A priming approach to the representation of English argument structure constructions

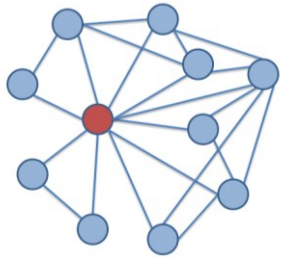
Concepts in Action: Representation, Learning, and Application (CARLA)
Berlin, August 22-24, 2022

Tobias Ungerer
Concordia University, Montreal
tobias.ungerer@concordia.ca

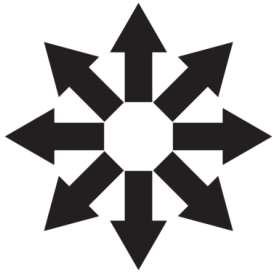
Outline

1 Intro: Priming as a window into grammatical representation

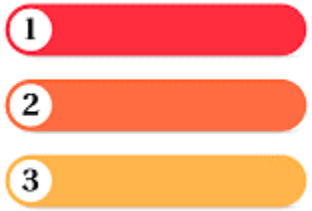
2 Network interpretations of structural priming effects



3 Extending structural priming to new constructions



4 Summary



https://vectorportal.com/vector/window-view-clip-art/31506
https://upload.wikimedia.org/wikipedia/commons/7/72/Ego_network.png
https://freesvg.org/8-directions-arrows
https://www.vectorstock.com/royalty-free-vector/bullet-points-with-numbers-colorful-boxes-vector-28132041

Intro:
Priming as a window into grammatical representation

Structural priming

- **Priming**: processing a prime stimulus affects participants' response to the same or a similar target stimulus (Lashley, 1951; Branigan & Pickering, 2017)
- **Structural priming** (Bock, 1986): e.g., after exposure to double-object primes, speakers produce more double-object targets
- Often used to investigate **processing**: e.g., comparing production and comprehension mechanisms (Bock et al., 2007) or monolingual and bilingual processing (Cai et al., 2011)
- But: priming can also be used to investigate speakers' **grammatical representations**, providing a measure of representational similarity (Branigan & Pickering, 2017)

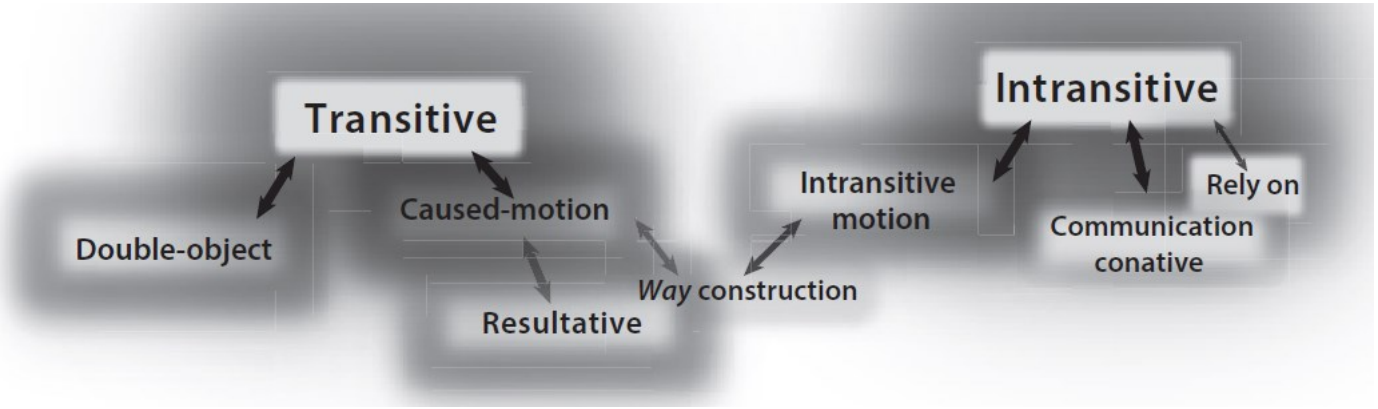
Questions for today

1. What does structural priming reveal about the representation of argument structure constructions?
2. Which theoretical framework can be used to interpret the effects?
3. How can priming be extended to a broader range of argument structure constructions?

Usage-based theories of grammar

- **Cognitive Construction Grammar** (Goldberg, 1995, 2006, 2019), **Usage-based Theory** (Bybee, 2006, 2010), **Cognitive Grammar** (Langacker, 1987, 2008), **Word Grammar** (Hudson, 1984, 2007), …

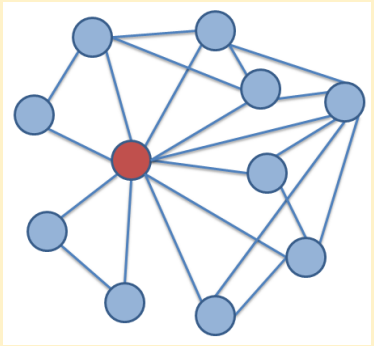
- Grammar = a mental network of declarative knowledge, i.e. a network of constructions that share varying degrees of syntactic, semantic and/or discourse-functional similarity



(Goldberg, 2019, p. 37)

