The usage basis of verb valency

Evidence from a language comprehension experiment

Florent Perek
Universität Basel
florent.perek@unibas.ch

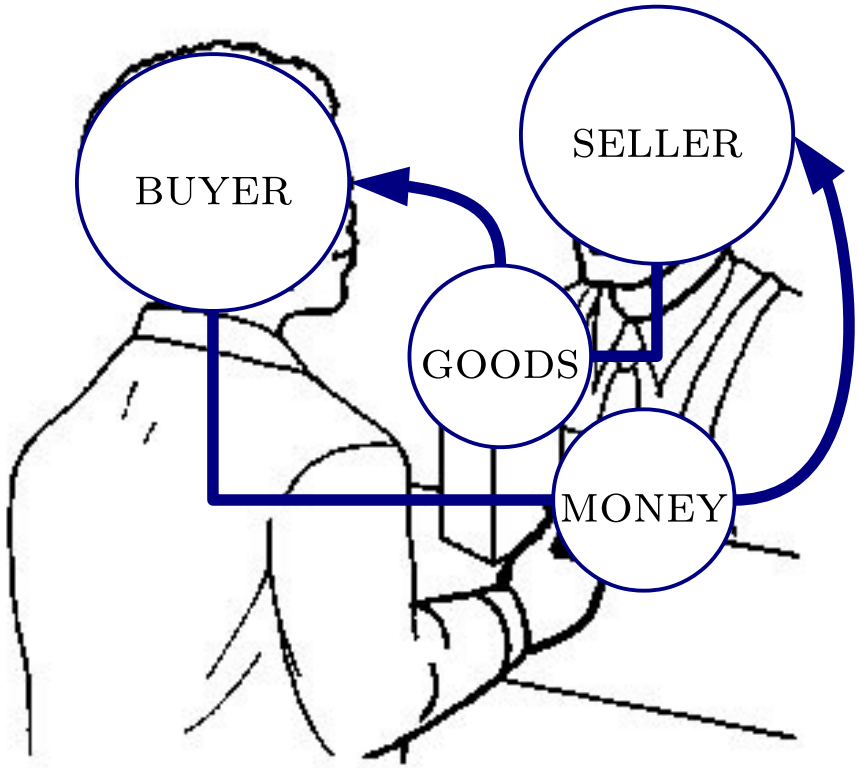
Overview

- Topic: cognitive representation of verbs in construction grammar
- Questions:
  - How much information is stored with verbs?
  - In particular, how many arguments (valency)?
- Hypothesis: valency is determined by usage
- Experiment testing this hypothesis

Preliminaries

- In cognitive terms, the meaning of a verb evokes an **event schema**
  - Rich conceptual structure about common situations and events as they typically occur in the world
  - Makes reference to a number of ‘actors’ and ‘props’
- Constructions impose different construals on the event schema
  - “Windowing of attention” (Talmy 1996)
  - Results in different valencies (i.e., sets of arguments)

‘pay’
commercial transaction event schema



The man pays for the milk.

The man pays one dollar for the milk.

The man pays.

The man pays one dollar to the shopkeeper for the milk.

What's (in) a verb?

- Verb = event schema?
  - We could not distinguish between verbs with the same schema
    - e.g., *buy*, *sell*, *pay*, *charge* (commercial transaction)
  - Lexical entry = a (conventional) construal of the event schema
    - i.e., profiling a specific set of arguments
- How to determine which arguments?

What's (in) a verb?

- In Construction Grammar:
  - Constructions can delete or contribute arguments
  - Ideally, a verb has a single lexical entry (Goldberg 1995)
  - All other valencies derived by combination with constructions
- Question: How do we decide which valency is "basic"?

John sold books.

2-participant verb?
3-participant verb with deleted recipient?

John sold books to the students.

3-participant verb?
2-participant verb construed as transfer?

The usage-based valency hypothesis

- Proposal: verb valency is determined by usage (cf. Langacker 2009)
  - i.e., the cognitive status of a given valency of a verb is related to the frequency of that valency in usage
- Cognitive status:
  - Either a conventional construal stored with the verb
  - Or one derived compositionally via combination with a construction
  - … probably with intermediate degrees of entrenchment
  - There can be several valencies stored with a given verb
- Prediction: more frequent valencies of a verb are more easily processed in language comprehension

Testing the usage-based valency hypothesis

- Incremental reading experiment (Perek 2012: Ch. 3)
- Goal: measure difference in processing time of different valency sets
- Does the integration time of a third argument for the following verbs vary according to its participant role?

