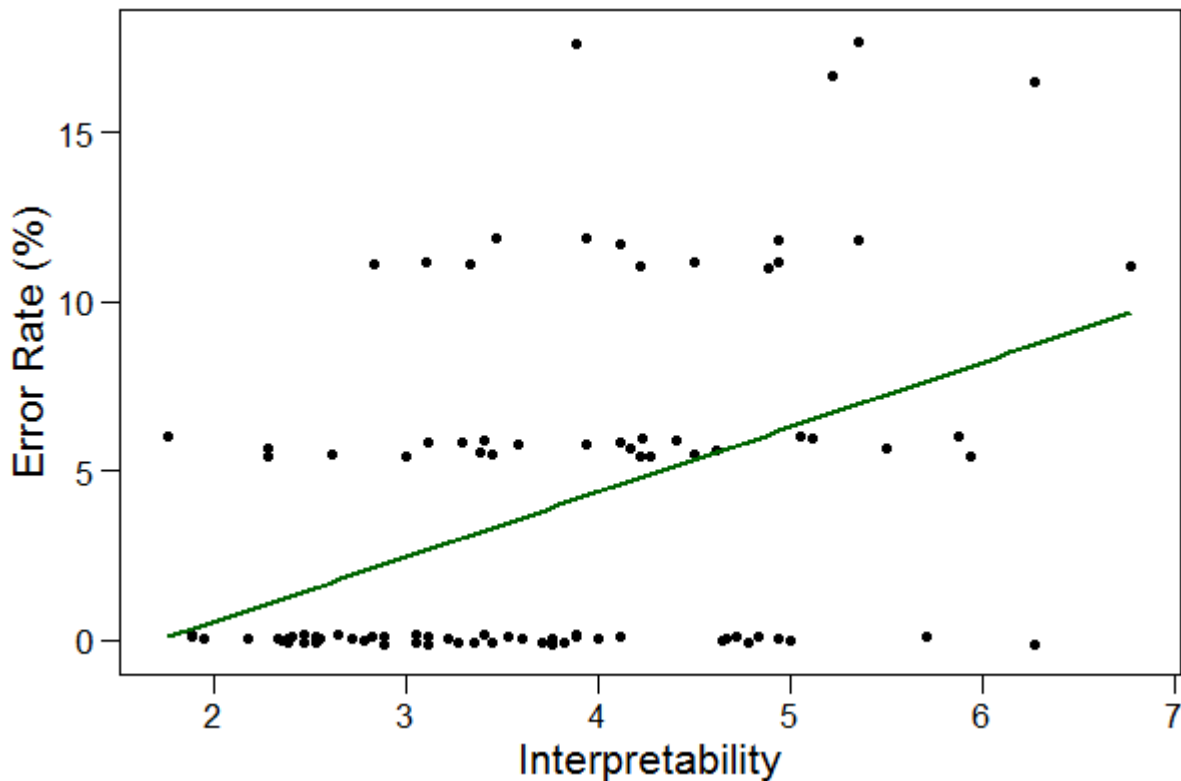
Position
 $z=2.33, p=.020$

Spec x Pos
 $z=0.66, p=.507$

Interpretability
 $z=-2.05, p=.040$

Error Rates

acc ~ Specificity*Position+Interpretability+(1|Subject)+(1|Combination)



$R^2 = 0.01$

Specificity
 $z=0.98, p=.330$

Position
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Spec x Pos
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Interpretability
 $z=-2.05, p=.040$

Two other experiment from the lab:

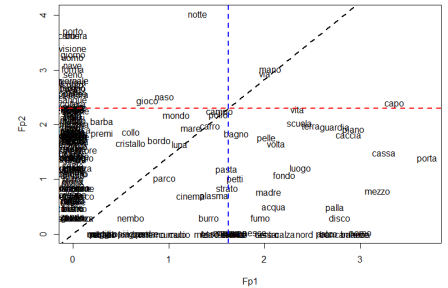
Regression design, instead of factorial design,
not just extremes, but entire distribution

2 presentation times:

1500 ms (or button press)

vs.

