Polysemy and Valence Structure
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Concept Types and Frames in Language, Cognition, and Science

Heinrich-Heine-University, Düsseldorf, bldg. 25.21
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Q: What is the meaning of a word?

There are many different answers.

Meaning as use

*How* words mean: The utterance of a word form triggers *the search for a concept* (…*which is connected to a network of related concepts*).
Essentialism

meaning of life: life

When asking ‘What is the meaning of a word?’…

‘We are up against one of the great sources of philosophical bewilderment: we try to find a substance for a substantive’ (Wittgenstein 1934).

essentialism: positing a substance for a substantive
Dangers of essentialism

→ can cause polysemiphobia (fear of polysemy!)

Polysemy is utterly ubiquitous. Why?

One reason is that the utterance of a word form triggers *the search for a concept*. Depending on context, different searches turns up different results!

Metonymy is a source of semantic change & hence polysemy.

(Traugott and Dasher 2002, i.a.)
English example of metonymic change

to make sound $x$
$\Rightarrow$ to perform activity that causes sound $x$

*crack, smack, clash, crash, click, …*
crack, V

orig. To make a dry sharp sound in breaking, to break with this characteristic sound; hence,

in branch I, mainly or exclusively of the sound;

in II, of the act of breaking.

(here and below, from The Oxford English Dictionary)
crack (sound)

I. Referring mainly to sound emission. (from c1000)
- To make a sharp noise in the act of breaking, or as in breaking; to make a sharp or explosive noise (said of thunder or a cannon, a rifle, a whip, etc.)

- To shoot (with firearms), fire.
- To cause (anything) to make a sharp noise.
- To strike with a sharp noise; to slap, smack, box.
- To utter, pronounce, or tell aloud, briskly, or with éclat (survives in crack a joke).
crack (breaking)

II. Referring mainly to the breaking indicated by the sound. (from c1300 AD)

- To break anything hard with a sudden sharp report; now chiefly of things hollow, a skull, a nut, etc.

1553. To cracke the nutte, he must take the payne.

- (from fig. to crack a nut) To puzzle out, make out, solve, discuss. (from 1640 on)
- To break or crush (corn, etc.) into small pieces. U.S.
- To break without complete separation or displacement of parts.
smack

To open or separate (the lips) in such a way as to produce a sharp sound; to do this in connection with eating or drinking, esp. as a sign of keen relish or anticipation.

1557. Not smackynge thy lyppes, As comonly do hogges.

To strike (a person, part of the body, etc.) with the open hand or with something having a flat surface; to slap.

1835. Mrs. A. smacks Mrs. B.'s child for ‘making faces’.
clash

To make … the loud sound of collision made by a heavy stroke or blow…

trans., where the object refers to the sound:

1667. And fierce with grasped arms Clash'd on their sounding shields the din of war. (Milton, Paradise Lost)

To come into violent and noisy collision (incl. without the notion of noise). To come into, or engage in, conflict.

1820. It is not possible that the learned professors and the reading public should clash.
click

To make a thin, dry, hard sound.

To strike with a click; to cause (anything) to make such a noise.
click


To press (one of the buttons on a mouse) … to activate (a program function) or select (a particular item) in this way…

2000. PC World. Click an entry and drag it to the Insert menu..
**click through (to)**


*to click through (to)*: to click on a hyperlink using a mouse or similar device in order to access a specific file, web page, etc.

2009. *Wired.* I clicked through to the user’s photostream and determined it was the woman I had seen earlier.
Semantic change through *invited inference* (IIN)

Stage I. Coded meaning

\[ L \rightarrow M_1 \]  

(Traugott and Dasher 2002)

- utterance-*token* meaning: SP/W exploits IIN innovatively  
  (factors favoring IINs: relevance, subjectivity, etc.)
- utterance-*type* meaning: IIN conventionalized as GIIN

Stage II. New coded meaning

\[ L \rightarrow M_1 + M_2 \]
Semantic change: *click*

Stage I. Coded meaning

[*click*] → ‘make a thin, dry, hard sound’

SP/W exploits IIN innovatively: *Click here!*

lit. ‘Place the cursor here and make a thin, dry, hard sound’
IIN: ‘Place the cursor here and press the mouse button.’

