Tense and Aspect Semantics for Sentential AMR

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Abstract

Many English tense and aspect semantic contrasts are not currently captured within Abstract Meaning Representation (AMR) annotations. The proposed framework augments the representation of finite predications in AMR to include a four-way temporal distinction (event time before, up to, at, or after speech time) and several aspectual distinctions (including static vs. dynamic, habitual vs. episodic, and telic vs. atelic). We validate this approach with a small annotation study of sentences from *The Little Prince* and report details of ongoing discussion to refine the framework. This will enable AMR to be used for NLP tasks and applications that require sophisticated reasoning about time and event structure.

The Abstract Meaning Representation (AMR) is a readable and compact framework for broad-coverage semantic annotation of English sentences (Banarescu et al., 2013).[1] AMR aims to abstract away from syntactic idiosyncrasies such that sentences with the same basic meaning are represented by the same AMR graph. This paper extends existing AMR to include a coarse-grained representation of tense and aspect. Figure 1 shows a sentence with its annotation from the existing AMR corpus with our proposed additions for tense (in blue) and aspect (in purple).

Existing annotation in figure 1 specifies entities and propositional structure[2] but notably omits the present time meaning of the copula and the future meaning of *"going to."* It also does not specify whether these eventualities[3] are stative (temporary

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[1] `http://amr.isi.edu/;` data released at `https://amr.isi.edu/download/amr-bank-struct-v1.6.txt` (*Little Prince*) and `https://catalog.ldc.upenn.edu/LDC2017T10`

[2] This includes both the PropBank frameset `last-01` and the AMR-specific frameset `be-located-at-91`.

[3] We understand eventualities to include all kinds of events: states, activities, achievements, accomplishments, and processes.

```
(a / and
    :op1 (b / be-located-at-91
        :stable -
        :time (n2 / now)
        :ARG1 (p / person
            :ARG0-of (h / have-rel-role-91
                :ARG1 (y / you)
                :ARG2 (b2 / brother)))
        :ARG2 (h2 / hospital))
    :op2 (l / last-01 :polarity -
        :ongoing - :completable +
        :time (a / after :op1 (n3 / now))
        :ARG1 p
        :ARG2 (d / date-entity
            :dayperiod (n / night))))
```

Figure 1: AMR for "Your brother's in the hospital and he's not going to last the night." Bolded/colored relations show proposed tense and aspect annotation.

or permanent) or dynamic, and if the latter whether they are in progress, progressed to completion, or terminated prematurely. The AMR in figure 1 without new annotation would thus be identical for the sentence *"Your brother **was** in the hospital and **did not** last the night."* The distinction between these two interpretations could have vital importance for practical scenarios in which automated decision-making systems operate, as well as for information extraction applications that identify and situate linguistically described events both in time and in relation to one another.

1 Proposed Annotation Scheme

The scheme presented here is a slightly revised version of that presented in (Donatelli et al., 2018). We consider as sites for tense/aspect annotation those concepts in the AMR that correspond to finite predications in the syntax. This restriction is motivated by the understanding that finite clauses explicitly describe eventualities on the temporal dimension, and thus tense-aspect category values are relevant (Langacker, 1987). Though labels are annotated on the AMR concept corresponding to

the finite verb, they refer to the event structure denoted by the entire frameset predication.

1.1 Time

Time may be understood as the temporal location of an eventuality relative to speech time.[4]

Present Time. The current annotation scheme overtly marks expressions of well-defined semantically present tense when the event time cooccurs with the speech time. Target expressions are verbs in the present form. They are annotated by adding `:time (n / now)` under the AMR annotation target. For example, *"What are you doing here?"* would be present time.

Future Time. We mark expressions of semantically future tense when the event time occurs after the speech time. Typical targets are (i) the use of the auxiliary "will" in front of the bare verb; and (ii) the use of the present tense with a future-oriented temporal adverbial, as in *"I leave for Paris tomorrow."* Targets are annotated with `:time (a / after :op1 (n / now))`.

