

Lexicon in Linguistic Theory

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June 24 - July 19, 2019
2019 LSA Linguistics Institute
University of California Davis



Lecture 2: June 27

Lexicon in Syntactic Frameworks

- Lexicon-syntax interface: core issues
- First approaches to lexical issues and Structuralism
- Generative Grammar
- Head-Driven Phrase Structure Grammar (HPSG)
- Construction Grammar
- Generative Lexicon

Lexicon-syntax interface: core issues

- Syntactic theories are primarily interested in accounting for the combinatorial properties of natural languages, i.e., how words are combined into phrases and sentences.
- Today we will look at how different syntactic frameworks make use of lexical information.
- **Lexicon-syntax interface**: factors involved in how the lexical and syntactic components interact.

Lexicon-syntax interface: core issues

- 1 Are lexicon and syntax clearly separated?
- 2 Do the lexical properties determine how syntactic structure is built (*bottom-up approach*) or does the syntactic structure impose its constraints on the lexicon (*top-down approach*)?
- 3 Are linguistic and encyclopedic kinds of knowledge demarcated?
- 4 Are regularities and productive processes included into the lexicon or are they considered purely syntactic?

First approaches to lexical issues

- Aristotle's *Metaphysics*: compositional hierarchy of linguistic units; syntactic functions (subject/predicate); aspectual classification of verbs; *aitia*
- Starting from the Middle Ages: language change and etymology (James Murray's *Oxford English Dictionary*)
- 19th century: Erdmann, Brèal (polysemy; early theories of semasiology)

European and American Structuralism

- 20th century: shift from diachrony to synchrony; development of linguistics as a theoretically grounded discipline
- **Linguistic sign**: arbitrary conjunction of acoustic form and conceptual meaning. → **arbitrary and unmotivated lexicon**
- Language as a system of *signs*. The *value* of each sign is determined by the relations it holds with other signs
- **Syntagmatic/ paradigmatic relations** between linguistic units

1 mis- $\left\{ \begin{array}{l} \text{adventure} \\ \text{conduct} \\ \text{diagnosis} \end{array} \right\}$

2 John told us about his $\left\{ \begin{array}{l} \text{misadventure} \\ \text{misconduct} \\ \text{misdiagnosis} \end{array} \right\}$.

- **Is there a connection between paradigmatic and syntagmatic relations? Do semantically related words show similar syntactic behavior? → Sessions 4, 7, 8**

European and American Structuralism

- Lexicon is not seen as a separate component of grammar because grammar and lexicon can be functionally equivalent: the same linguistic distinction may be encoded grammatically or lexically (Saussure)

1 *spros-i-t*^P / *spraš-iva-t*^I 'ask'

2 *govor-i-t*^I / *skaz-a-t*^P 'say'

- American Structuralism (Bloomfield): lexicon as a “list of basic irregularities”

Drastic separation of lexicon and grammar: all the regularities in the construction of words/phrases are encoded in grammar and morphology, and the lexicon lists the morphemes and grammatically unpredictable combinations of morphemes

European and American Structuralism

- **Componential analysis, lexical decomposition**: word meaning is complex, it can be broken down into smaller components which can be studied independently from each other.
- **Lexical field**: representation of paradigmatic relations between words, which are analyzed and compared along a set of dimensions.
- Coseriu (1977): **lexical field** is a group of lexemes sharing semantic content and mutually opposed by means of minimal *distinctive features*.
- **Archilexeme**: set of features shared by all the lexemes in a lexical field, or an actual word presenting these features

Lexical field of cooking words (Lehrer 1974)

	Water	Oil or fat	Vapor	Liquid amount	Heat source	Cooking action	Special utensil	Added purpose	Cooking speed
<i>boil</i> ₁	+	-	-						
<i>boil</i> ₂	+	-	-			[Vigorous]			
<i>stew</i>	+	-	-			[Gentle]		[To soften]	[Slow]
<i>steam</i>	+	-	+				(Rack, sieve)		
<i>fry</i>	-	+	*				(Frying pan)		
<i>sauté</i>	-	+	*	[Small]					[Fast]
<i>broil</i>	-	-	*	*	[Radiant]	*			
<i>grill</i>	-	-	*	*	[Radiant]	*	(Grill, griddle)		
<i>barbecue</i>	-	-	*	*	[Radiant	*			
<i>charcoal</i>	-	-	*	*	(Hot coals)]	*			
<i>bake</i>	-	-	*	*	[Conducted]	*	(Oven)		
<i>roast</i>	-	-	*	*	[Radiant or	*			
					conducted]				