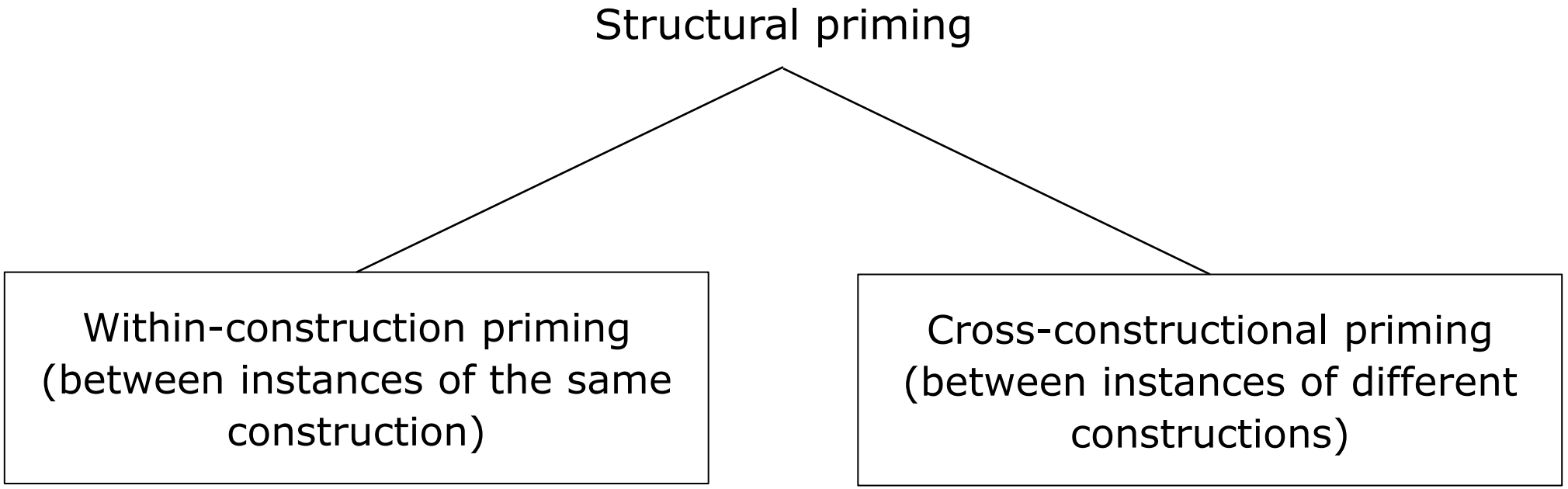
- Constructions are represented at varying degrees of abstraction (e.g., [NP V NP NP] vs. [*the* X-*er the* Y-*er*] vs. [*kick the bucket*])

- Speakers' grammatical knowledge emerges from specific usage events: it is shaped by the frequency distribution of witnessed instances



Network interpretations of structural priming effects

Two types of priming effects



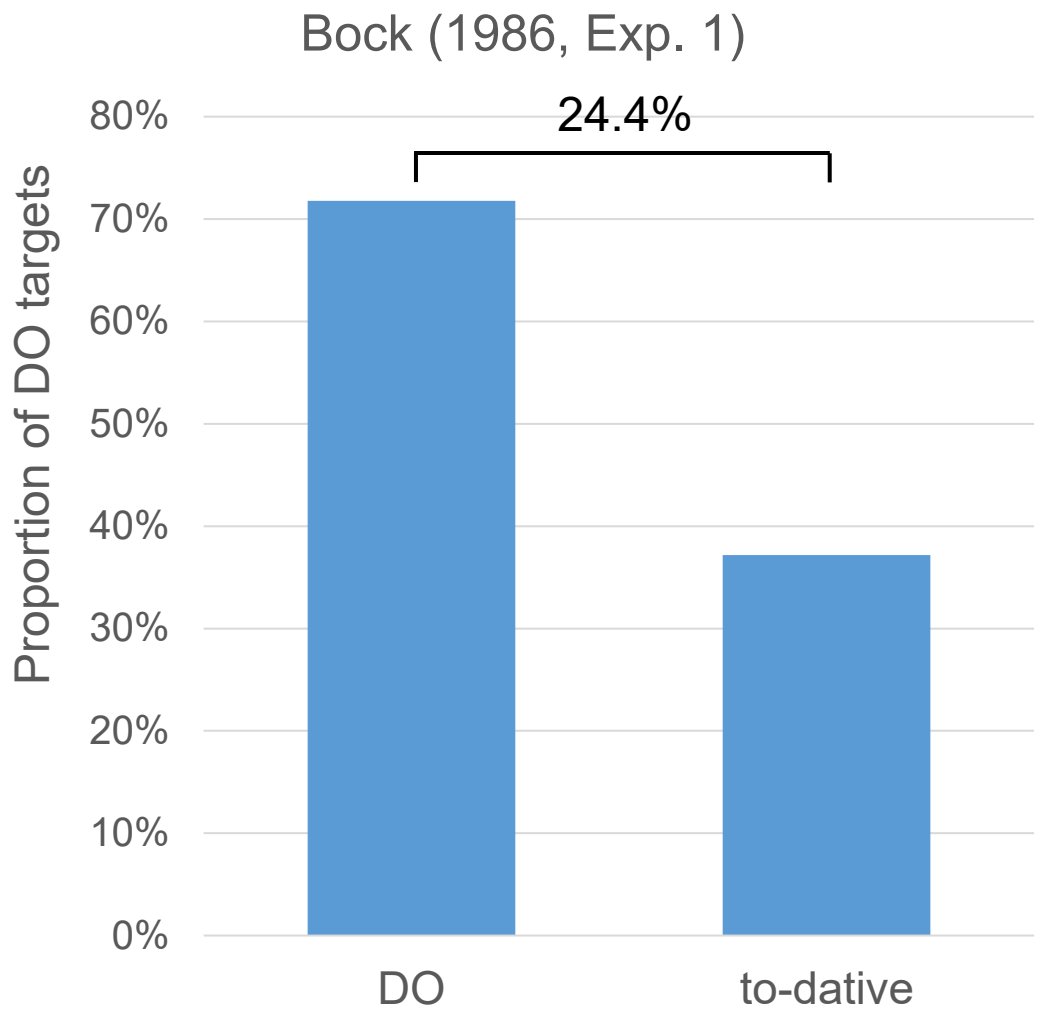
Within-construction priming: the dative alternation

Double-object primes:
A rock star sold an undercover agent some cocaine.

