Structural priming meets Construction Grammar:

Using priming to explore networks of constructions

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Outline of the talk

1   Structural priming and Construction Grammar: compatible worlds?

2   Extending structural priming to new groups of constructions

3   Experiment 1: priming between the English caused-motion and resultative construction

4   Experiment 2-3 [ongoing]: priming between English resultatives and depictives

Structural priming and Construction Grammar: compatible worlds?

Structural priming as a window into linguistic representation

Structural priming:

- Processing a stimulus affects subsequent processing of another stimulus with the same or related characteristics (above the word level) (Branigan & Pickering, 2017, sect. 1.4, para. 1)

Branigan & Pickering (2017, *Behav Brain Sci*):

- "We have now reached the stage at which structural priming is a mature method that provides **extensive evidence about representation**." (sect. 4, para. 1; my highlighting)

- Structural priming evidence about grammatical representation is compatible with:

  - Constraint-based grammatical theories with shallow syntax

  - E.g. Parallel Architecture (Culicover & Jackendoff, 2005), HPSG (Pollard & Sag, 1994), and **Construction Grammar** (Goldberg, 1995)

Construction Grammar and constructional networks

Construction Grammar (e.g. Goldberg 1995, 2006, 2019; Croft, 2001; Traugott & Trousdale, 2013)

- Grammatical constructions = form-meaning pairings, i.e. generalisations over formal (e.g. syntactic) and functional (semantic, pragmatic, contextual) features

- E.g. the double-object construction (e.g. *She gave him the book*):
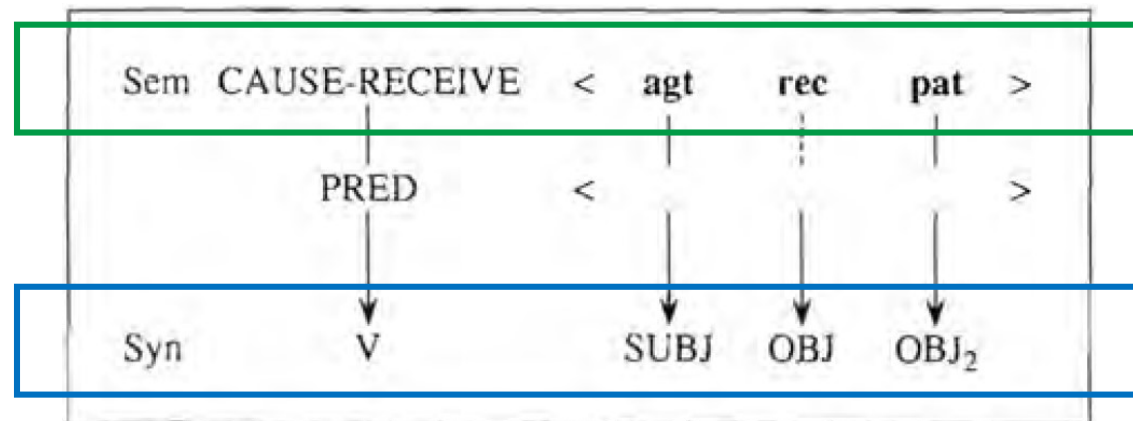
Goldberg, 1995, p. 77

Construction Grammar and constructional networks

Constructions form **networks** of similar structures: "knowledge of language consists of a network of form-function correspondences at varying levels of specificity" (Goldberg, 2013, p. 27)

E.g. the network of dative and benefactive constructions:

Zehentner & Traugott, 2020, p. 195
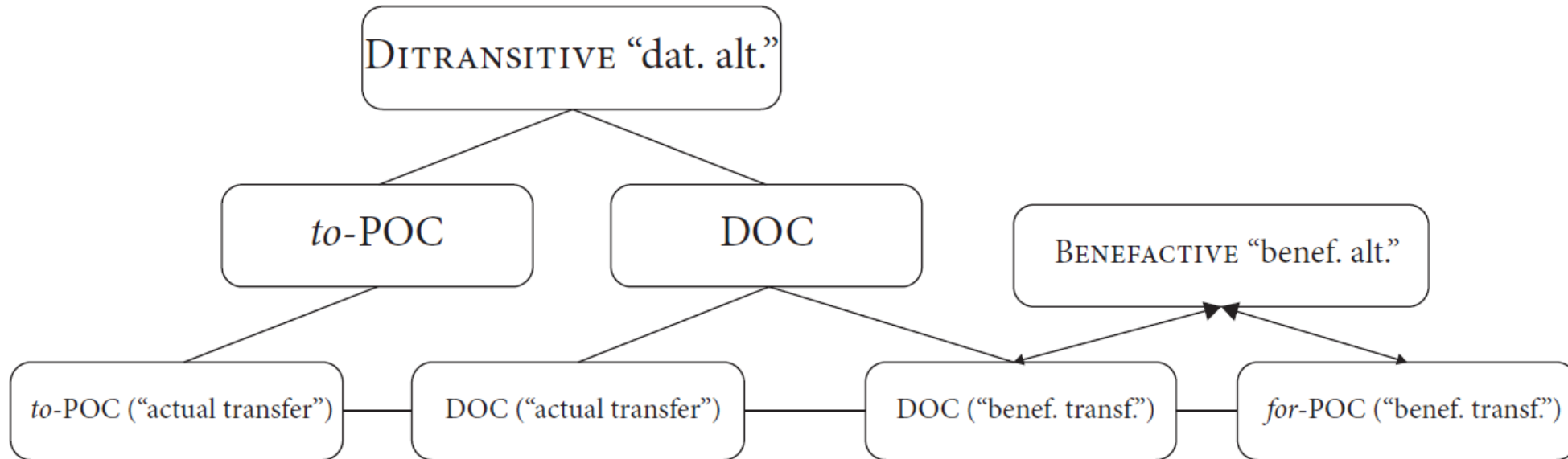
Is structural priming sensitive to both form AND function?

Sensitivity to formal-syntactic features:

- Actives with locative *by*-phrases prime passives with *by*-agents:
  The 747 was landing <u>by the airport's control tower</u> → The 747 was alerted <u>by the airport's control tower</u>
  (Bock & Loebell, 1990; but see alternative explanation by Ziegler et al., 2019)

Sensitivity to semantic-functional features:

- Thematic roles: 'provide-with' sentences prime double-object sentences:
  His editor credited Bob with the hot story → His editor offered Bob the hot story
  (Hare & Goldberg, 1999; see also Chang et al., 2003; Ziegler & Snedeker, 2018)

- Event structure: manner and path components of motion events can be primed
  (Bunger et al., 2013; see also Ziegler et al., 2018)

- Information structure: clefts that emphasise the patient (rather than agent) prime passives
  (Vernice et al., 2012; see also Bernolet et al., 2009)

Combinations of formal and functional factors, e.g. syntactic structure + thematic roles
(Salamoura & Williams 2007; Ziegler et al. 2018; Ziegler & Snedeker 2019)

Some conclusions

Construction Grammar provides a theoretical framework for the interpretation of structural priming effects:

- Structural priming is sensitive to both formal and functional features of clause-level patterns, which can be analysed via the concepts of 'constructions' and 'constructional networks'

Structural priming provides an empirical testing ground for Construction Grammar claims:

- Priming indexes similarities between constructional representations, which form the basis for the network relations proposed in Construction Grammar

Extending structural priming to
new groups of constructions

Target phenomena in previous research

- Most previous structural priming studies have targeted a relatively small set of **alternating constructions** (e.g. the dative alternation, the active/passive alternation, the locative alternation, …)

- One reason for this is that most production priming methods (and some comprehension methods) measure participants' choice between structural alternatives (Branigan & Pickering, 2017)

- In Mahowald et al.'s (2016) meta-analysis of production priming studies, **217 (63%) out of all 343 experimental conditions** instantiate the dative constructions, and **291 (85%)** conditions instantiate either the datives or actives/passives

- How can the scope be extended beyond alternating constructions?

The advantages of comprehension priming

- "Priming in comprehension can be informative about the representation of structures **in the absence of alternatives**" (Branigan & Pickering, 2017, sect. 3.4, para. 3; my highlighting)

- Comprehension methods involving reading (e.g. self-paced reading) provide **mutually independent outcomes** (reading time, eye movements, brain activity measures)

- Independent outcomes allow researchers to identify **which target construction** is affected by priming (and thus distinguish between facilitatory and inhibitory effects)

- Some constructions are hard to elicit with pictures or sentence fragments in production, whereas the comprehension methods can in principle be applied to any construction

Experiment 1: priming between the English caused-motion and resultative construction

Ungerer, Tobias. accepted. Using structural priming to test links between constructions: English caused-motion and resultative sentences inhibit each other. *Cognitive Linguistics*.