By way of comparison: distinctive features in phonology

	/p/	/t/	/k/	/b/
Consonant / Non-consonant	+	+	+	+
Compact / Diffuse	-	-	+	-
Grave / Acute	+	-		+
Nasal / Oral	-	-	-	-
Tense / Lax	+	+	+	-
Continuant / Interrupted	-	-	-	-

- Similarities: presence of gaps
- Differences:
 - Binary features are not expressive enough for lexical meaning (e.g., HEAT SOURCE)
 - No two opposed feature values can be applied to the same phoneme but this is acceptable for lexical units (*roast*: [*Radiant/conducted*] heat source)
 - No two phonemes share the same features, but words can be synonymous (*barbecue, charcoal*).

Evolution of the view on the lexicon in GG

Programmatic goals of GG: unveiling and formalizing universal properties underlying human language; separating them from the “residue”.

- **Syntax**: plays a central role since it drives the linguistic computation; it is regular and easier to model
- **Lexicon**: idiosyncratic and hence less relevant, acting in the service of syntax and morphology. Bloomfield’s “an appendix of the grammar, a basic list of irregularities”

- 1 *Syntactic Structures* (Chomsky 1957): grammar without a dedicated lexical component
- 2 *Aspects of the Theory of Syntax* (Chomsky 1965): lexicon separated from syntax; lexical entry as a structured set of irregularities
- 3 *Lexicalist Hypothesis* (Chomsky 1970): regularities in the lexicon
- 4 *Principles and Parameters Theory* (GB): *Projection Principle*
- 5 *Principles and Parameters Theory* (Minimalism): abstract lexical features trigger syntactic phenomena

Syntactic Structures (Chomsky 1957)

- Unanalyzed lexical units are embedded in **preterminal rules**

Derivation of *the houses*:

- $\text{NP}_{pl} \rightarrow \text{D} + \text{N} + \text{-s}$
- $\text{D} \rightarrow \textit{the}$
- $\text{N} \rightarrow \textit{house}$

Aspects (Chomsky 1965)

- Separate lexical component; lexical entries as feature matrices that account for selectional constraints
 - a. (*boy*, [+N, +D___, +Common, +Count, +Animate, +Human])
 - b. (*happiness*, [+N, +D___, -Count, +Abstract])
 - c. (*house*, [+N, +D___, +Common, +Count, -Animate, -Human])
 - d. (*hate*, [+V, +[+Animate] ___ NP])
- *Preterminal rules* are replaced with **lexical insertion rules**, that make sure that appropriate lexical items are inserted in the syntax.
 - a. *The boy hates around the corner.
 - b. ?Happiness hates the boy.
 - c. The boy hates the house.
- **Redundancy rules**: encode regular relations between lexical features: which features are predictable given others
 - a. [+Animate] → [±Human]
 - b. [+N] → [±Common]
 - c. (*boy*, [+D___, +Common, +Count, +Human])
 - d. (*house*, [+D___, +Common, +Count, -Human])

“Remarks on Nominalization” and Lexicalist Hypothesis

- Nominalization
 - Deadjectival Ns: *eager-eagerness, easy-easiness, difficult-difficulty*
 - Deverbal Ns: *ignore-ignorance, reside-residence, relax-relaxation*
- Nominalization rules are more constrained than syntactic rules →
Word derivation rules are encoded in the lexicon and not syntax →
Morphology is a lexical phenomenon
 - 1 Only some deadj. Ns can mirror the structure of full sentences:
 - a. John is eager to please / John's eagerness to please
 - b. John is easy to please / *John's easiness to please
 - 2 Idiosyncratic semantic relationships between derived N and base:
 - *ignore-ignorance* ('state or property related to V')
 - *reside-residence* ('place of V/ act of V')
 - *construct-construction* ('act or result of V')
 - 3 Derived Ns have the internal structure of NPs (not VPs/APs):
 - a. John's unmotivated criticism of the book/ *John's unmotivated criticizing the book.
 - b. John's three buildings/ {Many/some} of John's buildings.