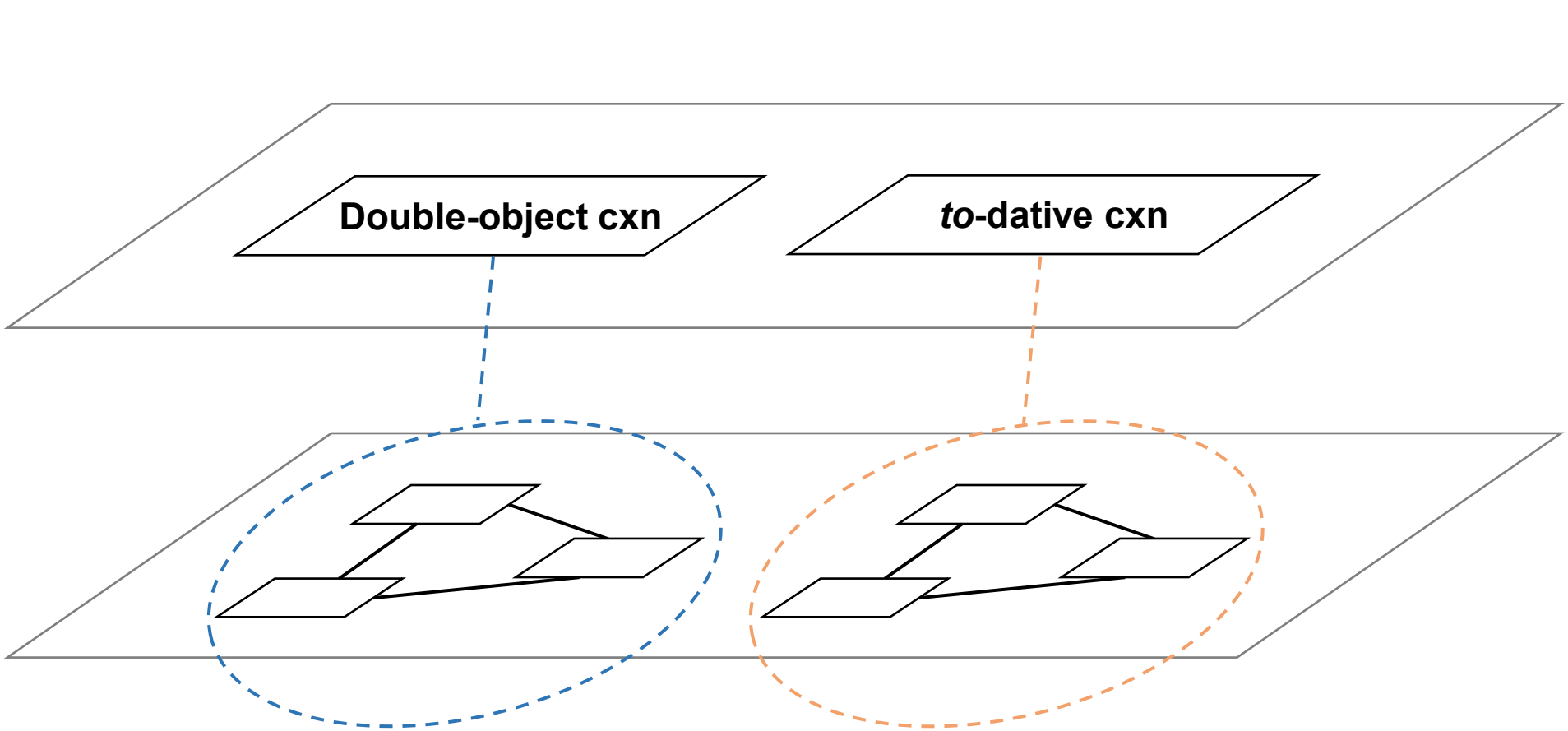
to-dative primes:
A rock star sold some cocaine to an undercover agent.

(both from Bock, 1986)

- After double-object primes, participants produce more double-object targets; and same for *to*-datives
- This is even though primes and targets share no lexical material (e.g., verb)
- Interpretation:
  evidence that speakers represent abstract argument structure constructions



