

UMR Road Map Guidelines

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1 Introduction

This annotation scheme forms one piece of Uniform Meaning Representation (UMR), which seeks to annotate semantic information uniformly across languages. In this piece of the annotation scheme, we annotate semantic roles for participants and modality, polarity, and aspect for events. It is important to emphasize that UMR is a semantic annotation scheme; it aims to annotate semantic information regardless of the morphosyntactic strategies used to express that information in any particular language. This means that UMR annotations may be different for the same grammatical construction, depending on the context in which it occurs. Nevertheless, certain types of grammatical constructions may serve as ‘clues’ to the appropriate UMR annotation.

UMR seeks to achieve both flexibility and comparability across a diverse range of languages. Languages differ from each other not only with regard to linguistic features, but also in terms of which types of computational resources have already been developed. The pieces of the UMR annotation scheme presented here make use of two types of solutions for these differences across languages: typologically-informed lattices, and the road map approach.

The lattice approach gives annotators the flexibility to select coarser-grained (or finer-grained) annotation values. The lattices are constructed based on typological generalizations and indicate which annotation values are comparable.

The road map approach defines different stages of UMR annotation, depending on the resources available in a given language. This allows languages without a large amount of pre-existing computational resources to be annotated with UMR. For certain annotation categories, earlier stages of the road map only annotate a subset of events/participants with the relevant value; but, importantly, the events/participants that are annotated receive comparable annotations to later stages in the road map. For participant roles, the earlier stages of the road map involve building the computational resources to enable Stage 2 annotation. Here, the computational resource (namely, frame files) will indicate the relationship between the Stage 1 and Stage 2 annotation values.

2 Identification of annotation targets

The first annotation task involves identifying the events and participants that will be annotated with semantic values for the different UMR annotation categories. This task is the same at every stage of the road map. This section will only cover which semantic types of events and participants should be identified for annotation; it is a separate task to decide which spans of text should be selected for each identified event and participant. Currently, we don’t have guidelines for selecting spans of text for events and participants. It is more important that the right semantic events and participants are identified for annotation.

For languages that already have a lexicon of frame files available, events are labelled with the relevant predicate from the frame files. For all languages, special UMR predicates are used to label certain types of “nonverbal events” (see 2.1.3). Otherwise, label the events and participants with whichever words from the text help you to read the annotations. In general, using lemmatized forms of the words that express the event or participant in the text with a number indicating the sentence of the text (e.g., **give-03**) works well.

2.1 Event Identification

The criteria used to identify events in UMR are largely based on the criteria used in TimeML (Pustejovsky et al. 2005). Event identification is not based on parts of speech or word classes, since these vary greatly across languages. Instead, event identification is based on a combination of semantic type and information packaging (Croft 2001). Semantic type refers to the difference between entities (or, objects), states (or, properties), and processes; this can be thought of as a categorization of things in the real world. Information packaging (also called discourse function or information structure), on the other hand, characterizes how a particular linguistic expression “packages” the semantic content. There are three fundamental information packaging functions: reference, modification, and predication. Croft (in preparation) defines them as:

reference: what the speaker is talking about

modification: additional information provided about the referent

predication: what the speaker is asserting about the referents in a particular utterance

The three semantic types can occur with any of the three fundamental information packaging functions, as shown in Table 1 from Croft (in preparation).

Cross-linguistically, certain types of morphosyntactic constructions tend to express specific combinations of semantic type and information packaging; these are shown in Table 2, modified from Croft (2001). Prototypical combinations of semantic type and information packaging are indicated with small caps. These correspond to well-known part-of-speech classes across languages: entities in reference correspond to nouns, states in modification to adjectives, and processes in predication to verbs.

	Reference	Modification	Predication
Entities	the sharp thorns	the bush’s thorns	It is a thorn.
States	sharpness	the sharp thorns	Those thorns are sharp.
Processes	I said [that the thorns scratched me]. the [scratching of the thorns]	the thorns that [scratched me] the thorns [scratching me]	The sharp thorns scratched me.

Table 1: English examples of semantic type and information packaging (Croft, in preparation)

The most prototypical expression for an event is a process in predication, therefore we identify a word/phrase as an event if it has either the semantic type of the prototype (process) or the prototypical information packaging (predication). The categories which are identified as events in UMR are shown in bold in Table 2.

2.1.1 Processes in predication

Predicated processes are the most prototypical subcategory of events, corresponding cross-linguistically to unmarked verbs. They will therefore always be identified as events. This is shown in 1 below.

	Reference	Modification	Predication
Entities	UNMARKED NOUNS	relative clauses, PPs on nouns	predicate nominals, complements
States	deadjectival nouns	UNMARKED ADJECTIVES	predicate adjectives, complements
Processes	event nominals, complements, infinitives, gerunds	participles, relative clauses	UNMARKED VERBS

Table 2: Constructions associated with semantic type and information packaging (Croft 2001)

(Throughout this section, words that are identified as events will be shown in bold; the relevant phenomenon under discussion will be underlined.)

- (1) a. She repaired her bike.
b. Before she went to school, she **repaired** my bike.

Regardless of whether they are in an independent clause, like *repaired* in 1a, or a dependent clause, like *went* in 1b, predicated processes are always identified as events.

2.1.2 Processes in modification and reference

Processes packaged as modifiers or referents should also be identified as events. Cross-linguistically, these may take a variety of morphosyntactic forms, such as event nominals (as in 2a), non-finite complements (as in 2b), participles (as in 2c), or relative clauses (as in 2d).

- (2) a. The storm **damaged** the roads.
b. She **wanted** to go to school.
c. The student playing the violin **likes** Bach.
d. The student, who is playing the violin, **likes** Bach.

The combination of semantic type and information packaging determines whether or not a particular word in a particular context is identified as an event. The morphological structure of a word (i.e., whether or not it derives from a verb) doesn't factor into whether or not it is identified as an event. For example, not all event nominals are derived from verbs, as in 3a; and, not all words derived from verbs actually refer to processes, as in 3b.

- (3) a. He is **planning** a ceremony for Saturday.
b. The bus driver **turned** the corner too sharply.

Even the same lexical item may or may not refer to a process, depending on context as in (4) below.

- (4) a. The final exam began at 8:00.
b. One student **threw** their final exam in the trash.

In (4a), *final exam* refers to a process and therefore is identified as an event. In (4b), however, *final exam* refers to a physical object and therefore is not identified as an event.

Participles (or other non-finite verb forms) are identified as events, unless they are part of a compound. For example, *floating* in *floating hospitals* is identified as an event, but *firing* in *firing squad* is not, since it is part of a compound. One way to check for this distinction is to see if the event described by the participle must be ongoing at the reference time. For example, one can say *I saw the firing squad* without having seen an actual firing event, whereas *I saw the floating hospitals* implies that the seer witnessed the floating event as well.

2.1.3 States and entities

As mentioned above, anything that is predicated is identified as an event, even if it is not a process. Two-place statives, such as *love* in 5, are annotated in the same way as predicated processes, i.e. an event is identified and labelled with the predicate in the language.

- (5) My cat loves wet food.

Other types of predicated states and entities require a different solutions based on their function and the strategy used to express them in a language; we call these “nonverbal clauses”. The different functional types of nonverbal clauses are shown below in Table 3.

Semantics	Information-packaging	Example
possession	thetic/presentational	The teacher has a dog.
possession	predicational	The dog belongs to the teacher.
location	thetic/presentational	On the rock was a symbol.
location	predicational	The symbol was on the rock.
property	predicational	The cat is black.
object	predicational	Panda is a cat.
object	equational	Panda is my cat.

Table 3: Nonverbal clause types

There are four semantic types of nonverbal clauses: possession, location, property, and object. All of these occur with predicational information-packaging: the possessive relationship, location, property, or object category are predicated of the possession or theme. Possession and location are, in addition, used in a context in which the entire information is presented as ‘thetic’ or ‘all-new’ in the terms of Lambrecht’s theory of information structure (Lambrecht 1994; cf. the contrast between ‘have’ possession [thetic] and ‘belong’ possession [predicational] in Heine 1997). One common thetic function is presentational, as in the examples in Table 4 above. For objects, it can be difficult to distinguish equational (corresponding to Lambrecht’s identificational information structure) and predicational information-packaging in context (see Stassen (1997, 106-111)). Object predication asserts that the theme is part of a category of objects (i.e., *Panda* fits within the category of *cat*), whereas equational sentences indicate that two referents are the same (i.e. *Panda* is the same referent as *my cat*).

According to the cross-linguistic studies in Stassen (1997, 2009), Heine (1997), and Creissels (2019), languages tend to use three general strategies for these nonverbal clause types, shown below in 6 for object predication.

- (6) a. Juxtaposition (“zero copula”) - Kukama
 ajan kunumi tsumi
 this young.man shaman
 ‘This young man is a shaman.’

- b. Separate Predication - English
Panda is a cat.
- c. Participant Predicativization - Náhuatl (Launey 1994)
ni-t̃icitl
1SG-doctor
'I am a doctor'

The first strategy, shown in 6a from Kukama, juxtaposes the two participants, here the theme and object category, but does not overtly express the predication. The second strategy, shown in 6b from English, has a predicative element (here, the copula) that is separate from either participant. Finally, some languages, like Náhuatl in 6c, treat the object category participant (*t̃icitl* 'doctor') as the predicate. For all of the nonverbal clause categories, there is only one of the participants which can act as the predicate cross-linguistically; that is, for object predication, it is always the object category participant that looks a predicate with this strategy (and never the theme).

For these nonverbal clause categories, the event identified is labelled with a special UMR predicate that indicates the relevant combination of semantics and information-packaging. These are shown below in Table 4. For the labelling of participants with these nonverbal clause predicates, see §4.

Clause type	UMR Predicate
thetic/presentational possession	have-03
predicative possession	belong-01
thetic/presentational location	exist-91
predicative location	have-location-91
property predication	have-mod-91
object predication	have-role-91
equational	identity-91

Table 4: Nonverbal clause predicates

States in modification, as in 7a and 7b, and states in reference, as in 7c, are not identified as events.

