Preparing SNACS for Subjects and Objects

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Abstract

Research on adpositions and possessives in multiple languages has led to a small inventory of general-purpose meaning classes that disambiguate tokens. Importantly, that work has argued for a principled separation of the semantic role in a scene from the function coded by morphosyntax. Here, we ask whether this approach can be generalized beyond adpositions and possessives to cover all scene participants—including subjects and objects—directly, without reference to a frame lexicon. We present new guidelines for English and the results of an interannotator agreement study.

1 Introduction

Studies of verbal argument structure have established some clear semantic correlations of syntactic relations like subject and object, and there are various approaches to expressing these generalizations using categorical semantic roles (Fillmore, 1968, 1982; Levin, 1993) or bundles of proto-properties (Dowty, 1991; Reisinger et al., 2015) that generalize across verbs. A parallel line of work (§2) has looked at the meanings coded by grammatical phrase-markers such as prepositions and possessives and how to disambiguate them. These inquiries necessarily overlap because many prepositions mark verb arguments or modifiers. Consequently, insights from the study of prepositions/case may improve the meaning representation of core syntactic arguments, or vice versa.

In this paper, we investigate whether SNACS (Schneider et al., 2018b), an approach to semantic disambiguation of adpositions and possessives, can be adapted to cover syntactically core grammatical relations (subjects and objects). We believe this may have several practical advantages for NLP.

First, many of the semantic labels in SNACS derive from VerbNet (Kipper et al., 2008) role labels. However, VerbNet and other frame-semantic approaches like FrameNet (Fillmore and Baker, 2009) and PropBank (Palmer et al., 2005) assume a lexicon as a prerequisite for semantic role annotation. This can be an obstacle to comprehensive corpus annotation when out-of-vocabulary predicates are encountered. But is a lexicon really necessary for role annotation? A general-purpose set of role labels with detailed criteria for each can potentially bypass coverage limitations of lexicon-based approaches, while still supporting some degree of generalization across grammatical paraphrases.

Second, the nonreliance on a lexicon potentially simplifies the annotation process in some respects. For example, no explicit predicate disambiguation step is necessary, and the annotator does not need to consult frame-specific role definitions.¹

Third, the semantic criteria for SNACS labels are designed to be language-neutral, and investigations thus far suggest that they can be generalized to languages besides English (Hwang et al., 2017; Zhu et al., 2019). While this paper focuses on English, we see the future opportunity for cross-lingual extension without the construction of new lexicons as a major advantage.

Finally, SNACS is unique in allowing two semantic labels per target, one reflecting a level of meaning closer to the grammatical coding, and the other at a deeper level associated with the predicate scene type (§3). We show below that the SNACS analysis, while designed for PPs, can be extended to subjects and objects, to the extent that the coarse-grained inventory distinguishes roles in the scene.

We summarize SNACS in §2, and in §3 propose a strategy for adapting SNACS for English subjects

¹On the other hand, consulting a frame-specific set of core roles may simplify the role labeling task for an annotator, producing higher-quality annotations. In the future it may be worth exploring a hybrid solution that maps lexicon-defined roles to supersenses and asks the annotator to apply supersenses directly only for out-of-vocabulary predicates.
and possessives (Schneider et al., 2018a, e.g., P
lar syntactic alternations involving the same subset
and FrameNet, SNACS labels are highly coarse-
ences involved in a static relationship to one another
in various challenging phenomena. We conduct a
 pilot interannotator agreement study on Wikipedia
articles (§4) and release the annotations. 2

2 Background

The SNACS hierarchy is a taxonomy of coarse-
grained supersenses developed to mark semantic
relations as expressed by adpositions (prepositions + postpositions) and possessives (Schneider et al., 2018b). The complete SNACS hierarchy is shown in figure 1 with our modifications highlighted.

SNACS includes the usual thematic relations (e.g., AGENT, THEME, RECIPIENT) and adjunct relations (e.g., TIME, LOCUS including locations, PURPOSE) used by most resources designed for SRL annotation. SNACS diverges from the general predicate-argument labeling standards in its inclusion of non-standard roles such as ORIGINATOR in creation (creator), transfer (giver) and communication (speaker) events, and labels regarding properties involved in a static relationship to one another (e.g., POSSESSION in “owner of the car”).

Unlike labels used by efforts such as PropBank and FrameNet, SNACS labels are highly coarse-grained and generalize across various scenes and situations. This approach also differs from frame-alternation–based lexicons like VerbNet, which defines classes of verbs whose members exhibit similar syntactic alternations involving the same subset

2 https://github.com/adishalev/SNACS_DMR_IAA
3 Semantic Network of Adposition and Case Supersenses

of roles. Instead, SNACS places the burden of
semantics directly on a fixed set of supersenses,
forgoing the use of frame (or class) definitions. The
supersenses can be thought of as disambiguating
course-grained adposition senses. The supersense
labels effectively encapsulate—at a highly abstract/
schematic level—various basic scenarios that are
important to language and grammar, such as transi-
tive action, motion, unidirectional transfer/commu-
nication, and psychological events, as well as sta-
tive relations like possession, quantity, comparison,
and identity. SNACS does not formalize a semantic
core/non-core or argument/adjunct distinction,
though roles in the PARTICIPANT hierarchy are
typically core and roles in the CIRCUMSTANCE hierarchy are typically non-core in predicate-argument
annotation schemes like PropBank and FrameNet.