The caused-motion and resultative construction

<u>Similarities</u>

▪ Constituent structure up until final phrase:
NP V NP {...}

▪ Metaphorically related constructional
semantics: change of location ≈
change of state (Goldberg, 1995)

| **Caused-motion**
*Sarah swept the glass
into the bin.* | ← → | **Resultative**
*Nancy swept the floor
clean.* |

<u>Differences</u>

▪ Sentence-final constituent: PP vs. Adj

▪ Constructional semantics

▪ Semantic type of object noun:
'figure' (*the glass*) vs. 'ground' (*the floor*)
(Langacker, 1987)

Exp. 1: Participants and method

Participants

- 160 self-reported native speakers of English recruited via Amazon Mechanical Turk

Method

- 'Maze' version of self-paced reading (Forster et al., 2009)

- At every word of the sentence, participants choose between a correct sentence continuation and an incorrect distractor

- Advantages: encourages deeper processing of the stimuli + reduces spillover effects

- Boyce et al. (2020) provide a helpful tool to automatically create distractor words (via an NLP model)

PRIMES

Caused-motion:
Bob swept the breadcrumbs off the table.

Resultative:
Daniel squeezed the tube flat.

Baseline (unrelated constructions):
Amy practiced speaking in public.

With verb overlap

Without verb overlap

TARGETS

Critical region 1: Object noun

Critical region 2: First word of complement

Caused-motion:
Sarah swept the | *glass* | *into* | *the bin.*

Resultative:
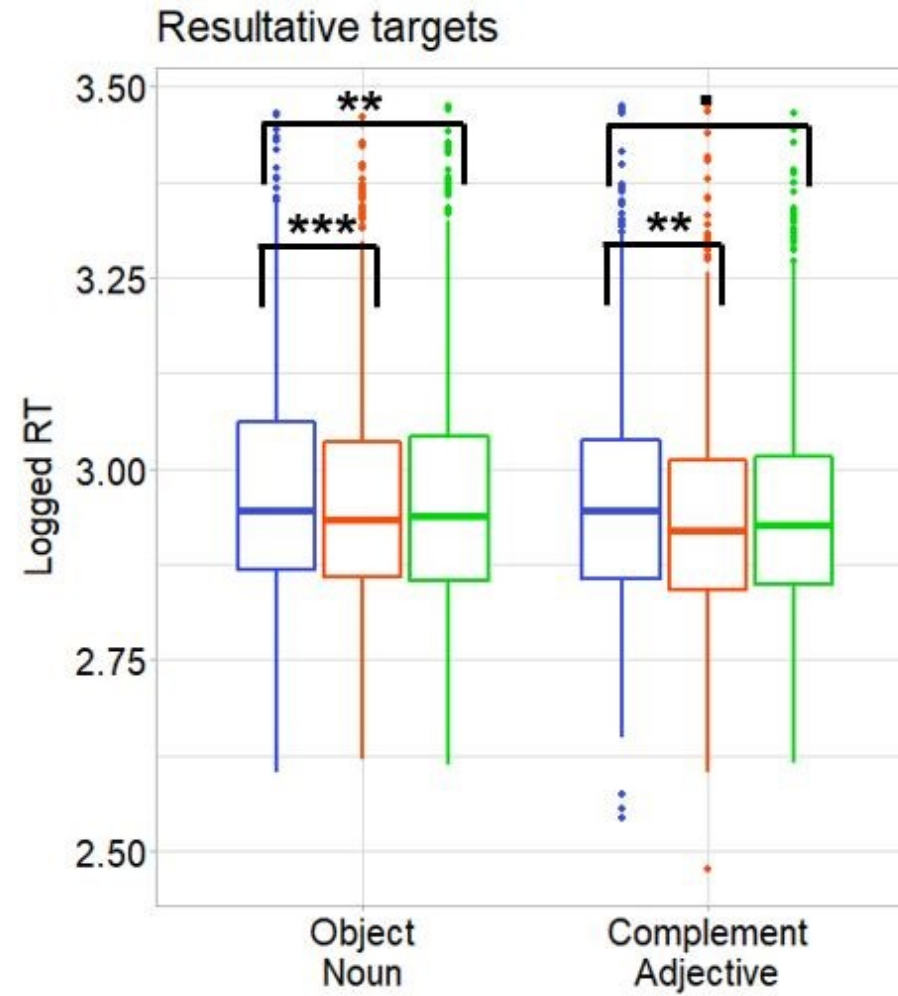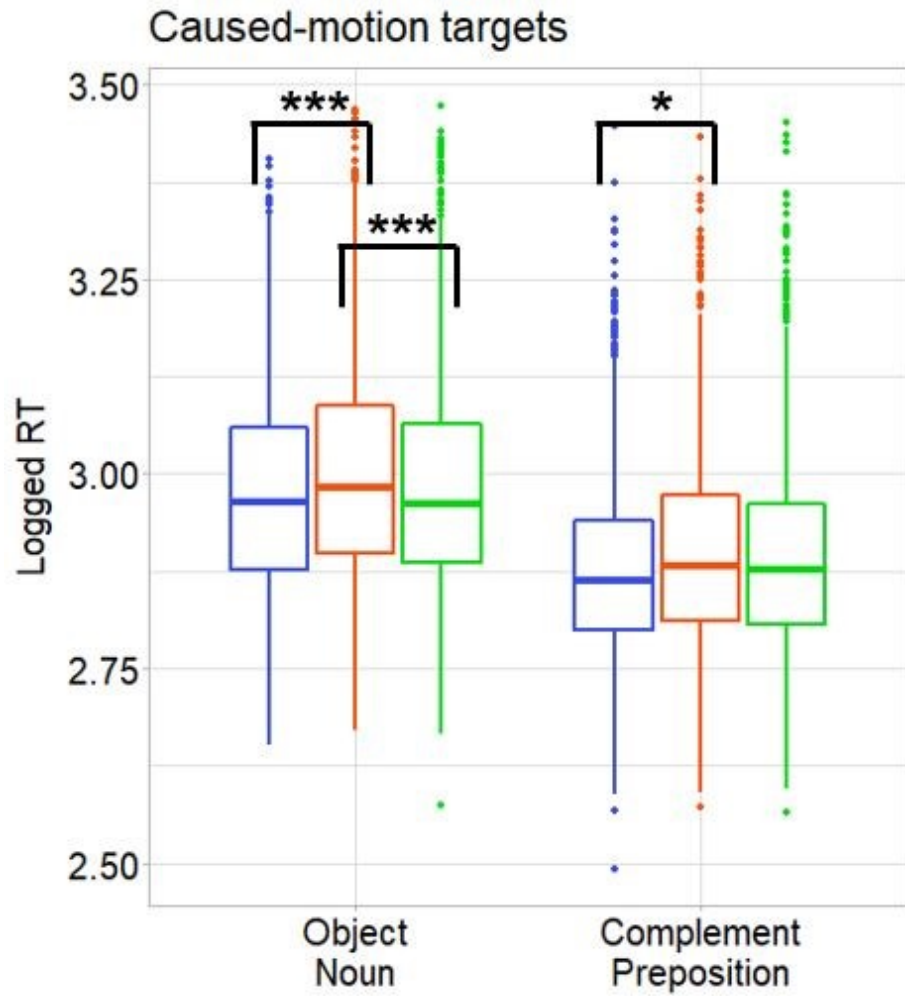*Nancy swept the* | *floor* | *clean.*

Comprehension priming only occurs with verb overlap

(Arai et al., 2007; Branigan et al., 2005; Traxler et al., 2014)

vs. comprehension priming occurs with and without verb overlap

(Fine & Jaeger, 2016; Kim et al., 2014; Thothathiri & Snedeker, 2008)

Exp. 1: Hypotheses

(H1) Cross-constructional priming occurs between the two (putatively related) constructions: response times for resultative targets after caused-motion primes differ from baseline; response times for caused-motion targets after resultative primes differ from baseline

(H2) Within-construction priming (caused-motion → caused-motion; resultative → resultative) is distinguishable from cross-constructional priming (caused-motion → resultative; resultative → caused-motion), e.g. via the nature of the priming effects (facilitation vs. inhibition)

(H3) Verb overlap could strengthen the priming effects ('lexical boost'), but might not necessarily do so (given the mixed evidence from previous studies)

Caused-motion targets

Resultative targets

Prime construction
- Caused-motion
- Resultative
- Unrelated

. $p < 0.10$
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Sarah swept the glass into *the bin.*

Nancy swept the floor clean.

