

Using structural priming to test links between constructions:

Priming between caused-motion and resultative sentences

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Workshop 'Language as Network: How to conceive of a usage-based construction'

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Research question

What can structural priming tell us about speakers' representations of **distinct but related** grammatical constructions?

A case study

- Goldberg (1995) argues that the **caused-motion construction** in (1) and the **resultative construction** in (2) are related via metaphorical extension
 - (1) Bill rolled the ball **down the hill**. ('CAUSE TO **MOVE**')
 - (2) Herman hammered the metal **flat**. ('CAUSE TO **BECOME**')
- Metaphorical extension links are part of Goldberg's **four-way classification of 'inheritance links'**, i.e. a model of the primary relations which interrelate grammatical constructions in speakers' mental networks

Outline of the talk

1 Previous research on structural priming

What is it and under which conditions does it occur?

2 Two exploratory experiments

Structural priming between the English caused-motion and resultative construction

3 Conclusion

Methodological potential and challenges; further research questions

Previous research on structural priming

Some basics

- “Priming effects occur when processing a stimulus with particular characteristics affects subsequent processing of another stimulus with the same or related characteristics” (Branigan & Pickering, 2017, p. 6)
- Primes can **facilitate** target processing or **hinder** it (e.g. Hilpert & Correia Saavedra, 2016)
- **Lexical priming** – since Meyer & Schvaneveldt (1971): Participants recognise *nurse* faster after having seen *doctor* than after seeing *butter*
- **Structural priming** – since Bock (1986): Participants are more likely to produce an active sentence after having read an active rather than a passive sentence, and vice versa

Previous research on structural priming

Under which conditions does structural priming occur?

- ... an ongoing controversy
- Can be caused by **syntactic and/or semantic similarities** (e.g. Bock & Loebell, 1990; Hare & Goldberg, 1999; Ziegler et al., in press)
- Occurs both in **production and comprehension** (e.g. Segaert et al., 2013; Tooley & Bock, 2014)
- May be enhanced by repetition of the same verb between prime and target, a so-called **'lexical boost'** (Pickering & Branigan, 1998)
 - but some studies have found similar effects with and without lexical boost (Tooley & Bock, 2014)

Two exploratory experiments

****Distinct but related**** constructions

Caused-motion (CM)  Resultative (RES)

Research questions specified

- 1 Can structural priming in comprehension be observed between the two constructions?
- 2 Does priming occur equally in both directions, or is there an asymmetric effect (e.g. from metaphorical source to target)?
- 3 Which role does lexical boost play?
- 4 Which experimental methods and task designs are most effective to test speakers' representations of the two constructions?

Experiment 1 & 2: Participants

Experiment 1

159 participants

Experiment 2

160 participants

Adult English native speakers (self-reported) living in the U.S.

Recruited online via Amazon Mechanical Turk

Experiment 1 & 2: Materials

Experiment 1

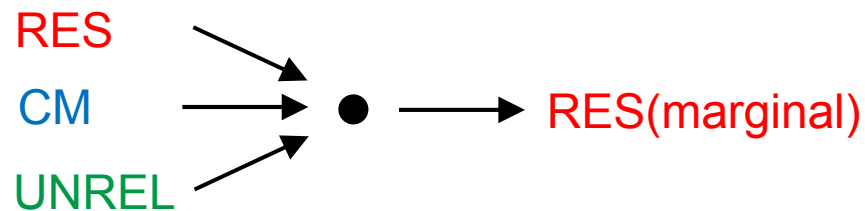
Experiment 2

Primes

3 prime types: **RES**: e.g. *Allan wiped the table dry.* [adjectival]
CM: e.g. *Steve pushed the chair into the kitchen.*
UNREL: e.g. *Jenny managed to escape.*

Targets

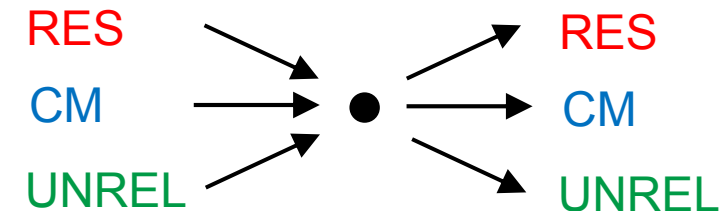
Marginally acceptable **RES**:
e.g. *Robert kissed Sandra unconscious.*
Leslie frightened Fred awake.