IIN → GIIN: In the context of computers, *click* generally, by convention, invites the inference ‘press the mouse button’

Stage II. New coded meaning

[*click*] → ‘make a thin, dry, hard sound’ + ‘press mouse button’
A polysemy pattern

L → ‘Make a type $x$ sound’

> 

L → ‘Make a type $x$ sound’ +
‘Do a particular activity that causes a type $x$ sound’
Result complements

When a noisy activity has other results (besides the sound), then the verb takes the appropriate result complements:

1. The truck rumbled down the street.
2. The wooden-legged man clumped into the room.
3. The train screeched into the station.
4. The fly buzzed out the window.
5. The door squeaked open.
6. As we began our drive to Nairobi, a tire hissed flat.
   (exs. 1-5 from Goldberg 1995)
The tire hissed flat.

\[\text{hiss} \rightarrow \text{‘make a hissing sound’} + \]
\[\text{‘leak air, causing a hissing sound’}\]

Causal relations:

- hissing
- leaking
- flattening
The tire hissed flat.

\[ \text{hiss} \rightarrow \text{‘make a hissing sound’} + \]
\[ \text{‘leak air, causing a hissing sound’} \]

Hyp1. Speakers (mistakenly) conclude that \textit{hissing causes flattening}.

Fallacy of \textit{cum hoc ergo propter hoc} (‘with this, therefore because of this’)
The tire hissed flat.

Hyp2. Speakers name the cause after the sound it produces.
The tire hissed flat.

Hyp1. Speakers conclude that hissing causes flattening.
Hyp2. Speakers name the cause for the sound it produces.

Either way, the word *hissed* comes to denote a type of event that causes the tire to flatten.

But is it a generalized invited inference or a new coded meaning?
Generalized invited inference or new coded meaning?

1. The fly buzzed out the window.

\[\text{[buzz]} \rightarrow \text{‘to make a buzzing sound’} + \]
\[\text{‘to fly, causing a buzzing sound’}\]

Sense anaphora zeugma test:

1. One fly \textbf{buzzed} into the kitchen, and another \textbf{did so} into the dining room. (‘to fly, causing a buzzing sound’)
2. One trapped, immobile fly \textbf{buzzed} under the paper blinds, and another \textbf{did so} under a cup. (‘to make a buzzing sound’)
3. ??\[\text{Z}\] A trapped, immobile fly \textbf{buzzed} under the paper blinds, while a free one \textbf{did so} into the room.

If 3 is bad (zeugmatic) \(\Rightarrow\) new coded meaning (polysemy).
If 3 is ok (non-zeugmatic) \(\Rightarrow\) GIIN
Related Proposals

Synchronic lexical rule: Verbs of sound emission $\Rightarrow$ verbs of directed motion. (Levin and Rappaport Hovav 1995, 189ff)

Generative Lexicon: Coercion as type-shifting. (Pustejovsky 1995; Copestake and Briscoe 1995)

Pragmatic coercion (Asher 2011):
- *Type presuppositions* are induced because a predicate specifies semantic types for its arguments.
- Mismatches lead to accommodation.
- Could be seen as a synchronic theory of the GIIN stage.
A construction proposal: the *construction* is polysemous

The door swung open.

Syn: 

\[ \ldots V \ldots [_{AP} \text{open/shut}]\ldots \]

Sem: “As a direct result of and concurrently with an internal motion described by V, the state of being open/shut obtains”

Figure 12. Open/shut *result state construction for internal motion*  

(Iwata 2008, 1074)

The door squeaked open.

Syn: 

\[ \ldots V \ldots [_{AP} \text{open/shut}]\ldots \]

Sem: “As a direct result of and concurrently with a sound-emitting event described by V, the state of being open/shut obtains”

Figure 16. Open/shut *result state construction for sound-emission*  

(Iwata 2008, 1082)
Iwata’s proposal:
- The verb of sound emission is monosemous.
- The construction around V is polysemous

Problem: No mechanism for change.

Stage I. The door swung open. [V - *open* ] construction
The mouse squeaked. *squeak* (sound)

Stage II. ??
The point

• Generalized invited inferences arise from interaction between a word meaning and the utterance context, due to correlation between type of situation denoted by the word (‘hissing sound’), and some other type (‘air leaking’).