(H1) The related constructions give rise to cross-constructional priming

- H1 is supported: inhibitory effects of cross-constructional priming in both directions relative to the baseline (caused-motion → resultative; resultative → caused-motion)

- This suggests that speakers perceive the constructions as related

- This relatedness of the constructions is unlikely to rely purely on syntactic overlap (→ effect at the object noun), but instead points to semantic (or semantic + syntactic) factors at both sentence regions

Exp. 1: Conclusions

(H2) Within-construction priming is distinguishable from cross-constructional priming

- No significant effects of within-construction priming (compared to the baseline)

- Cross-constructional effects are different from within-construction effects, suggesting that speakers perceive caused-motion and resultative as distinct constructions

- So in a sense, H2 is supported

- Why does (facilitatory) within-construction priming not occur?

  - Difficult to tell given the novelty of the constructions and the method

  - Processes implicated by the maze task (≈ ambiguity resolution?; Fine & Jaeger, 2016) may be more prone to eliciting inhibitory rather than facilitatory effects

Exp. 1: Conclusions

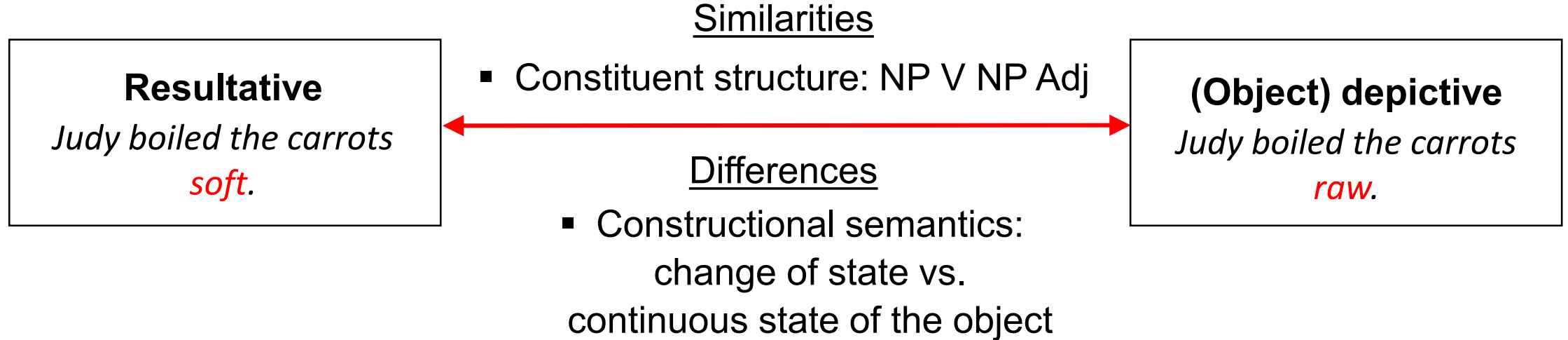**(H3) Verb overlap could strengthen the priming effects ('lexical boost')**

- Little effect of verb overlap on priming

- Verb overlap was involved in a **marginally significant** interaction with priming (but only for resultative targets and only at the object noun)
  - Faster response times for resultative targets after resultative primes with verb overlap than without verb overlap (p = 0.094)
    $\rightarrow$ a 'positive' lexical boost?
  - Slower response times for resultative targets after caused-motion primes with verb overlap than without verb overlap (p = 0.070)
    $\rightarrow$ a 'negative' lexical boost?

Exp. 1: Summary

- Evidence of structural priming between two previously understudied constructions

- Inhibitory cross-constructional priming in both directions at both critical regions

- Evidence that the caused-motion and the resultative construction are **distinct but related** in a way that goes beyond purely syntactic difference/overlap

- The effects raise questions about the role of inhibition in structural priming studies, which "have focused so far on facilitatory effects" (Branigan & Pickering, 2017, fn. 2)

- Little effect of verb overlap on priming; only some (marginally significant) evidence that verb overlap can enhance priming (both a 'positive' and a 'negative' lexical boost)

Experiment 2 & 3 [ongoing]: priming between the English resultative and depictive construction