500 ms



(Ktori, Hasenäcker, Cevoli, & Crepaldi, in preparation)

Comparison with other experiment from the lab:

Regression design, instead of factorial design,
not just extremes, but entire distribution

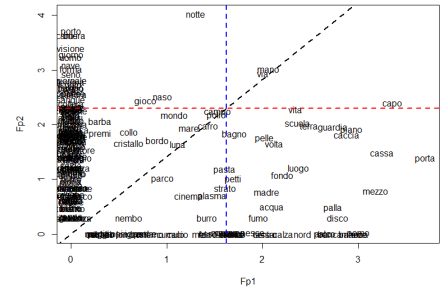
2 presentation times:

1500 ms (or button press)

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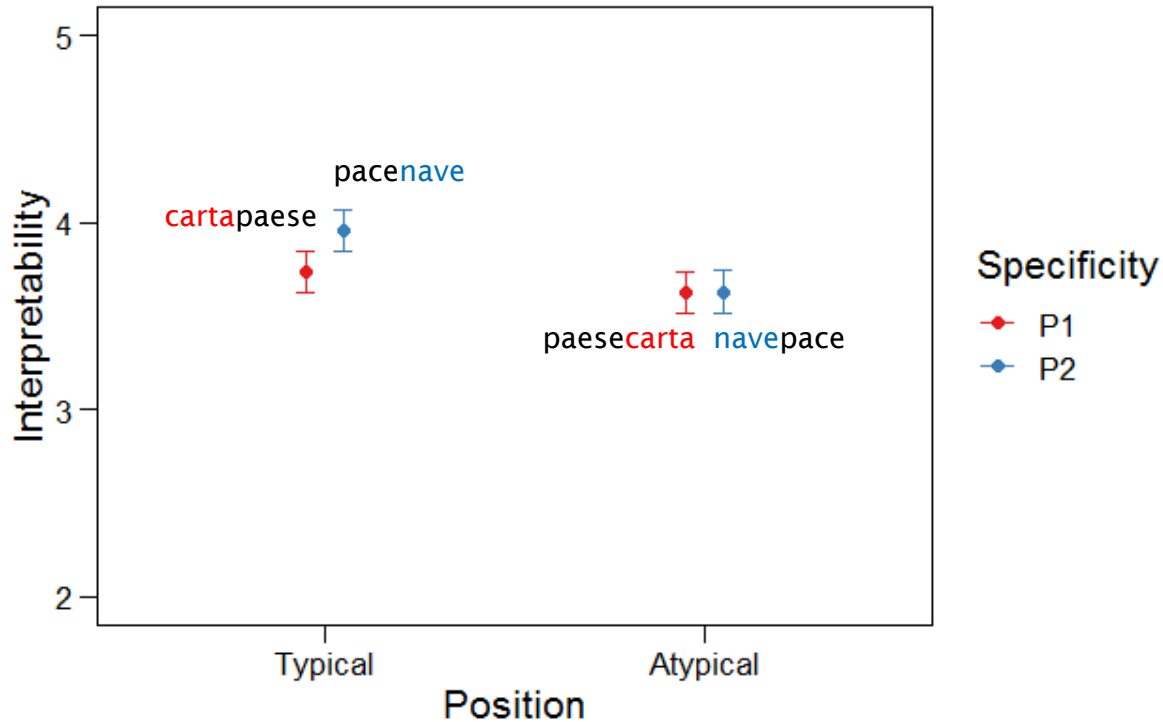
Effect of position-specificity with short
presentation time

Always strong effect of Interpretability



(Ktori, Hasenäcker, Cevoli, & Crepaldi, in preparation)