Remarks on Nominalization and Lexicalist Hypothesis

- **Lexical redundancy rules** encode the regularities in derivational morphology
 - a. $[_{VP} V NP] \rightarrow [_{NP}[_{AP} V\text{-ble}] N]$.
 - b. *John is believable '=*John believes*' / This claim is believable '=*The claim can be believed*'.
- Two versions of the Lexicalist Hypothesis:
 - *Weak Lexicalist Hypothesis*: derivational morphology is a lexical phenomenon, while inflection is a syntactic one (Jackendoff 1975, Aronoff 1976, Anderson 1982, Booij 1996).
 - *Strong Lexicalist Hypothesis*: both derivation and inflection operate within the lexicon (Lieber 1980, Selkirk 1982, Di Sciullo and Williams 1982).

Principles and Parameters model

- The main goal is to capture the general properties of natural languages in the form of a limited set of innate and invariant in all languages principles of Universal Grammar (UG).
- Inter-language variation is determined by the vocabulary and the parameters (language-specific aspects of grammar).
- **Projection Principle**: syntactic structures are projected from the lexicon and lexical features must be preserved at every syntactic level, including Logical Form (Chomsky 1981).
- Lexical features dealt with are those involved in selectional constraints.

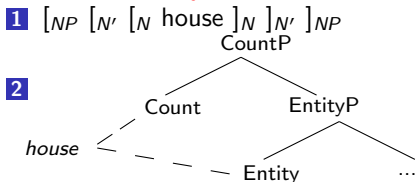
Minimalism

- *Minimal* (austere) syntactic representations
- **Inclusiveness Condition**: syntax is only allowed to rearrange “what you’ve already got” (lexical properties); no new objects may be added in the course of syntactic computation
- Stages of linguistic derivation:
 - 1 **Lexicalization**: process of turning linguistic features into words
 - 2 **Combination**: construction of syntactic structures from lexical items by *Merge*, whose application is determined by the selectional requirements of one of the combined elements
 - 3 **Externalization**: mapping to phonology

Minimalism

Lexicalization in the Syntax (Distributed Morphology, Nanosyntax)

- Syntax assembles features into words (*l-syntax*, Hale and Keyser 1993)
- Syntax manipulates morphosyntactic feature bundles, devoid of phonological form, and the vocabulary emerges post-syntactically by matching fragments of the syntactic tree with phonological form.
- → **Syntax can no longer be projected from the lexicon since there is no lexicon before syntax**



(Based on Starke 2014)

Minimalism

Properties of lexical features trigger syntactic phenomena:

- Some lexical items come with features that cannot be processed at the semantic and/or phonetic interface. By the **Full Interpretation principle**, they must be deleted before reaching the interfaces.
 - The *case* feature is always semantically uninterpretable.
 - The *number* feature is interpretable on Ns and pronouns, and uninterpretable on Vs and DETs
- An uninterpretable feature, *F*, of a head category *K* (*probe*), can only be deleted if it matches an interpretable feature, *F'*, of the category *K'* (the *goal*).

There has been a progressive reevaluation of the role of the lexicon in GG: from not even recognizing it as an independent component of grammar to aiming at discovering what lexical features determine the properties of the syntactic structure.

Issues pending for the following sessions

- Is lexical decomposition in the syntax justified?
- Is it justified assuming that syntactically relevant lexical features are syntactic in nature? Nirenburg and Raskin (1996):
“There is a thirty-year-old tradition in transformational syntax of “encroaching” into the domain of [lexical] semantics, often without recognizing or admitting it, usually in order to make some lexical features work for syntax. [...] One difference between earlier excursions from generative syntax into semantics and the current ones is that the latter do profess –and often show– an interest in at least some elements of word meaning per se.”
- How should we handle the rest of information encoded in lexical entries (i.e., conceptual content not necessarily visible to grammar)?

