

ENGLISH MORPHOLOGY IN CONSTRUCTION GRAMMAR

Nathan Schneider
Carnegie Mellon University

CSDL/ESLP
September 2010, San Diego

nathan@cmu.edu
http://www.cs.cmu.edu/~nnschneid

Challenges

CxG and ECG

Phenomena of interest

How does morphology fit into construction grammar theories?

Here, we treat morphological units as constructions and present a formal analysis of several morphological phenomena in English. This entails:

- describing **productivity** (which units can combine) and **compositionality** (how they combine to give shape and meaning to an expression)
- handling **nonconcatenative** morphographemics
- representing **paradigmatic** structure

Construction Grammar (CxG) views a language as an organized inventory of expressive conventions, known as *constructions*. Constructions pair (lexical and/or grammatical) **forms** with (semantic and/or pragmatic) **functions**, at different levels of abstractness. Form-function conventions present at the discourse level all the way down to subword units count as constructions. Language learning is taken to be the process of recognizing constructions in context and generalizing them to new situations.

Here we adopt the **Embodied Construction Grammar (ECG)** formalism, which provides a precise notation and computational parsing tools for analyzing the forms of constructions and their meanings in terms of embodied semantics. We have extended ECG to support **morphological constructions**, the focus of this work.

- inflectional**: nominal and verbal suffixes, plus instances of suppletion (inflections of *be*) and a usage-based treatment of subregular verb paradigms
- derivational affixation**: causative *-ize*, agentive *-er*, *-ee*, and *-ation*

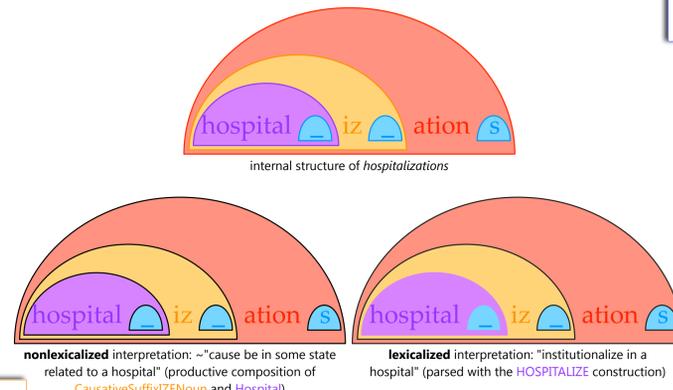
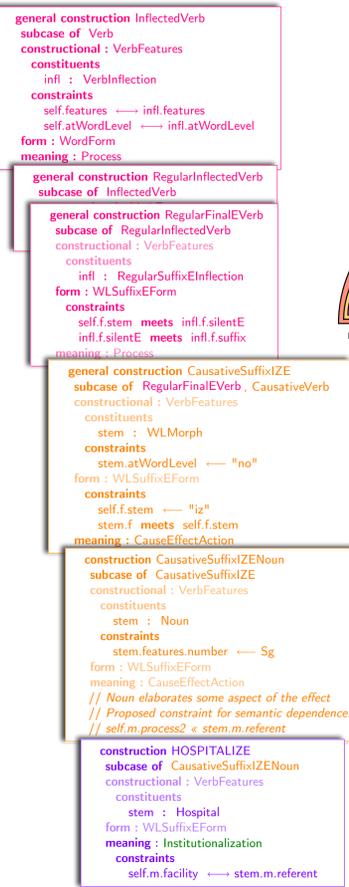
The basic approach: Stem constructions compose within affix constructions, which in turn compose within syntactic constructions as words. Each construction specifies how the form and meaning of its constituents are incorporated into the form and meaning of the whole. Constructions need not be fully compositional in the traditional sense.

Constructions in the grammar

Morphological compositionality

↑ general

↓ specific



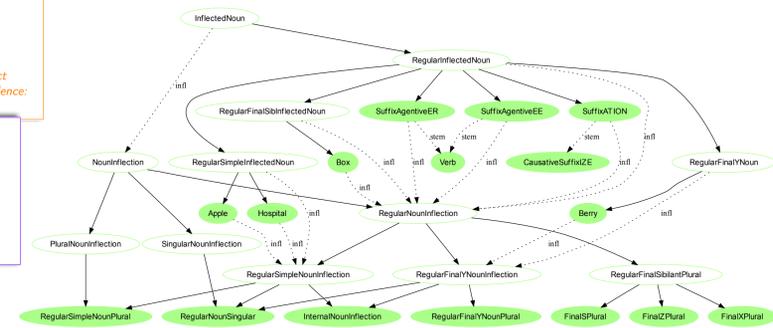
Semantic Specification of mover. The output of the ECG analyzer for the string "mover" given our grammar, this shows form and meaning schemas arrived at via composition of the verb stem and suffix. Note that role bindings indicate correspondence (identity) among the mover and protagonist roles of the Motion schema and the referent of the derived noun.

