

Topics in the Lexical Semantics–Morphosyntax Interface

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Extensions, II: Word formation vs. phrase formation from a
semantic perspective

Up to now

- ▶ Proposal to use separate tools to analyze composition of descriptive contents from the composition of token reference.
- ▶ Verb-based idioms as one example where this could be illuminating.
- ▶ Another example: Word formation

Outline for Part 8

- ▶ Why word formation is a challenge for semantic theory
- ▶ Insights and limitations of current approaches to the semantics of word formation
- ▶ Some tentative paths forward
- ▶ Last words on the course

“Word” for the purposes of this session

- ▶ My interest is in how we form new **names** for **classes** of entities (including events and properties) based on **preexisting** pieces of language, e.g.:
AGI (artificial general intelligence), *antipassivization*, *babyccino*, *bidding war*, *tech-savvy* [OED, June 2024]
- ▶ Setting aside (for the sake of discussion):
 - ▶ Names for single entities (*The University of the West Indies*)
 - ▶ Identifying descriptions of particular entities in context (*happy children*, *everybody*)
 - ▶ Other expressions that do not function as predicates of or relations between entities (*whether*)
- ▶ Roughly equivalent to a subtype of lexeme, with no *a priori* assumptions about how they map onto a hypothetical word/phrase distinction.

The questions

Clearly, there are form-meaning regularities in the way new words are formed from preexisting pieces of language.

- ▶ On what basis do language users choose the component parts for a new word?
- ▶ Can we assign these components parts meanings?
 - ▶ If so, can we define rules to compose these meanings into the meaning of the new word?
 - ▶ If not, how do hearers know what the new word means, and how can speakers count on hearers figuring out what the new word means?
- ▶ What do the answers to these questions tell us about language more generally?

Why word formation matters

- ▶ Word formation is a source of linguistic creativity, just as syntax is.
 - ▶ \approx 1000-1500 new forms added to the OED every year.
 - ▶ \approx 4000 Catalan neologisms detected/year since 1989, \approx 43% involve affixation Freixa i Aymerich 2019; similar data for Spanish.
 - ▶ Many more words don't get into dictionaries.
- ▶ Language users use knowledge about patterns of complex word forms and meanings when they make new words.
- ▶ In the debate over the similarities between morphology and syntax, semantic considerations should be relevant.

Building word meanings: First attempts

- ▶ Long history of attempts to decompose word meanings into primitives
- ▶ Motivations:
 - ▶ Machine translation (Mel'čuk 2000)
 - ▶ Search for universals of human thought/conceptualization (Leibniz, Wierzbicka 1972, Jackendoff 1990)
 - ▶ Generalizations about the morphosyntax/semantics interface (Lakoff 1965, McCawley 1968, Dowty 1979)
- ▶ Two problems:
 - ▶ How, if at all, to define these primitives?
 - ▶ How universal are they, and how many can be defined?

Classic problems with primitives

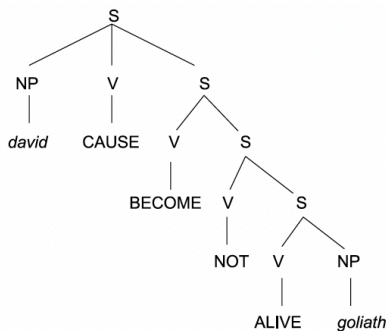
enter
V
___ <NP_{*j*}>
[Event GO ([Thing]_{*i*}), [Path TO ([Place IN ([Thing]_{*j*}))]]

- ▶ Primitives are typically based on English words, often not exactly translatable across languages (Bowerman 1996)
- ▶ Reduces specifying meaning to an unsolved problem (“markerese”, see Lieber 2020 for overview)

Jackendoff (1990: 46), cited in Engelberg (2011).

Dowty's partial solution

Dowty (1979): Proposed model-theoretic denotations for Lakoff and McCawley's primitives for verbs.



Dowty's partial solution

- ▶ Dowty aimed only “to show that the kind of decomposition analysis produced in G[enerative]S[emantics] can form a useful basis for expanding the class of entailments among English sentences that are formally provable in the theory” (viz., Montague Semantics, Dowty 1979: 31)
- ▶ “[i]n fact, the analysis I will propose below turns out not to require the assumption that the meanings of accomplishments and achievements are exactly ‘decomposable’ in terms of operators like CAUSE and BECOME at all, but merely that these two classes of verbs logically entail BECOME-sentences (or other formulas with equivalent semantic properties).” (op. cit.: 137)