- (7) a. The tall man...
- b. The man, who is tall...
- c. His happiness...

Similarly, entities in modification, as in 8a, and entities in reference, as in 8b, are not identified as events.

- (8) a. The man, who is a doctor...
- b. The doctor

Causal relationships follow the same rules as states and entities. They are identified as events when they are predicated, as in 9a, but they are not identified as events otherwise, like in 9b.

- (9) a. The **explosion** caused the house **to collapse**.
- b. The house **collapsed** because of the **explosion**.

2.1.4 Special cases

There are some common constructions where languages may use multiple words to express a single event, or a single word to express multiple events. Since the packaging of concepts into words varies across languages (much like the definition of a “word”), we make use of semantic criteria for determining if one or two events are identified.

Complex predicates. Following TimeML (Pustejovsky et al. 2005), complex predicates correspond to a single event. Complex predicates can be identified following some of FrameNet’s semantic guidelines for support predicates (Ruppenhofer et al. 2016, 34-36). Complex predicates in English generally consist of a *verb + noun* combination, as shown in 10.

- (10) She took a walk around the block.

With complex predicates in English, the noun supplies the bulk of the semantic information; in 10, the event describes an act of walking, not an act of taking. Furthermore, the meaning of the verb in a complex predicate has a different meaning when used by itself (i.e., there is no actual taking involved in *take a walk*). The final criterion for the identification of complex predicates is that the support verb (in FrameNet’s terms) is relatively fixed (i.e., a particular noun only occurs with the same support verb, or a small number of support verbs). For example, you can’t say **make a walk* or **give a walk*. Similarly, *give a talk* and *make a choice* also have fixed support verbs (**take a talk*, **take a choice*). The event noun (e.g., *walk*, *talk*, *choice*) in these cases is identified as the event.

Occurrence verbs. There are some verbs that only indicate the occurrence of an event expressed elsewhere, such as *happen*, *occur*, *take place*, etc.

- (11) The trip happened over Spring Break.

In 11, *happened* only indicates that the *trip* event occurred. These occurrence verbs are not identified as events; therefore, in 11, only *trip* is identified as an event.

Cognate objects. There are constructions in which a verb and its object refer to the same event; often, the verb and the noun are morphologically related. English allows a few constructions of this type, as in 12; other languages may make more extensive use of this construction.

- (12) She laughed a hearty laugh.

Only a single event is identified, since semantically there is only one event. For cognate objects, only the verb is identified as an event.

Valency. The marking of voice or valency, either morphologically on the verb, or through a separate word in the clause, is not annotated as its own event, i.e. only one event is annotated for the clause. For valency changes that affect the number or semantic type of participants (such as causatives), this is reflected in the participant role annotations (see §4). For valency changes that affect the information-packaging of the clause (such as passives), this is largely not reflected in the UMR annotation.

Languages use a range of strategies to express causative semantics, shown below in 13.

- (13) a. Grandmother **made** the kid **drink** the water.

- b. nai **kurata-ta** churan=ui uni=pu
grandmother drink-CAU kid=PST water=INS
‘Grandmother made the kid drink the water.’

- c. The ice cream **melted**. / He **melted** the ice cream.
- d. **tě-ad-ash** secque-sho chido-n mocodi
pull.off-ANTCAUS-after:S/A>S scatter-when:S/A/O>O woman-ERG seed
tsid-quid
gather-HAB
- ‘When it [the seed necklace string] **breaks** and the seeds scatter, the women gather up the mocodi seeds.’
Fleck 2003, 910

Causative semantics may be expressed by a word separate from the main verb, as in 13a from English, or derivational morphology, as in 13b from Kukama. Languages may also have isomorphic causative/anticausative pairs, where the causative isn't overtly expressed, as in 13c from English. Or, the underived form of the verb may have implicit causative semantics, with anticausative morphology necessary for a non-causal interpretation, as in 13d from Matses.

For all of these strategies, only a single event is identified that corresponds to both the main event and the causative semantics. The event is labelled with both the main verb and the causative (or anticausative) morphology (if applicable). The causative semantics will be annotated by way of the participant role annotation. This applies for all types of valency-changing morphology.

Aspectual marking. The marking of aspect is treated in much the same way as the marking of valency. That is, regardless of the strategy used in the language, aspectual marking is never identified as its own event and instead is considered a single event along with the main verb. The aspectual structure is indicated in the aspect annotation (see §6).

Aspect may be indicated by aspectual auxiliaries, as in 14a, or by morphology on the verb, as in 14b from Arapaho.¹

- (14) a. She is **starting to bead** around it.
 b. ceesisnoo'oebiicitiit.
 ceesis-noo'oe-biicitiit
 IC.begin-around-bead-3s
 'She is starting to bead around it.'

In both cases, a single event is identified for the aspectual marking and the main verb.

Aspectual verbs may also be used with event nominals, as in 15a, or with states in 15b.

- (15) a. She finished **the** race.
b. The **protests** turned **violent**.

These should be treated in the same way as constructions with verbs. That is, a single event is identified. The event nominal, like *race* in 15a, or the word expressing the state, like *violent* in 15b, are identified as events.

Modals. The expression of modality in a clause can take many forms; some of these look verb-like in nature and so it may be difficult to determine whether they should be identified as their own event or not. Some of the strategies that languages may use to express modality are shown below in 16.

- (16) a. xonouu niibeetwon3eiinein.

1. Additionally, what are overtly expressed aspectual distinctions in some languages may be left implicit in other languages.

2.1.5 Implicit events

Since UMR annotates meaning, and not form, there are situations where events are identified in the absence of explicit linguistic material. These correspond to events which are implicit, given the context, but not overtly expressed. We encourage annotators to be conservative on this front; when in doubt, don't add an implicit event.

We've identified two types implicit events: those where the implicit event corresponds to an event mentioned earlier in the text (as in 20), and those where it does not (as in 21).

- (20) a. John was **smoking** on the corner of the street, but when he **saw** me, he stopped [smoking].
b. They **told** me "a card was **left** on Tuesday" (no it wasn't [left] *of course*)...

In 20a, there is an implicit second *smoking* event and in 20b, there is an implicit second *leave* event. These implicit events should be annotated as co-referential with the event mentioned earlier in the text (see §3).

In 21, however, the implicit events don't have a relationship with an event previously mentioned in the text; instead, they refer to generic events which can be filled in from context.

- (21) a. **Phoned** Amtrak on Wednesday, [they said] "*We **need** a consignment number*".
b. "I have **ordered** the Coast Guard and our entire naval force in the (Central Philippines) region [to go] to the area," she **said**.

In 21a, the quotation marks make it clear that there is an implicit *say* event. In 21b, we can identify a very general *go* event, since *ordered...to the area* implies a motion event. For these types of implicit events, the most abstract, least specific event should be identified. For example in 21b, we could make an assumption based on context clues (e.g., *Coast Guard, naval force*), that the type of motion event is *sail*. But, that assumption may not be accurate (and may not be shared amongst annotators); therefore, the most general event possible should be identified.

2.2 Participant ID

Both entities and events in a text can receive participant role annotation. As a general rule, anything that is dependent on an event should be annotated as an argument of that event. This covers a wide range of morphosyntactic phenomena, including:

- i. core argument phrases
- ii. oblique phrases
- iii. complement clauses, and
- iv. other types of subordinate clauses.

Examples of these in English are shown below in 22; events are shown in bold and participants are in brackets.²

- (22) a. [The dog] **stole** [the pizza].
b. [He] **ate** [it] in [the hallway].
c. [He] **wanted** [to steal] [some beer] as well.
d. But, [he] **got caught** before [he] [had a chance].

2. We do not have guidelines for the span of text that should be selected as a participant; like event identification, annotators may select whichever words they feel serve to identify the participant.

Like event identification, there are some cases where it may not be clear if something should be identified as a participant. This involves grammatical phenomena which combine events and participants into a single word in a language, namely participant indexation (also called agreement or pronominal affixation) and noun incorporation.

In some languages, participants may be indicated by pronominal affixes on the verb, as in 23 from Arapaho.

(23) xonouu niibeetwon3eiinein.

xonouu nii-beet-won-3eiin-**ein**
immediately IMPERF-want.to-ALLAT-put.inside.a.place-**3s/2s**

‘Right away **he** wants to go and put **you** in jail.’

Here, the third person and second person participants are indicated by the suffix *-ein* on the verb. When participants are affixed on the verb, they should be identified as participants and should receive a participant role annotation. If a participant is expressed elsewhere in the clause and also indexed on the verb, it only needs to be identified once as a participant. If it’s possible, select the pronominal affix as the span of text for the participant; but, if there is a portmanteau affix, as in 23, the meaning of the affix (e.g., ‘3SG’) can be identified as the participant.

Noun incorporation involves a single word which expresses both an event and one of its participants. While this is a marginal grammatical phenomenon in English (e.g., *berry-picking*), in other languages it is much more widespread. For UMR, the question is whether the incorporated nominal should be identified and annotated as a participant, or if it should be considered a part of the verb (and therefore not annotated as a participant). We make that determination based on the level of grammaticalization of the construction in the language.

Mithun (1984) identifies four types (Type I - Type IV) of noun incorporation based on their level of grammaticalization. She also finds that the more grammaticalized types of noun incorporation only occur in languages that also exhibit the less grammaticalized types. For Types I-III, a separate participant should be identified for the incorporated noun; for Type IV, no separate participant is identified and the incorporated noun is considered part of the verb.

Type I noun incorporation is the least grammaticalized and involves a noun-verb compound that refers to a culturally common activity. Since Type I incorporation is restricted to conventionalized activities, it is also rather lexically restricted. Example 24 from English shows Type I incorporation; it is grammatical for a recognized sport like rock climbing, but not for climbing a wall.

- (24) a. They are rock **climbing**.
b. *They are wall climbing.
c. *They are rock climbing Half Dome.

When the incorporated nominal corresponds to the object in the clause, as in 24, Type I noun incorporation results in an intransitive clause; a direct object can’t be added to the clause (Mithun 1984). As shown in 24c above, the specific rock that is being climbed can’t occur in the clause.