Test Set

We verified our grammar by testing the following expressions in the ECG analyzer:

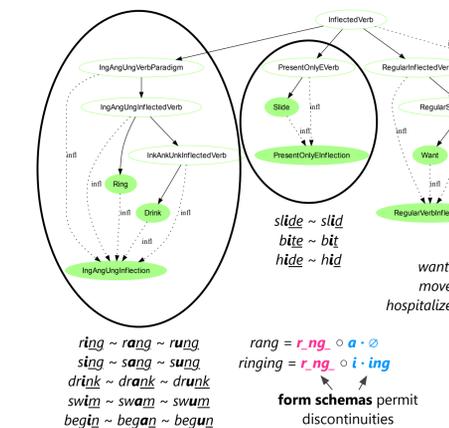
apple	moving	past, papart	drink	base, present3sg	mover	*appl	*bo	*wandt	*sliding	*stud	*moverser
apples	moved		drinks		slider	*apples	*boxe	*mov	*slidesing	*dranked	*ize
box	slide	base, present3sg	drinking		legalizer	*apples	*boss	*movs	*slided	*drankd	*legaliz
boxes	slides		drank		legalizers	*applr	*boxeses	*moving	*slidedd	*drankdng	*legalizationr
berry	sliding		drunk		legalization	*applr	*berrys	*movingg	*slid	*legalizing	*legalizationg
berries	slid	past, papart	legalize	base, present3sg	legalizations	*s	*wanting	*moved	*slide	*mover	*legalizationg
want	base, present3sg	ring	base, present3sg	legalizes	hospitalizations						
wants	ringing			legalizing	is						
wanted	rang	past, papart	wanting	legalized	past, papart	were					
move	base, present3sg	ring	base, present3sg	legalized	past, papart	were					
		move		ringg		wanter					

These words fit straightforwardly into argument structure constructions, which enforce agreement.



Future work

- Descriptions of more constructions in English and other languages
- A formal constructional/cognitive account of morphophonology
- Algorithms for learning morphological constructions



Inheritance hierarchy for verbs. Circled portions indicate the two subregular paradigms identified by Bybee & Slobin (1982). A paradigm is defined by phonological characteristics and inflectional patterns shared by a group of verbs.

Benjamin K. Bergen, Towards morphology and agreement in Embodied Construction Grammar. Manuscript, March 2003. URL: www2.hawaii.edu/~bergen/papers/ECGmorph.pdf.
 Benjamin K. Bergen and Nancy Chang, Embodied Construction Grammar in simulation-based language understanding. In Jan-Öla Östman and Mirjam Fried, editors, *Construction Grammars: Cognitive Grounding and Theoretical Extensions*, pages 147-190. John Benjamins, Amsterdam, 2005.
 Geert Booij, Compounding and derivation: evidence for Construction Morphology. In Wolfgang U. Dressler, Franz Rainer, Dieter Kastovsky, and Oskar Pfeiffer, editors, *Morphology and its Demarcations*, pages 109-132. John Benjamins Publishing Company, 2005.
 Geert Booij, Construction morphology and the lexicon. In Fabio Montemari, Gilles Boyé, and Nabil Harboub, editors, *Selected Proceedings of the 5th Dialectometrics: Morphology in Toulouse*, pages 34-44. Somerville, MA, 2007. Cascadia Press.
 John Bryant, Best-fit constructional analysis. Ph.D. dissertation, University of California, Berkeley, 2008.
 Joan L. Bybee, *Phonology and Language Use*. Cambridge University Press, 2001.
 Joan L. Bybee, *Morphology: A Study of the Relation between Meaning and Form*. Typological studies in language. John Benjamins, Amsterdam, 1985.
 Susanne Z. Riehemann, Type-based derivational morphology. *The Journal of Comparative Germanic Linguistics*, 2(1):69-77, 1998.
 Johanna Rubia, *Discontinuous Morphology in Modern Aramaic*. Ph.D. dissertation, University of California, San Diego, 1993.
 Nathan Schneider, Computational cognitive morphosemantics: modeling morphological construction in Hebrew verbs with Embodied Construction Grammar. *Berkeley Linguistics Society* 36, 2010.
 Nathan Schneider, Constructional morphosemantics: building Hebrew verbs. In Hans C. Boas, editor, *Computational Approaches to Construction Grammar and Frame Semantics*. John Benjamins, Amsterdam. To appear.
 Michael Tomasello, *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Harvard University Press, Cambridge, MA, 2003.

