Han Solo was washing the Millennium Falcon with Chewbacca.

Princess Leia says, ".... Can't you use a sponge?"

credit: https://twitter.com/kelly_knox/
Han Solo was washing the Millennium Falcon with Chewbacca.

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Han Solo was washing the Millennium Falcon with Chewbacca.

- Many meaning representation frameworks (word senses, semantic roles) have ways to disambiguate the two readings.

- This work: in-depth comparison of two of them—SNACS and Prague tectogrammatical functors.
**SNACS** (Schneider et al. 2018, *inter alia*): a set of lexical semantic classes ("supersenses") designed for disambiguating adpositions in English and other languages

- 52 total supersenses, organized into a hierarchy with 3 branches
  - influenced by VerbNet, FrameNet, AMR/UMR
  - comprehensive annotation
  - semantic criteria (rather than alternations or associations with a predicate lexicon)

Image from [SNACS guidelines for English](https://snacs.github.io/guidelines/), v2.6 (2022)
Han Solo was washing the Millennium Falcon with Chewbacca.

Princess Leia says, ".... Can't you use a sponge?"

Ancillary vs. Instrument

credit: https://twitter.com/kelly_knox/
**SNACS: 2 levels available**

*English:* Thanks **for** (noun or verb)  
*French:* Merci **pour** (thing)

*French:* Merci **de** (action)  

Explanation

Explanation

Explanation~>Source?
In Prague Czech-English Dependency Treebank, a parallel corpus of Wall Street Journal text
- We use PCEDT v2.0 (Hajič et al., 2012)
- We focus on the English section (PEDT)

Multiple Layers of Description
- **Analytical Layer (a-layer)**
  - Surface Syntax
- **Tectogrammatical Layer (t-layer)**
  - “Deep syntax” / Semantics
  - Argument structure relations
  - Formemes - keep track of surface syntactic realization (e.g. with a preposition)
  - 69 **functors** - mark the relationship between parent / daughter nodes

Image Source: https://ufal.mff.cuni.cz/pcedt2.0/
Goal of this Work - Annotation Comparison

- Compare definitions of PEDT functors and SNACS supersenses
- Quantitatively and qualitatively evaluate the overlap between similar tags in the two tagsets
**SNACS Locus Supersense**

“Location, condition, or value. May be abstract.” (Schneider et al., 2022)

- “I like to sing at **Locus** the gym.”
- “I read it in **Locus** a book.”

**PEDT LOC Functor**

“A functor for a free modification that specifies the location answering the question “where?”, i.e. it indicates the place at which the event or state is situated.” (Mikulová et al., 2005)

- “He works in **Prague. LOC**”
Example Overlap 2: SNACS Duration vs PEDT TFHL

**SNACS Duration Supersense**

“Indication of how long an event or state lasts (with reference to an amount of time or time period/larger event that it spans).” (Schneider et al., 2022)

- “I walked for **Duration** 20 minutes.”

- “I mowed the lawn for **Duration** an hour.”

**PEDT TFHL Functor**

“A functor for a free modification that expresses a temporal meaning related to the question “for how long?”; it gives the length of duration of a state which is a result of the event expressed by the governing word.” (Mikulová et al., 2005)

- “He came to stay for **a month** **TFHL**”
### SNACS Explanation

**Supersense**

“Assertion of why something happens or is the case.” (Schneider et al., 2022)

- “I went outside because **Explanation** the smell.”

### PEDT **CAUS** Functor

“The **CAUS** functor (cause) is assigned to modifications with the meaning of cause of an event or state...” (Mikulová et al., 2005)

- “The losses occurred due to **CAUS** poor management.”
Example Overlap 4: SNACS Gestalt vs PEDT APP

SNACS Gestalt Supersense

“Generalized notion of “whole” understood with reference to a component part, possession, set member, or characteristic.” (Schneider et al., 2022)

- “The blueness **of.** Gestalt the sky.”
- The president’s **.** Gestalt power”.

PEDT APP Functor

“a functor for a free adnominal modification denoting a person or an object, to which the person or object referred to by the governing noun is in the relation of appurtenance.” (Mikulová et al., 2005)

- “My **.** APP castle”
- “The quality **of.** APP the service”
Methodology

1. Use annotation guidelines / descriptions to create heuristic mapping to most likely SNACS *Supersenses* from PEDT *functors*