Type II noun incorporation is similar to Type I in that it is a type of lexical compounding. However, Type II differs from Type I in that the resulting clause does allow for the expression of a direct object. The noun in the direct object slot however, does not refer to the same participant as the incorporated noun and does not fill the same semantic role. Example 25 from Yucatec Maya (Mithun 1984) shows Type II noun incorporation.

- (25) a. k-in-č’ak-ø-k č’e’ ičil in-kool.
INCOMP-I-chop-it-IMPF **tree** in my-cornfield
‘I chop the tree in my cornfield.’

- b. k-in-č'ak-č'e'-t-ik in-kool.
 INCOMP-I-chop-**tree**-TR-IMPf my-cornfield
 'I clear my cornfield.'

Example 25a shows the corresponding sentence without noun incorporation. In 25b, *č'e* 'tree', the object in 25a, is incorporated into the verb and the location argument, expressed as an oblique phrase in 25a, is realized as the direct object.

Type III and IV noun incorporation are mostly restricted to highly polysynthetic languages (Mithun 1984). In Type III, a referent that is unimportant in the discourse is backgrounded by means of incorporation into the verb. Like Type I, this creates an intransitive clause when the incorporated referent corresponds to the direct object. Unlike Type I, this is generally a more productive process, where a wide range of nouns can be incorporated, not just those that refer to a conventionalized activity. Example 26 from Koryak (Mithun 1984) shows Type III noun incorporation. The whale is first introduced in the discourse by a separate noun, and then subsequently expressed as an incorporated noun.

- (26) wūtču iñññin yūñi qualaivun. mal-yūñi. ga-**yuñy**-upényiñenau.
 this.time.only such whale it.comes good-whale they-**whale**-attacked
 'This is the first time that such a whale has come near us. It is a good one (whale). They attacked it (the whale).'

For Types I-III noun incorporation, a participant should be identified for the incorporated noun.

In Type IV noun incorporation, a semantically general noun is incorporated into the verb, which has the effect of narrowing the semantic scope of the verb. This often results in a classificatory system, whereby the incorporated noun classifies the semantic type of an argument of the verb; this can be seen in 27 below from Gunwingu.

- (27) a. ... bene-**dulg**-nañ mangaralaljmayn.
 they.two-**tree**-saw cashew.nut
 '... They saw a cashew tree.'
 b. ... bene-**red**-nañ ředgereneni
 they.two-**camp**-saw camp.new
 'They saw a camp which was freshly made.' ('They saw a new camp.')

Here, the incorporated noun acts to classify the type of entity that is seen. Type IV noun incorporation is distinct from Types I-III in that a separate noun can occur in the same clause that expresses the same referent as the incorporated noun. In 27a, *dulg* 'tree' is incorporated into the verb and *mangaralaljmayn* 'cashew nut' specifies the type of tree. For Type IV noun incorporation, the incorporated noun is not identified as a participant. If there is a separate noun in the clause, as in 27a and 27b, that noun is identified as a participant.

3 Co-reference

Once all events and participants are identified, the next step is to annotate co-reference relations between them. Only strict co-reference should be annotated, i.e. only annotate two events as co-referential if they refer to exactly the same event in space and time. Similarly, participants should only be annotated as co-referential if they refer to exactly the same participant (this excludes subsets, supersets, part-whole relations, etc.).

Following Richer Event Description (RED; Palmer et al.)'s guidelines, the co-referential relationship between two annotation targets should be both symmetrical and transitive. That is, if event A and event B are annotated as co-referential, the relation should be symmetrical: A is co-referential

with B and B is co-referential with A. The relation should also be transitive: if A and B are co-referential and B and C are co-referential, then A and C are co-referential as well. If the relation between A and B is not both symmetrical and transitive, then the two annotation targets should not be annotated as co-referential.

One event may refer to the sub-part of another event (i.e., subevent structure), as in 28.

- (28) The **trial** continued on Tuesday, with the defense’s **cross-examination** of the prosecution’s key witness.

Here, *cross-examination* refers to a subpart of the *trial*. Therefore, these two events should not be annotated as co-referential: they do not refer to exactly the same event in space and time.

3.1 Anaphoric reference to events

Since we’re identifying all semantic processes as events regardless of their expression, this means that anaphoric reference to processes will also be identified as its own event. This can be seen in 29.

- (29) The **storm damaged** the roads and some buildings; it also **knocked out** power to the whole city.

Since *it* refers to the storm, which is an event, then *it* is also identified as an event. Anaphoric reference to events is also identified as co-referential with the event to which it refers. That is, *it* and *storm* are annotated as co-referential.

4 Participant roles

Every entity and event identified as a participant is related to an event (the event that it is dependent on) and annotated with a participant role label. The participant role annotation looks rather different at the different stages of the road map. The factor which determines where a language begins on the road map is whether there is an existing PropBank-style lexicon for the language. An English PropBank frame file is shown below:

Predicate: **give.01**

Roles:

Arg0: giver

Arg1: thing given

Arg2: entity given to

Following AMR, UMR uses PropBank frame files to annotate lexicalized participant roles. But, this only works for languages which have PropBank-style frame files. This is considered the ‘Stage 2’ participant role annotation (see §4.2). The Stage 1 annotation involves using a set of general participant roles, while building a lexicon of PropBank-style frame files in order to move towards Stage 2 annotation.

Some types of valency alternations (or, argument structure alternations) are indicated in the participant role annotation; other types of alternations are not annotated in UMR. Not all valency alternations have the same relationship between the basic construction and the non-basic construction. Givón (1994) distinguishes semantic and pragmatic valency alternations. In semantic alternations, the basic and non-basic constructions differ in terms of the semantic content that they express, i.e., they don’t refer to the same “real-world” event. Reciprocals are an example of a semantic alternation, seen below in 30 from Torau (Parkinson 2018, 53).

- (30) a. ta-di=lo daki-a tioni arimi ta besu
 PFV-3PLS=go find-3SGO man feel.sorry 3SG.PFV be.hungry
 ‘When they found him, the poor many was hungry.’
 b. ta-di=lama ari da-daki uua=i
 PFV-3PLS=TAM RECP RDP-find in.that.direction=LOC
 ‘They had found each other.’

The event described in 30a is different than the event described in 30b. This is in contrast to valency alternations which reflect a pragmatic difference between the basic and non-basic construction. With pragmatic alternations, both constructions refer to the same “real-world” event, but they package that information differently, often in terms of the topicality (or, discourse salience) of participants. Passive constructions are an example of a pragmatic valency alternation, as seen in 31 from Balinese (Shibatani and Artawa 2013).

- (31) a. Anake muani cenik ento ngajeng buahe ento.
 anak=e muani cenik ento ngajeng buah=e ento
 person=DEF male small that eat fruit=DEF that
 ‘The boy ate the fruit.’
 b. Buahe ento ajenga taken anake muani cenik ento.
 buah=e ento ajeng=a taken anak=e muani cenik ento
 fruit=DEF that eat=PASS by person=DEF male small that
 ‘The fruit was eaten by the boy.’

Here, 31a and 31b could refer to the same event, with the main difference being the saliency or topicality of *anak=e muani cenik* ‘the boy’.

Broadly, UMR indicates semantic valency alternations with the participant role annotation, while pragmatic alternations are not reflected in the UMR. This means that the participant role annotations for 30a and 30b would be different, where as the participant role annotation for 31a and 31b would be the same. The annotations for valency alternations also depend on the stage of the road map, so that will be detailed below.

4.1 Stage 1

At Stage 1, a set of general (i.e., non-lexicalized) semantic roles are used. These certainly will not map exactly to the grammatical marking of argument phrases in any language, but this set of roles was selected based on cross-linguistic patterns of argument marking. The set of participant role labels, a brief description for each label, and examples are shown below in Table ??.

UMR Annotation	Definition	Example
ACTOR	animate entity that initiates the action	the doctor laughed the boy ate a salad
UNDERGOER	entity (animate or inanimate) that is affected by the action	the papers burned he burned the onions
THEME	entity (animate or inanimate) that moves from one entity to another entity, either spatially or metaphorically	she put the books on the shelf she tore a page from the book he gave a sandwich to me she told him a story
RECIPIENT	animate entity that gains possession (or at least temporary control) of another entity	he gave a sandwich to me she told him a story
FORCE	inanimate entity that initiates the action	the wind knocked down the tree
CAUSER	animate entity that acts on another animate entity to initiate the action	the mother made her child eat the broccoli
EXPERIENCER	animate entity that cognitively or sensorily experiences a STIMULUS	the dog heard a sound
STIMULUS	entity (animate or inanimate) that is experienced by an EXPERIENCER	the dog heard a sound
INSTRUMENT	inanimate entity that is manipulated by an external causer in order to initiate the action	she hit him with a broom
COMPANION	animate entity that acts with the ACTOR to initiate the action	he cooked dinner with his wife
MATERIAL	entity (inanimate) that is transformed into a new entity	he made a roux with flour and butter
SOURCE	entity from which the THEME detaches	he plucked a flower from the the bush
PLACE	location at which the action takes place	he read a book in the garden
START	location at which a motion event begins	she biked from her house
GOAL	location at which the action ends, the end point at which the THEME arrives	she put the books on the shelf
AFFECTEE	animate entity which the action has a positive or negative influence on, i.e. beneficiary or maleficiary	he made a cake for the dog she stole a watch from the CEO
CAUSE	inanimate entity that causes the action to happen	he was late because of the fire
MANNER	manner in which the action takes place	she exercised by lifting weights
REASON	motivation for the ACTOR to initiate the action	they got married because they are in love
PURPOSE	intended event that results from the action	they dropped water in order to fight the fires
TEMPORAL	event that has a temporal relation with the action	she left after dinner
EXTENT	measurement phrase	he ran seven miles
OTHER	this role can be used when an annotator is unsure of which role is appropriate	

Table 5: UMR non-lexicalized roles

External Cause	Central Event	Circumstantial
ACTOR COMPANION INSTRUMENT FORCE CAUSER	(CHANGE OF) STATE: MATERIAL, UNDERGOER	AFFECTEE PLACE
	MOTION/LOCATION: THEME, GOAL, START, SOURCE, PLACE	MANNER PURPOSE
	TRANSFER: THEME, RECIPIENT	REASON CAUSE
	EXPERIENTIAL: EXPERIENCER, STIMULUS	TEMPORAL EXTENT

Table 6: Categorization of UMR non-lexicalized roles

These general semantic roles can be categorized based on the types of events with which they occur, shown in Table ?? . Some participant roles express the external cause of an event; these can occur with many semantic classes of events. Similarly, the “circumstantial” type semantic roles can occur with a wide range of semantic event classes.