Dowty's semantics for primitives: Some examples

- ▶ $[\phi \text{ CAUSE } \psi]$ is true if and only if (i) ϕ is a causal factor for ψ , and (ii) for all other ϕ' such that ϕ' is also a causal factor for ψ , some $\neg\phi$ -world is as similar or more similar to the actual world than any $\neg\phi'$ -world is.
- ▶ $\text{BECOME}(\phi)$ is true at I iff (1) there is an interval J containing the initial bound of I such that $\neg\phi$ is true at J , (2) there is an interval K containing the final bound of I such that ϕ is true at K , and (3) there is no non-empty interval I' such that $I' \subset I$ and conditions (1) and (2) hold for I' as well as I . (p. 141)

A payoff: Extension to affix semantics

Dowty leveraged these primitives for the semantics of certain affixes in English:

- ▶ *-en* forms inchoative verbs from adjectives (*soften*, *redde**n*, *widen*, etc.): $[[\text{-en}]]([\text{soft}]]$:
 $\lambda P \lambda x. \mathbf{BECOME}(P(x))(\lambda y. \mathbf{soft}(y)) =$
 $\lambda x. \mathbf{BECOME}(\mathbf{soft}(x))$
- ▶ Similar extensions possible for causative morphology (e.g., *-ate*, *-ize*, *-ify*)
- ▶ Inspired some further formal semantic work on word formation (e.g., Koontz-Garboden 2007; Pross 2019, and references therein)

Beyond change of state and causation

- ▶ Independently of the empirical adequacy of Dowty's proposed semantics (see, e.g., Ramchand 2008; Alexiadou *et al.* 2015; McNally 2024), another, a more serious problem is apparent affix polysemy.
- ▶ Especially visible in nominalization.

Semantic category	Paraphrase	Example	Translation
Event	'action of V-ing'	<i>lavage</i>	'washing'
Product	'resulting object'	<i>construction</i>	'building'
Means	'what Vs'	<i>emballage</i>	'wrapping'
State	'fact of being Ved'	<i>embrouillement</i>	'muddle'
Manner	'manner of V-ing'	<i>marche</i>	'gait'
Location	'place where one V-s'	<i>garage</i>	'garage'
Group	'people who V'	<i>équipage</i>	'crew'
Period	'time during which one V-s'	<i>hivernage</i>	'wintering'

From Plag *et al.* 2018, data due to B. Fradin)

Beyond change of state and causation

- ▶ No obvious single semantics for the affix.
- ▶ Difficult to argue that the affix simply turns the base into a reification of the base:
 - ▶ Range of participants in a situation type can be the referents
 - ▶ We cannot even rely strictly on the argument structure of the verb – consider e.g. Manner, Period.
- ▶ Yet there are strong generalizations (see e.g. Plag *et al.* 2018 on English *-ment* or Fradin 2024 on French noun-forming *-ier*).
 - ▶ ARTEFACT-*ier*: Trader/producer of ARTEFACT
FRUIT-*ier*: Tree bearing FRUIT
SUBSTANCE-*ier*: Container for SUBSTANCE
 - ▶ Yet the affix does *something*: *chapelier* vs. *chapellerie*

Other general problems in the semantics of word formation

- ▶ Not always clear what (classical) semantics to give the base
 - ▶ Semitic roots: What does e.g. [ktb] contribute?
 - ▶ Affix replacement: e.g., *altruism* / *altruist*, *incarceration* / *decarceration* (e.g., Booij and Masini 2015)
- ▶ The morphological structure of the word may not correspond to the semantic composition
 - ▶ *decarceration* 'reducing the use of imprisonment'; *aquamation* (= *water cremation* = *resomation*; *aquamator* exists with unrelated meaning; *aquamate* does not appear to exist)
- ▶ Without semantics for all component parts and proper structure to support composition, how to calculate meaning?

Strategies we have already seen

Treat affix as an **indexically** valued function of (possibly indexically valued) base:

▶ *lavage*: $\lambda x.(f_c(\mathbf{laver}))(x)$

▶ Observations

- ▶ Suitably flexible.
- ▶ Limited explanatory value, as with adjectives and verbs.
- ▶ Not clear how to make it work for bases to which no obvious indexical value can be assigned.