Resultative
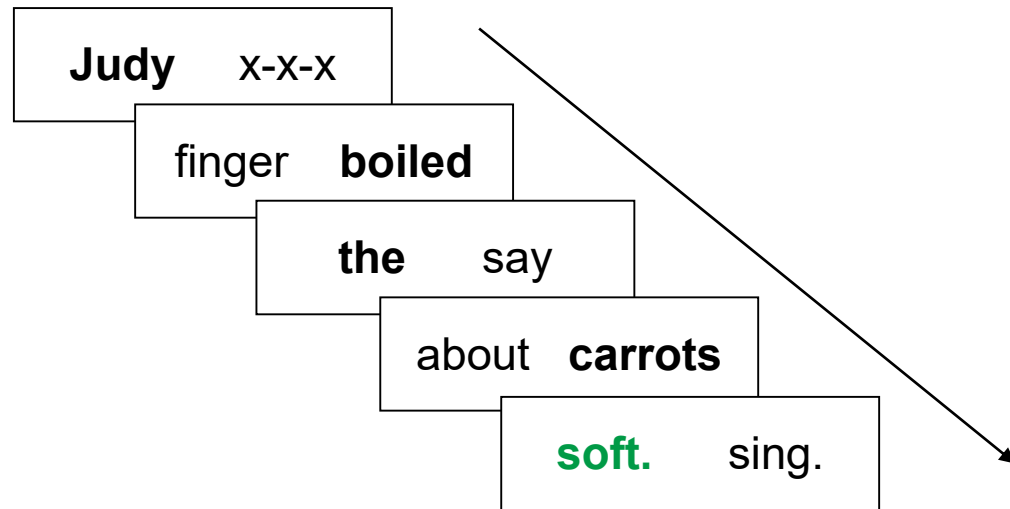
Judy boiled the carrots *soft*.

Similarities

▪ Constituent structure: NP V NP Adj

Differences

▪ Constructional semantics:
change of state vs.
continuous state of the object

(Object) depictive

Judy boiled the carrots *raw*.

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Exp. 2: standard maze task

- Final word: resultative/depictive vs. distractor

Judy	x-x-x
finger	**boiled**
the	say
about	**carrots**
soft.	sing.

- No direct competition between constructions
- Outcome measure: response time
- Tapping into comprehension?

Exp. 3: modified maze task

- Final word: resultative vs. depictive

Judy	x-x-x
finger	**boiled**
the	say
about	**carrots**
soft.	**raw.**
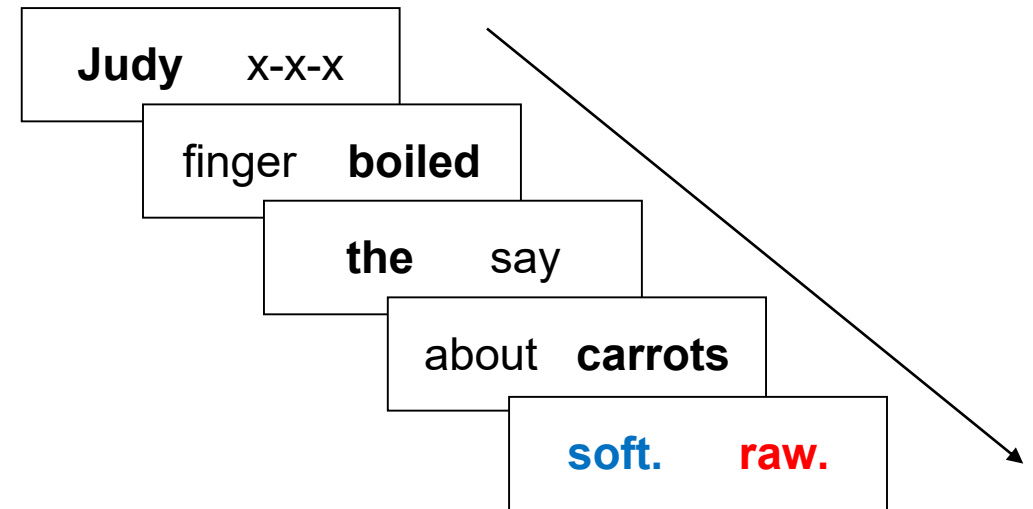
- Direct competition between constructions
- Outcomes: structure choice + response time
- Tapping into comprehension + production?

Summary

- Structural priming and Construction Grammar can mutually inform each other

- In order to study more large-scale constructional networks, structural priming should be extended to new groups of constructions

- Comprehension priming methods could allow for such extensions

- Experiment 1 provides evidence from structural priming that the English caused-motion and resultative are related constructions in the network

- A range of questions remain for follow-up research:
  - How can these comprehension methods be applied to other groups of constructions?
  - How can formal-syntactic and semantic-functional factors be distinguished in the interpretation of structural priming effects?
  - Under which conditions do facilitation and inhibition occur? What processes are implicated?

Thank you!

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