For the roles that characterize the central participant(s) in the event, the best way to decide which participant role label a given participant should receive is to consider the semantic class of the event. The UNDERGOER role only occurs with change-of-state events, construed broadly to include creation and contact events as well. The UNDERGOER role is used for the entity that undergoes the change-of-state, is the endpoint of force in a contact event, or is created in a creation event, as seen in 32. The MATERIAL role only occurs with creation events, as in 32c, and is used for the raw materials that are transformed into the created object.

- (32) a. The ice cube melted. (m / melt
:UNDERGOER (i / ice cube))
- b. The enemy sank the ship. (s1 / sank
:ACTOR (e / enemy)
:UNDERGOER (s2 / ship))
- c. She built a house out of wood. (b / build
:ACTOR (s / she)
:UNDERGOER (h / house)
:SOURCE (w / wood))
- d. He hit the stick against the fence. (h1 / hit
:ACTOR (h2 / he)
:INSTRUMENT (s / stick)
:UNDERGOER (f / fence))

The EXPERIENCER and STIMULUS roles always occur with experiential events, as seen in 33. The EXPERIENCER role is used for the mental-level entity which attends to, reacts to, or passively experiences the STIMULUS role.

- (33) a. The audience listened to the concerto. (l / listen
:EXPERIENCER (a / audience)
:STIMULUS (c / concerto))
- b. The cat startled me.

(s / startle
 :EXPERIENCER (m / me)
 :STIMULUS (c / cat))

The START, GOAL, and SOURCE roles only occur with motion events; PLACE has two different uses, one with Motion/Location events and one with other event classes. START, GOAL, and PLACE are used for locations – START is the location from which motion originates, as in 34a, GOAL is the location in which motion ends, as in 34b and 34c, and PLACE is used for static locations, as in 34d. The SOURCE role is in the removal subclass of motion events; it is used for the entity from which the THEME is removed, as in 34e. With motion events, the THEME role is used for the entity that moves (unless the motion is volitional), as in 34a.

- (34) a. She walked home from the store. (f / fall
 :THEME (l / leaf)
 :GOAL (g / ground))
- b. The leaf fell to the ground. (w / walk
 :ACTOR (s1 / she)
 :GOAL (h / home)
 :START (s2 / store))
- c. He put the books in a box. (p / put
 :ACTOR (h / he)
 :THEME (b1 / books)
 :GOAL (b2 / box))
- d. She is sitting on the couch. (s1 / sit
 :ACTOR (s2 / she)
 :PLACE (c / couch))
- e. He picked some berries from the bush. (p / pick
 :ACTOR (h / he)
 :THEME (b1 / berries)
 :SOURCE (b2 / bush))

The RECIPIENT role only occurs with transfer events, or metaphorical transfer events like communication. With these events, the initiator of the transfer is an ACTOR, the entity that is transferred is the THEME and the entity that the THEME is transferred to is labelled as the RECIPIENT. For transfer of possession events that express the original possessor of the THEME, the original possessor is annotated as AFFECTEE, as in 35d.

- (35) a. He gave the cat some wet food. (g / give
 :ACTOR (h / he)
 :THEME (w / wet food)
 :RECIPIENT (c / cat))
- b. I showed the pictures to her.
- c. She told me that they they're attending.
- d. She stole the information from a competitor.

(s / show
 :ACTOR (i / I)
 :THEME (p / picture)
 :RECIPIENT (h / her))

(s1 / steal
 :ACTOR (s2 / she)
 :THEME (i / information)
 :SOURCE (c / competitor))

(t1 / tell
 :ACTOR (s / she)
 :RECIPIENT (m / me)
 :THEME (a / attend
 :ACTOR (t2 / they)))

The other participant roles can occur pretty much freely with any semantic class of event. The external cause roles are used to annotate entities that bring about the central event. The ACTOR role is used for “active” single-participant events, in which the single participant acts volitionally to bring about the event, as in 36a. This contrasts with “inactive” single-participant events, in which the single participant undergoes a change outside of its control, as in 32a above. See Appendix B for examples of single-participant verbs and their participant role annotation. The ACTOR role is also used for animate entities that initiate an action, as in 32b above.

The COMPANION role is used for the entity that helps the ACTOR bring about the action, as in 36b.³ Note that this role is only annotated when the COMPANION participant is expressed separately from the ACTOR. Plural participants and conjoined participants, as in 36c and 36d, are annotated with a single ACTOR role. In some languages, a marker may be ambiguous between a comitative marker and a conjunction. When the two participants are expressed separately in the clause, they should be treated as separate participants, annotated with ACTOR and COMPANION. When they are expressed together, they are treated as a single ACTOR participant.

The INSTRUMENT role is used for an entity that is manipulated by one of the other external cause roles, often an ACTOR, in order to initiate the action. The entity which manipulates the INSTRUMENT may or may not be present in the clause; see 36e and 36f.

The FORCE role is used for physical entities which initiate an action, or cause another entity to undergo a change, as in 36g. Finally, the CAUSER role is used for the external initiator in some causative constructions, see 4.1.2.

- | | |
|--|--|
| (36) a. He winked. | (w / wink
:ACTOR (h / he)) |
| b. Jane wrote the paper with Chris. | (w / write
:ACTOR (J / Jane)
:COMPANION (C / Chris)
:UNDERGOER (p / paper)) |
| c. They wrote the paper. | |
| d. Jane and Chris wrote the paper. | (w / write
:ACTOR (t / they)
:UNDERGOER (p / paper)) |
| e. She slicked the bread with a knife. | |
| f. The knife sliced through the bread. | (w / write
:ACTOR (J / Jane and Chris)
:UNDERGOER (p / paper)) |
| g. The storm damaged the power lines. | |

3. This means that all events annotated with a COMPANION role will also have a participant annotated with an ACTOR role.

(s / slice :UNDERGOER (b / bread))
:ACTOR (s / she)
:INSTRUMENT (k / knife)
:UNDERGOER (b / bread))
(s / slice :ACTOR (s / storm)
:INSTRUMENT (k / knife) :UNDERGOER (p / power lines))

See Table ?? for examples of the circumstantial roles. In addition, there is an OTHER placeholder role that can be used when annotators are unsure of which participant role annotation is accurate for a particular participant. Also see Appendix B for a list of verbs and how their microroles are annotated.

At Stage 1, participant roles that aren't explicitly expressed in the clause do not have to be annotated, even if they are implied by the context. If the annotator is certain about them, however, they can be annotated. For example, in 37, the GOAL is left implicit; at Stage 1, this role may be left out of the annotation.

(37) They loaded the boxes.
(l load
:ACTOR (t / they)
:THEME (b / boxes))

4.1.1 Nonverbal clauses

There is a small set of predicates that use lexicalized roles at all stages of the road map; therefore, frame files for these predicates are created at Stage 1 annotation. These are the nonverbal clause predicates shown above in Table 4. These are repeated below with their participant role annotation. Each nonverbal clause predicate has an ARG0 and an ARG1; these map to the semantic roles as shown in Table ??.

Clause type	UMR Predicate	ARG0	ARG1
thetic/presentational possession	have-03	<i>possessor</i>	<i>possession</i>
predicative possession	belong-01	<i>possession</i>	<i>possessor</i>
thetic/presentational location	exist-91	<i>location</i>	<i>theme</i>
predicative location	have-location-91	<i>theme</i>	<i>location</i>
property predication	have-mod-91	<i>theme</i>	<i>property</i>
object predication	have-role-91	<i>theme</i>	<i>object category</i>
equational	identity-91	<i>theme</i>	<i>equated referent</i>

Table 7: Nonverbal clause predicates

The argument that can be predicativized in some languages is always Arg1. Examples 38-44 show how nonverbal clauses are annotated with participant roles. Note that these annotations will be the same at every stage of the road map.

(38) Thetic/presentational Possession - (e / iara-yara 'has canoe'
Kukama :ARG0 (m / Mijiri 'Miguel')
Mijiri-tin iara-yara :ARG1 (i / iara 'canoe'))
Miguel-CER canoe-owner
'Miguel does have a canoe.' (Lit. 'Miguel
is a canoe-owner')

- | | |
|--|---|
| (39) Predicative Possession - English

The dog belongs to the teacher. | (b / belong-01
:ARG0 (d / dog)
:ARG1 (t / teacher)) |
| (40) Thetic/presentational Location - English

On the rock was a symbol. | (e / exist-91
:ARG0 (r / rock)
:ARG1 (s / symbol)) |
| (41) Predicative Location - Yabem (Demp-
wolff 1939)

àndu kê-kô malac
house 3SG-be.at village

‘The house is in the village.’ | (h / have-location-91
:ARG0 (a / àndu ‘house’)
:ARG1 (m / malac ‘village’)) |
| (42) Property Predication - English

The cat is black. | (h / have-mod-91
:ARG0 (c / cat)
:ARG1 (b / black)) |
| (43) Object Predication - Kukama

ajan kunumi tsumi
this young.man shaman

‘This young man is a shaman.’ | (h / have-role-91
:ARG0 (k / kunumi ‘young man’)
:ARG1 (t / tsumi ‘shaman’)) |
| (44) Object Equational - English

She is the winner. | (h / identity-91
:ARG0 (s / s)
:ARG1 (w / winner)) |

4.1.2 Valency alternations

As discussed in 4, certain types of semantic valency alternations are reflected in the participant role annotation. At Stage 1, these alternations influence the choice of general participant role labels. For information-packaging alternations, such as passives, antipassives, or valency-rearranging applicatives, participants are annotated in the same way as in the basic construction in the language. If a participant is omitted, for example the agent in a passive construction as in 45 from Berber (Guerssel 1986, 52), then it simply isn’t annotated at Stage 1.⁴

- | | |
|--|--|
| (45) a. Y-usy wrba tafirst.
3MS-pick.up boy:CST pear
‘The boy picked up the pear.’ | (u / usy ‘pick up’
:ACTOR (w / wrba ‘boy’)
:UNDERGOER (t / tafirst ‘pear’)) |
| b. T-ttw-asy tfirst.
3FS-DETR-pick.up pear
‘The pear was picked up.’ | (t / ttw-asy ‘pick up’
:UNDERGOER (t / tafirst ‘pear’)) |

4. This means that agentless passives and anticausatives will have the same participant role annotation at Stage 1.

Causatives. There are a few different types of causatives that require different annotation solutions. For most causatives of transitives, the causer is annotated as CAUSER, the causee as ACTOR, and the rest of the participants receive the same annotation labels that they would in a non-causative construction. In 46 from Kukama, *nai* ‘grandmother’ is annotated as CAUSER, the causee *churan* ‘kid’ is annotated as ACTOR, and *uni* ‘water’ as UNDERGOER.

