What is compositionality?

Compositional interpretation:

Examples of compositional interpretation:


Recent overview.

Known exception: Idioms, e.g., a red herring

Camp, Kais. Montague, Davidson. Cresswell. Paradox ...

Historical source: Frege ("Frege's principle").

and the way how they are semantically combined is determined by the meaning of its immediate parts in

The meaning of a syntactically complex expression.

Compositionality Interpretation.
Why compositionality?

Compositionality is central to interpretation as it embodies the combinatorial potential of composition in formal semantics. It is the primary principle of component concepts. Knowledge of the whole determines knowledge of the parts, and vice versa. Frege, Wittgenstein, Schiewer'scherer pointed out the importance of distinguishing in philosophy and logic.

Frege: The meaning of expression depends on the context in which it is used. Compositionality vs. Contextuality

Refers to the meaning of a word in isolation, but only in the context of a sentence.

A counteracting principle (also called "Frege's principle"): Frege on compositionality:

- Need to increase decoding speed (p. 212).
- Need to frame new concepts to adapt to new situations.
- Need to increase ease of memorization.
- Need to increase learnability.
- Need to express an increasing number of concepts.
- Solves a bottleneck in cultural evolution (cf. Smith & Kirby 2012).

With recursion rules, still a very high number.

Why compositionality vs. contextuality?

Why compositionality?

Why compositionality is a central principle of interpretation?
Compositionality before human language?

Evidence for compositionality in non-human communication is scarce:

- But there is evidence for the ability of certain animals to acquire compositional rules.
- Such sequences are very limited (Huntforth 2009)
- Sequences of brain cells in birds and male song in primates
- Meaningful repetition of cells (Stern et al. 2006)
- Another meaning modulation in human language: green vs. greenish
- e.g., eagle, vs., possible danger from above, e.g., sudden flying animal

Meaning in all cases: broadening of concept.

Scalpel operations and to enhance / suppress expression of gene.
- Boundary symbols (prosody, punctuation, signs) in language.
-しないStop codons (AGC / UAA...) to identify a gene.

Additional similarities:

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CDNA/CAGCUU

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From holistic to compositional meaning:

Theoretical aspects

Making use of accidental similarities between holistic symbols and their meaning.

Examples from holistic to compositional meaning:
Composition types: Accumulation

A very simple sort of composition, - if "4 ≠ C₁ and "S₂ = C₂ then "A. Beware of rocks" with traffic signs:

\[4 \land S₂ = C₂\] and \[S₂ = C₂\]

Accumulated signs might have more meaning, Accumulation with excessive meaning:

Composition type: Accumulation
Modification in language: 

**Composition types:** Sequence

- If \( S_1 = C_1 \) and \( S_2 = C_2 \), then \( [S_1 < S_2] = C_1 < C_2 \)

Simple due to iconicity of \(< \) and \( > \)

Language: no explicit marking in narrative sequences, cf. German *erzählen*, French *conter*.

Example traffic sign: 

- *Beware of rocks* 
- For the next 2 km

**Modification types:** Modification

- Conceptual modification:

  - \([\text{Modifier Head}] < [\text{Modifier} (\text{Head})]\)

  - The modifier adds meaning to a head that carries meaning already.

  - Examples: *adjective [N]*, *adverb [V]*, *sentence adverb [S]*

  - Structure in X-bar-Theory: \( \alpha \cdot \{ \alpha \} \cdot \{ \alpha \} \)

Varieties of modification:

- **Intersective:** no special role of head, rather accumulation.
- **Subsective:** special role of head, e.g. *huge mouse, skillful surgeon*.

Example: 

- If \( x \) is a skillful surgeon, then \( x \) is a surgeon.
- \( \text{skillful} \) is dependent on the head: *skillful as a surgeon*.

Example traffic sign: 

- *Beware of rocks* 
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**Modification in animal communication?**

- Attenuative modifiers (e.g. *-oo* in alarm calls of Campbell monkeys)
- Intensive modifiers – greater signal strength?
Composition types: Boolean operations

- Apparently does not exist.

- Saturated in animal communication?
  - Negation as erasure, with conventionalized erasure sign
  - Conjunction expressed by accumulation (see above)
  - Disjunction expressed by accumulation with conventionalized erasure sign

- Boolean concept combinations are complex.
- Saturation in language: Structure in X-bar-Theory:

  - [Verb Object], [Preposition Object]
  - Multiple saturation?
    - [Subject [Verb Object]]

  - Alternatives:

  - Saturation in animal communication?

  - Saturation: [Subject [Verb Object]]

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- For indefinites, argument: Dummy expression, etc.

  - e.g. Chinese: chun ren, eat rice, eat

  - For indefinites, argument: Dummy expression, etc.

  - (cf. Frege, saturated/nonsaturated meanings)

- Head is incomplete, resulting expression is complete

- The argument satisfies a slot provided by the head

  - Head Argument

- Concept saturation:

  - [Head Argument] = [Head Argument]

  - Beware of... kids

  - Forbidden for... cars

- Composition types: Saturated

- In pictopen.com

- Attempts of q. conventionalized signs

- Implication (if-then)?

- German sign:

  - Turn left or turn right

  - Conjunction expressed by accumulation

  - Disjunction expressed by accumulation with conventionalized erasure sign

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- Composition types: Saturated
Tool making (and perhaps other complex activities) lead to a "compositional mind".

