Verb Meaning and Co-compositionality: Manner, Means, and Result

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Outline

- Meaning Components for Predicates
- The Manner/Result Complementarity Hypothesis
- Event Factorization in Generative Lexicon
- Architecture of the Lexicon
- Event Structure: Dynamic Event Models
Manner/Result Verbs

(1) a. **MANNER VERBS**: specify a manner of carrying out an action. 
   cry, hit, pound, run, shout, shovel, smear, sweep, ...

   b. **RESULT VERBS**: specify the result of an event. 
   arrive, clean, come, cover, die, empty, fill, put, remove, ...

(5) a. A manner verb can combine with a result XP:
   Pat wiped the table clean.

   b. A result verb can be accompanied by an adverbial XP expressing manner:
   Pat cleaned the table by wiping it.
Manner/Motion-Path Encoding in Russian

Process-Result in Russian Manner/Creation Predicates

a. Ivan stroil dom  
lit. ‘Ivan build-PAST.IMPERF the house’  
‘Ivan was building the house’

b. Ivan po-stroil dom  
‘Ivan po-build-PAST.PERF the house’  
‘Ivan built the house’

c. Ivan žaril rybu/ omlet  
lit. ‘Ivan fry-PAST.IMPERF’  
‘Ivan was frying the fish/ the omelet’

d. Ivan po-žaril rybu.  
lit. ‘Ivan po-fry-PAST.PERF the fish’  
‘Ivan fried the fish’

e. Ivan s-žaril omlet  
‘Ivan s-fry-PAST.PERF the omelet’  
‘Ivan fried the omelet’
Manner/Motion-Path Encoding in Spanish and Russian

a. 'Kim cruzó el río nadando'
lit. ‘Kim crossed the river swimming-GERUND’
‘Kim swam across the river’

b. Kin pere-plyla reku
lit. ’Kim across-swam-PERF. the river’
‘Kim swam across the river’
a. **CREATION:**
   \[ \text{coser un vestido `sew a dress`} \]

b. **MANNER:**
   \[ \text{coser un botón `sew a button`} \]
Object Semantics Determines Polysemy of Verbs

(1) a. **CHANGE-OF-STATE**: \([\text{DP} \_\_ \text{DP}_{\text{PHYS}_\text{OBJ}}]\)
   b. **CREATION**: \([\text{DP} \_\_ \text{DP}_{\text{ARTIFACT}}]\)

(2) a. Mary baked the potato.
   b. John sewed a button.
   c. The child carved the stick.

(3) a. Mary baked a cake.
   b. John sewed a dress.
   c. The child carved a boat.
Some Factors Contributing to Meaning

- Change of being or state of an individual (e.g., location, size, constitution, or other relation);
- Causation and encoding of agency;
- Specific attributes of the arguments of the verb;
- Specification of manner and means of an activity;
- Temporal or spatial constraints on the event;
- Intentionality of the actor;
- Specification of an instrument involved;
- Mention of the psychological state of the participants;
- Determination of the medium of the situation or event.
Canonical realization rules
Rappaport Hovav and Levin (1998)

(7) \[ \text{manner} \rightarrow [ \ x \ \text{ACT}_{<\text{MANNER}>} ] \]
    (e.g., jog, run, creak, whistle, …)

(8) \[ \text{instrument} \rightarrow [ \ x \ \text{ACT}_{<\text{INSTRUMENT}>} ] \]
    (e.g., brush, hammer, saw, shovel, …)

(9) \[ \text{container} \rightarrow [ \ x \ \text{CAUSE} [ \ y \ \text{BECOME AT} <\text{CONTAINER}> ] ] \]
    (e.g., bag, box, cage, crate, garage, pocket, …)

(10) \[ \text{internally caused state} \rightarrow [ \ x <\text{STATE}> ] \]
    (e.g., bloom, blossom, decay, flower, rot, rust, sprout, …)

(11) \[ \text{externally caused, i.e. result, state} \rightarrow [ [ x \ \text{ACT} ] \ \text{CAUSE} [ y \ \text{BECOME} <\text{RESULT-STATE}> ] ] \]
    (e.g., break, dry, harden, melt, open, …)
LEXICALIZATION CONSTRAINT: A root can only be associated with one primitive predicate in an event schema, as either an argument or a modifier.