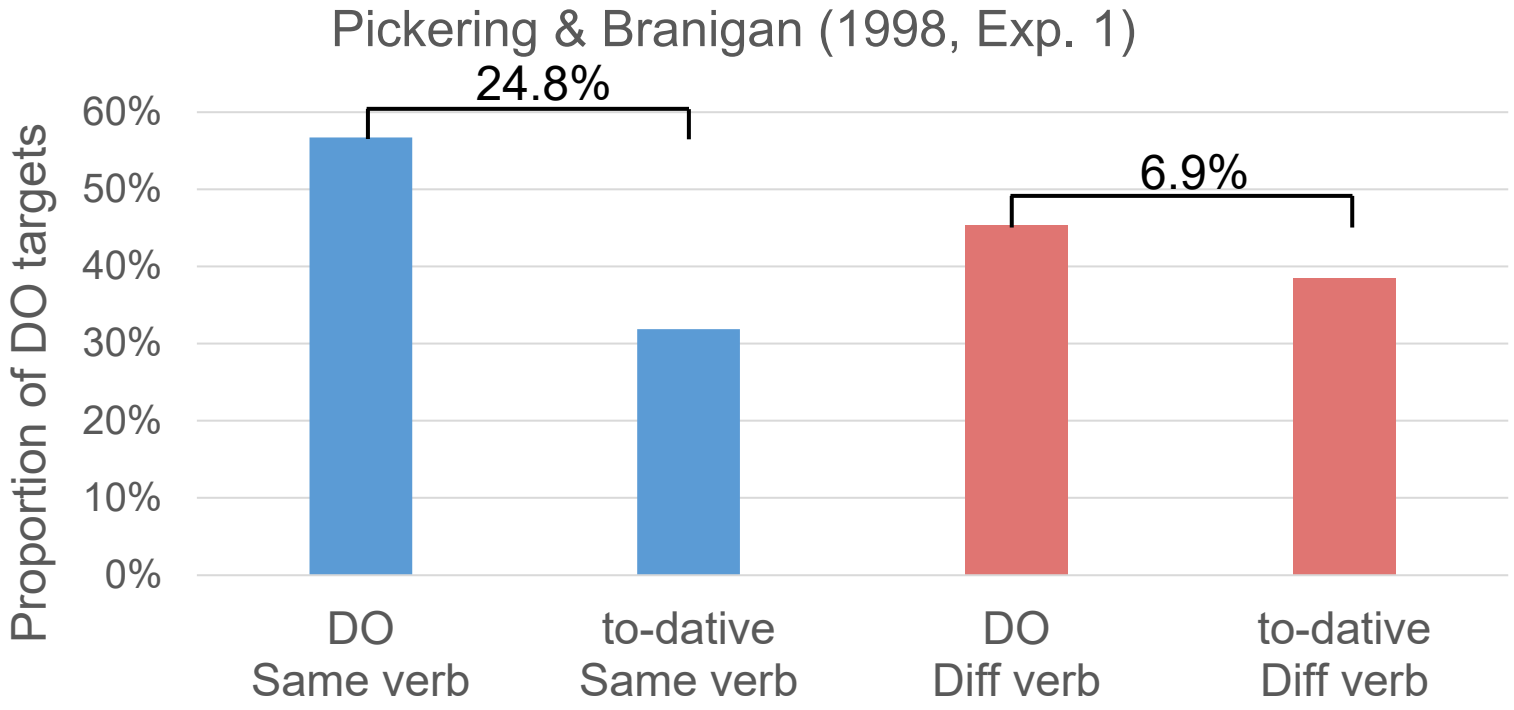
A network model



ABSTRACTION

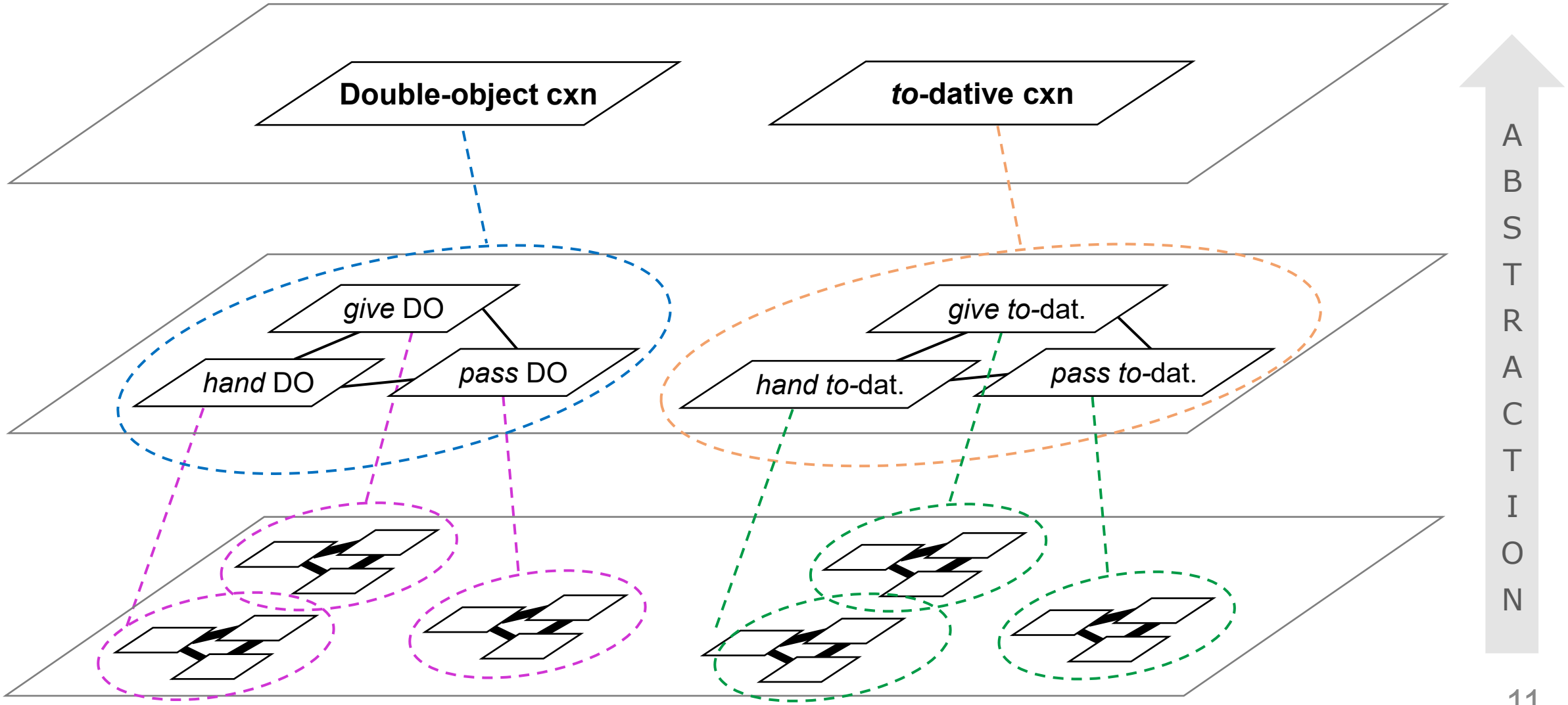
Within-construction priming: the lexical boost