• That interaction can only arise if the word (hiss) is uttered.

• Thus polysemy inheres in the word— not in a construction or anything else outside the word.
Variable object selection

Variable object selection:

spray the plants ~ spray the water
draw a sunset ~ draw a picture
paint a sunset ~ paint a portrait
film a demonstration ~ film a movie
carve a notch ~ carve the wood

Hypotheses:
1. Monorelational
2. Polyrelational
1. a. Mary sprayed the water.
   b. Mary sprayed the plants.
Monorelational Hypotheses

• constant verb meaning across the alternants
• verb combines with different constructions or silent light verbs to yield alternants

1. Ordered argument (Davidsonian; Montagovian)

\[ \text{spray}'(e, \text{agent}, \text{theme}, \text{goal}) \]

*Mary sprayed the water:* \[ \exists z \exists e. \text{spray}'(e, \text{mary}, \text{water}, z) \]

*Mary sprayed the plants:* \[ \exists y \exists e. \text{spray}'(e, \text{mary}, y, \text{plants}) \]

2. Neodavidsonian:

\[ \text{spray}'(e) \land \text{Theme}(y, e) \land \text{Goal}(z, e) \]
Polyrelational Hypothesis

One form (phon., declension), multiple semantic relations

PHON  /sprej/
SEM  \[\exists e. \text{spray}_1'(e, \text{agent, theme})\]
\[\exists e. \text{spray}_2'(e, \text{agent, goal})\]
Competing hypotheses:

Monorelational: spray

Polyrelational: spray1’, spray2’
Predicted winner:

- **Monorelational:** spray'

- ✓ **Polyrelational:** spray1’, spray2’

The upshot: The monorelational theory may appear simpler, but it’s not.
The Locative Alternation

1. a. John loaded the hay (on the wagon).
   b. John loaded the wagon (with the hay).

2. a. Mary sprayed the plants (with the water).
   b. Mary sprayed the water (on the plants).
Contructional / Templatic Analysis

One **load** relation; two different event templates:

[ X moves Y into/onto Z ]

[X causes Y to change state (by means of moving Z to Y)]

Verbs like *load* or *spray* can be inserted into either structure

(Rappaport and Levin (1988), Pinker (1989, 77ff))
The current proposal: one frame, many relations

• The verb (*load, spray*, etc.) evokes a conceptual frame. This captures what is common across a diathesis alternation

• Various relations, defined on subsets of the frame elements, are encoded by verbs and prepositions
# Frames

**Table 6.1** Partial description of the Cutting frame in FN 1.5

<table>
<thead>
<tr>
<th>Core frame elements:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agent</strong></td>
</tr>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td><strong>Pieces</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-core frame elements:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instrument</strong></td>
</tr>
<tr>
<td><strong>Manner</strong></td>
</tr>
<tr>
<td><strong>Result</strong></td>
</tr>
<tr>
<td><strong>In addition:</strong></td>
</tr>
</tbody>
</table>

Lexical units: *carve, chop, cube, cut, dice, fillet, mince, pare, slice*

from Osswald and Van Valin (2014, 129)
One frame, many relations

The *spray* frame elements:
- Agent
- Material
- Goal
- Instrument

The verb *spray*:
- evokes the *spray* frame
- Phonological form
- Semantics: a set of relations defined on *subsets of the FEs*
2. a. Mary sprayed the water.
b. Mary sprayed the plants.
One frame, many relations

\textbf{spray1}(e, \text{agent}, \text{material})

\textbf{spray2}(e, \text{agent}, \text{goal})
1. a. Mary sprayed the water.  (spray1)
   b. Mary sprayed the plants.  (spray2)

$spray$:
PHON /sprej/
SEM \{ spray$_1$(e, x, y), spray$_2$(e, x, y), … \}
Evokes conceptual spray-frame.

$spray_1$(e, x, y): e is an event in which x diffuses y in the
form of minute drops.

$spray_2$(e, x, y): x wets y so that fine particles of water or
other liquid are distributed over the surface of y.
Theory comparison

Monorelational:  \textit{spray}(agent, theme, goal)

Polyrelational: \textit{spray1}(agent, theme), \textit{spray2}(agent, goal)

1. a. John loaded the hay (on the wagon).
   b. John loaded the wagon (with the hay).