2. Run an automatic SNACS *Supersense* tagger on a small subset of PEDT (838 sentences, 1837 preposition tokens)

3. Evaluate overlap of predicted SNACS *Supersenses* with the expected corresponding PEDT *functors*

4. Compare results of automatic classifier and heuristic mapping
### Heuristic Mapping: Descriptive Overlap

<table>
<thead>
<tr>
<th>Functor Supersense</th>
<th>Functor Supersense</th>
<th>Functor Supersense</th>
<th>Functor Supersense</th>
<th>Functor Supersense</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSIN StartTime</td>
<td>LOC Locus</td>
<td>MEANS Instrument,Means</td>
<td>ACT Agent,Force</td>
<td>EXT Cost</td>
</tr>
<tr>
<td>TTILL EndTime</td>
<td>DIR1 Source</td>
<td>MANN Manner</td>
<td>PAT Theme,Topic</td>
<td>APP Gestalt</td>
</tr>
<tr>
<td>TFHIL Duration</td>
<td>DIR2 Direction,Path</td>
<td>CAUS Explanation</td>
<td>ORIG Originator</td>
<td>COMPL Identity</td>
</tr>
<tr>
<td>THIL Duration</td>
<td>DIR3 Goal</td>
<td>AIM Purpose</td>
<td>ADDR Recipient</td>
<td>MAT QuantityItem</td>
</tr>
<tr>
<td>THO Frequency</td>
<td>EXT Extent</td>
<td></td>
<td>BEN Beneficiary</td>
<td>RSTR Characteristic</td>
</tr>
<tr>
<td>TPAR Time</td>
<td></td>
<td></td>
<td>ACMP Ancillary</td>
<td>CPR ComparisonRef</td>
</tr>
<tr>
<td>TWHEN Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 32 of 52 Supersenses have a descriptively similar PEDT functor
- Many PEDT functors are probably not relevant to SNACS hierarchy (e.g. `CONJ`, `VOCAT`)
- Mapping from PEDT to remaining 20 supersenses (many of which are in the Configuration branch) remains unclear
Empirical Comparison - Heuristic vs Classifier Overlap

- How do our expected Supersenses (from our heuristic mapping) compare to automatically predicted SNACS Supersenses?

- Well, they don’t align as well as we would hope 😞

- Heuristic for functors aligning with Circumstances are more accurate than functors aligning with Configurations

<table>
<thead>
<tr>
<th>Class of Functors</th>
<th># of Tokens</th>
<th>Percent Overlap</th>
</tr>
</thead>
<tbody>
<tr>
<td>circumstancials</td>
<td>818</td>
<td>50.3</td>
</tr>
<tr>
<td>spatial</td>
<td>446</td>
<td>52.7</td>
</tr>
<tr>
<td>temporals</td>
<td>212</td>
<td>66.5</td>
</tr>
<tr>
<td>other</td>
<td>160</td>
<td>21.9</td>
</tr>
<tr>
<td>participants</td>
<td>500</td>
<td>47.0</td>
</tr>
<tr>
<td>ACT</td>
<td>113</td>
<td>55.8</td>
</tr>
<tr>
<td>PAT</td>
<td>238</td>
<td>58.0</td>
</tr>
<tr>
<td>other</td>
<td>149</td>
<td>22.8</td>
</tr>
<tr>
<td>configurations</td>
<td>386</td>
<td>36.0</td>
</tr>
</tbody>
</table>
Empirical Comparison - SNACS Spatiotemporals

- Most supersenses are mapped from one functor the majority of the time.

- **Duration** is predicted from **THL** and **TFHL** as expected.

- **Source** maps from **DIR1** as predicted, but also **LOC**.

- **Goal** aligns with **DIR3** but also **LOC**.
Empirical Comparison - SNACS Configuration Branch

- Large “other” percentage

- Significant portion of predicted supersenses are aligning with unexpected functors

- Best matches: **APP** with **Whole / Gestalt**, **MAT** with **QuantityItem**
Empirical Comparison - Overview

- We see for most spatiotemporal categories there is an alignment between PEDT and predicted supersenses
  - Most reliable correspondences are between **TWHEN** and **Time**, **LOC** and **Locus**, and **TSIN** and **StartTime**, **TILL** and **EndTime**
  - **DIR1** and **Source**, **DIR3** and **Goal** do align, but **LOC** seems to overlap with **Source** and **Goal**

- Configuration: less clear patterns, supersenses don’t seem to line up with any one functor
  - **APP** has representation across multiple Supersenses
Why do the overlaps diverge from expectations?

1. Errors by the automatic SNACS tagger
   • WSJ is out-of-domain for SNACS classifier (which achieves ~80% F1 in-domain)

2. Errors relating to SNACS scene/function distinction
   • LOC vs Locus ~> Goal, ACMP vs Agent ~> Ancillary

3. Errors due to unexpected systematic divergent usages of categories in the two sets
   • CPR vs ComparisonRef, DIR3 vs Goal, DIR2 vs Direction
1. The new plant, located in Chinchon about 60 miles from Seoul, will help meet increasing and diversifying demand for control products in South Korea, the company said.

2. Moscow has settled pre-1917 debts with other countries in recent years at less than face value.
1. A seat on the Chicago Board of Trade was sold for $350,000, down $16,000 from CPR.Locus~>Source the previous sale last Friday.
   - CPR and ComparisonRef used differently

2. A disaffected, hard-drinking, nearly-30 hero sets off for DIR3.Direction snow country in search of an elusive sheep…
   - DIR3 (“where to”) is closer to Direction than DIR2 (“which way”)
   - SNACS groups Direction as subtype of Path
Conclusions

● Similar descriptions for some functors and supersenses lead to broad overlap
  ○ Predominantly for temporal / spatial relationships

● However, descriptively similar categories do not always demonstrate good alignment in practice

● In particular, more work is needed to investigate more complex mappings from PEDT functors onto Configuration supersenses


Merci de votre attention.