- When primes and targets share lexical material (especially the verb), priming is enhanced (Pickering & Branigan, 1998; Rowland et al. 2012; Tooley et al. 2019)



- According to a meta-analysis of production priming studies (Mahowald et al., 2016), the lexical boost is stronger than the effect of abstract priming itself
- Interpretation: speakers store verb-specific subconstructions at a lower level of abstraction

Network model ctd.



Cross-constructional priming: Datives and benefactives

Benefactives

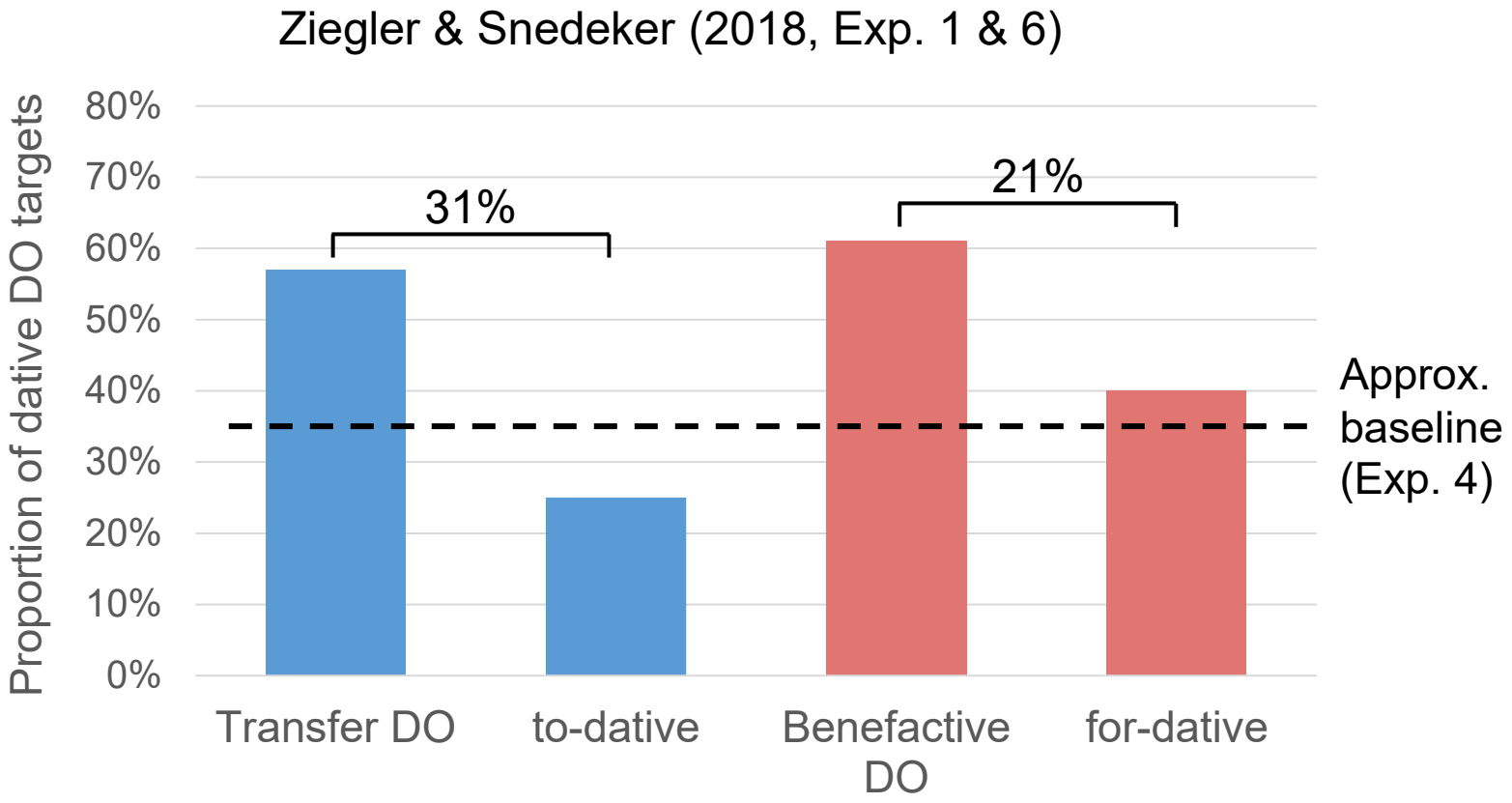
DO: *The girl fetched the cowboy the hammer.*

