Why Crystal Barrels are Faster than Whiskey Spoons
A Frame-Theoretic Remark to Psycholinguistic Studies of Compounding

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Compounding in the CRC 991

• Cooperation of
  – C05 "Frames and Nominal Word Formation" (Pi: Sebastian Lübner)
  – A04 "Accessing Conceptual Information in Language Production and Comprehension" (Pi: Peter Indefrey)

Outline

1 Compounding in German
2 Psycholinguistic Paradigms in Research on Compounding
3 Modeling Compound Interpretations in Barsalou Frames
4 Empirical Data
5 Relation Priming in Frames

1 COMPOUNDING IN GERMAN
Terminology

**Compounding:** process of juxtaposing two or more radical elements

**Holztisch**
- translation: Holz 'wood', Tisch 'table'

**Compound:** result of such a process

**Holztisch**

**endocentric N-N compounds:** the second noun(head) is determined by the first one (modifier)

\[ \text{\_{is made of \_}} \]

**Relation:** linking element between the concepts of modifier and head

Compositionality

- ambiguity of compounds >> interpretation results in a reading

**Example:** Metallsäge, Metall 'metal', Säge 'saw'
  
  reading 1: "saw made of metal"
  reading 2: "saw for cutting metal"
  reading 3: "saw that is stored in a box made of metal"

**DEFINITION:** The reading of a compound is **compositional** if it can be expressed in terms of the compound constituents. Otherwise the reading is called **opaque**.

**Example for an opaque meaning:** Augenblick, Auge 'eye', Blick 'look'
  reading: "instant"

- focusing on relations in compositional readings

Relation-set approach

**Assumptions:**
- relations are deduced from existing compounds and stored in the lexicon
- interpreting compounds: choosing the most plausible relation

**Holztisch**
Relation priming

- Gagné (2002): Relations can be primed by the modifier

<table>
<thead>
<tr>
<th>pairs of compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>semantically similar modifiers</td>
</tr>
</tbody>
</table>
| different modifiers/
different relations |
| same relation: steal spoon metal door |
| different relation: steal spoon metal saw |
| metal door fleece curtain |

However: no priming effect by the head noun

Schema approach

Assumptions:
- activation of schemata by modifier and head
- Interpreting compounds as a special case of concept matching by slot filling

- Subjects can create more than 20 interpretations on the fly

Comparing the Paradigms

Relation-set approach:
- motivates why relations can be primed by the modifier
- is not able to explain how initial relations arise

Schema approach:
- explains how initial or new relations arise
- nearly no experimental support

➤ We need a model which
  - explains how initial relations arise,
  - accounts for why relations can be primed by the modifier,
  - is empirically supported.

3 EXPLAINING COMPOUNDING IN BARSALOU FRAMES
Barsalou Frames

Mathematical modeling of frames
- frames are represented as directed graphs, where
  - arcs correspond to attributes
  - nodes correspond to values
- attributes
  - functions mapping values on values
- values
  - instantiation of types
  - ordered in a type hierarchy of specification

(cf. Petersen 2007)

Example:
- Liz
- car
diesel automatic
- color
- 4-cylinder

Compound Interpretation in Frames

Thesis:
- Interpretations of compounds correspond to operations on frames.
- These operations result in specific readings.

Example: Holztisch, Holz ‘wood’ Tisch ‘table’
reading: “table made of wood”

Example: Ketchupflasche, Ketchup ‘ketchup’ Flasche ‘bottle’
reading: “bottle that contains ketchup”

Example: Suppenlöffel, Suppe ‘soup’ Löffel ‘spoon’
reading: “spoon for eating soup”

Compounding and Conceptual Distance

Thesis:
- Interpretations differ in complexity.
- Complexity can be measured in the length of paths in frame graphs.