COMPLEMENTARITY: Manner and result meaning components are in complementary distribution; a verb typically lexicalizes only one.
Problems with M/R Complementarity

- It’s too strong: there are many examples not explained: *cut* has both manner and result readings; *climb* incorporates both components at the same time.
- It’s too weak: it doesn’t link manner and result behavior to the other event types, most importantly, accomplishment verbs.
- Creation verbs incorporate elements of both manner and result.
Models of lexical semantics

Traditional view

- The denotation of a word may be single or multiple.
  - English *lamp*, denoting the device for giving light.
  - English *paper*, which denotes, inter alia, “the material used for writing” (recycled paper) and an “essay published in an academic journal” (a technical paper).
- A word with a single denotation is called *monosemous*, while a word with multiple denotations is referred to as *polysemous*.
- Polysemy is seen as a **checklist of senses**.
- Sense enumerative lexicons.
Models of lexical semantics
Dynamic view (Pustejovsky, 1995, 2011)

- Context Dependence of meaning
  - Functional notion of polysemy.
  - The ability of lexical items to exhibit different (conceptually) related senses in different contexts, rather than a checklist of separate senses.

- Two major approaches.
  - **Meaning potential**: meaning is attached to units larger than words (.i.e. patterns: corpus linguistics and computational lexicography).
  - **Core meaning** and contextual operations of meaning adjustment.
By spreading the semantic load of composition in language, we allow a predicate’s arguments to contribute to the dynamics of meaning construction.

This requires a deeper ontology for arguments than typically assumed, including a rich type system and qualia structure.

This also requires more flexible rules of compositionality.
Factoring the Meaning of Events

- **DYNAMIC EVENT MODEL:**
  (a) states;
  (b) state transitions

- **EVENT MODEL consists of:**
  (a) object model (what changes);
  (b) action model (what makes it change or self-change).

- **EVENT TEMPLATES** assumed by Rappaport Hovav and Levin (1998) are derivable from simple these dynamic event models.
Typology of Manner

- EVENT-ORIENTED: spatial, temporal, or social constraints on a predicate:
  - swim/fly, stare/glance

- AGENT-ORIENTED: posture, self-defined movement of the agent:
  - stagger/walk/teeter, stutter/slure/mumble
Given an opposition structure, employ the manner below:

- open by cracking
- open by cutting
- open by smashing
- open by shaving

Hence, \textit{cut} is a manner for achieving a resulting state, \textit{open}. 
Manner Subtypes

Cutting

Given an manner for achieving a resulting state, employ the means below:

- cut by means of a saw
- cut by means of a knife
- cut by means of an axe
- cut by means of a laser

Hence, saw is a means subtype of a manner for achieving a resulting state, open.
(4) a. SYNTACTIC TYPE: this identifies the structural mode of presentation of a word in the syntax, e.g., as a Noun, Verb, Adjective, as so on, as well as the word’s argument structure.

b. SEMANTIC TYPE: this identifies the conceptual type for a lexical item, while positioning it within a type hierarchy. This typing includes basic semantic class distinctions as well as those associated with event classes and qualia structure.

c. LEXICAL SEMANTIC RELATIONS: this includes relations such as meronymy, antonymy, synonymy, and varieties of CAUSE.

d. WORD SYNTAX: this includes the structure of a lexical item as a word or morpheme (morphology), or as a multiword expression or phrasal construction.
- $B \subseteq A$ means that $B$ is a subtype of $A$ in our domain.
- $A$ is said to be completely defined by its daughters: that is, a least upper bound operation $\sqcup$, called *join*, has the following property: $A = B \sqcup C \sqcup D$. 

```
    A
   / \   \\
  B   C  D
```
Lattice Structures

- If we intersect the properties of different types, then we have an operation called *meet*, \( \sqcap \), which is formally the greatest lower bound of two types.
- In the tree below, \( E \) is the meet of \( C \) and \( D \).
- That is, the category \( E \) inherits all the properties from both \( C \) and \( D \) above it.
Syntactic Types
Entity Subtypes