Interpretability



LMM
 $R^2 = 0.32$

Specificity
 $t = -1.08, p = .280$

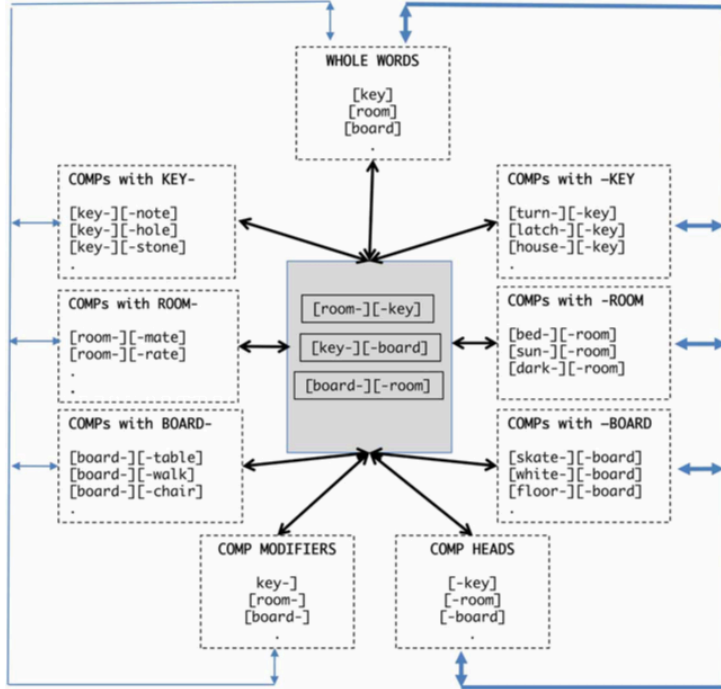
Position
 $t = -2.30, p = .021$

Spec x Pos
 $t = 0.37, p = .714$

Position-specificity

- taken into account as an additional source of information in compound processing
- BUT: effect on meaning-blind automatic morpho-orthographic processing weak, instead more strongly entering through the “backdoor” of semantic interpretability

Position-specificity based on distribution in language

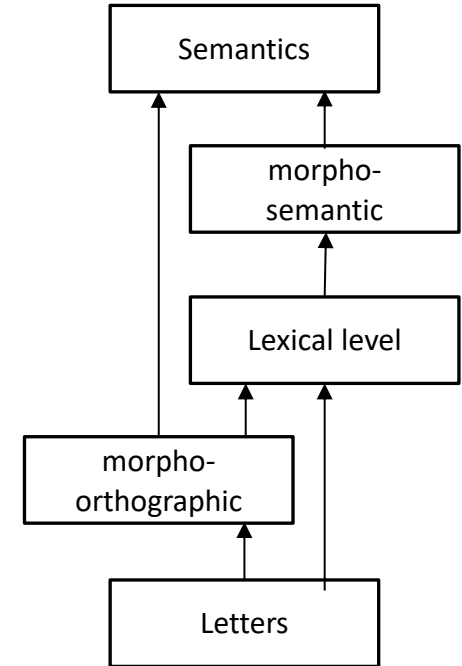


(Libben, 2014)

impacts on



morphological processing in reading



(Beyersmann et al., 2012; Diependaele et al., 2009)

Maybe not specific for experience with *written words* (morpho-orthographic level), but “things in the world”?

houseboat



boathouse

Maybe not specific for experience with *written words* (morpho-orthographic level), but “things in the world”?

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boathouse

Modifier vs. head instead of first vs. second position?

Maybe not specific for experience with *written words* (morpho-orthographic level), but “things in the world”?

houseboat



boathouse

Modifier vs. head instead of first vs. second position?
Computational measures of compositionality instead of human rating?

Thank you!

Stille Betrachtung
- Alexander Roda Roda

Es gibt Tiere, Kreise und Ärzte.
Es gibt Tierärzte, Kreisärzte und Oberärzte.
Es gibt einen Tierkreis und einen Ärztekreis.
Es gibt auch einen Oberkreistierarzt.
Ein Oberkreistier aber gibt es nicht.



Silent contemplation
- Alexander Roda Roda

There are Tiere, Kreise and Ärzte.
There are Tierärzte, Kreisärzte and Oberärzte.
There is a Tierkreis and a Ärztekreis.
There is also an Oberkreistierarzt.
But there is no Oberkreistier.



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 jhasenac@sissa.it
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