- | | | | |
|------|---|---|---|
| (46) | <i>nai</i>
grandmother drink-CAU
<i>uni</i> =pu
water=INS
‘Grandmother made the kid drink the water.’ | <i>kurata-ta churan=ui</i>
kid=PST

 | (k / <i>kuratata</i> ‘make drink’
:CAUSER (n / <i>nai</i> ‘grandmother’)
:ACTOR (c / <i>churan</i> ‘kid’)
:UNDERGOER (u / <i>uni</i> ‘water’)) |
|------|---|---|---|

There are certain causatives of transitives which do not use the CAUSER role. These are constructions which express transfer events, including mental/cognitive transfer. Some languages express these types of events with monomorphemic verbs, like English, but other languages use causatives of transitive verbs. Languages may differ in terms of which types of causative constructions are construed as transfer; in order to annotate the same semantic events in the same way across languages, the ACTOR, THEME, RECIPIENT roles are used for transfer of possession (giving), sending, and mental transfer, which includes showing and communication. Bezhta in 47b (Comrie, Khalilov, and Khalilova 2015, 560) uses the causative of *b-egā-yo* ‘see’ as equivalent to English *show*.

- | | | |
|------|---|--|
| (47) | a. <i>hogco-l raʔad b-egā-yo</i>
he.OBL-LAT sea(III) III-see-PST
‘He saw the sea.’ | (b / <i>b-egā</i> ‘see’
:EXPERIENCER (h / <i>hogco</i> ‘he’)
:STIMULUS (r / <i>raʔad</i> ‘sea’)) |
| | b. <i>hogco kibba-l raʔad</i>
he.OBL(ERG) girl.OBL-LAT sea(III)
<i>b-ega-l-lo</i>
III-see-CAUS-PST
‘He showed the sea to the girl.’ | (b / <i>b-ega-l</i> ‘show’
:ACTOR (h / <i>hogco</i> ‘he’)
:THEME (r / <i>raʔad</i> ‘sea’)
:RECIPIENT (k / <i>kibba</i> ‘girl’)) |

For causatives of ditransitives, the causer receives the CAUSER role, the causee the ACTOR role, and the other participants receive the same annotation as in a non-causative construction. This can be seen in 48 from Shipibo-Konibo (Valenzuela 2003, 612). If ‘the man’ was expressed in the clause, that participant would be annotated as RECIPIENT.

- | | | |
|------|--|--|
| (48) | <i>Ja-tian ja xontako</i>
that-TEMP that unmarried.girl:ABS
<i>jawen tita-n</i>
POS3 mother-ERG
<i>xoi meni-ma-[a]i</i>
roasted.meat/fish:ABS give-CAUS-INC
<i>keen-yama-[a]i-bi...</i>
want-NEG-SDS-EM
‘Then her mother makes the unmarried girl give roasted meat/fish (to the man who had asked her in matrimony) even though she doesn’t want to...’ | (m / <i>meni-ma</i> ‘make give’
:CAUSER (t / <i>tita</i> ‘mother’)
:ACTOR (x1 / <i>xontako</i> ‘unmarried girl’)
:THEME (x2 / <i>xoi</i> ‘roasted meat’)) |
|------|--|--|

There are two types of causatives of intransitives, based on the two types of intransitives. For intransitives whose single participant corresponds to an UNDERGOER role, such as change-of-state verbs in many languages, the causer is annotated as ACTOR and the single participant retains its UNDERGOER label. This can be seen in 49 from Falam Chin (King 2011, 195) below.

- (49) a. Ka kedam hri a (c / cat ‘broken’
 1SG shoe STRING 3SG.NOM :UNDERGOER (k / kedam hri ‘shoelace’))
 cat.
 broken.1 (c / cat-ter ‘break’
 ‘My shoelace is broken/broke.’ :ACTOR (t / Thangte)
 :UNDERGOER (k / kedam hri ‘shoelace’))
- b. Thangte in ka kedam hri
 Thangte ERG 1SG shoe STRING
 a cat-ter.
 3SG.NOM broken.1-CAUS
 ‘Thangte broke my shoelace.’

Regardless of whether the causative or anticausative verb is derived (or, neither is derived), the anticausative/intransitive meaning is annotated with a single UNDERGOER participant and the causative/transitive meaning is annotated with an ACTOR and an UNDERGOER participant.

When the single participant of the intransitive corresponds to the ACTOR role, then the causer receives the CAUSER annotation and the single participant retains its ACTOR label. This can be seen in 50 from Falam Chin King 2011, 195 below.

- (50) a. Cinte a hni. (h / hni ‘laugh’
 Cinte 3SG.NOM laugh.1 :ACTOR (C / Cinte))
 ‘Cinte laughed.’
- b. Parte in Cinte a (h / hni-ter ‘make laugh’
 Parte ERG Cinte 3SG.NOM :CAUSER (P / Parte)
 hni-ter. :ACTOR (C / Cinte))
 laugh.1-CAUS
 ‘Parte made Cinte laugh.’

Applicatives. Peterson (2007) distinguishes between “valency-increasing” applicatives and “valency-rearranging” applicatives. In valency-rearranging applicatives, a participant is expressed as an oblique in the basic construction and expressed as a core argument in the applicative construction; they are generally associated with the increased saliency or topicality of the oblique participant. Therefore, these fit into the category of pragmatic valency alternations, and both the basic and applicative construction receive the same participant role annotation. This can be seen in 51 from Falam Chin (King 2011, 240).

- (51) a. Parte in Thangte hrang=ah hmeh
 Parte ERG Thangte for=LOC curry
 a suang.
 3SG.NOM cook.1
 ‘Parte cooked some curry for Thangte.’
- b. Parte in Thangte hmeh a
 Parte ERG Thangte curry 3SG.NOM
 suan-sak
 cook.2-BEN
 ‘Parte cooked Thangte some curry.’

(s / suang ‘cook’
 :ACTOR (P / Parte)
 :UNDERGOER (h / hmeh ‘curry’)
 :AFFECTEE (T / Thangte))

(s / suang-sak ‘cook for’
 :ACTOR (P / Parte)
 :UNDERGOER (h / hmeh ‘curry’)
 :AFFECTEE (T / Thangte))

Whether the beneficiary, *Thangte*, is expressed as an oblique or a core argument, it is annotated as AFFECTEE. Valency-increasing applicatives involve the addition of a participant, compared to the basic construction. Here, the added participant is simply annotated with the appropriate semantic role. This can be seen in ADD EXAMPLE.

Reflexives & Reciprocals For reflexive and reciprocal constructions, the single participant is annotated with both of the semantic role labels which it is fulfilling in the construction. This can be in 52 and 53 from Supyire (Carlson 1994, 416-7).

(52) U a ù-yé bání
 he PERF he-REFL wound
 ‘He has wounded himself.’

(b / bání ‘wound’
 :ACTOR (u / u ‘he’)
 :UNDERGOER (u))

(53) Pi a pì-yé kánù
 they PERF they-REFL love
 ‘They loved each other.’

(k / kánù ‘love’
 :ACTOR (p / pi ‘they’)
 :UNDERGOER (p))

4.2 Stage 2

The Stage 2 participant role annotation requires access to PropBank-style frame files in the language for a large number of predicates. At this stage, each predicate identified as event is linked to its corresponding frame file. The participants dependent on that event are annotated with the lexicalized roles, as determined by the frame file. This can be seen in 54 below.

predicate: **tease.02**
 arguments:
 ARG0: teaser
 ARG1: teased
 ARG2: about what

(54) He teased the boy about his hat.
 (h / **tease.02**
 :ARG0 (h / he)
 :ARG1 (b / boy)
 :ARG2 (h / hat))

Since the nonverbal clause functions require the use of lexicalized predicates at Stage 1, these are annotated in the same way at Stage 2 (see 4.1.1). Unlike Stage 1, implicit participants are annotated for their semantic role at Stage 2. This is shown in 55 below.

(55) She parked the truck in the driveway. They loaded the boxes.

(h / **park.01**
 :ARG0 (s / she)
 :ARG1 (t / truck)
 :ARG2 (d / driveway))

(h / **load.01**
 :ARG0 (t2 / they)
 :ARG1 (t)
 :ARG2 (b / boxes))

The second sentence in 55 does not include explicit mention of the truck, but it is understood from the context that the truck is the goal participant of the loading event. Therefore, at Stage 2, these implicit roles receive participant role annotation.

4.2.1 Valency alternations

The approach to valency alternations at Stage 2 is largely the same as that detailed for Stage 1 in 4.1.2. However, at Stage 2, predicates with valency-changing morphology should have their own frame files with lexicalized arguments. Therefore, the annotation of participant roles for valency alternations is the same as that for other types of predicates. The predicate is matched with its frame files and the participants are annotated accordingly.