Some proposals:
- Compuflization and creation of tools.
- Action sequences, e.g., hunting, collecting, preserving, food preparation, tool making.

Possible answers:
- Are there functional homologues of the compositional types?
- Precursors?
Topic-comment structure and information storage

Nature of topic-comment structure

Relational database about volcano eruptions

<table>
<thead>
<tr>
<th>Volcano</th>
<th>Year</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karymsky</td>
<td>2500 BC</td>
<td>5</td>
</tr>
<tr>
<td>Sakura-Jima</td>
<td>3550 BC</td>
<td>4</td>
</tr>
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<td>2900 BC</td>
<td>4</td>
</tr>
<tr>
<td>Pinatubo</td>
<td>3550 BC</td>
<td>6</td>
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<td>4</td>
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File cards about volcanoes

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File cards about years

Properties of topic:
- Topics are typically given (denoted, deaccented).
- Direct topic marking, e.g., Japanese wa, Tagalog ang.
- Default information status of subjects is in artificial languages, e.g., algebra: \( f(x) = x^2 + 1 \).
- Tendency for initial position (e.g., Rizzi 1997 for Italian, Frey 2001 for German).

Influence on ease of recall:
- CT: Repetition 20 times.
- CT: Repetition 20 times.
- Comment: that she married Aristoleo Onassis.
- Aristoleo Onassis married Jacqueline Kennedy.
- Comment: that she married Aristoleo Onassis.
- Jacqueline Kennedy married Aristoleo Onassis.
A precursor for topic/comment: bimanual manipulation

Non-dominant hand performs more coarse-grained operations.

Basic similarity:

Explanation of asymmetry:

Role of hand asymmetries in brain lateralization,

and is certainly much older (e.g., Neanderthals, Lommel 2011)


Non-dominant hand encodes a frame into which the dominant hand adds content.


- Time orientation: 
- Temporal sequencing:

- Topic expression identifies a concept, first, modification by comment follows.

- Non-dominant hand gets first by grasping an object.

- Non-dominant hand is used to operate on the object (kinematic theory, Glimcher).

- Hence topic-comment sequence.

- Temporal sequencing: 

Topics are typically shorter, less complex, decorated.

Dominant hand is able to perform finely controlled movements.

Non-dominant hand performs more coarse-grained operations.

A precursor for topic/comment: bimanual manipulation

Exploration of asymmetry:

Gleit for neurophysiology of language

in the results of the motions of the non-dominant (left) hand.

Left lateralization, for right handers, less strong for left handers.

Human hands are symmetrical, but are used in different ways:

About 90%: right hand to throw a stone, to eat with a spoon, to write with a pen etc.

Asymmetry in hand use:

Bimanual manipulation
Asymmetric hand use in language: Sign and Gesture

21

22

Gesture in spoken language:

Topic and hand use: take

The verb take can be grammaticalized as a discourse topic marker:

\[ \text{Take John. He is a vegetarian.} \]

\[ \text{I don't think that people will like this kind of food.} \]

\[ \text{My communication peer.} \]

The word take can be grammaticalized as a discourse topic marker:

Topics and hand use:

*Non-topic use of take, should relate to non-dominant hand.*

*Topic use of take, should relate to dominant hand.*

Use of take and hand asymmetry:

Commands of the form take x can grammaticalize to instructs in line to make x a topic.

The identification of the object can be categorized as a taking of the object.

A topic-comment structure consists in an instruction to identify an object.

One purpose for grasping an object is to modify it.

Take verbs basically denote grasping an object.

Analysis:

May be widespread—perhaps including take as marker for definite objects.

Mentioned by Hopper (2002, p. 33) about the take x and ... construction.


Take John. He is a vegetarian.

I don't think that people will like this kind of food.

My communication peer.

The word take can be grammaticalized as a discourse topic marker:

Gesture in spoken language:

so-called "home bases" for non-dominant hand.

so-called "bypo" signs that structure discourse by non-dominant hand.

Liddell (2002); so-called "bypo", signs that structure discourse by non-dominant hand.
Propositions: Their nature and their benefits

What are propositions?

Communication is an unsatisfied concept, saturated by the topic.

Combinatorial Topic + Combinatorial + Compositionally:

is it possible to look making (50 c.e. 2008. 2012)
is the action of the speaking area of the brain? (Greenfield 1991)
and work combinatorial (Greenfield 1991)

Input is the concept of the combinatorial of the combinatorial in communion
of combinatorial structures in communion
of the development of the combinatorial brain
of the combinatorial to achieve the commutation of hands for asymmetric bimanual work
of the depth of asymmetric bimanual manipulation to produce attacks.

Time depth of asymmetric bimanual manipulation to produce attacks.
Propositions, reference and compositionality

Wrapping up

Declarative sentences:

The King of France visited the exhibition. The King of France visited the exhibition.

The King of France was visited by the King of France. The King of France was visited by the King of France.

so-called thetic sentences (9. It is raining) attribute a property to a given situation.

Institutional sentences (10. It is raining) attribute a property to an entity.

Explanatory sentences:

If there is a concept c such that, when combined with x, results in p,

then there is a proposition p that is about an object x.

If there is a proposition (concept) c that is about an object x,

from that proposition (concept) a reference (a proposition, a reference) can be derived.

Primary of proposition (pression: "began" and reference)

Believes are "about something" – this something can be referred to

A first take:

Propositions, reference and compositionality