SNACS further adopts a device called construal (Hwang et al., 2017), explained below.

3 Applying SNACS

We adopt the SNACS labels originally developed
for disambiguating adpositions and possessives as
exemplified in (1) and extend their use to annotate
the subject and object of a verb as seen in (2).

(1) a. The bagel was eaten byAGENT Jane.
b. Jane dined onTHEME a bagel.
(2) [Jane]AGENT ate [a bagel]THEME.

Following the construal approach, which is il-
ustrated in table 1 for adpositions, we separate
two semantic dimensions of an annotation target:
Scene Role: What semantic role is most closely as-
associated with the type of scene (typically indicated by the verb/predicate)? Function: What semantic role is most salient in the morphosyntactic coding of the phrase (with a grammatical relation like subject or object, or overt marking with closed-class morphology like adpositions and case)? Consider the following examples. Construal is notated by

Scene Role~Function.

(3) [Jane]RECIPIENT~AGENT bought [the
book]POSSESSION~THEME.
(4) [Bingley]SOCIALREL~THEME married
[Jane]SOCIALREL~THEME.

The scene role indicates the participation role of
the target in the scene described by the verb. Jane is the RECIPIENT in a transfer scene in (3), and
she is in a certain social relationship with Bingley (i.e., SOCIALREL) given the marriage scene in (4).
The function label, on the other hand, captures the
ortho-
labels such as AGENT or THEME to appear multiple times in a given scene, opting for the use of a “Co-” label for the second participant sharing the same role (e.g., CO-AGENT). In applying SNACS guidelines for subjects and objects, this became untenable, as “Co-” prefixation could apply to a good majority of the PARTICIPANT labels, threatening a quick proliferation of the supersenses. E.g., (4) would require CO-SOCIAL.REL., (16) would require CO-EXPERIENCER, and so forth. In an effort to keep the supersense inventory limited, we diverge from the latest SNACS standards to allow role duplication in a scene. This is allowed even when targets assigned the same role are not fully symmetric or are qualitatively distinct as in (17).

(5) a. [Rachel] AGENT-AGENT opened [the door] THEME-THEME with the remote control INSTRUMENT-INSTRUMENT.
b. [The remote control] INSTRUMENT-INSTRUMENT opened [the door] THEME-THEME.
c. [AGENT-AGENT used] the remote control INSTRUMENT-INSTRUMENT to open the door PURPOSE-PURPOSE.
d. [The door] THEME-THEME opened.

(6) [Rachel] THEME-THEME sneezed.

(7) [Rachel] EXPERIENCER-AGENT watched [the children playing] STIMULUS-THEME.

(8) [Rachel] EXPERIENCER-THEME heard [the noise] STIMULUS-THEME.

(9) [Rachel] AGENT-AGENT spent $5 COST-COST on coffee POSSESSION-THEME.

Thematic hierarchy. As discussed above, the function label generally reflects AGENT-THEME relations of a proposition. More specifically, we annotate all subjects and direct objects with a function in the following thematic hierarchy: {AGENT, CAUSER} > {INSTRUMENT, MEANS} > {THEME, TOPIC, COST}. In a transitive clause, the supersense of the subject cannot be ranked lower than the direct object (e.g., a subject construed as a THEME cannot have a direct object construed as an AGENT). Indirect objects in the English double object construction are treated as RECIPIENT construals.

(15) [A reception] THEME-THEME will precede [the dinner] THEME-THEME.

(16) [He] EXPERIENCER-THEME heard the news [with a stranger] EXPERIENCER-ACCOMPANIER.

(17) Replace [the old one] THEME-THEME with the new one THEME-ACCOMPANIER.

Figure 2: Annotated examples from our guidelines.

Copular sentences. These are treated differently from non-copular sentences. The English copula relates a subject to an object in what is semantically an identificational (22a) or predicational (22b) relationship. To these cases we assign IDENTITY-IDENTITY or GESTALT-CHARACTERISTIC at the scene level, respectively. Roughly speaking, IDENTITY indicates the identified or identifying category or referent, and CHARACTERISTIC indicates a property being ascribed to the GESTALT:

(22) a. [John] IDENTITY-IDENTITY is [a man] IDENTITY-IDENTITY.
b. [John] GESTALT-THEME is [tall] CHARACTERISTIC-CHARACTERISTIC.

Open issues. The unresolved problem of causatives and caused-motion constructions is discussed in appendix A.

4 Interannotator Agreement Study

Data. We piloted our guidelines using a sample of 100 scenes from the English UCCA-annotated Wiki corpus as detailed by Abend and Rapporport (2013). UCCA is a scheme for annotating coarse-grained predicate-argument structure such that syntactically varied paraphrases and translations should receive similar analyses. It captures both static and dynamic scenes and their participants, but does not mark semantic roles.