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Role of the lexicon in HPSG

- The role of the lexicon is very prominent → HPSG is a *lexicalized grammar*
- Lexical entries are rich and highly structured
- Lexicon as a whole is viewed as a system. Relationships between lexical entries are captured by means of *multiple inheritance hierarchies* and *lexical rules*.

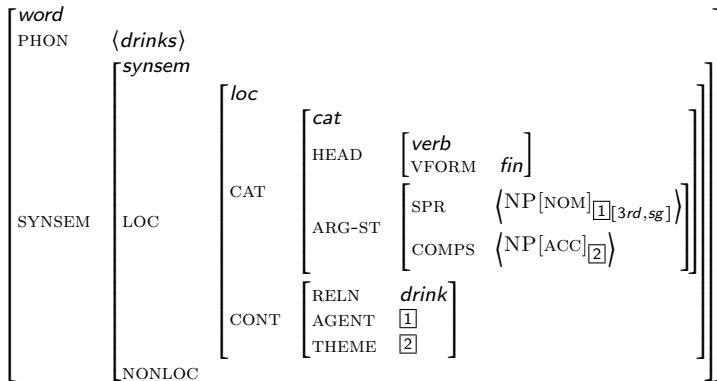
Feature structure and attribute-value matrix (AVM)

- **Feature structure**: data structure that identifies any kind of object through its *attributes* and their *values*.
- **Attribute-value matrix (AVM)**: a kind of feature structure that consists of:
 - The name of the described object
 - Its attributes/features of the object
 - The values of the attributes, which can be *simple* (atomic) or *complex* (consisting of another attributed-value pair)

$$\left[\begin{array}{l} \textit{box} \\ \text{COLOR} \\ \text{SIZE} \end{array} \right] = \left[\begin{array}{l} \text{brown} \\ \left[\begin{array}{l} \text{WIDTH} = 20.0\text{cm} \\ \text{HEIGHT} = 10.0\text{cm} \\ \text{DEPTH} = 15.0\text{cm} \end{array} \right] \end{array} \right]$$

Lexical entry in HPSG

drinks:



Lexical entry in HPSG

Attributes of feature structure of type *word*

- PHON (PHONOLOGY): phonological representation of the word.
- SYNSEM (SYNTAX-SEMANTICS): semantic and syntactic features that can be selected for by other words.
 - LOC (LOCAL): locally relevant features: categorial selection, head-complement agreement, case, semantic roles, etc.
 - CAT (CATEGORY):
 - HEAD: categorial info shared between the word (*head daughter*) and its syntactic projection (*head mother*)
 - ARG-ST: an ordered list of the word's arguments: SPR (SPECIFIER) (V subjects and DETs of NPs) and COMPLS (COMPLEMENTS)
 - CONT (CONTENT): thematic relations in the predicate
 - NONLOC (NON-LOCAL): non-local dependencies (e.g., that relate a moved constituent to its original position)

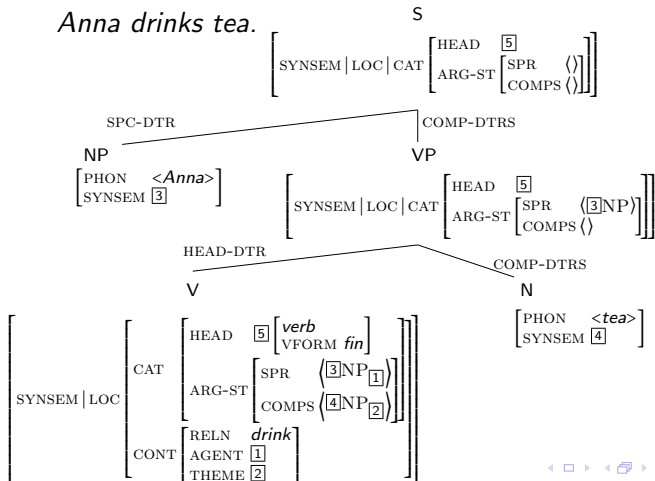
Reentrancy: property of values shared by two or more features. ↻ 🔍 🔄