2. a. Mary sprayed the water (on the plants).
   b. Mary sprayed the plants (with the water).

Q: Does \textit{load} denote the same relation in 1a and b?
   Does \textit{spray} denote the same relation in 2a and b?

A: No: cp. the holistic effect.
The holistic effect

1. a. John loaded the hay on the wagon.
   → all the hay is loaded; space may remain in the wagon

   b. John loaded the wagon with (the) hay.
   → the wagon is full; some hay may remain

2. a. Mary sprayed the water (on the plants).
   → the water is depleted; plants need not be all wet

   b. Mary sprayed the plants (with the water).
   → plants wet; water need not be depleted

A quantized incremental theme direct object provides the telic bound. A role is an incremental theme iff parts of the entity filling this role correspond to temporal parts of the event, and vice versa. A predicate P is quantized iff no entity that is P can be a subpart of another entity that is P.
The holistic effect

Holistic effect sharpened with modifiers:

1. a. John completely loaded the hay on the wagon.  
   b. John completely loaded the wagon with hay.  
   c. #John completely loaded hay on the wagon.

2. a. Mary completely sprayed the water on the plants.  
   b. Mary completely sprayed the plants with water.  
   c. #Mary completely sprayed water on the plants.

*hay & water are not quantized → can’t provide telic bound (parts of hay are hay; parts of water are water)*
The Holistic Generalization

An incremental theme role is expressed as the Direct Object (rather than an oblique complement) of that verb.
Contructional / Templatic Accounts of HG

[X moves Y into/onto Z]
[X causes Y to change state (by means of moving Z to Y)]

How it works:
• Y argument of template, which maps to OBJ, is a ‘patient’; it is conceived as ‘affected’ by the event

Variants:
• Aspectual principle (Tenny 1987; 1994)
• Spec,AspP (Borer 2005)
• Incremental Themehood as Patient Proto-role property (Dowty 1991)
Proposed polyrelational account of HG

Premise: Lexically encoded relations capture certain regularities, including regularities constitutive of events:

Mary sprayed the water. \(\text{(spray1)}\)

\text{spray1}(e, x, y): e is an event in which x diffuses y in the form of minute drops, and parts of the temporal trace of e correspond to parts of y
Preposition-encoded relations between FE’s

on(e, material, goal)

with(e, goal, material)
Preposition-encoded relations between FE’s

on(e, material, goal)
with(e, goal, material)
More relations between FE’s

use(e, agent, instr.)

Mary used the spray bottle.

spray3(e, agent, instr.)

Mary sprayed the hose at me.
Combining V and P

1. a. Mary (completely) sprayed the water on the plants
   b. Mary (#completely) sprayed water on the plants

\[\exists e [\text{spray1}(e, \text{mary, water}) \land \text{on}(e, \text{water, plants})]\]

HG explained:
• \text{spray1} (but not \text{on}) is conditioned on a homomorphism between \(e\) and the theme.
• there can be no such condition on \(e\) and \text{plants} because \text{plants} is not an argument of \text{spray1}

By definition, relations depend only on their arguments.∗

Combining V and P

2. a. Mary (completely) sprayed the plants with the water.
b. Mary (#completely) sprayed plants with the water.

\[ \exists e[\text{spray}2(e, \text{mary, plants}) \land \text{with}(e, \text{plants, water})] \]

HG explained:
• \text{spray2} (but not \text{with}) is conditioned on a homomorphism between \( e \) and the theme.
• there can be no such condition on \( e \) and \text{plants} because \text{plants} is not an argument of \text{spray1}
Summary of the Polyrelational Account of Holistic Generalization

- Lexically encoded relations capture certain regularities.
- Among them are regularities constitutive of events: homomorphisms between temporal progression of the event and quantification of a participant in the event.
- Verbs typically denote relations holding between their grammatical dependents. Thus the SUBJ and OBJ of a verb are coarguments of the verb-denoted relation (call it V), while the SUBJ of the verb and the OBJ of a (relation-denoting) preposition are not coarguments.
- Whenever V captures a regularity constitutive of events then the result is the Holistic Generalization.
Verbs vary in their ability to alternate

only material-type:
1. a. John poured the milk into the glass.
   b. *John poured the glass with (the) milk.