Verbs

All sentences use a different verb
(no lexical boost)

Same as prime constructions, i.e. all 3 constructions appear as prime and target



Each verb occurs in 2 RES + 2 CM items, i.e. prime-target pairs can occur with and without lexical boost

Experiment 1 & 2: Methods

Experiment 1

Experiment 2

Task

Self-paced reading (word by word)
+ speeded acceptability judgments
(1-5 Likert scale, max. 4 seconds)

Joe

pushed

Bob

into

the

kitchen.

Judge!

(Totally UNacceptable)

1

2

3

4

5

(Totally acceptable)

Press the number button on your keyboard.

Experiment 1 & 2: Methods

Experiment 1

Task

Self-paced reading (word by word)
+ speeded acceptability judgments
(1-5 Likert scale, max. 4 seconds)

Experiment 2

Self-paced reading (word by word)
with maze task (Forster et al., 2009;
experiment code from Boyce et al., 2019)

Words so far: 0

Vivian

e

X-X-X

i

Words so far: 1

plates

e

pulled

i

Words so far: 2

the

e

die

i

Words so far: 3

seeing

e

window

i

Words so far: 4

shut.

e

adds.

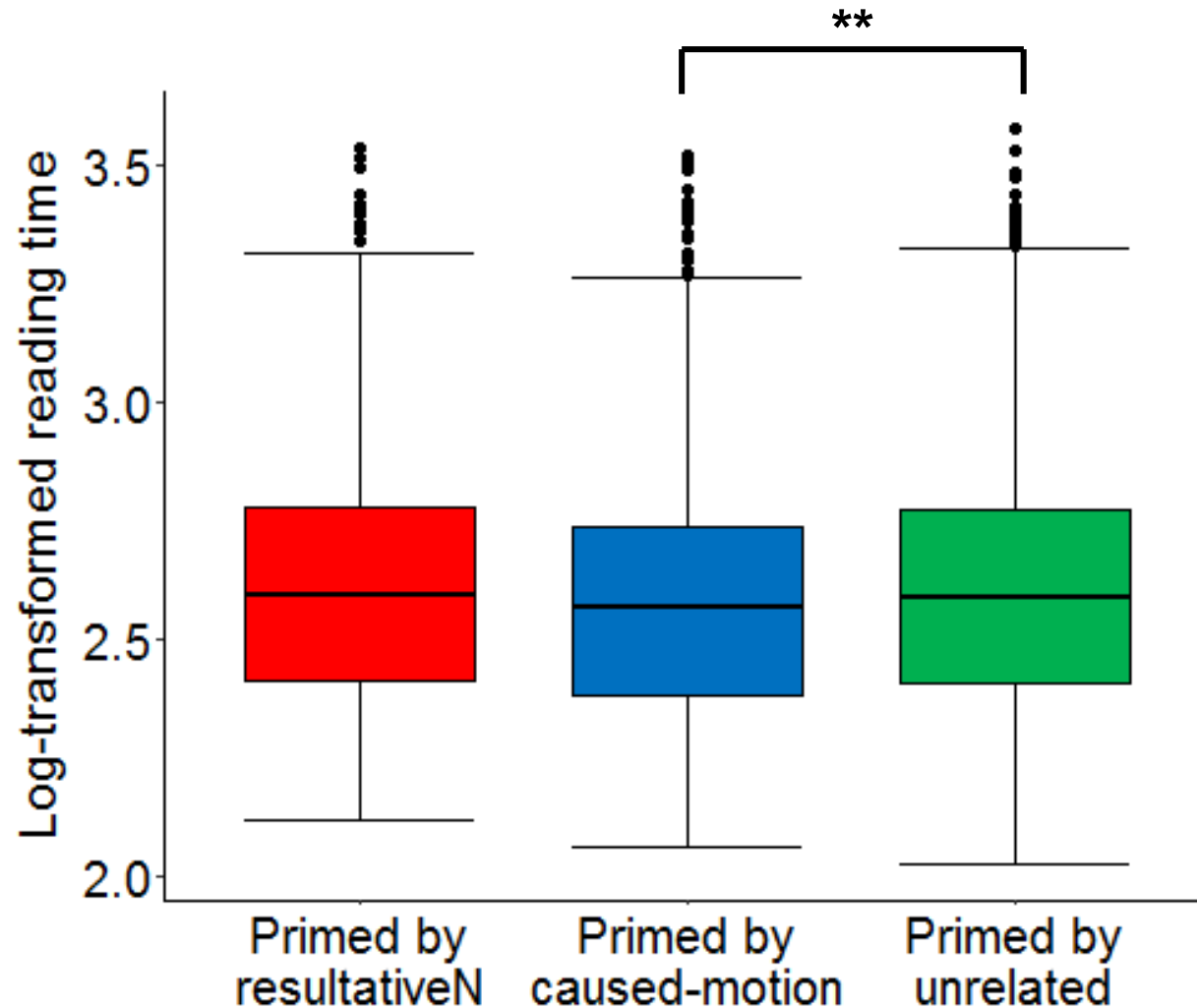
i

Correct! Press any key to continue

Experiment 1 & 2: Methods

	Experiment 1	Experiment 2
Task	Self-paced reading (word by word) + speeded acceptability judgments (1-5 Likert scale, max. 4 seconds)	Self-paced reading (word by word) with maze task (Forster et al., 2009; experiment code from Boyce et al., 2019)
Why?	Task engages participants' deep processing Several outcome measures	No spill-over effects Potentially more sensitive than pure self-paced reading (Boyce et al., 2019)
Outcome measures	Reading time, judgment score, judgment time	Reading time, (Correctness of maze choices)
Analysis	Linear mixed effects models and ordinal regression with R packages 'lmerTest' (Kuznetsova et al., 2017) and 'ordinal' (Christensen, 2018)	

Experiment 1: Results



RES targets

e.g. *Allan wiped the table* **dry.**

Critical region

- Significant effect of priming condition on reading time: RES were read approx. 19 ms faster after CM primes than after UNREL primes ($p = .001$)
- Surprisingly: no decrease in reading time of RES targets after RES primes
- No effect of priming on judgment score or judgment time

Experiment 2: Results

Critical region 1: whole sentence (- subject)

