Techniques of A.I. 2
- 24/03/2006: Construction Grammar

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These slides will be posted on the course’s web page with more information on evaluation of this particular subject.
‘Tits like coconuts’

... and sparrows like breadcrumbs.
Construction Grammar (CG)
Contents

• Traditional Linguistics

• The Chomskyan Revolution

• Construction Grammar (CxG)

• Adding ‘Fluidity’ to Construction Grammar

• Summary

• Recommended readings
Traditional Linguistics

Modular approach to language

- Phonetics & Phonology
- Morphology
- Syntax
- Semantics
- Pragmatics
Phonetics & Phonology

- *Le boulanger but onze bières.* - “The butcher drank eleven beers.”
Phonetics & Phonology

• Phonetics = the study of speech sounds
  
  • *card* versus *core*

  • *Did you see me?* versus *You saw me.*

  • Already a lot of variety and complexity

    *She sells sea-shells at the shore, and the shells she sells are sea-shells, I’m sure.*

• Phonology = the study of ‘discriminative’ sounds in a language

  • Minimal pairs: *fast* versus *last*

  • *Phonemes* are the smallest units that *cause* a change of meaning
Morphology

- A **morpheme** is the smallest unit that **carries** (lexical or grammatical) meaning
  - Unbound morpheme (house [house]) can occur as words
  - Bound morpheme (-s as in houses [Plural])
- Obvious problems with the definition:
  - *give-s* versus *was* versus *men* ([man] + [plural] ???)
Syntax (vs Lexicon)

- Set of rules that organize the sentence

  - S -> NP VP
  - NP -> Det Noun
  - Det -> the, a
  - Noun -> cat, book, ...
  - VP -> V
  - V -> hold, fall, give, ...

The cat jumped.
Semantics & Pragmatics

- Semantics = study of “meaning” in language
  - Paraphrasing (~ dictionary)
  - Logic
  - Procedural semantics

- Pragmatics
  - Traditionally: ‘waste basket’ for unsolved problems
  - Recent: study of functional and perspective pressures (= language use)
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The Chomskyan Revolution

- 1957: Syntactic Structures
  - Transformational grammar

- 1965: Aspects of a Theory of Syntax
  - Generative grammar

- Universal Grammar and the Language Acquisition Device (LAD)

- Nativist view on language acquisition
Why Chomsky was good

• Influence in formal languages (~ Chomsky hierarchy)

• Observation that language can learn us something about the human mind (vs ‘behaviouristic linguistics’)

• Created a totally new research paradigm within linguistics

• Catalyst of reactions
Why Chomsky is bad

- Reduces grammar to syntax and lexicon
  - Meaning is regarded as trivial
- ‘Competence’ versus ‘Performance’
  - Communication is ‘only side-effect and has no influence on form’
- ‘Universal Grammar’ without empirical evidence
  - Circularity and problems to gather empirical data
- Intellectual falsification
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- ‘Vanilla’ Construction Grammar (~ Croft 2005)

- Fillmorean CxG

- More cognitive approaches to CxG
‘Vanilla’ Construction Grammar

• CxG = a family of theories

• Shared assumptions:
  • Grammatical knowledge = organized in constructions (form-meaning pairs)
  • Syntax-lexicon continuum
  • Structured inventory

• Range from ‘universalists’ (Fillmore - Kay - Goldberg) to ‘language-specificness’ (Croft - Langacker)
‘Vanilla’ Construction Grammar

• Construction = a conventional symbolic unit

• ‘Conventional’ = shared by a speech community
  ‘Symbolic’ = pairing of form and meaning
  ‘Unit’ = entrenched routine

• [cat] - cat

• [to die - idiom] - (kick+Tense) the bucket

• [CAUSE-MOTION  Agent  Goal  Theme]
  Instance: sneeze  sneeze  sneeze-place  sneezed
  Predicate  Subject  Oblique  Object
  ‘He sneezed the napkin of the table’.
  ‘He flipped me his card.’
  ‘She tossed him a bottle.’
‘Vanilla’ Construction Grammar

- Syntax-lexicon continuum

  - [big] - *big*: definitely lexicon
  
  - [to die] - *kick(+-tense) the bucket*: part of lexicon, syntax or both?
  
  - *I love you*: rule or fixed expression?
  
  - *John saw Mary*: Clearly from a very productive SVO-construction

- All ‘traditional’ linguistic modules are integrated within the constructions
‘Vanilla’ Construction Grammar

- Grammatical knowledge = structured inventory of a speaker’s knowledge of the conventions in her speech community

- Goldberg: inheritance networks
  
  e.g. *John baked Mary a cake.*
  = benefactory di-transitive constr. that inherits its central meaning from the more productive di-transitive construction.