for-dative: *The girl fetched the hammer* ***for*** *the cowboy.*

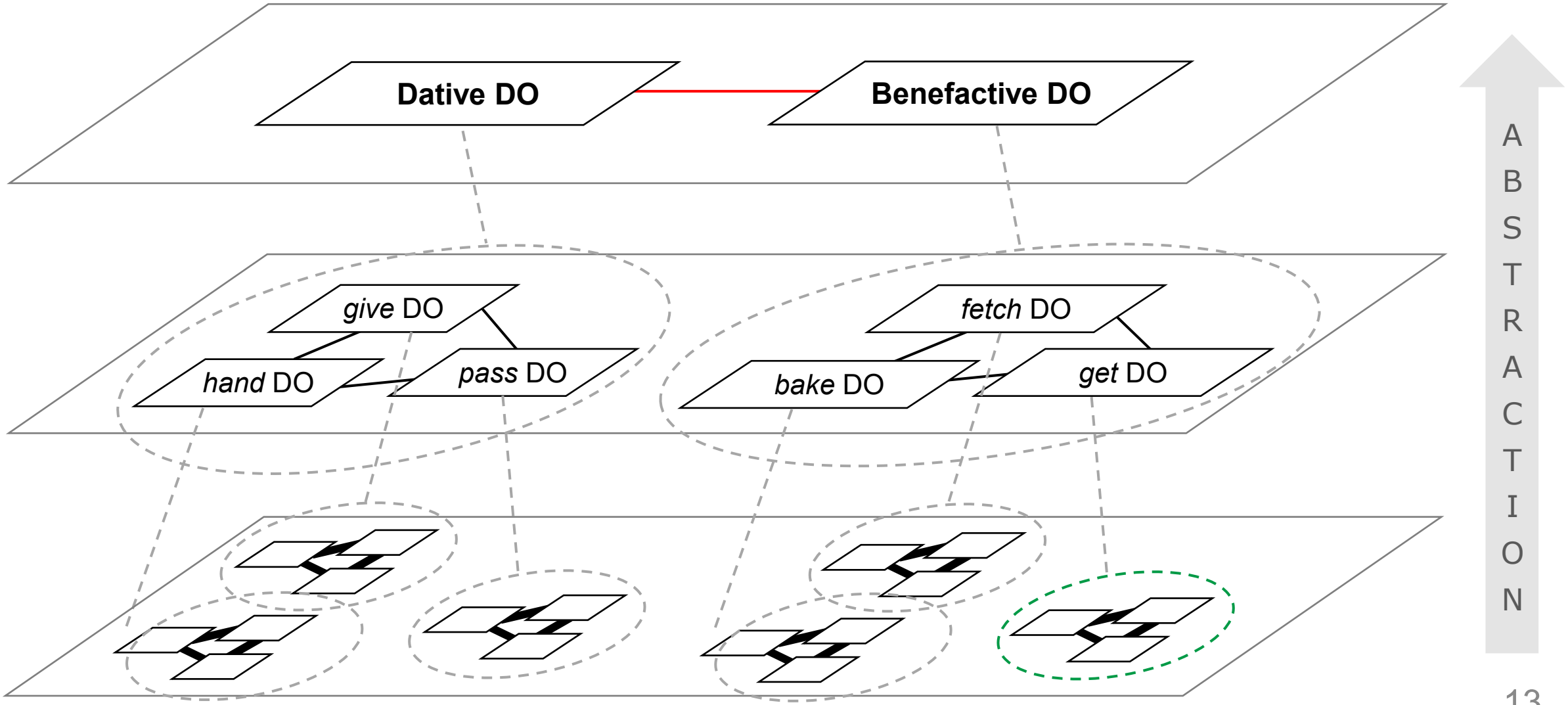
Datives

DO: *The boy handed the fireman the teapot.*

to-dative: *The boy handed the teapot* ***to*** *the fireman.*



Network model ctd. ctd.



Extending structural priming to new constructions

Production vs. comprehension priming

- Previous priming studies of argument structure constructions have been largely restricted to alternating patterns, such as the dative alternation (Bock, 1986), the benefactive alternation (Chang et al., 2003) and the locative alternation (Ziegler & Snedeker, 2018)

- This is due to the limitations of production priming methods, which are typically restricted to testing "structural alternatives" (Branigan & Pickering, 2017): speakers choose between two ways of encoding the same event

- How can priming be extended to other (non-alternating) argument structure constructions?

- Comprehension priming methods (e.g., SPR) provide mutually independent outcomes for each target construction (e.g., reaction time)

Example: resultative–depictive priming (Ungerer, 2022)

Resultatives (adjectival)

Max cooked the chicken tender.

Nancy cut the grass short.

response time

Depictives (object-oriented)

Gary cooked the chicken whole.

John cut the grass wet.

Participants

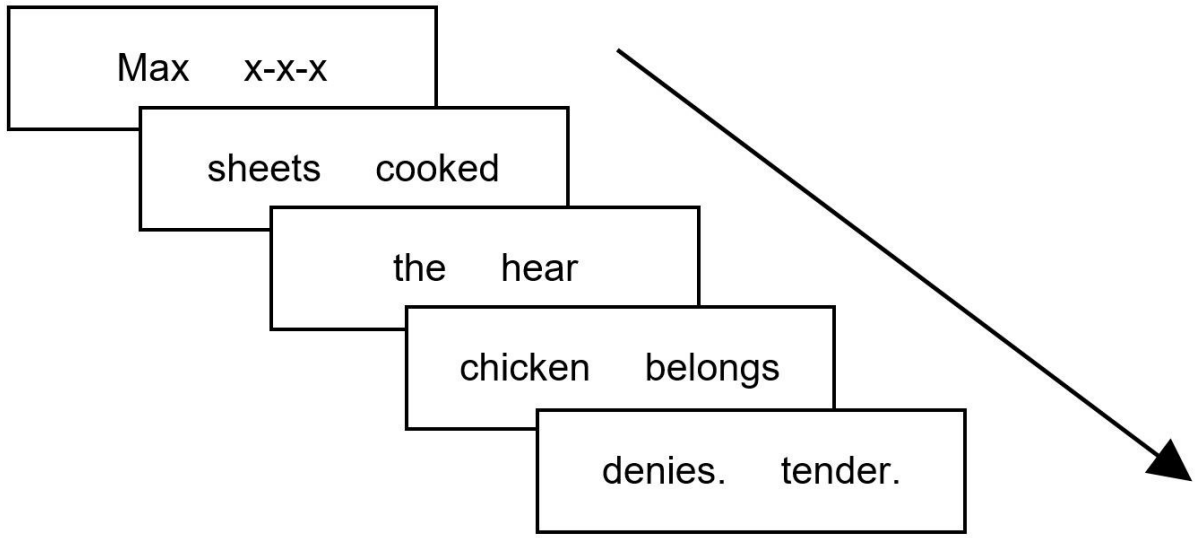
160 self-reported English native speakers, recruited via Amazon Turk