only container-type:
2. a. *John filled the milk into the glass.
   b. John filled the glass with (the) milk.

alternating:
3. a. John stuffed the books into his bag.
   b. John stuffed his bag with the books.
Pinker’s (1989) generalizations:

**G1. A Patient-like role is direct object.**
Types of actions that can be easily construed as *something that can happen to the goal*:
  ⇒ goal is direct object.
Types of actions that can be easily construed as *something that can happen to the material*:
  ⇒ material is direct object.

**G2. Specificity tends to go with the direct object.**
  a. If goal is direct object, verb should specify a *particular* state-change the goal undergoes.
  b. If material is direct object, verb should specify *what kind* of material, or *how it moves*. 
Alternating

I. Forceful contact and motion of mass against a surface: *brush, dab, plaster, rub, smear, smudge, spread.*

1. a. Mary brushed the paint on the wall.
   b. Mary brushed the wall with paint.

II. Force is imparted to a mass, causing ballistic motion: *inject, splash, splatter, spray, sprinkle, squirt.*

2. a. Mary splashed water on the dog.
   b. Mary splashed the dog with water.

→ action leads to a specific change in the goal
Verb-specific effects on the goal

1. She sprayed the wall with paint.
2. She brushed the wall with paint.
Material-type only

Gravity-induced motion: pour, spill, dribble(?), drip, dump, etc.

1. a. John poured the milk into the glass.
   b. *John poured the glass with the milk.
      → specifies how the material moves
      → nothing specific about the goal
Just a tendency

1. She poured my glass full (with beer).
   (Pinker 1989, citing Levin and Rappaport Hovav)

2. The chain’s brioche found its way to the Waldorf-Astoria Hotel, where the chefs stuffed it with prawns as an appetizer and dribbled it with chocolate sauce as a dessert.
   → in this case, specifies effect on goal
Material-type only

Expulsion of a mass: *emit, excrete, expel, secrete, spit, vomit*

1. a. John spat tobacco juice onto the table.
   b. *John spat the table with tobacco juice.*
      → specifies how the material moves
      → no specific effect on the goal

Attachment: *attach, fasten, glue, nail, paste, pin, staple, stick, tape.*

2. a. John taped the note on the letter.
   b. *John taped the letter with the note.*
      → specify type of attachment
      → no specific effect on the goal
Alternating

Forcing objects into a container against the limits of its capacity: *pack, cram, crowd, jam, stuff:*

1. a. John *crammed* the books into his backpack.
   b. John *crammed his backpack with books.*
   → The container is affected to its limits.

Contrast:

2. a. John put / threw the books into his backpack.
   b. *John put / threw his backpack with books.*
   → No specific effect on the container.
Alternating

Vertical arrangement on a horizontal surface: *heap, pile, stack.*

1. a. John stacked the books on the shelf.
   b. John stacked the shelf with books.
   → a particular quality of the movement (against gravity), and resulting configuration of the objects (stacked up)
   → specific properties of the goal (horizontal surface)
Alternating

Objects are put into a container in the container’s intended use: *load* [for vehicles, guns], *pack* [for suitcases], *stock* [for shelves]

1. a. John loaded the gun with the bullets.
   b. John loaded the bullets into the gun.

→ Specific type of goal.
Goal-type only

Expressing a qualitative change of the goal: adorn, burden, clutter, endow, enrich, litter, soil, stain, taint

1. a. Mary stained the carpet with wine.
   b. *Mary stained wine onto the carpet.

→ Specific effect on the goal.
→ No specific effect on the theme.
Material-type only

A surface or volume is completely covered or filled: *flood, coat, cover, pad, pave, tile, soak, drench, saturate.*

1. a. John covered the baby with a blanket.
   b. *John covered the blanket on the baby.*
→ depends on the goal whether it is completely affected, and hence this must be construed as a property of the goal
Contructional / Templatic Account of Verb Variation

Generalizations:
G1. Patient-like role is direct object.
G2. a. If goal is direct object, verb should specify a particular state-change the goal undergoes.
   b. If material is direct object, verb should specify what kind of material, or how it moves.