- Langacker: usage-based model

- FCG: usage-based + variables
Construction Grammar

- ‘Vanilla’ Construction Grammar (~ Croft 2005)
- Fillmorean CxG
- More cognitive approaches to CxG
Fillmorean Construction Grammar

- Charles J. Fillmore = father of CxG framework

- Most important claim: organization of grammar as constructions (Form-Meaning Pairs)

- According to Fillmore, CG should...

  - be a generative grammar and thus formalizable;

  - integrate all domains or components of grammar (phonology, morphology, syntax, semantics and pragmatics);

  - be a grammar with universal impact;

  - be consistent with what is known about cognition and social interaction.
(Fillmorean) Construction Grammar

• Generative?

• It should be able to describe, analyze and generate all the linguistic constructs of a language

• No distinction between ‘core grammar’ or ‘periphery’ (~ Chomsky)
  E.g. *John loves Mary* is not more central than *Ay caramba!*

• Can be formalized


• Flirts with HPSG (Head-Driven Phrase Structure Grammar).
(Fillmorean) Construction Grammar

- Integration of all domains?
  - There is no sharp division between syntax and the lexicon;
    - Words: cat - [cat]
    - Expressions: kick the bucket - [to die]
    - General constructions: SVO-word order
  - Form-Meaning pairs combine in the first place semantics and syntax, but also contain phonological and morphological information (vs traditional ‘modular’ approach)
  - Linguistic knowledge = inventory of constructions
    - Hierarchically organized;
    - Inheritance relations between constructions.
(Fillmorean) Construction Grammar

• Universal impact?
  
  • “[...] sharing of abstract constructions across languages [...]”  
    (Kay & Fillmore 1999 - p. 1)
  
  • the architecture of the representation system is not only considered to be a grammatical theory, but also as a general model of language
  
• Be consistent with studies in cognition and social interaction?
  
  • “Unfortunately, the cognitive dimension of Construction Grammar has been somewhat neglected by late. [...] Kay’s definition of CG] lacks any reference to the cognitive and interactive dimensions [...].”  
    (Östman & Fried 2005 - p. 4-5)
  
  • Only recently, discourse and pragmatic issues are starting to be taken into account
  
• Recent “flirtations” between Kay and the (generative) grammar formalisms HPSG and LFG (Lexical-Functional Grammar) seem strange
(Fillmorean) Construction Grammar

- How is the Semantic pole implemented?
  - Frame Semantics
  - FrameNet Project
    (International Computer Science Institute in Berkely)
Construction Grammar

- ‘Vanilla’ Construction Grammar (~ Croft 2005)
- Fillmorean CxG
- More cognitive approaches to CxG
More cognitive approaches to CxG

• Radical Construction Grammar (William Croft)
  
  • All constructions are language-specific

  • All categories are defined by constructions (and thus Cx-specific)

  • Constructions = primitive units in language
    (no real formal categories such as noun, verb, adjective, etc. or syntactic relations)

• Cognitive Grammar (Ronald W. Langacker)

• George Lakoff (?) - Nancy Chang - Benjamin K. Bergen
  (implementation of image schemas in Embodied Construction Grammar)
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Adding more ‘Fluidity’ to CxG

- ‘Open-endedness’ towards linguistic categories and constructions
- Emergent Grammar
- Multi-agent perspective and Social dynamics
- Bi-directionality (explicit addressing both production and parsing)
Open-endedness in constructions and categories

- Evidence from linguistic typology: talking about directions in Manam

Diagram:
- ilau ‘seaward’
- ata ilau
- ilau ata
- ata ilau
- ilau awa
- awa ilau
- at a auta
- awa auta
- auta at a
- auta awa
- auta ‘inland’
Open-endedness in constructions and categories

• Specific versus abstract locatives (e.g. Pomo vs English)
  
  • *dul* - *xka* - *t*
    across/over (water) paddle they
    ‘They paddled across water.’

  • Locatives contain information on the nature of the goal (water, surface, enclosed space, ...), the travel medium (water, land), deviations from a straight line (up, down, random, circular) and changes in motional state (come to rest, intensive change in state)

• Elevational markers (e.g. Alamblak)

  • *fēh* - *m* - *ko*
    pig -3 Plural up (higher than speaker)
    ‘the pigs up there’
Open-endedness in constructions and categories

- Location is expressed by constructions, cases, prepositions, directional and spatial verbs, adverbial phrases of space, etc.