Materials

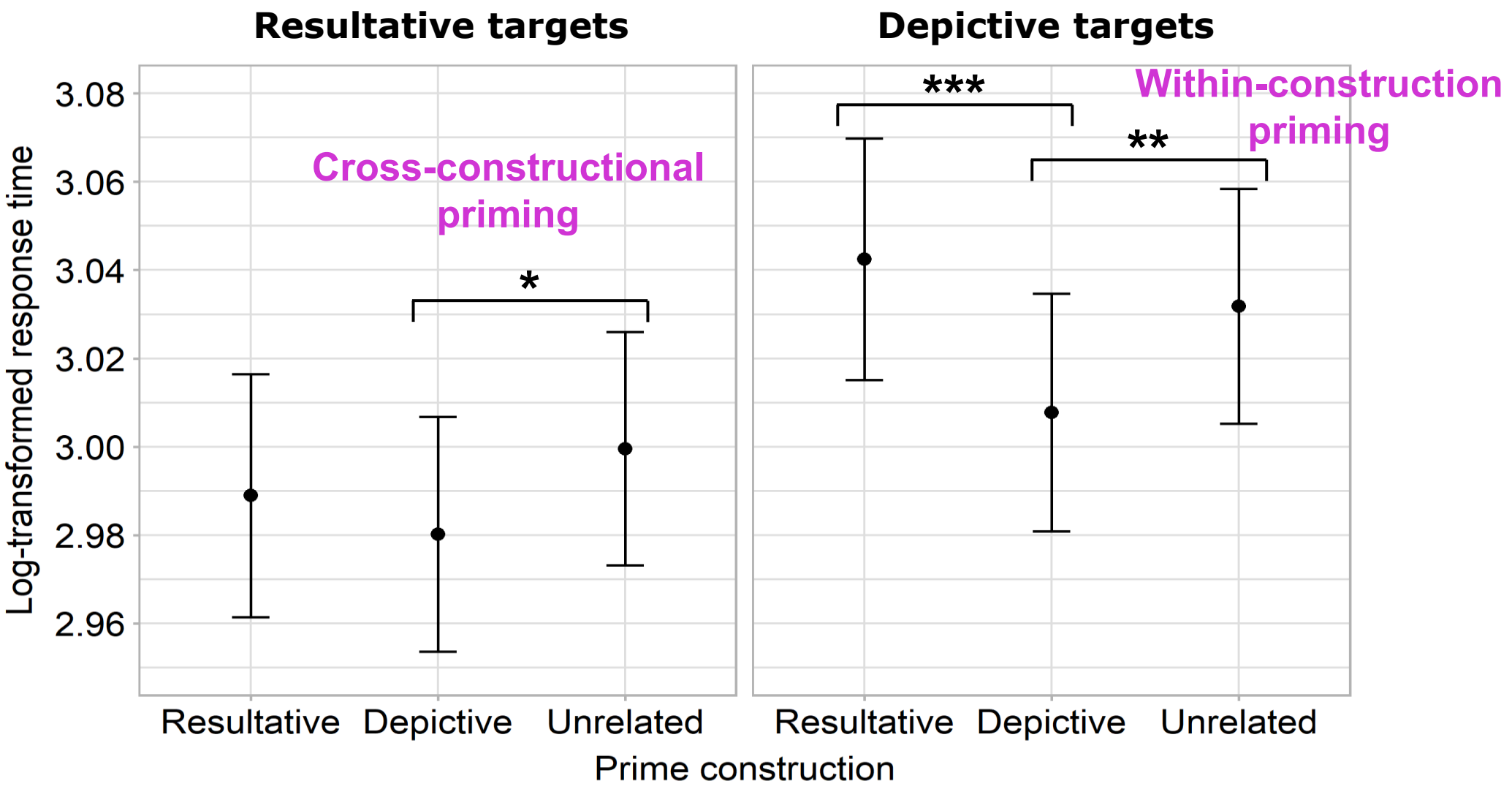
20 resultatives, 20 depictives, 60 fillers

Method

Maze task (Forster et al., 2009), a variant of self-paced reading

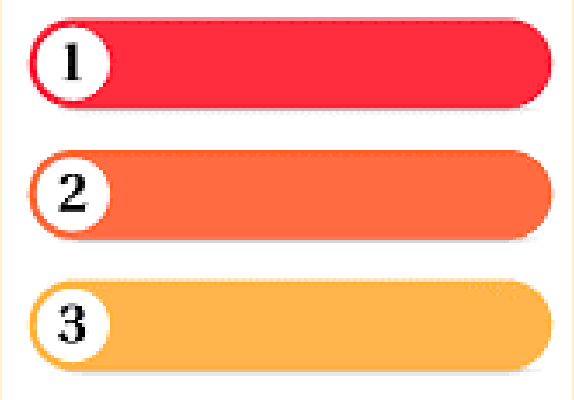


Results


Resultative targets
Depictive targets
Log-transformed response time
3.08
3.06
3.04
3.02
3.00
2.98
2.96
Cross-constructional priming
*
***
**
Within-construction priming
Resultative
Depictive
Unrelated
Resultative
Depictive
Unrelated
Prime construction