  BUYER *buy* GOODS { *from* SELLER vs. *for* MONEY }

  BUYER *pay* MONEY { *for* GOODS vs. *to* SELLER }

  SELLER *sell* GOODS { *to* BUYER vs. *for* MONEY }

- Do these differences correlate with differences in the frequency of the corresponding valency sets?

Stimuli

Dependent variable: reading time of the preposition (measured in a maze task; cf. Forster 2010)

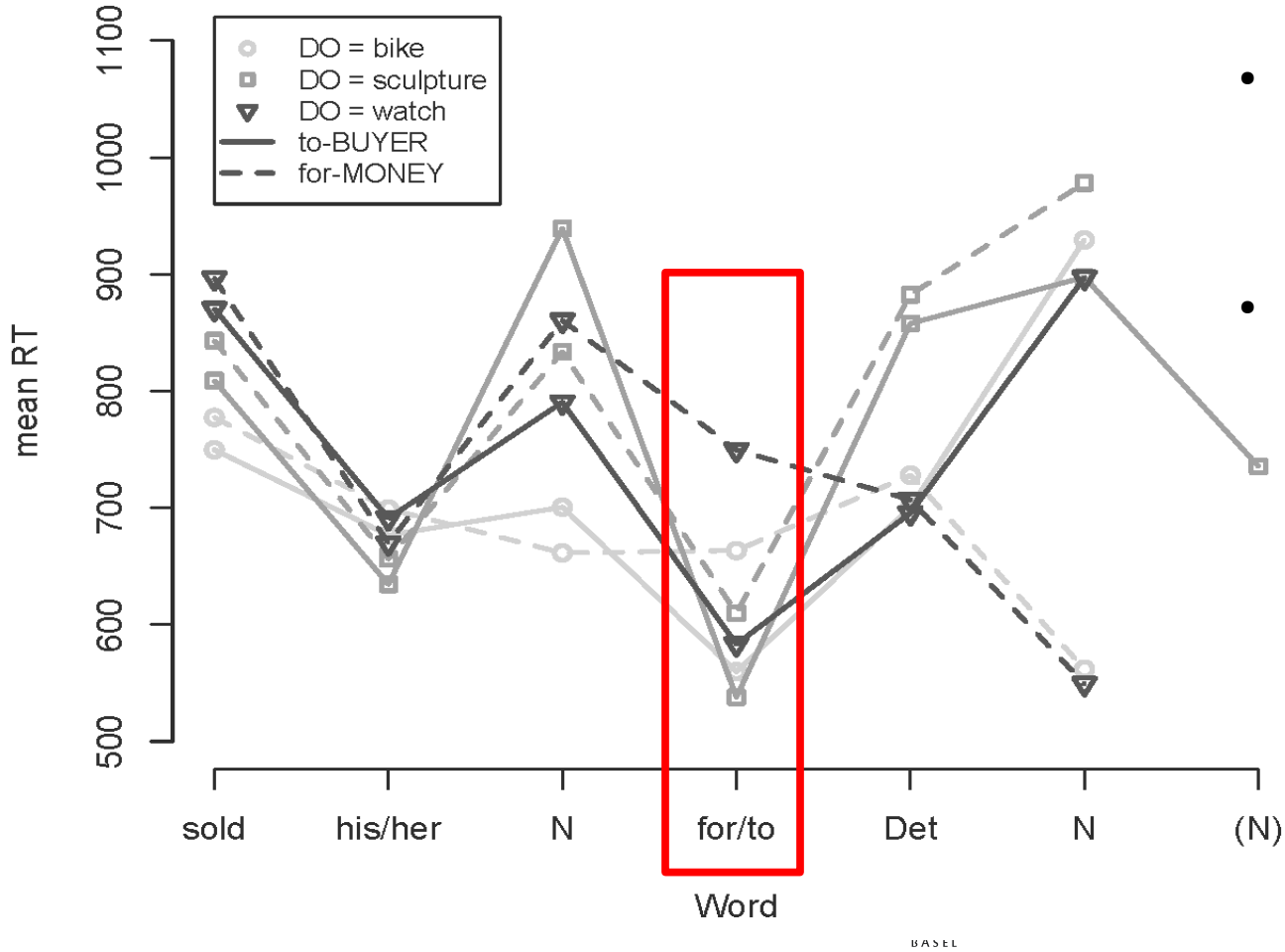
- Eighteen stimuli sentences: 3 verbs × 3 direct objects × 2 valency sets