Strategies we have already seen

Alternative composition rules (Namer & Jacquy 2013, a.o.):

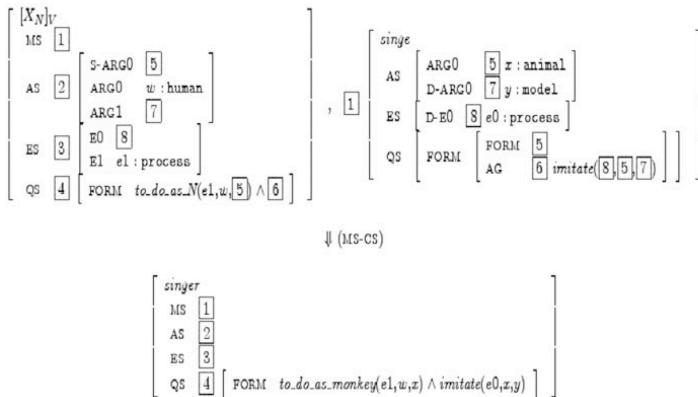


Fig. 17.3 Conversion class -3-: $\text{singe}_N \rightarrow_{\text{conv}} \text{singer}_V$

- **Observations:** Complex, and assumes semantics can be assigned to individual word parts.

Strategies we have already seen

Alternative lexical representations (Plag *et al.* 2018):

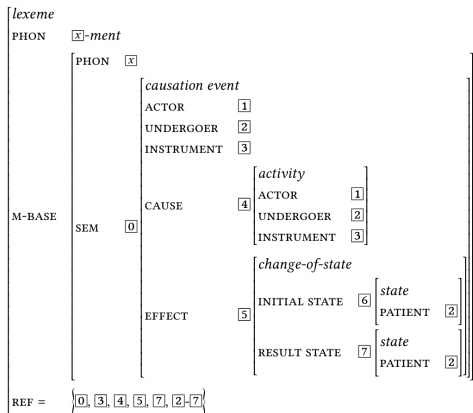


Figure 4: *-ment* on change-of-state verbs

- **Observations:** Complex, and assumes semantics can be assigned to individual word parts.

Strategies we have already seen

Rich type polymorphism:

- ▶ Asher (2011): Nominalizing suffixes as “arrows” that shift the type of the base to the type of the newly formed word.
 - ▶ $\text{-ION}(\text{EVT}) \Rightarrow \text{E}$
- ▶ **Observations:**
 - ▶ Noteworthy: Affixes are given fundamentally different sort of semantics from bases.
 - ▶ Rich type system has little specific to offer over other approaches other than slightly improved treatment of base semantics.

Strategies we have already seen

Vector-based semantics:

- ▶ Marelli and Baroni (2015): Early proposal to treat affixes as functions from base vectors to full words vectors

- ▶ $-IER(\overrightarrow{\text{chapeau}}) = \overrightarrow{\text{chapelier}}$

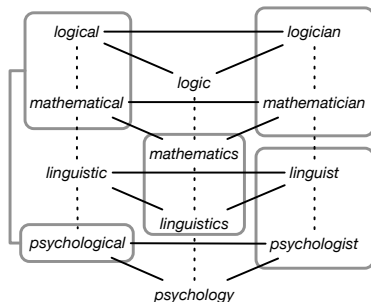
- ▶ Vectors can be formed for subword strings of characters (e.g. Bojanowski *et al.* 2017): Alternative way to capture affix semantics, even without morphological parsing.

- ▶ **Observations:**

- ▶ Allows (but does not force) one to eliminate discreteness of component words parts.
 - ▶ Subword vectors can be composed in a “flat” way, avoiding problems of word structure-meaning mismatches.
 - ▶ Some potential for working for new words.
 - ▶ But depending on how this is done, may little resemble semantic composition based on syntactic structure.

Another idea: Use a structured lexicon

McNally *et al.* (2024): Reason probabilistically over structured lexicon



- ▶ Opens the door to associating scenario knowledge (Sanford and Garrod 1998) with **word families**, and only indirectly with individual words.
- ▶ Other kinds of information (e.g. about likely sort of reference) can be associated with **morphological series**.

Another idea: Use a structured lexicon

- ▶ Intended to model what happens when an unfamiliar word is encountered or a new complex word is coined.
- ▶ Joint reasoning on scenario and word series information (+ context) \Rightarrow name-concept pair.
- ▶ Maintains a certain discreteness in linguistic system via the family/series distinction (and their respective semantic contributions), without requiring discreteness within the word structure itself.
- ▶ But it requires rethinking lots of basic theoretical assumptions.
- ▶ To be continued...

Last words

- ▶ Recognizing the ways in which lexical semantics and the composition of lexical contents differ from the referential dimensions of meaning can open areas for research that have historically remained on the margins of formal semantics.
- ▶ Exploring the lexicon is easier now because new tools can be added to complement formal semantic analyses where there are reasons to do so.
- ▶ Bringing in these tools can benefit syntactic analysis and have implications for larger questions in syntactic theory as well.

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










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