Interpretation

- Both within-construction and cross-constructional priming effects emerge after depictive primes, but not after resultative primes
- Speakers treat constructions as related despite their semantic differences
- Asymmetric priming probably due to lower frequency and lower acceptability of depictives ("inverse frequency effect"; Ferreira 2003)
- Limitations:
  - Source ambiguity
  - Naturalness of the maze task?
  - Small effect sizes in comprehension (null effects?)



Summary

Summary

- Structural priming can provide rich evidence about grammatical representation

  → E.g., the level of abstraction at which argument structure constructions are encoded

- A range of priming effects can be fruitfully interpreted within a usage-based view of grammar as a hierarchically structured network of constructions that share varying degrees of similarity

- Comprehension methods can be used to extend structural priming to understudied argument structure constructions

  → E.g., asymmetric priming from English depictives to resultatives suggests that speakers are sensitive to the similarity of the constructions but also to their differences in frequency, acceptability, etc.

Thank you!

References I

Bock, K. (1986). Syntactic persistence in language production. *Cognitive Psychology*, *18*(3), 355–387. https://doi.org/10.1016/0010-0285(86)90004-6

Branigan, H. P., & Pickering, M. J. (2017). An experimental approach to linguistic representation. *Behavioral and Brain Sciences*, *40*, e282. https://doi.org/10.1017/S0140525X16002028

Bock, K., Dell, G. S., Chang, F., & Onishi, K. H. (2007). Persistent structural priming from language comprehension to language production. *Cognition, 104*(3), 437–458. https://doi.org/10.1016/j.cognition.2006.07.003

Bybee, J. (2006). From usage to grammar: The mind's response to repetition. *Language*, *82*(4), 711–733.

Bybee, J. (2010). *Language, usage and cognition*. Cambridge University Press.

Cai, Z. G., Pickering, M. J., Yan, H., & Branigan, H. P. (2011). Lexical and syntactic representations in closely related languages: Evidence from Cantonese–Mandarin bilinguals. *Journal of Memory and Language, 65*(4), 431–445. https://doi.org/10.1016/j.jml.2011.05.003

Chang, F., Bock, K., & Goldberg, A. E. (2003). Can thematic roles leave traces of their places? *Cognition*, *90*(1), 29–49. https://doi.org/10.1016/S0010-0277(03)00123-9

Ferreira, V. S. (2003). The persistence of optional complementizer production: Why saying "that" is not saying "that" at all. *Journal of Memory and Language, 48*(2), 379–398. https://doi.org/10.1016/S0749-596X(02)00523-5

Forster, K. I., Guerrera, C., & Elliot, L. (2009). The maze task: Measuring forced incremental sentence processing time. *Behavior Research Methods*, *41*(1), 163–171. https://doi.org/10.3758/BRM.41.1.163

Goldberg, A. E. (1995). *Constructions: A Construction Grammar approach to argument structure*. University of Chicago Press.

Goldberg, A. E. (2006). *Constructions at work: The nature of generalization in language*. Oxford University Press.

Goldberg, A. E. (2019). *Explain me this: Creativity, competition, and the partial productivity of constructions*. Princeton University Press.

References II

Hudson, R. A. (1984). *Word Grammar*. Blackwell.

Hudson, R. A. (2007). *Language networks: The new Word Grammar*. Oxford University Press.

Langacker, R. W. (1987). *Foundations of Cognitive Grammar. Vol. 1: Theoretical prerequisites*. Stanford University Press.

Langacker, R. W. (2008). *Cognitive Grammar: A basic introduction*. Oxford University Press.

Lashley, K. S. (1951). The problem of serial order in behavior. In L. A. Jeffress (Ed.), *Cerebral mechanisms in behavior: The Hixon Symposium* (pp. 112–131). Wiley.

Mahowald, K., James, A., Futrell, R., & Gibson, E. (2016). A meta-analysis of syntactic priming in language production. *Journal of Memory and Language*, *91*, 5–27. https://doi.org/10.1016/j.jml.2016.03.009

Pickering, M. J., & Branigan, H. P. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language*, *39*(4), 633–651. https://doi.org/10.1006/jmla.1998.2592

Rowland, C. F., Chang, F., Ambridge, B., Pine, J. M., & Lieven, E. V. M. (2012). The development of abstract syntax: Evidence from structural priming and the lexical boost. *Cognition*, *125*(1), 49–63. https://doi.org/10.1016/j.cognition.2012.06.008

Tooley, K. M., Pickering, M. J., & Traxler, M. J. (2019). Lexically-mediated syntactic priming effects in comprehension: Sources of facilitation. *Quarterly Journal of Experimental Psychology*, *72*(9), 2176–2196. https://doi.org/10.1177/1747021819834247

Ungerer, T. (2022). *Structural priming in the grammatical network: A study of English argument structure construction* [Dissertation]. University of Edinburgh.

Ziegler, J., & Snedeker, J. (2018). How broad are thematic roles? Evidence from structural priming. *Cognition*, *179*, 221–240. https://doi.org/10.1016/j.cognition.2018.06.019