Past Time. We mark expressions of semantically past tense when the event time occurs prior to speech time. Typical target expressions are past tense verbs, though not all uses of morphological past tense reflect past time. Targets are annotated with `:time (b / before :op1 (n / now))`.

Continuative Time. The English perfect can indicate that an eventuality has been in effect up to the present moment, without specifying whether it will continue. We represent this with `:time (u / up-to :op1 (n / now))`.

Discourse Time. Often, the time reference of a event is sensitive to the structure of the discourse, which is not fully determined by the grammatical tense of the predicate. In such cases, we omit `:time` annotation and leave the sentence temporally underspecified.

1.2 Aspect

Grammatical aspect may be understood as the *how* of an eventuality, in comparison to the *when* denoted by grammatical tense (Comrie, 1976; Croft, 2012).

:stable + / - We use this aspectual feature to refer to states, thus capturing the canonical distinction between events and states in our annotation. `:stable +` states are those that are per-

manent characteristics of individuals or entities that are construed as lasting a lifetime; acquired states that signal a (mostly) irreversible change; and identity relationships. `:stable −` states are likely to change, including transitory states that are bounded in time; point states that are bounded and exist at a single point in time; and descriptions that vary by context or time.

:ongoing + / - / ? This feature indicates the interior (in progress) (+) or exterior (viewed as a whole) (−) perspective on the event signaled by grammatical tense or context. `:ongoing ?` leaves room for ambiguity in meaning, such as with some English perfects.

:complete + / - We use this feature for episodic, realized, telic events, i.e. directed events that include a measurable change in the status of one of the verb's arguments and that have taken or are taking place. The annotation `:ongoing +/−/?` is a prerequisite for adding `:complete +/−`.

:completable + / - This feature refers to non-real events: `:completable +` signals non-real, episodic, telic events (parallel to real events marked with `:complete`); `:completable −` signals non-real, atelic events. These events are hypothetical or unreal due to the presence of modal operators, negation, or future orientation within the sentence. We would like to note, however, that our treatment of non-real events with the `:completable` feature is simply a placeholder for a general annotation of modality.

:habitual + This feature is used for clauses that contain a lexically dynamic verb and that denote a regular recurrence of an event, whether attributed to a kind (*"Bears usually eat blueberries"*) or an individual (*"I used to make pie daily in summer"*) (Mathew and Katz, 2009). This contrasts with episodic events, which refer to specific finite, individual events (*"Mary ate oatmeal for breakfast yesterday"*). `:habitual +` also applies to recurring `:stable −` states. Future adjustments to our scheme may include treating `:habitual` within the context of modality.

1.3 Exceptional Cases

Distinct pilot annotation tasks involving both naive and expert annotators have motivated refinement of previous annotation labels into the current scheme. Challenging areas for the scheme presented here include: (i) the English perfect construction (Comrie, 1976, 1985; Croft, 2012); (ii)

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[4]Hence the label "time" instead of "tense."

quotations; (iii) copula constructions; (iv) inceptive states (Croft, 2012); (v) negation; and (vi) conditionals and other modals.

2   Related Work

Temporality and aspectuality have played an important role in several annotation schemes that have been applied to English corpora for NLP. We reference the schemes of TimeML (Pustejovsky et al., 2017); Situation Entity (SE) labeling (Friedrich et al., 2016); Richer Event Description (RED) (O'Gorman et al., 2016); Causal and Temporal Relations Scheme (CaTeRS) (Mostafazadeh et al., 2016); and Tense Sense Disambiguation (TSD) (Reichart and Rappoport, 2010) in our annotation design. The scheme presented here integrates ideas from these frameworks regarding the ability to reason with contextually underspecified events; annotation at the clause, not word, level; and dissociating semantic senses from grammatical constructions.

Acknowledgments

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