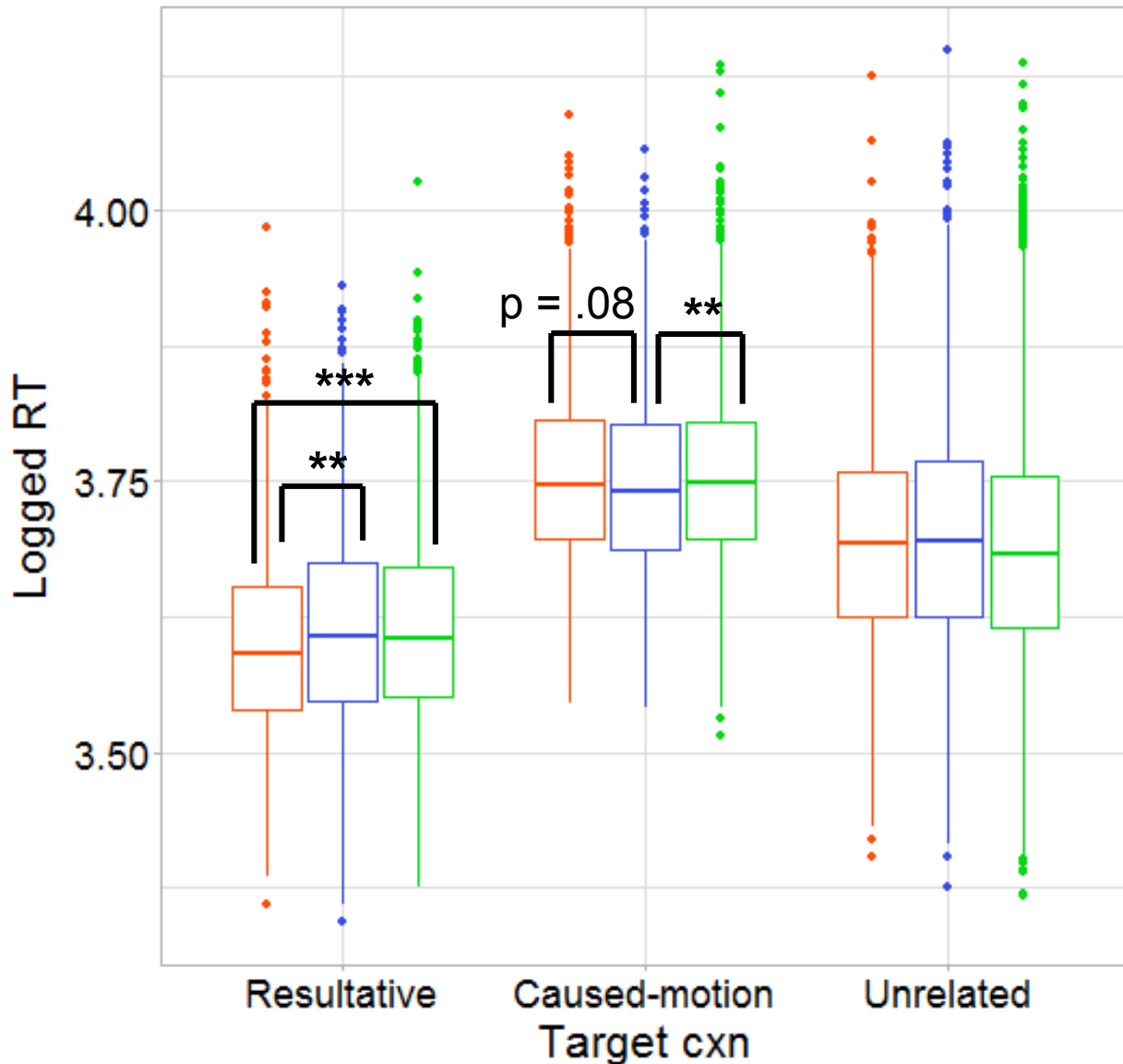
RES targets: e.g. *Allan wiped the table dry.*

CM targets: e.g. *Steve pushed the chair into the kitchen.*

UNREL targets: e.g. *Jenny managed to escape.*