5 Modality

UMR represents modal strength and polarity as a dependency structure. The nodes are either events or conceivers (i.e., a source, an entity whose perspective on an event is modelled in the text). The edges in the dependency structure correspond to modal strength and polarity values (i.e., how certain a specific conceiver is about the occurrence of the event in the real world). Annotators do not have to construct the dependency structure directly, but it can be built up “behind the scenes” by annotating some modal/polarity information and leveraging the participant role annotation.

The modal annotation captures the modal strength of events, but not the modal type of the event (i.e., epistemic/evidential, deontic, permissive, etc.). These modal strengths are annotated based on a lattice of annotation values that differ in terms of granularity. An example of the UMR annotation and the underlying modal dependency structure is shown below in 56.

- (56) Martin **said** that the package has probably already **arrived**.

(s / say

:ACTOR (M / Martin)

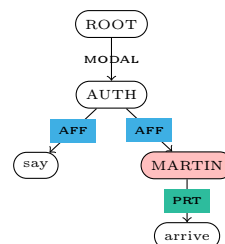
:THEME (a / arrive

:THEME (p / package)

QUOT: s

MODSTR: PRT)

MODSTR: AFF)



The UMR annotation is shown on the left; the saying-event and the arriving-event each get a modal strength value (MODSTR), which can then be represented in the dependency as shown on the right. The QUOT value indicates that an event is being reported, and the participant role annotation can be used to automatically select the conceiver for the reported event(s), here, *Martin*.

The road map stages build on each other to end up at a fully specified modal dependency structure. This means that Stage 2 annotation involves first doing the Stage 1 modality annotations. (This contrasts with participant roles, where annotators can largely ignore Stage 1 if the annotation language has existing frame files.)

5.1 Stage 1

There are two types of modal annotations at Stage 1: a MODSTR annotation that consists of a single epistemic strength/polarity value and a dependency annotation that indicates a relation between

two events. There are four dependency relations, MOD for the link between a modal event and the event(s) that it modalizes, QUOT for the link between a reporting event and the event(s) that it reports, PURP for the link between a main clause event and an event in a purpose clause, and COND for the relation between the apodasis and protasis in a conditional construction. The MODSTR annotation applies to all events, except for those under the scope of a modal identified as its own event (i.e., events with MOD relations). This is summarized below.

Events under the scope of modal events: MOD relation
 Events under the scope of reporting events: MODSTR annotation; QUOT relation
 Events in purpose clauses: MODSTR annotation; PURP relation
 Events in conditionals: MODSTR annotation; COND relation
 All other events: MODSTR annotation

5.1.1 MODSTR values

The modal strength values correspond to epistemic strength, i.e. the author or conceiver’s certainty about the occurrence of the event in the real world, or certainty about another conceiver’s mental content. Based on Boye (2012), a typological study of modal systems across languages, and following FactBank (Pustejovsky et al. 2005), the UMR annotation is based around three levels of modal strength: Full, Partial, and Neutral, illustrated in 57.

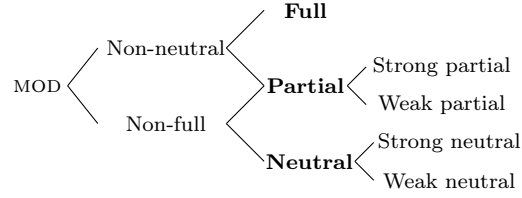
- (57) a. Full:
 The cat already **ate** breakfast.
- b. Partial:
 The cat probably already **ate** breakfast.
- c. Neutral:
 The cat might have already **eaten** breakfast.

The Full modal strength value, as in 57a, corresponds to complete certainty; that is, the conceiver is 100% certain that the event occurs in the real world. The Neutral modal strength value, shown in 57c, indicates the possibility of the event; essentially, this corresponds to 50/50 certainty that the event occurs in the real world. The Partial modal strength value, as in 57b, falls between the Full and Neutral values; the conceiver believes that more likely than not, the event occurs in the real world.

But, Full, Partial, and Neutral aren’t the only possible modal strength annotation values. Languages differ in the modal strength distinctions that are conventionalized in their grammar. In order to accommodate these differences, we use a typological lattice of annotation values, constructed based on the structure of the annotation categories across languages (Van Gysel et al. 2019).

One level of granularity in the lattice is designated as the “base level”: annotators are encouraged to use categories from this level as the default. These values are selected as the base level because these distinctions occur the most frequently across languages. The higher and lower levels, respectively, contain equally typologically-motivated coarser-grained and finer-grained categories, which can be used when a language conventionalizes these distinctions in its grammar. Such lattices capture the idea that many semantic categories are structured as hierarchical scales, where the middle values can group together with either end, but the extremes of the scale are highly unlikely to be categorized together in any language. For example, no language has a grammatical form that is used for both Full and Neutral epistemic strength, but not Partial. The typological lattice for epistemic strength is shown below.

This lattice is based around the base level of Full vs. Partial vs. Neutral, but also allows for the annotation of more coarse-grained values that lump together the distinctions in the base level, and



more fine-grained annotation values. For contexts where it is unclear if the modal strength is Full or Partial, the Non-neutral value can be used; if it is unclear whether the modal strength is Partial or Neutral, then the Non-full value can be used. The most fine-grained modal strength values are generally used with languages that have grammatical forms that encode the relevant distinction.

Also following FactBank (Pustejovsky et al. 2005), the MODSTR annotation combines the epis-temic strength values with a binary polarity distinction (Affirmative, Negative). This results in six modal strength/polarity values for the default level, shown below in Table 8. These values and their interpretation are shown below; the corresponding FactBank values are in parentheses.

Label	Value
AFF	full strength, affirmative polarity
PRT	partial strength, affirmative polarity
NEUT	neutral strength, affirmative polarity
NEUTNEG	neutral strength, negative polarity
PRTNEG	partial strength, negative polarity
NEG	full strength, negative polarity

Table 8: Epistemic strength labels

AFF: full affirmative support; complete certainty that the event occurs (CT+)

PRT: partial affirmative support; there is strong, but not definitive certainty that the event occurs (PR+)

NEUT: affirmative neutral support; there is neutral certainty that the event occurs/doesn't occur; event is expressed positively (PS+)

NEUTNEG: negative neutral support; there is neutral certainty that the event occurs/doesn't occur; negation of event is expressed (PS-)

PRTNEG: partial negative support; there is strong but not definitive certainty that the event does not occur (PR-)

NEG: full negative support; complete certainty that the event does not occur (CT-)

Degree of certainty corresponds most straightforwardly to the degree of confidence of a conceiver (often, the author) in the occurrence of an episodic event, i.e. the epistemic continuum from certainty to possibility. We use these same values for the evidential continuum from direct evidence to second-hand (reported or inferred) evidence; see 5.1.1.2 below. And these values are interpreted into the domain of future-oriented or deontic modality, as explained in 5.1.1.3. The interpretation of the value - as epistemic, evidential or deontic - is not reflected in the modal strength annotation.

5.1.1.1 Non-future events

For non-future (non-deontic) events, the MODSTR values correspond to the author's level of certainty towards the occurrence of the event in the real world. Events presented as fact are annotated with AFF, while events for which the author categorically denies their occurrence are annotated NEG.

When the author doesn't present the event as fact, but has a higher level of certainty towards the event either being true or not true, this is annotated as PRT or, when the polarity is negative, PRTNEG. When the author doesn't lean either direction towards the event being true in the real world or not, the event is annotated as NEUT or NEUTNEG, depending on the polarity of the linguistic expression. These strength values are exemplified in (58).

- (58) a. The dog **barked** last night. (b / bark
MODSTR: AFF)
- b. The dog probably **barked** last night. (b / bark
MODSTR: PRT)
- c. The dog may have **barked** last night. (b / bark
MODSTR: NEUT)
- d. The dog may not have **barked** last night. (b / bark
MODSTR: NEUTNEG)
- e. The dog probably didn't **bark** last night. (b / bark
MODSTR: PRTNEG)
- f. The dog didn't **bark** last night. (b / bark
MODSTR: NEG)

5.1.1.2 Evidential justification

Following Boye (2012) and Sauri and Pustejovsky (2009), we conflate evidential justification with epistemic support. Boye (2012) finds that there is cross-linguistic evidence for lumping epistemic support and evidential justification together into the same relations. Languages may encode direct evidential justification (sensory perception) with the same forms as full epistemic support; indirect justification (hearsay, inferential) may be encoded by the same forms as partial epistemic support.

Example 59 shows how direct and indirect justification correspond to epistemic support.

- (59) a. (I **saw**) Mary FEED the cat. (f / feed
MODSTR: AFF)
- b. Mary **must** have FED the cat. (f / feed
MODSTR: PRT)

In 59a, the author has direct knowledge of the feeding event, by way of witnessing it. Therefore, *feed* is annotated with AFF modal strength. In 59b, however, *must* signals that the author is inferring that the feeding event occurred without direct, perceptual knowledge. Therefore, *fed* in 59b is annotated with PRT modal strength.

5.1.1.3 Future events and deontic modality

For events presented as (potentially) happening in the future, MODSTR refers to the predictability of the occurrence of the event in the future, as presented by the author. Predictive future has full

strength (AFF or NEG); intentions and commands correspond to partial strength (PRT or NEGPRT); and desire and permission correspond to neutral (NEUT or NEUTNEG) strength.⁵

This is illustrated in (60).

- (60) a. I will **go** to Santa Fe. (g / go
MODSTR: AFF)
- b. You must **go** to Santa Fe. (g / go
MODSTR: PRT)
- c. You can go to Santa Fe. (g / go
MODSTR: NEUT)

The predictive future, as in 60a, is annotated with full modal strength because it presents the future event as a certainty (i.e., it is as certain as is possible for future events). Commands, as in 60b, are annotated with partial modal strength because they present the future event as less likely than the predictive future, but more likely to happen than the neutral strength deontics. Finally, permission, as in 60c, is annotated as neutral strength.

5.1.2 MOD relation

Events under the scope of a modal identified as its own event are only annotated with a MOD relation to the relevant modal. This is shown below in 61.

