The interaction of usage and function in the emergence of constructions

A novel construction learning study

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• Learners want to understand messages given forms (comprehension).

and

• They need to choose forms to express the messages they want to convey (production).
Need to categorize
form ~ function pairings: *constructions*. 
Constructions involve:

(Abstract) surface form

The X-er ___, the Y-er ___

Subj V Obj1 Obj2

<verb>-able, e.g., reachable, dialable

think out of the box, pull <oneself> together

Function: semantics and/or information structure

Register, genre, dialect

Relationships to other constructions

Remembered exemplars
Subtle semantic differences between constructions

a. Jo baked Sam a cake.

b. Jo baked a cake for Sam.
She gave *him* a book.  >  
She gave *a man* a book.

Strong statistical skewing toward pronominal/topical recipients. (Bresnan 2010; Dryer 1986; Givon 1979; Langacker 1987; Arnold et al. 2000; Bresnan and Nikitina 2008; Wasow 2002; Levin and Rappaport Hovav 2004; Goldberg 2006)
Usage-based constructionist approach

- Grammar emerges from usage
- Language acquisition is input-driven
- Speakers are sensitive to statistical information
Novel construction learning studies

• “Made-up” languages involving scene-sentence pairs
• The statistical structure of the input is manipulated
• The role of statistics in language learning is investigated

(e.g., Goldberg et al. 2004; Casenhiser & Goldberg 2005; Hudson Kam & Newport 2005; Wonnacott, Tanenhaus, & Newport 2008; Wonnacott, Boyd, & Goldberg 2012)
Wonnacott, Newport, & Tanenhaus (2008)

• Two constructions with same meaning
  – “Verb Agent Patient ” (VSO)
  – “Verb Patient Agent ka ” (VOS-ka)

• Distribution varied across conditions
  – Some verbs occurred only in either VSO or VOS-ka
  – Some verbs alternated, i.e., they occurred in both
Wonnacott, Newport & Tanenhaus (2008)

• Learners depended on the statistics in the input:
  
  – “Lexicalist” input condition:
    No verbs alternated
Wonnacott, Newport & Tanenhaus (2008)

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  Partially general and partially lexically specific behavior.

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- Alternating input condition:
  All verbs alternated $\rightarrow$ fully productive behavior
• Does language learning only consist of gleaning statistical regularities in the input?

• There are also learning biases & constraints
  
  – Communicative (e.g., Levy 2008; Gibson et al. 2011; Piantadosi et al. 2012)

  – Cognitive: memory (e.g., Gathercole & Baddeley 1993; Gibson 1994), inductive categorization processes (e.g., Griffiths et al. 2010; Suttle & Goldberg 2011), associative learning (e.g., Yu & Smith 2008)

• What about the function of constructions themselves?
Differences in grammatical form typically correspond to differences in function (Bolinger 1968; Goldberg 1995)

→ Use constructions with distinguishable functions.
Our experiment

• Two word order constructions: SOV and OSV

• OSV order used exclusively with pronoun patients

the panda the pig mooped \( \rightarrow \) SOV
him the panda mooped \( \rightarrow \) ProSV

  meaning: ‘the panda_{agent} pushed the pig_{patient}’

• Six novel verbs (e.g., glim, moop, wub) referring to transitive actions (e.g., ‘punch’, ‘push’, ‘head-butt’)
Our experiment

• Two experimental conditions
  – Lexicalist condition: 3 SOV-only, 3 ProSV-only verbs
  – (Partially) alternating condition: 2 SOV-only, 2 ProSV-only, 2 alternating verbs

• Control condition (same-meaning condition)
  – 3 SOV-only; 3 OSV-only

to replicate Wonnacott et al. and check that speakers are able to learn verb-specific behavior

Perek & Goldberg
(to appear, Journal of Memory and Language)
Example of exposure pair

the rabbit the panda norped
Procedure

• Exposure (2 days)
  – 36 sentence-scene pairs, each verb used 6 times
  – Participants asked to repeat each sentence

• Sentence production task
  – Participants asked to describe new scenes with learned novel verbs.
  – Interspersed with distractor tasks (vocabulary questions, forced-choice sentence comprehension)

• Sentence rating task (not reported here; consistent with production)
Production task

- Different question contexts:
  - “What happened here?”
  - “What happened to the <patient>?”

Two trials per verb, one in each context
Example of production trial

what happened here?
Example of production trial

what happened to the panda?
Participants

• 64 Princeton undergrads, aged 18-22
  – 24 in lexicalist condition
  – 18 in partially alternating condition (2/6 verbs alternate)
  – 12 in the control, same-meaning, lexicalist condition
To what extent do speakers generalize constructions to unattested verbs?

Hypothetical data: conservative, verb-based behavior
To what extent do speakers generalize constructions to unattested verbs?

Hypothetical data: full generalization across verbs
Results

Lexicalist condition: no alternating verbs

Partially alternating condition

Verb-based conservativeness

Full generalization
Results

Lexicalist condition: no alternating verbs

Mixed effects logistic regression

Main effect of Context: responses are context-dependent in both conditions ($p < 0.0001$).

Interaction between Condition and VerbType ($p = 0.0001$): a (conservative) effect of verb type is specific to the lexicalist condition

Subjects, items as random effects.
Results

Lexicalist: no alternating verbs, different functions

Same-meaning: no alternating verbs, same function

Verb-based conservativeness

Full generalization

Perek & Goldberg
(to appear, *Journal of Memory and Language*)
Results

Lexicalist: no alternating verbs, different functions

Mixed effects logistic regression

Condition interacts with both Context (p < 0.0001) and VerbType (p = 0.0029)

Same-meaning: no alternating verbs, same function

No effect of Context in the same-meaning condition.

Effect of VerbType stronger in same-meaning than in lexicalist condition

Perek & Goldberg
(to appear, Journal of Memory and Language)
Summary

• Tendency for participants to generalize, using contextually appropriate construction
  – Evidence of ignoring verb-specific input

• This tendency interacts with the input
  – Alternating verbs promote productivity, as in Wonnacott et al.
  – But here: full generalization when only 1/3 of verbs alternate

• Sentence rating results support production data

Perek & Goldberg
(to appear, *Journal of Memory and Language*)
• SOV and ProSV constructions are distinguished by discourse contexts (not by verb semantics).

• Constructions define relevant dimensions of similarity
Got _____? as rhetorical question

Constructions determine dimensions of similarity

<something that is essential for good quality of life.>

milk

soccer

got milk?

Jesus

hope

got soccer?

got Jesus?
Conclusions

Refinement of the usage-based approach

– Statistical information is essential to learn both item-specific patterns and general constructions

– But communicative functions of constructions determine which dimensions of similarity are relevant to generalizations
Thanks for your attention!

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Got constructions?