Lisa bought	a camera	**for**	seventy euros
		from	the department store
	a painting	**for**	two hundred euros
		from	an art gallery
	a sandwich	**for**	three euros
		from	a takeaway
Jane paid	forty euros	**for**	the meat
		to	the butcher
	ninety euros	**for**	a necklace
		to	the jeweler
	ten euros	**for**	a cake
		to	the baker
Mike sold	his bike	**for**	seventy euros
		to	the neighbor
	his sculpture	**for**	one grand
		to	an old woman
	his watch	**for**	sixty euros
		to	the landlord

Participants

- 25 native speakers of English (11 male, 14 female)
- All students at the University of Freiburg
- Pseudo-randomized stimuli list for each participant
  - Consecutive occurrence of the same verb was avoided
  - Interspersed with blocks of three filler sentences with different verbs and constructions (to avoid priming effects)
  - 72 items in each list

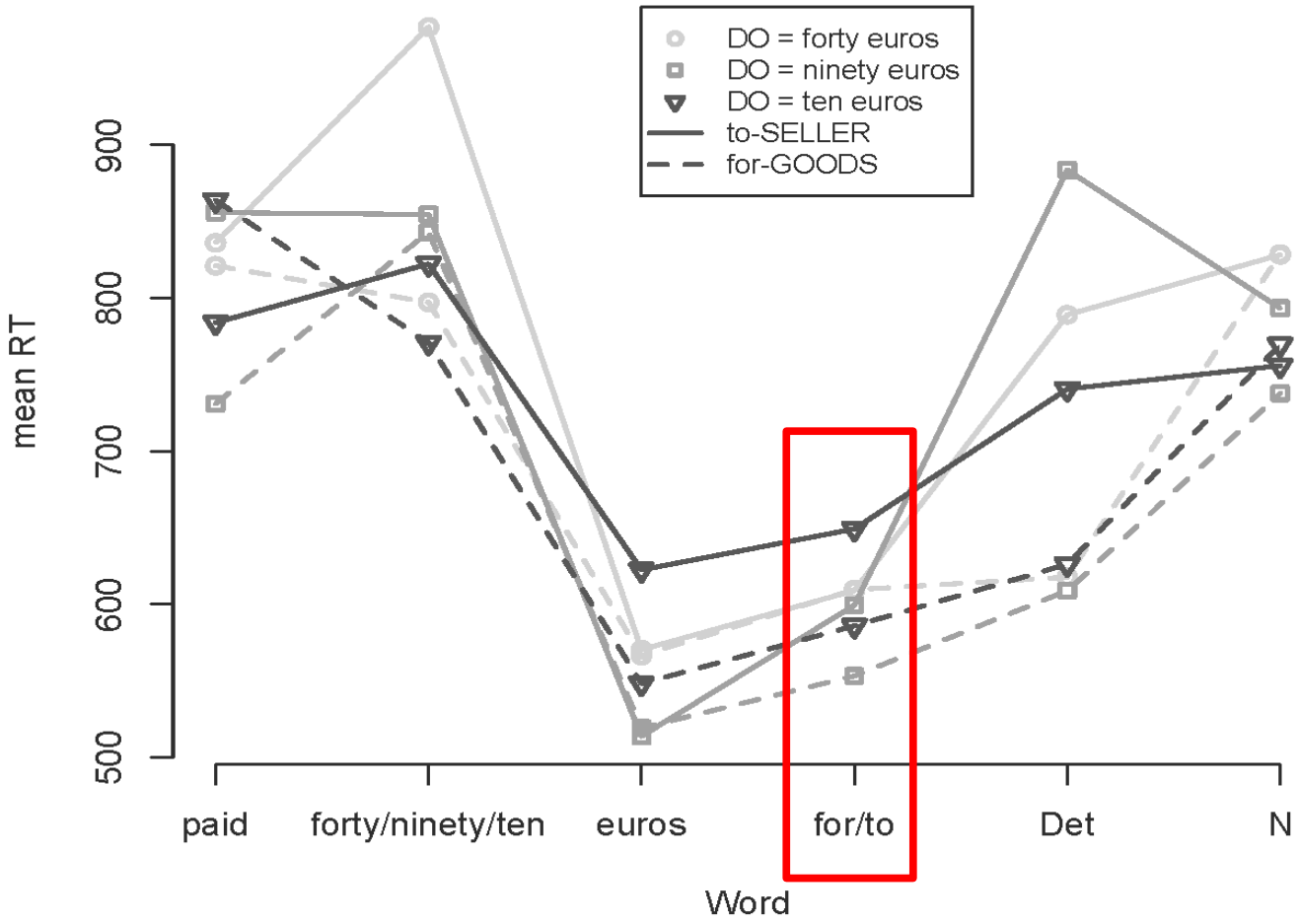
Results: *sell*



Linear regression analysis:

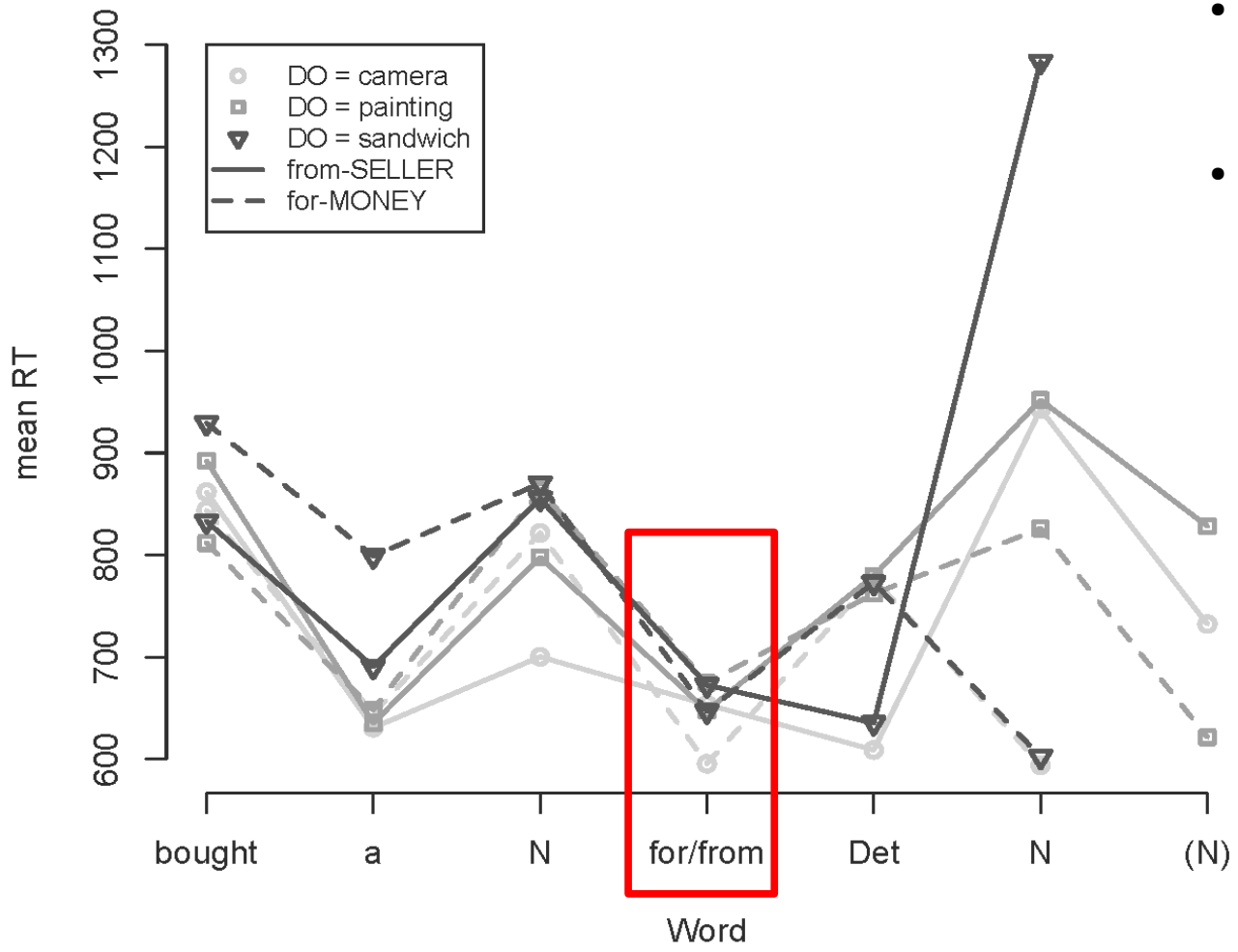
- Main effect of VALENCY (*to*-BUYER): 88.57 msec, $p = 0.0002$
- No significant interactions with DO