- (61) a. Mary wants to **visit** France. (w / want
(v / visit
MOD: w)
MODSTR: AFF)
- b. Rob thinks the dog **escaped** through the fence. (t / think
(e / escape
MOD: t)
MODSTR: AFF)
- c. They probably **decided** to **leave** on Monday. (d / decide
(l / leave
MOD: d)
MODSTR: PRT)
- d. His parents forbid him from **smoking**. (f / forbid
(s / smoke
MOD: f)
MODSTR: AFF)

Note that the modal itself is annotated with a MODSTR value (if it is not under the scope of another modal). The actual modal value imparted by the modal event is not annotated at Stage 1.

5. Keep in mind that events under the scope of modals identified as their own event don't receive any MODSTR value at all. This section refers to deontic meanings indicated by grammaticalized modals that don't fit the criteria to be identified as events.

5.1.3 QUOT relation

Events under the scope of a reporting predicate or a speech predicate are annotated with a QUOT relation to the reporting or speech predicate. Unlike events under the scope of modals, these events are also annotated with a MODSTR value.

- (62) a. Mary said that she **went** to Santa Fe. (s / say
(g / go
QUOT: s
MODSTR: AFF)
MODSTR: AFF)
- b. The New York Times reported that Congress **voted** on the bill this afternoon. (r / report
(v / vote
QUOT: r
MODSTR: AFF)
MODSTR: AFF)
- c. Mary might have said that she **went** to Santa Fe. (s / say
(g / go
QUOT: s
MODSTR: AFF)
MODSTR: NEUT)
- d. Mary didn't say that she **went** to Santa Fe. (s / say
(g / go
QUOT: s
MODSTR: AFF)
MODSTR: NEG)
- e. Mary said that John might have **gone** to Santa Fe. (s / say
(g / go
QUOT: s
MODSTR: NEUT)
MODSTR: AFF)
- f. Mary said that John probably didn't **go** to Santa Fe. (s / say
(g / go
QUOT: s
MODSTR: PRTNEG)
MODSTR: AFF)

As can be seen above, both the reporting predicate and the reported events are annotated with a MODSTR value. The MODSTR value of the reporting predicate corresponds to the author's certainty that the reporting event happened. The MODSTR value associated with the reported events corresponds to the certainty with which the sayer/reporter reports the events. For example, in 62e, the author is certain about the saying event, so it is annotated with AFF; but Mary is unsure about the reality of the going event, and therefore it is annotated with NEUT modal strength.

5.1.4 PURP relation

Events in purpose clauses are annotated with both a MODSTR value and PURP relation to the main clause event.

- (63) They **dropped** water in order to **fight** (d / drop
the fire. (f / fight
PURP: d
MODSTR: AFF)
MODSTR: AFF)
- (w / walked
(a / arrive
PURP: w
MODSTR: NEG)
- (64) He **walked** quickly in order to not **arrive** MODSTR: AFF)
late.

The MODSTR value represents any modals or negation that are present within the purpose clause. That is, this value doesn't capture the fact that the purpose clause itself imparts a non-full epistemic stance on its events; that is captured by the PURP relation.

5.1.5 COND relation

The COND relation indicates the relationship between events in conditional constructions. These events also receive a MODSTR annotation. As can be seen in 65, the event in the apodasis is annotated with a COND relation to the event in the protasis.

- (65) a. If she's **hungry**, I'll **feed** her dinner. (h / have-mod-91
MODSTR: AFF)
(f / feed
MODSTR: AFF
:COND h)
- b. If she's **hungry**, maybe I'll **cook** (h / have-mod-91
MODSTR: AFF)
pasta. (f / feed
MODSTR: PRT
:COND h)
- c. If she **isn't hungry**, we'll just **watch** (h / have-mod-91
MODSTR: NEG)
a movie. (f / feed
MODSTR: AFF
:COND h)

As with purpose clauses, the MODSTR value doesn't capture the uncertainty imparted by the conditional construction itself; it corresponds to any negation or modals which are expressed inside of the conditional construction. The modal value of the conditional construction is captured by the COND value.

5.1.6 Modal dependency structure

At Stage 1, there are some pieces of the modal dependency structure that are unspecified. The modal strength that a modal verb imparts on its complement is one of these pieces. As the modal annotation progresses, this information is added to the frame files for modal verbs. For example, the complements of English *want* have a NEUT MODSTR value; this will be indicated in the frame file as shown below.

```
predicate: want.01
arguments:
  ARG0: wanter
  ARG1: thing wanted
  ARG2: beneficiary
  ARG3: in-exchange-for
  ARG4: from
MODSTR of complement: NEUT
```

For the complements of modals, the MODSTR values work largely the same way that they do for other events; however, they reflect the beliefs of the EXPERIENCER participant of the modal event, who is often not the author. For example, in 66, Mary believes that the visit event may take place in the future (NEUT strength), but the author disagrees.

(66) Mary wants to visit France next month, but I don't think that's possible.

The value associated with the modal event in its frame file corresponds to Mary's beliefs, as the EXPERIENCER of the wanting event.

Some predicates impart full, positive (AFF) strength on their complements, often called factive predicates (e.g., *manage to*). Strong epistemic modals (e.g., *expect that*, *deduce*) and strong deontic modals, including intention modals (e.g., *plan to*, *decide to*) and obligation modals (e.g., *need*, *demand*), impart PRT strength on their complements. Weak deontic modals, including desire (e.g., *want*) and permission (e.g., *allow*), impart NEUT strength on their complements. Certain modals may also lexicalize negation, such as *doubt*, *forbid*, or *wish*. These are annotated with the NEUTNEG, PRTNEG, and NEG values, respectively. See Appendix A for a list of English modals and the modal strengths that they impart on their complement.

5.2 Stage 2

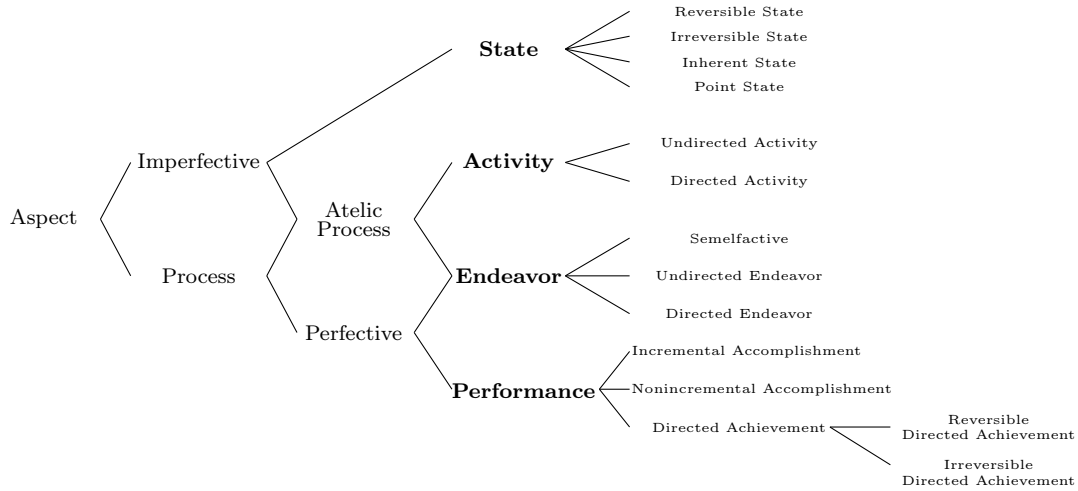
6 Aspect

The aspect annotation consists of a single value that is annotated for every event identified in 2.1. The aspect annotation doesn't have distinct annotation stages, unlike modality and participant roles. Instead it relies on a typological lattice which ranges from very coarse-grained to very fine-grained aspectual values. It's expected that languages at an earlier stage of semantic analysis or annotation will tend to use more coarse-grained values, and languages at later stages of annotation will tend to use more fine-grained values.

This is also heavily dependent on the aspectual distinctions that are grammaticalized and/or obligatory in the language. For example, although English has a long history of semantic analysis and many computational resources, it has very little overt aspectual marking in its grammar and therefore the most fine-grained aspect distinctions are very difficult to judge in annotation. This aspect lattice is shown below. Below are the aspect values with a brief definition.

```
HABITUAL: occurs/occurred usually or habitually
IMPERFECTIVE: ambiguous between state and process
```

PROCESS: unspecified type of process
 ATELIC PROCESS: process that does not reach a result state
 PERFECTIVE: process that comes to an end
 STATE: unspecified type of state
 REVERSIBLE STATE: acquired state that is not permanent
 IRREVERSIBLE STATE: acquired state that is permanent
 INHERENT STATE: state that is not acquired and permanent
 POINT STATE: state that is acquired and reversed at a single point in time
 ACTIVITY: process that does not end
 UNDIRECTED ACTIVITY: process that does not end and does not progress linearly along a scale
 DIRECTED ACTIVITY: process that does not end and does progress linearly along a scale
 ENDEAVOR: process that ends without reaching a result state
 SEMELFACTIVE: process that ends without reaching a result state and happens at a single point in time
 UNDIRECTED ENDEAVOR: process that ends without reaching a result state and does not progress linearly along a scale
 DIRECTED ENDEAVOR: process that ends without reaching a result state and progresses linearly along a scale
 PERFORMANCE: process that ends and reaches a result state
 INCREMENTAL ACCOMPLISHMENT: process that ends and reaches a result state, and progresses linearly along a scale
 NONINCREMENTAL ACCOMPLISHMENT: process that ends and reaches a result state, and does not progress linearly along a scale
 DIRECTED ACHIEVEMENT: process that ends and reaches a result state within a single point in time, and progresses linearly along a scale
 REVERSIBLE DIRECTED ACHIEVEMENT: process that ends and reaches a result state, which is not permanent, within a single point in time, and progresses linearly along a scale
 IRREVERSIBLE DIRECTED ACHIEVEMENT: process that ends and reaches a result state, which is permanent, within a single point in time, and progresses linearly along a scale



In order to select the appropriate annotation value for each event, annotators proceed through

a series of decisions.