Critical region 2:
final complement
phrase

Experiment 2: Results



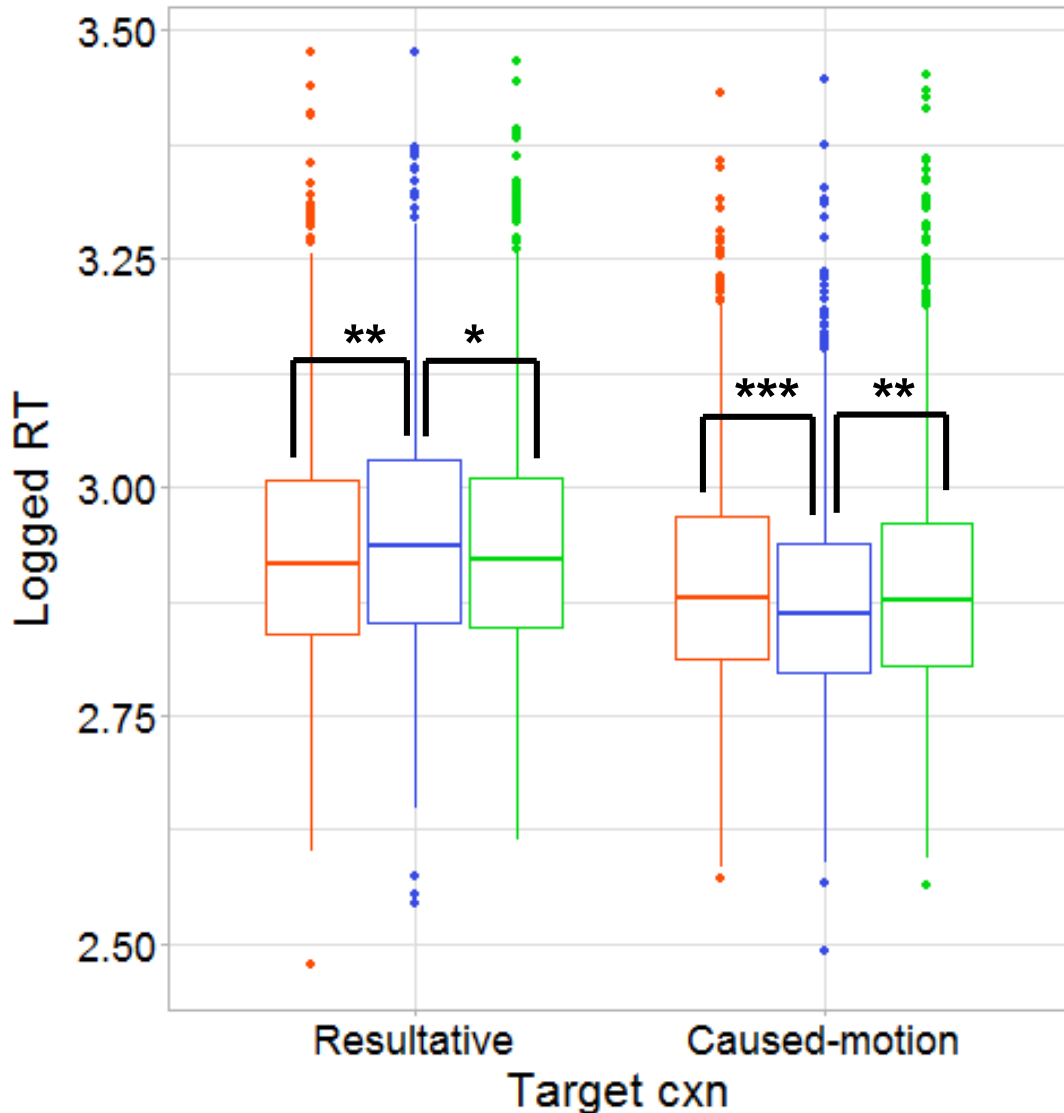
Reading times for overall sentence (without subject)