Pinker’s (1989) templatic account:
[X moves Y into/onto Z]
[X causes Y to change state (by means of moving Z to Y)]

G1: Y argument of template, which maps to OBJ, is a ‘patient’; it is conceived as ‘affected’ by the event
G2: Languages avoid synonymy (E. Clark’s ‘Principle of Contrast’); if these verbs were not specific, they would all mean ‘cover/fill’ (G2a) or ‘put’ (G2b).
Proposed polyrelational account

Sources of observed specificity in verb meaning:
1. the **relation**; 2. the **frame**.

A **relation** specifies properties of the participants filling its argument roles: changing properties (‘state-change’, ‘affectedness’) and sortal restrictions.

Mary sprayed the paint (on the wall).  \( (\text{spray1}) \)
Mary sprayed the wall (with the paint).  \( (\text{spray2}) \)

**spray1**(e, x, y): e is an event in which x diffuses y in the form of minute drops …

**spray2**(e, x, y): x wets y so that fine particles of water or other liquid are distributed over the surface of y …

By definition, relations depend only on their arguments.
Semantic conditions inherent in the frame

Sortal restrictions:

1. a. Mary smeared paint on the wall.
   b. Mary smeared the wall with paint.

In both 1a and 1b, the material must be an unctuous, greasy, sticky or dirty substance.

Explanation for G1 and G2 tendencies: For direct arguments of the verb, there are two ways that specific conditions arise: the relation and the frame. For oblique arguments, there is only the frame.
Theory comparison

*The polyrelational account:*

- Explains the connection between (i) G1 (Patient-like tendency) / G2 (the verb-specific tendency) and (ii) objecthood.

*The template account (and variants):*

- ‘Affectedness’ is *semiologized*, i.e. attributed to silent grammatical formatives, so this connection must be stipulated.

The semantic properties previously attributed to the ‘templates’ are reinterpreted here as properties favoring the lexicalization of relations: perhaps *regularity, usefulness, relevance, imageability*
Many more alternations

1. a. Bill is painting a picture.
   b. Bill is painting a tiger.
1. a. poke the needle through/into the cloth  (Levin 1995, 154)
b. poke the cloth with a needle

2. a. carve the wood into a toy
b. carve a toy from wood

3. a. inscribe his name on the ring  (Levin 1995, 169)
b. inscribe the ring with his name

4. a. blame him for the mess
b. blame the mess on him

5. a. admire his honesty  (Levin 1995, 192)
b. admire him (for his honesty)

…etc.
Monorelational Hypotheses

1. a. Bill is painting a picture.
   b. Bill is painting a tiger.

Templatic: More ad hoc templates?

\[
\begin{align*}
& [ X \text{ creates } Z \text{ (to depict } Y) ] \\
& [ X \text{ depicts } Y \text{ (by creating } Z) ]
\end{align*}
\]

Neodavidsonian: More ad hoc silent secondary predicates?

\[
paint'(e) \land \text{depictee}(y, e) \land \text{product}(z, e)
\]
Summary

Polyrelational account:

• Verbs typically denote relations between their syntactic dependents (valence structure). Relations depend only on their arguments.

• Generalizations regarding ‘holism’ are side effects of argumenthood.

• We moved the account of semantic differences among alternates from the putative silent meaning-bearer (construction / template / light verb), to the theory of the development of polysemy, or more precisely, polyrelationality.

Discussion:

• For any empirical generalizations, an essential question is whether positing a silent, meaningful formative (a construction, template, light verb, etc.) explains them better than accounts of the discrimination of relations.
Concluding remarks

The standard linguistic methodology of seeking minimal pairs and recurring partials leads the analyst naturally to the monorelational account of verb alternations: the verb form is constant across the alternation, hence it would seem that any difference in meaning is due to something other than the verb. That ‘something’ has no phonological form, so many linguists have posited silent but meaningful ‘constructions’ or ‘light verbs’. That approach is reasonable on its face, but it may be leading us further away from an explanation, rather than closer to one.

The alternative view, explored today, is that alternations reflect the fact that an alternating verb form encodes one frame but many relations.
Thank-you!