Annotators. Four annotators (A, B, C, D), all authors of this paper, took part in this study. All are computational linguistics researchers.

Datasets. Prior to development of guidelines for subjects and objects, one of the annotators (Annotator A) sampled 106 Wiki documents (44k tokens) and tagged all 10k instances of UCCA Participants with a supersense based on the existing guidelines.

5http://cs.huji.ac.il/~oabend/ucca.html; the Wikipedia corpus contains 369 documents (biographies of entertainment industry figures) with 159k tokens and 36k Participant units.

6The UCCA category Participant is broader than the PARTICIPANT supersense, also including locations, for example.
were written, four annotators first annotated a prac-
tice dataset of 48 UCCA Participant tokens, then adjudicated disagreements through discussion and clarified certain policies before annotating a final sample of 100 tokens for measuring agreement. Participants were sampled based on the preliminary annotation, stratified across subtypes of Participant and Configuration to ensure diversity. In the final sample, the syntactic distribution is as follows: 31 subjects (including 4 passive subjects and 6 copular subjects); 26 objects (including 1 indirect object and 2 copular complements); 42 PPs; and 1 possessive.

Coverage of the hierarchy. Under the Participant tree in the hierarchy, there are 12 supersenses, of which 11 were used as scene roles and 9 as functions. (By design, Participant itself is never used and exists only to organize the hierarchy.) The Configuration tree includes 19 supersenses, of which 14 were used as scene roles and 10 as functions. In the Circumstance tree—which primarily applies to syntactic adverbials—Goal, Locus, Source, Manner, Means, and Circumstance were all used as functions, and all but Source also appeared as a scene role.

Quantitative IAA results. We first compare agreement on two subsamples: the subject/object Participants, and the prepositional phrase Participants. Pairwise Cohen’s $\kappa$ scores appear in table 2.

<table>
<thead>
<tr>
<th>Scene Role</th>
<th>Subjects/Objects (N=57)</th>
<th>PPs (N=42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\kappa$</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Scene Role</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPs</td>
<td></td>
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</tr>
</tbody>
</table>

Thus subjects/objects (SOs) receive higher scene role agreement than PPs—somewhat surprising given that the labels were originally designed for prepositions! This may be an artifact of the particular sample, or may indicate that the scene role is more intuitive for SOs than for PPs. PPs have higher agreement than SOs with respect to function; this may be due to some difficulty deciding between Agent and Theme for the function of SOs, plus the availability of extensive guidelines/examples for prepositional SNACS annotation.

Disagreements involving agentivity. We found it can be difficult to choose between Agent and Theme for the function of a subject with borderline agentivity, e.g., in scenes of befriending someone or forming a musical group with others. Likewise, the line between Agent and Theme for the function can be unclear in cognition/perception scenes like [She] enjoyed the fame and [She] saw the social scene as tedious and superficial. We decided the annotator should consider whether the scene involves judgment or is more of a passive experience; Experiencer $\rightarrow$ Theme would thus apply to the first example and Experiencer $\rightarrow$ Agent to second. Finally, the line between Causer and Instrument can be unclear in sentences like I was hit by a car and I was quoted by a magazine.

UCCA issues. We found a handful of UCCA annotation errors—primarily where two verbs were analyzed as separate scenes but the first ought to be considered a light verb. A more interesting case was the relation between the two bolded expressions in William S. Paley set terms that included...ownership of the negative at the end of the contract. The UCCA annotation treats William S. Paley as a Participant of ownership (i.e., the owner). Though Possessor is a natural scene role for the owner of something, we concluded that this was an indirect inference not suitable for annotating with a function.

5 Conclusion
We explored whether a system for semantic relation annotation can be extended beyond prepositions and possessives to cover English subjects and objects. While initial annotation results are promising, further work is needed to substantiate the approach on a larger scale, and ideally in multiple languages.

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4 tokens where annotators noticed a problem with the UCCA annotation were discarded and replaced.

8 Raw agreements are higher than kappa, but the same trends hold.

9 There is precedent for this distinction in FrameNet’s Perception_active vs. Perception_experience frames.
Acknowledgments

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References


A Open Issues

Sometimes a sentence will construe a scene as involving more arguments than a predicate normally licenses, as in the following causative or caused-motion examples (Goldberg, 2006):

(23) [Rachel] THEME→? sneezed (implicit: blew) | the napkin | THEME→THEME | off the table | PATH→SOURCE.
(24) [Rachel] AGENT→? (implicit: caused) jumped | the horse | AGENT→THEME | over the fence | PATH→PATH.

So far, we have posited the scene to be the situation or event described by the predicate. The problem is that in addition to the scene evoked by the verb (sneezing in (23) and jumping in (24)), there is an added caused-motion scene whose semantics derives from the construction. Should there be an indication that the sneezer is also the causer of motion, and that the ultimate causer of jumping is separate from the impelled jumper? One possible solution would be to add implicit predicates so the verb- and construction-triggered scenes would be annotated separately. A different solution may be to relax the definition of what constitutes a scene to allow for non-predicate-driven scenes as well.