Type 1: Attribute compounds
- modifier frame is directly linked to the head frame

Example: Holztisch, Holz ‘wood’ Tisch ‘table’
reading: “table made of wood”

Example: Suppenlöffel, Suppe ‘soup’ Löffel ‘spoon’
reading: “spoon for eating soup”

Type 2: Frame compounds
- frames of modifier and head are linked by an implicitly given action frame

Example: Suppenlöffel, Suppe ‘soup’ Löffel ‘spoon’
reading: “spoon for eating soup”

Research question: How can we get empirical support for our frame analysis?
4 EMPIRICAL DATA

Stimuli

**Condition I**  frequently occurring compounds (German compounds with > 130.000 hits on Google)

<table>
<thead>
<tr>
<th>Experimental Condition</th>
<th>Control Condition</th>
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<tbody>
<tr>
<td>(a1) Frame compounds</td>
<td>(b1) Attribute compounds</td>
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<tr>
<td><em>für</em> 'for'</td>
<td><em>aus</em> 'made of'</td>
</tr>
</tbody>
</table>

- **Type 1: Attribute compounds**
  - Material _object_
  - Theme _instrument_

- **Type 2: Frame compounds**
  - Material _object_
  - Theme _instrument_

- Thesis: The higher the conceptual distance the higher the cognitive effort.
- Aim: measure interpretational processes
  - We have to make sure that the investigated compounds are not lexicalized.
- Hypothesis: The interpretation of frame compounds should take longer than that of occasional attribute compounds.

**Stimuli**

**Condition II**  occasional compounds (German compounds with < 55 hits on Google)

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- **Type 1: Attribute compounds**
  - Soft _object_
  - Soft _instrument_

- **Type 2: Frame compounds**
  - Soft _object_
  - Soft _instrument_

- Thesis: The higher the conceptual distance the higher the cognitive effort.
- Aim: measure interpretational processes
  - We have to make sure that the investigated compounds are not lexicalized.
- Hypothesis: The interpretation of frame compounds should take longer than that of occasional attribute compounds.
What did we expect?

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<td>Titan 'titanium' Schüssel 'bowl'</td>
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Method & Procedure

Pretest: Plausibility rating of the Paraphrases by 80 students with German as their only native language

Subjects: 30 right-handed native speakers of German

Design: online, within-subjects

Procedure: forced choice paradigm

- visual presentation of the compounds on a computer screen in a sound attenuated booth at the reaction time lab of the HHU
- pseudo-randomized order of the stimuli to avoid relation-priming effects as shown by Gagné (2002)

Did our Subjects choose the expected Paraphrase?

- Subjects chose significantly more often the expected paraphrase (p < .01)
- The distribution of unexpected paraphrases did not differ for the four categories
Results

- Significantly higher reaction times for the occasional compound condition (surprise 😃)
- Unequal behaviour of the different categories in the frequent and the occasional compound condition suggest different processing strategies

Explanation: Frequency Effect

A look into the Leipzig Corpora Collection (LCC) reveals, that compounds of this type are considerably less frequent in German
A closer look at the two types of compounds reveals that we most likely modelled a different reading than is normally preferred unfortunately both readings can be expressed by the paraphrase für 'for’

Explanation: A Categorical Error

Categorical Error

- Error in defining the preferable reading
  - reading 1: “container that contains sth.”
  - reading 2: “container that is made for filling it with sth.”

Example: Saftschüssel, Saft ‘juice’ Schüssel ‘bowl’
  - reading 1: “bowl that contains juice”
  - reading 2: “bowl that is made for filling it with juice”

Analogy Interpretations in Frames

- Question: How is it possible that relations can be primed (as Gagné 2002 demonstrated)?
- Solution builds on type hierarchies of values
  - Example: Holztisch, Holz ‘wood’ Tisch ‘table’
    - material
    - object
    - Stahl
    - Für
  - Example: Stahltür, Stahl ‘steal’ Tür ‘door’
    - material
    - object
    - Stahl
    - Für

5 RELATION PRIMING IN FRAMES
Summary & Outlook

• Barsalou frames offer a tool to make predictions about the complexity of interpretational processes.
• Frame compounds may reflect greater conceptual distance and therefore greater cognitive effort which result in higher reaction times.
• Frames give rise to a schema approach on compounding in which the phenomenon of relation-priming can be explained.
• Open question: Are the compounds of the type content__container frame compounds?

References