- Entity
  - Count
    - Individual
      - Tribe
      - Team
    - Animate
      - Girl
      - Dancer
      - Scientist
    - Inanimate
      - Tree
      - Table
      - Cheese
      - Rumor
    - Org
      - School
      - Church
      - Bank
  - Mass
    - Substance
      - Soap
      - Water
      - Gas
      - Information
    - Aggregate
      - Cattle
      - Rice
      - Underwear
      - Data
  - Group
    - Tribe
    - Team
  - Substance
    - Soap
    - Water
    - Gas
    - Information
  - Aggregate
    - Cattle
    - Rice
    - Underwear
    - Data
  - Group
    - Tribe
    - Team
  - Mass
    - Substance
    - Aggregate
    - Group
  - Count
    - Individual
    - Animate
    - Inanimate
    - Org
  - Entity
    - Count
    - Mass
    - Substance
    - Aggregate
    - Group
    - Human Group
    - Individual
    - Animate
    - Inanimate
    - Org
A Quale (singular of Qualia) indicates a single aspect of a word’s meaning, defined on the basis of the relation between the concept expressed by the word and another concept that the word evokes.
A *Quale* (singular of *Qualia*) indicates a **single aspect of a word’s meaning**, defined on the basis of the **relation** between the **concept** expressed by the word and **another concept** that the word evokes.

Among the conceptual relations that a word may activate Qualia relations as defined in GL are those that are **exploited in our understanding of linguistic expressions**.
A Quale (singular of Qualia) indicates a single aspect of a word's meaning, defined on the basis of the relation between the concept expressed by the word and another concept that the word evokes.

Among the conceptual relations that a word may activate, Qualia relations as defined in GL are those that are exploited in our understanding of linguistic expressions.

fresh bread = “bread which has been baked recently.”
Qualia Structure

- **Formal role (F):** basic semantic type, including features that distinguish the object within a larger domain (orientation, shape, dimension, color): *violin* is a **MUSICAL INSTRUMENT**.

- **Agentive role (A):** factors involved in the origin or ‘bringing about’ of an object, such as creator, artifact, causal chain, etc. E.g., the violin is created through the event of **BUILDING** or, more generally, **CREATING**.

- **Telic role (T):** purpose or function of the object, or the built-in function or aim of certain activities. The violin is created for **PRODUCING MUSICAL SOUND**.

- **Constitutive (C):** relation between an object and its proper parts (i.e., its material and component elements), or between an object and the whole it is a part of. E.g., *WATER* is major constituent of coffee; and a finger is part of a **HAND**.
(5) \[
\begin{align*}
Q_S &= \begin{bmatrix}
violin(x) \\
F &= \text{musical}_{-}\text{instrument}(x) \\
A &= \text{build}(y,x) \\
T &= \text{produce}_{-}\text{music}_{-}\text{on}(z,x) \\
C &= \text{strings}_{-}\text{of}(w,x)
\end{bmatrix}
\end{align*}
\]
Qualia as Semantic Type Constraints

- Natural Types
- Artifactual Types

\[
\begin{align*}
\text{tree} & \\
QS & = \left[ \begin{array}{l}
\text{FORMAL} = \text{phys_obj}(x) \\
\text{CONSTITUTIVE} = \text{trunk_of}(y,x), \text{foliage_of}(z,x) \\
\text{TELIC} = \text{unspecified} \\
\text{AGENTIVE} = \text{unspecified}
\end{array} \right]
\end{align*}
\]

\[
\begin{align*}
\text{cake} & \\
QS & = \left[ \begin{array}{l}
\text{FORMAL} = \text{phys_obj}(x) \\
\text{CONSTITUTIVE} = \text{ingredient_of}(v,x), \text{part_of}(w,x), \\
\text{TELIC} = \text{eat}(y,x) \\
\text{AGENTIVE} = \text{bake}(z,x)
\end{array} \right]
\end{align*}
\]
Multiple Inheritance with Qualia

- ENTITY
  - MASS
  - COUNT
    - INDIVIDUAL
  - ANIMATE
    - SUBSTANCE
      - HUMAN
      - ANIMAL
        - INANIMATE
  - FUNCTION
    - FUNCTIONAL
    - MATERIAL
    - SOCIAL ROLE
    - OCCUPATION
    - FOOD
    - TOOL

soap, boss, scientist, cake, laptop