- All languages seem to categorize differently

- Not all languages distinguish between nouns, verbs, adjectives, prepositions, adverbs, etc.

- All languages have “nouns” and “verbs”, but they behave differently

- For almost every claim on linguistic universals, there is a typologist who has evidence of some “weird” or “exotic” language that falsifies the universal
Adding more ‘Fluidity’ to CxG

• ‘Open-endedness’ towards linguistic categories and constructions

• Emergent Grammar

• Multi-agent perspective and Social dynamics

• Bi-directionality (explicit addressing both production and parsing)
Emergent Grammar

• Languages change all the time

• Changes in sounds
  hebban olla vogal-a vs hebben alle vogels
  have-3PL all bird-PL
  ‘All the birds have...’

  Latin: *Pater* - French: *Père* versus Dutch: *Vader* - English: *Father*

• Changes in or addition to word meaning
  wif -> wijf
  ‘woman’ -> ‘bad woman’ (very negative connotation)

  mouse -> animal
  computer mouse
Emergent Grammar

- Changes in syntax
  E.g. loss of case system in English - word order replaces it
  *You saw her bathing on the roof.*
  Remnants of case is still present in pronouns.

- Is English still English?
  *He ærest sceop* (Old English)
  he first created
  ‘He first created...’

  *And smale fowles maken melodye* (Middle English)
  and small birds make songs
  ‘And small birds are singing songs...’
Emergent Grammar

• Grammaticalization

• Example of Thaï:
  \textit{thân cà bin maa Krungthêep}
  he will fly come Bangkok
  ‘He will fly from Bangkok.’

• Example in Dutch:
  \textit{ik loop even naar de bakker}
  I go.1SG swiftly to the bakery
  ‘I’m going to the bakery for a moment.’

\textit{lopen} ‘go / run’ is gradually becoming more common, and its specific meaning of ‘running’ is being replaced by \textit{rennen} ‘run’.
Emergent Grammar

- Heterogeneity in a speech community
  - Different dialects;
  - Personal preferences (ideolects);
  - Social influences (job interview versus bar talk);
  - ...

Emergent Grammar

- Language is a complex adaptive system that is self-organized much like an ant path is formed (~ Talking Heads experiment, Luc Steels);

- ‘Fluidity’: Some constructions are not yet conventionalized in a speech community, and others might lose their status;

- Multi-agent perspective and the Language Game Framework to take functional - pragmatic - social dynamics into account

- Language
  - Infrastructure: cognitive capabilities of a language user
  - Use/function: linguistic behaviour of a language user
  - These two are sides of the same coin
Adding more ‘Fluidity’ to CxG

- ‘Open-endedness’ towards linguistic categories and constructions
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Reference material: bibliography of Luc Steels from 1995 until now
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Summary

- Construction Grammar = family of theories

- Specific ‘Fluid CxG’ that we adopt:
  - Constructions (form-meaning pairs);
  - Open-endedness towards grammatical categories and constructions;
  - Emergent grammar
    (language is fluid, language is a complex adaptive system)
  - Cognitive view combined with (functional-pragmatic) language game framework and population dynamics.
Recommended readings

General Linguistics

  [Webpages on some traditional linguistic topics, a decent introduction for beginners.]

  [Dictionary of linguistic terminology. Might come in handy, but it does not contain specific terminology on
  Construction Grammar.]

Computational Linguistics

  [Excellent introduction to computational linguistics and linguistics in general. Tackles all traditional modules in
  language (including unification grammars and feature structures) and gives important bibliographical and historic
  pointers.]
Recommended readings

Construction Grammar

  [Impressive evidence from languages across the world that there are no universal linguistic categories.]

  [The introduction contains a characterization of ‘Vanilla Construction Grammar’ and the rest of the article summarizes RCG very well.]

  [Best developed framework for Construction Grammar on the side of the group ‘Fillmore - Kay - Goldberg’. Influential papers of Paul Kay and Charles Fillmore are downloadable on their websites.]

  [Collections of papers, with good introduction articles on the history and cognitive foundations of CG.]
Recommended Readings

Fluid Construction Grammar

  [Contains links to important publications.]

- Bibliography of Luc Steels from 1995 until now
  [List of publications that starts with the Naming Game in 1995. These publications mainly deal with lexicon formation, but are of great value and importance for carrying the research into the domain of grammar.]
Questions and Answers...

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