Results: *pay*



- Main effect of VALENCY (*to*-SELLER): 45.18 msec, p = 0.0324
- Significant interaction with DO (*forty euros*): p = 0.469
- But it disappears at the sixth word

Results: *buy*



- No effect of VALENCY (p = 0.3479)
- No interactions with DO

Results: summary

- For *sell*

  'SELLER *sell* GOODS *to* BUYER' more cognitively accessible than 'SELLER *sell* GOODS *for* MONEY' (shorter reaction time)

- For *pay*

  'BUYER *pay* MONEY *for* GOODS' more cognitively accessible than 'BUYER *pay* MONEY *to* SELLER' (shorter reaction time)

- For *buy*

  No difference in cognitive accessibility between 'BUYER *buy* GOODS *from* SELLER' and 'BUYER *buy* GOODS *for* MONEY' (no difference in reaction time)

Comparison with usage data

- Do these differences correlate with differences in frequency?
  - Analysis of the usage of *buy*, *pay* and *sell*
    - BrE: BNC conversations (4MW; only half the tokens were kept)
    - AmE: several corpora of conversations (~600,000 words)
  - All instances annotated for overtly expressed participants:
    BUYER, GOODS, MONEY, SELLER

Frequency distribution of *pay*

Valency	BrE		AmE	
	F	%	F	%
BUYER-MONEY	366	36.35%	34	24.64%
BUYER-GOODS	252	25.02%	41	29.71%
BUYER	125	12.41%	17	12.32%
BUYER-MONEY-GOODS	**111**	**11.02%**	**21**	**15.22%**
BUYER-SELLER	67	6.65%	15	10.87%
BUYER-MONEY-SELLER	**43**	**4.27%**	**8**	**5.80%**
BUYER-SELLER-GOODS	17	1.69%	1	0.72%
MONEY-GOODS	7	0.69%		
BUYER-RECIPIENT	5	0.50%		
BUYER-SELLER-MONEY-GOODS	4	0.40%	1	0.72%
BUYER-MONEY-RECIPIENT	4	0.40%		
MEANS-MONEY-GOODS	2	0.20%		
MEANS-MONEY	2	0.20%		
BUYER-GOODS-RECIPIENT	1	0.10%		
MEANS-GOODS	1	0.10%		
Total	1007		138	

BrE: $\chi^2 = 30.03$, $p < 0.0001$
AmE: $\chi^2 = 5.83$, $p = 0.0157$

Frequency distribution of *sell*

Valency	BrE		AmE	
	F	%	F	%
SELLER-GOODS	271	70.20%	46	55.42%
SELLER-GOODS-BUYER	**59**	**15.28%**	**18**	**21.69%**
SELLER	24	6.22%	7	8.43%
SELLER-GOODS-MONEY	**16**	**4.15%**	**1**	**1.20%**
SELLER-BUYER	5	1.29%	2	2.40%
SELLER-GOODS-BUYER-MONEY	4	1.04%	4	4.82%
GOODS	4	1.04%	1	1.20%
SELLER-BUYER-MONEY	1	0.26%		
GOODS-MONEY	1	0.26%	4	4.82%
SELLER-MONEY	1	0.26%		
Total	386		83	