- RES targets are read faster after RES primes than after UNREL and CM
- CM targets are read faster after CM primes than after UNREL (and RES?)
- UNREL targets are not affected by prime construction

Prime cxn

- Resultative
- Caused-motion
- Unrelated

Experiment 2: Results



Reading times for first word of final complement phrase

- RES targets are read more slowly after CM primes than after RES and UNREL (by approx. 39 ms and 25 ms respectively)
- CM targets are read faster after CM primes than after RES and UNREL (by approx. 67 ms and 48 ms respectively)

Prime cxn

- Resultative
- Caused-motion
- Unrelated

Experiment 1 & 2: Summary & discussion

Priming *within* the two target constructions, i.e. RES → RES and CM → CM, compared to unrelated controls

- Facilitation of target processing
- But not under all conditions where it would be expected (e.g. Exp. 1)

Priming *between* the two target constructions, but only in the direction CM → RES

- Potential asymmetry from metaphorical source to target
- Facilitatory effect (Exp. 1) vs. inhibitory effect (Exp. 2) – why these differences?

No effect of lexical boost on priming

- There might even be a tendency towards inhibition (!)

Conclusion: Methodological potential & challenges

Priming in comprehension

- Seems to work
- Affords a lot of flexibility over production priming
- Effects are small to medium-sized → use sufficiently large sample sizes

Methods

- Reading time measures seem promising
- Participants' deep processing needs to be ensured by combining self-paced reading with additional task requirements (e.g. maze task)

Materials

- Controlling for lexical artifacts (animacy, verb class, collocations etc.) is challenging
- Lexical boost does not seem to be a necessary requirement for observing inter-constructural priming (and its possible inhibitory effect deserves further investigation)

Conclusion: Further research questions

Types of constructional links

- Can priming contribute direct evidence about the *type* of link that relates two constructions (e.g. metaphor, taxonomy, meronymy, etc.)?
- Can differences in priming effect size help distinguish between linking types?

Facilitatory vs. inhibitory priming effects

- Under which conditions do they arise? What do they tell us about linguistic representations and processing?

Experimental design

- Which materials, tasks and procedures can maximise our chances of detecting priming effects between distinct but related constructions?
- What benefits could alternative methods contribute (e.g. eye-tracking, brain measures)?

And extending the paradigm to other constructions, other languages, etc. ...

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