- morph.grm**
- gen cxn WRGOT
 - gen cxn Morph
 - gen cxn WLMorph
 - gen cxn Affix
 - gen cxn Suffix
 - gen cxn WLAffix
 - gen cxn WLSuffix
- verbmorphology.grm**
- gen cxn InflectedVerb
 - gen cxn RegularInflectedVerb
 - gen cxn RegularSimpleInflectedVerb
 - gen cxn Want
 - gen cxn RegularFinalEVerb
 - gen cxn Move
 - gen cxn PresentOnlyEVerb
 - gen cxn Slide
 - gen cxn VerbInflection
 - gen cxn RegularVerbInflection
 - gen cxn SuffixEInflection
 - gen cxn RegularSuffixEInflection
 - gen cxn BareInflection
 - gen cxn PresentNonSgInflection
 - gen cxn NonWordLevelInflection
 - gen cxn BaseInflection
 - gen cxn WordLevelInflection
 - gen cxn Present3SgInflection
 - gen cxn PastInflection
 - gen cxn PresentParticipleInflection
 - gen cxn PastParticipleInflection
 - gen cxn InternalInflection
 - gen cxn PastInflectionBare
 - gen cxn PresentOnlyEInflection
 - gen cxn PastParticiplePresentOnlyEInflection
 - gen cxn IngAngUngVerbParadigm
 - gen cxn IngAngUngInflectedVerb
 - gen cxn Ring
 - gen cxn InkAnkUnkInflectedVerb
 - gen cxn Drink
 - gen cxn IngAngUngInflection
 - gen cxn BaseIngAngUngInflection
 - gen cxn PresentNon3SgIngAngUngInflection
 - gen cxn Present3SgIngAngUngInflection
 - gen cxn PastIngAngUngInflection
 - gen cxn PastParticipleIngAngUngInflection
 - gen cxn PresentParticipleIngAngUngInflection
 - gen cxn BEAbstract
 - gen cxn Be
 - gen cxn Am
 - gen cxn Is
 - gen cxn Are
 - gen cxn Was
 - gen cxn Were
 - gen cxn Been
 - gen cxn Being
- nounmorphology.grm**
- gen cxn PluralNoun
 - gen cxn InflectedNoun
 - gen cxn RegularInflectedNoun
 - gen cxn RegularSimpleInflectedNoun
 - gen cxn RegularFinalSibilantInflectedNoun
 - gen cxn RegularFinalNoun
 - gen cxn NounInflection
 - gen cxn InternalNounInflection
 - gen cxn SingularNounInflection
 - gen cxn PluralNounInflection
 - gen cxn RegularNounInflection
 - gen cxn RegularSimpleNounInflection
 - gen cxn RegularNounSingular
 - gen cxn RegularSimpleNounPlural
 - gen cxn RegularFinalNounInflection
 - gen cxn RegularFinalNounPlural
 - gen cxn RegularFinalSibilantPlural
 - gen cxn FinalSPPlural
 - gen cxn FinalZPlural
 - gen cxn FinalPlural
 - gen cxn FinalSHPPlural
 - gen cxn FinalCHPlural
- inflectionalsuffixes.grm**
- gen cxn BareSuffix
 - gen cxn Suffix
 - gen cxn EDSuffix
 - gen cxn NSuffix
 - gen cxn INGSuffix
- derivationalsuffixes.grm**
- gen cxn DerivationalMorpheme
 - gen cxn SuffixAgentiveER
 - gen cxn SuffixAgentiveEE
 - gen cxn SuffixATION
 - gen cxn CausativeSuffixIZE
 - gen cxn CausativeSuffixIZEAdj
 - gen cxn CausativeSuffixIZENoun
 - gen cxn HOSPITALIZE