Phrase structure in HPSG

- **Unification**: mechanism ensuring that, when two AVMs are combined, all syntactic/semantic constraints they encode are satisfied.
 - **!Two feature structures cannot be unified if they contain conflicting feature types or different values for the same feature**
 - Phrase attribute `DTRS` (`DAUGHTERS`): encodes the constituent structure of a phrase
 - The most frequent type of constituent structure is *headed structure*, with attributes `HEAD-DAUGHTER`, `SPECIFIER-DAUGHTER`, `COMPLEMENT-DAUGHTER`
- Principles ensuring that the arguments satisfy the selectional requirements of the head
 - 1 **Head Feature Principle**: In any headed phrase, the `HEAD` value of the mother and the `HEAD` value of the daughter are identical.
 - 2 **Valence Principle**: Unless the rule says otherwise, the mother's `SPR` and `COMPS` values are identical to those of the head daughter (Sag *et al.*, 1999).

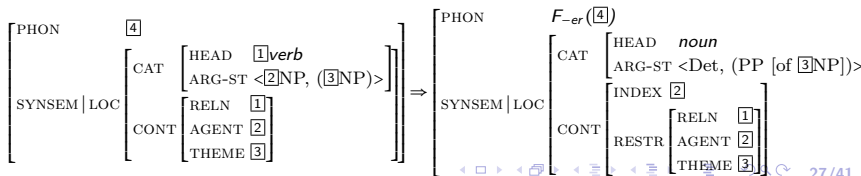
Phrase structure in HPSG

Anna drinks tea.



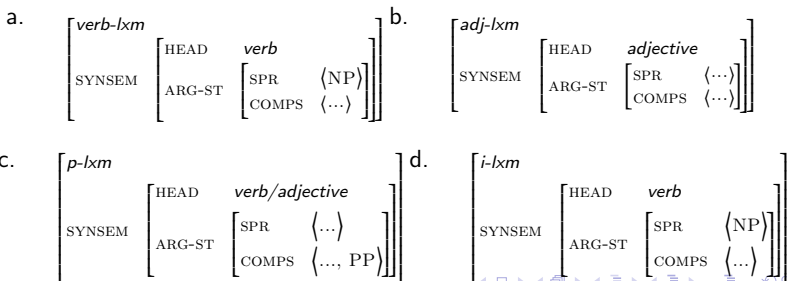
Lexical rules in HPSG

- General format: ' $X \Rightarrow Y$ ': "for any lexical entry that is consistent with the description in X , there is another lexical entry that includes the description in Y " (Sag *et al.* 1999: 185).
- Lexical rules are used, e.g., to model different phenomena of derivational and inflectional morphology
- Agent nominalization lexical rule



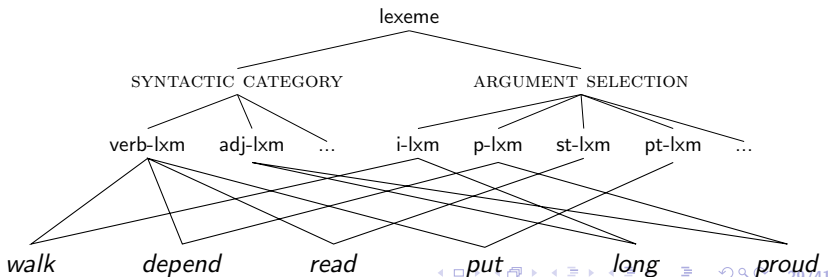
Multiple inheritance hierarchies in HPSG

- Typed feature structures are organized into hierarchies: each *subtype* inherits the constraints of its *supertype*.
- E.g., CAT is the supertype for syntactic categories (HEAD attribute) and the argument structure (ARG-ST).



Multiple inheritance hierarchies in HPSG

- Lexical items can be classified along several different dimensions.
- Multiple inheritance hierarchy**: each subtype is allowed to have more than one immediate supertype.