BrE: $\chi^2 = 25.65$, $p < 0.0001$
AmE: $\chi^2 = 15.22$, $p = 0.0001$

Frequency distribution of *buy*

Valency	BrE		AmE	
	F	%	F	%
BUYER-GOODS	1013	71.39%	189	75.90%
BUYER-GOODS-RECIPIENT	248	17.48%	33	13.25%
BUYER	56	3.95%	10	4.02%
BUYER-GOODS-SELLER	**50**	**3.52%**	**12**	**4.82%**
BUYER-GOODS-MONEY	**32**	**2.26%**	**4**	**1.61%**
BUYER-RECIPIENT	5	0.35%		
BUYER-GOODS-MONEY-RECIPIENT	4	0.28%		
BUYER-GOODS-SELLER-RECIPIENT	3	0.21%		
BUYER-SELLER	3	0.21%	1	0.40%
MONEY-GOODS	2	0.14%		
BUYER-GOODS-SELLER-MONEY-RECIPIENT	1	0.07%		
BUYER-GOODS-SELLER-MONEY	1	0.07%		
BUYER-MONEY	1	0.07%		
Total	1419		249	

BrE: $\chi^2 = 3.95$, $p = 0.0468$
AmE: $\chi^2 = 4$, $p = 0.0455$

Conclusion

- For *pay* and *sell*:
  - The predictions of the usage-based valency hypothesis hold
  - The more cognitively accessible valency is also in each case the more frequent one
- Not for *buy*:
  - But the difference in frequency is weaker (barely significant)
  - Both relative frequencies are low
    - It is a plausible explanation: relative frequency was shown to be the relevant factor in derivational morphology (Blumenthal 2013)

Conclusion

- These results confirm the usage-based valency hypothesis
  - i.e., frequency appears to shape the structure of the verbal lexicon

  "Grammars code best what speakers do most" (Du Bois 1985: 363)

- Some prospects:
  - Use a wider range of verbs
  - Evaluate the effect of relative (vs. absolute) frequency

- Theoretical and methodological implications:
  - Usage-based conception of verb meaning: event schema shaped by occurrence in constructions
  - Invalidates the introspection-based methodology to define lexical entries of verbs: it is necessary to look at usage

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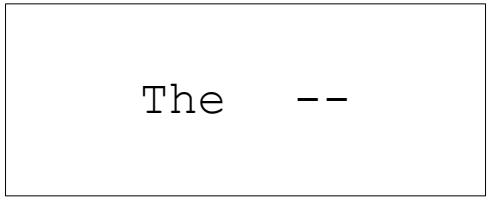
The maze task design



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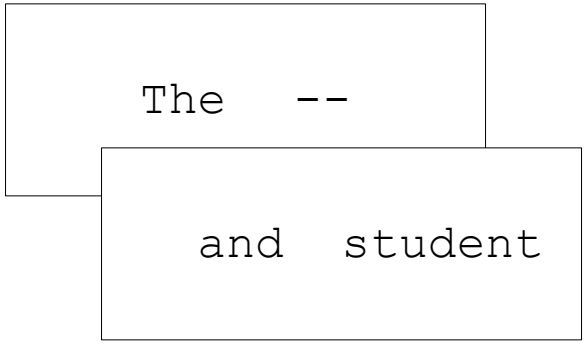

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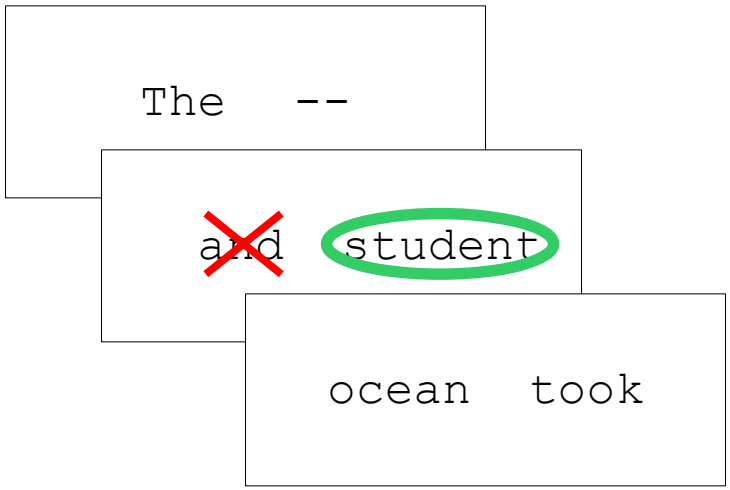

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