Lexical expressions as constructions (CG)

- Standard view on the division of labor between lexicon and syntax:
 - Lexicon gathers all the information that cannot be deduced from other linguistic components
 - Syntax combines lexical items through regular mechanisms
- CG: many or all word combinations have specific properties associated with the construction as a whole, rather than with the meaning contributed by individual components.
- **Construction**: C is a *construction* iff C is a form-meaning pair $\langle F, S \rangle$ such that some aspect of F or S is not predictable from C's component parts or from other previously established Cs.
- All levels of linguistic knowledge (morphology, lexicon, syntax) are modeled as constructions. → Lexicon is no longer 'special'

Types of constructions in CG

Parameters distinguishing between types of constructions:

- **Complexity**: non-decomposable (atomic) vs. complex (made up by smaller components)
- **Schematicity** or **phonological fixedness**: presence/absence of open slots where variation is allowed

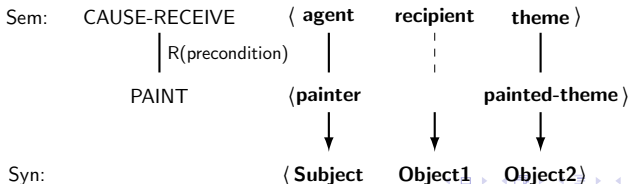
LINGUISTIC UNIT	EXAMPLE	COMPLEXITY	SCHEMATICITY
Morpheme	<i>un-, post-, -al</i>	atomic	fixed
Word	<i>sun, live, in</i>	atomic	fixed
Word	N-s (<i>socks, apples</i>), un-Adj (<i>unethical, uneven</i>)	complex	partially fixed
Idiom	<i>end of story, red herring</i>	complex	fixed
Idiom	<i>X push Y's buttons</i>	complex	partially fixed
The way construction: [DP _i [V [Poss _i way] PP]]	<i>She laughed her way into his heart</i>	complex	minimally fixed

Complex constructions in CG

- Basic clause constructions are regarded as meaningful (conveying syntactically relevant **constructional meaning**) and associated with basic event types:
 - transitive construction: 'someone did something to someone'
 - resultative construction: 'someone causes someone to become something'
 - motion construction: 'someone moved'

Integration of lexical and constructional meaning

- *Ethan painted his mother a portrait.*
- Ditransitive construction + lexical meaning of *paint*
 - Constructional meaning: 'X CAUSES Y TO RECEIVE Z'
-Argument roles X=agent, Y=recipient, Z=Theme
 - Frame-semantic meaning of *paint*: A **creator** produces a physical **object** which is to serve as a **representation** of an actual or imagined **entity** or **event**.
-Participant roles **painter** and **painted-theme**



Integration of lexical and constructional meaning

- The existence of two sources of meaning (lexical and constructional) allows accounting for AS alternations:
 - a. He painted a portrait.
 - b. He painted his mother a portrait.
 - c. He painted the portrait black and white.
 - d. He painted his way to fame and fortune.
- Unlike neoconstructionist frameworks, CG does not allow syntactic structure to blindly force itself onto “unsuspecting words”. CG requires that lexical and constructional meanings be *integrated* following a restricted set of principles.

Inheritance networks among constructions

Types of inheritance links:

■ Polysemy links

- Ditrans. construction 'X CAUSES Y TO RECEIVE Z' (*Ethan gave his mother a portrait*) → submeaning 'X INTENDS TO CAUSE Y TO RECEIVE Z' (*Ethan painted his mother a portrait*)

■ Subpart links

- Intrans. result. construction (*The lemonade froze solid*) is a part of the result. construction (*We froze the lemonade solid*).

■ Instance links

- '*drive someone {crazy/insane/bananas}*' is an instance of result. constr. 'X [agent] CAUSES Y [patient] TO BECOME Z [result-goal]'.

■ Metaphorical extension links

- Result. construction (*John knocked Dan unconscious*) is related to caused-motion construction 'X [agent] CAUSES Y [theme] TO MOVE TO Z [goal]' (*John knocked Dan to the ground*) by the link 'CHANGE-OF-STATE AS CHANGE-OF-LOCATION'.

Main tenets of GL

- An encompassing model of the lexicon in its own right, not as a mere appendix of other linguistic components
- The lexicon is viewed as genuinely **generative**:
 - Specific lexical mechanisms derive an infinite number of word senses from a finite number of meaning elements.
 - It incorporates and dictates essential components of other linguistic levels: syntax and semantics.
- **Decompositional approach** to word meaning: the lexicon comprises several levels of representation and *sublexical* components. → **Session 5**

Decomposition is applied to uncover compositional/relational aspects of lexical semantics.

- *The girl scouts almost built the hut.*

- almost(build_act, be_built)

- [build_act, almost(be_built)]

Lexical structures in GL

- **Argument structure**: specification of number and type of the predicate's arguments. → **Session 4**
 - Rich argument typology, including unexpressed arguments.
- **Event structure**: overall event type of the predicate, its parts (*subevents*), their relative ordering and prominence. → **Session 4**
 - *Dynamic Event Structure*: scalar properties of events.
- **Qualia structure**: decomposed representation of lexical meaning in terms of four dimensions → **Session 5**:
 - a. FORMAL (F): basic semantic typing (**is_a** relation: *fence* is a kind of 'barrier'); features that distinguish the object within a larger domain
 - b. AGENTIVE (A): factors involved in the origin of an object ('build' for *fence*).
 - c. TELIC (T): purpose/function of the object ('separate/ prevent from entering or leaving' for *fence*).
 - d. CONSTITUTIVE (C): relation between an object and its proper parts ('wood/metal' for *fence*), or what it is a part of.

Lexical structures integrated in a lexical entry

build	
AS =	$\left[\begin{array}{l} \text{ARG}_1 = x: \text{animate} \\ \text{ARG}_2 = y: \text{phys_obj} \\ \text{D-ARG}_1 = w: \text{phys_obj} \end{array} \right]$
ES =	$\left[\begin{array}{l} \text{E}_0 = e_0: \text{transition} \\ \text{E}_1 = e_1 \text{ process} \\ \text{E}_2 = e_2 \text{ state} \end{array} \right]$
QS =	$\left[\begin{array}{l} \text{FORMAL} = \text{be_built}(e_2, y) \\ \text{AGENTIVE} = \text{build_act}(e_1, x, w) \end{array} \right]$

- **ES/ QS**: ES subevents are identified as processes and resultant states in the QS
- **QS/ AS**: QS (formal role) provides the semantic typing of the arguments in the AS
- **ES/ AS**: AS arguments are involved in different parts of the ES

Compositional mechanisms in GL

How does GL account for contextual meaning malleability?

- a. Mary *finished* her beer (= 'finished drinking her beer')
- b. Mary *finished* the draft (= 'finished writing/reading the draft')
- c. Mary *finished* high school (= 'finished studying at high school')
- a. *easy* recipe (= 'a recipe that is easy to cook')
- b. *easy* answer (= 'an answer for a question that is easy to give')
- c. *easy* question (= 'a question that is easy to answer')
- d. *easy* prey (= 'prey that is easy to catch')

- Neoconstructionist explanation: lexicon is subordinated to syntax and lexical meaning tries to match the interpretational constraints imposed by syntactic structure.

- **BUT:** not any word can fit into any syntactic structure
- The part of lexical meaning that makes it impossible can be proven to be linguistic (=syntactically relevant) and not just pragmatic or encyclopedic.

Compositional mechanisms in GL

- GL explanation: basically projectionist. No constructional meaning need be postulated in addition to lexical meaning.
 - Word meaning is flexible because it is **underspecified**. The meanings of different words interact in a sentence through a set of **compositional mechanisms**.
 - **Underspecification**: absence of specification of linguistic signs that enables them to participate in different syntactic structures and, as a consequence, in different operations of semantic composition (Pustejovsky, 1995).
 - Underspecification with respect to subevent headedness:
 - a. The girl scouts are building the hut.
 - b. The girl scouts built the hut in three days.

Compositional mechanisms in GL

A set of generative devices operates on the different lexical structures when words are combined, to ensure that the selectional requirements are met and the resulting word combination is acceptable. → **Session 8**

- 1 License word combinations where the selectional requirements are satisfied in a straightforward fashion
 - *John painted the fence: paint* + DO PHYSICAL_OBJ
- 2 Rescue unacceptable word combinations by looking for the needed licensing elements inside the lexical entry.
 - *Mary finished her beer: paint* + EVENT, but *beer* is SUBSTANCE
 - Telic of *beer* = 'drink' (EVENT).
- 3 Reject word combinations that cannot be salvaged (unless used in metaphorical contexts or in poetic speech):
 - *'paint the absence', *'finish the blue', etc.

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