6.1 Event Nominals

The first decision concerns the morphosyntactic expression of the event. Events expressed as nominals often lack any grammatical clues as to their aspectual structure. This makes determining an aspectual annotation value difficult. We do, however, know that these events are processes, and not states, since nominals expressing states are not identified as events. On the lattice, PROCESS is the aspectual value that includes all types of processes. Therefore, events expressed as event nominals, as in 67, are annotated as PROCESS.

- (67) a. He presented his research at **the meeting** yesterday. (m / meeting
ASPECT: PROCESS)
- b. After **the game**, she went home. (g / game
ASPECT: PROCESS)
- c. He had **the operation** on Tuesday. (o / operation
ASPECT: PROCESS)

Any event packaged in a referring expression is considered an event nominal and annotated with PROCESS. This includes underived nominals, nominalizations, and gerunds, as in 68.

- (68) a. **The second training** was cancelled yesterday. (t / training
ASPECT: PROCESS)
- b. The dog interrupted the meeting with **his barking**. (b / barking
ASPECT: PROCESS)

Note that *-ing* forms in English can occur in a variety of constructions; they should only be treated as event nominals when they are used in referring expressions (as in 68a and 68b above). When they occur in other types of constructions, as in 69, they should not receive an aspect annotation at this point and annotators should continue on to the next step.

- (69) The dog stopped **barking** for a few seconds.

Event nominals that occur in predicate nominal constructions, as in 70, are also not annotated at this point; these are treated like other predicate nominal constructions.

- (70) It was **an earthquake**.

6.2 Habitual

The next step concerns the application of the HABITUAL aspect value. This value should be applied to all events that are presented as occurring usually or habitually, as in 71.

- (71) a. He **bakes** pies.
- c. They **vacation** in Taos every winter.
- b. She **rides** her bike to work.

- | | |
|---|------------------------------------|
| d. They used to vacation in Taos every winter. | (b / bake
ASPECT: HABITUAL) |
| | (r / ride
ASPECT: HABITUAL) |
| | (v / vacation
ASPECT: HABITUAL) |
| | (v / vacation
ASPECT: HABITUAL) |

In English, present habitual events are signalled by the Simple Present construction; past tense habitual events are expressed with the *used to* construction. Note that the HABITUAL annotation is not used for ability modals (e.g., *he can bake apple pie*); these events should continue on to the next step.

6.3 State

The next step assesses whether the event is a STATE. The distinction between states and processes is necessary for event identification (as states are only identified as events when predicated). According to Vendler (1967), states are those events which are stative—that is, no change takes place over the course of the event. There are various ways to express states in predication, shown in 72; note that all of the nonverbal clause types identified in 2.1 and annotated with UMR predicates are annotated as STATE.

- | | |
|--|---|
| (72) a. My cat loves tuna. | (l / love
ASPECT: STATE) |
| b. The doctor is tall . | (h / have-mod-91
ASPECT: STATE) |
| c. The book is on the table . | (h / have-location-91
ASPECT: STATE) |
| d. She is an architect . | (h / have-role-91
ASPECT: STATE) |
| e. Your glass is in the kitchen . | (h / have-location-91
ASPECT: STATE) |

Modal verbs, as in 73, and events under the scope of ability modals, as in 74, are also annotated as STATE.

- (73) a. He **wants** to travel to Albuquerque.
- b. The cat **needs** to be fed.
- c. He's **dreading** their decision.

(w / want
ASPECT: STATE)

(n / need
ASPECT: STATE)

(d / dread
ASPECT: STATE)

(74) a. She is able to **sing** that aria.

(s / sing
ASPECT: STATE)

b. This car can **go** up to 150 mph.

(g / go
ASPECT: STATE)

In this analysis, ability modals refer to a static state of affairs, i.e. an entity possesses the relevant ability. For examples like 74a, ability modals may look more like event quantification. That is, there are probably multiple singing events that this example is generalizing over. Examples like 74b, however, show how ability modals are more like states. It is possible that the car has never actually gone as fast as 150 mph; the car just has the parts and (theoretical) ability to do so. Therefore, all types of ability modals, both 74a and 74b, are analyzed as states and annotated as such.

There is a type of event, called “inactive actions” by Croft (2012), which is semantically intermediate between states and processes. In many languages, they can be construed either way. For example, English *lie* can occur in the Progressive (*Bill **is lying** on the bed*) or the Simple Present (*The Sandias **lie** to the east of Albuquerque*). And across languages there is variation as to the default construal of inactive actions. The most frequent inactive actions are posture verbs (*sit, stand, lie, hang*), perception verbs (*see/look at, watch, hear/listen to, feel*), some sensation verbs (*ache*), mental activity verbs (*think, understand*), and verbs of operation/function (*work* in *This washing machine **works/is working***). For the UMR annotation, inactive actions in all constructions are annotated as STATE. If it is unclear whether an event refers to a STATE or an ATELIC PROCESS, then the IMPERFECTIVE annotation value is used.

There are different types of states, shown in 75, which can optionally be distinguished in the aspect annotation.

(75) a. My cat **is black and white**.

(h / have-mod-91
ASPECT: INHERENT STATE)

b. My cat **is hungry**.

(h / have-mod-91
ASPECT: REVERSIBLE STATE)

c. The wine glass **is shattered**.

(h / have-mod-91
ASPECT: IRREVERSIBLE STATE)

d. It **is 2:30pm**.

(h / have-mod-91
ASPECT: POINT STATE)

Events that are annotated as INHERENT STATE, as in 75a, refer to states that are an inherent property of the entity, i.e. they did not ‘start’ at any particular point in the entity’s history and are not changeable in the future. Events annotated as REVERSIBLE STATE, as in 75b, refer to properties of entities that are not inherent, meaning they have come into existence at some point during the entity’s history; these states are reversible, meaning the entity likely will revert back to its base state in the future. Events annotated as IRREVERSIBLE STATE, as in 75c, refer to properties of entities that

are not inherent, but cannot be reversed in the future; once acquired, these states are permanent. Finally, events that are annotated as POINT STATE, as in 75d, refer to states that come into and out of existence over a single point in time (what is considered a ‘point’ is open to construal); these states necessarily do not persist into the future.

Events that are not annotated as a type of STATE move on to the next step.

6.4 Activity

The ACTIVITY label applies to processes when there is no evidence that the event has come to an end, as in 76.

- | | |
|---|---------------------------------|
| (76) a. He is still writing his paper. | (w / write
ASPECT: ACTIVITY) |
| b. He was writing his paper yesterday. | (w / write
ASPECT: ACTIVITY) |

This covers cases where it is clear that the process is still ongoing at document creation time, as in 76a, but also cases where it is ambiguous whether or not the process continues, as in 76b.

This step is largely dependent on context and real world knowledge, however there are some grammatical cues that can help. Events in the present tense, as in 77, are annotated as ACTIVITY.

- | | |
|---------------------------------------|--------------------------------|
| (77) He is playing the violin. | (p / play
ASPECT: ACTIVITY) |
|---------------------------------------|--------------------------------|

Inceptive and continuative aspectual marking, as in 78, also do not imply that an event has (necessarily) ended.

- | | |
|--|--------------------------------|
| (78) a. He <u>started</u> playing the violin. | (p / play
ASPECT: ACTIVITY) |
| b. He <u>kept on</u> playing the violin. | (p / play
ASPECT: ACTIVITY) |

If an annotator is unsure about whether the text indicates that an event has ended or not, the ATELIC PROCESS label can be used.

There are two finer-grained ACTIVITY categories which can optionally be distinguished. Certain type of activities describe directed change, as in 79a, whereas other activities describe undirected change, as in 79b; these are annotated as DIRECTED ACTIVITY and UNDIRECTED ACTIVITY respectively.

- | | |
|---|---|
| (79) a. The soup was cooling on the counter. | (c / cool
ASPECT: DIRECTED ACTIVITY) |
| b. The cat was meowing outside the door. | (m / meow
ASPECT: UNDIRECTED ACTIVITY) |

Events annotated as DIRECTED ACTIVITY refer to change that occurs gradually along a qualitative scale. In 79a, the temperature of the soup continues to decrease in a linear fashion. Events annotated as UNDIRECTED ACTIVITY refer to change that does not progress incrementally along a scale; in 79b, there is no scale or gradual change.

Events that have ended prior to document creation time and have not yet received an annotation move on to the next step.

6.5 Endeavor and Performance

At this point, only PERFECTIVE events are left: ENDEAVOR and PERFORMANCE. Both the ENDEAVOR and PERFORMANCE aspectual types entail that the process has come to an end; they are distinguished by the boundedness of the event in terms of qualitative state. The PERFORMANCE value is used when the event reaches a result state distinct from the base (start) state, that is, a specific “natural” endpoint. The ENDEAVOR value is used when the events ends, but does not reach a distinct result state. The PERFORMANCE value can be seen as the ‘default’ value for events at this step; the ENDEAVOR value is only annotated in the presence of explicit marking, which may come in several forms detailed below. If it’s not clear which category an event fits into, it can be annotated as PERFECTIVE.

The explicit aspectual markings which suggest an ENDEAVOR annotation are terminative aspect marking, durative adverbials, and non-result paths. These are illustrated for English below.

- (80) a. Mary stopped **mowing** the lawn. (m / mow
ASPECT: ENDEAVOR)
- b. Mary **mowed** the lawn for thirty minutes. (m / mow
ASPECT: ENDEAVOR)
- c. *Mary finished **mowing** the lawn
for thirty minutes. (w / walk
ASPECT: ENDEAVOR)
- d. They **walked** along the river. (w / walk
ASPECT: ENDEAVOR)
- e. They finished **walking** along the river. (w / walk
ASPECT: PERFORMANCE)
- f. They **walked** along the river
in 3 hours. (w / walk
ASPECT: PERFORMANCE)

Terminative aspectual marking, such as *stop* in English, is the strongest evidence that an event has ended without reaching a result state and should therefore be annotated as ENDEAVOR. Durative adverbials, such as in 80b, are the second strongest evidence for an ENDEAVOR annotation: they indicate that the event took place for a defined period of time and then ended, likely without completion. At least in English, durative adverbials cannot co-occur with completive aspectual marking; see 80c. A non-result path is the weakest evidence for an ENDEAVOR annotation; in the absence of other aspectual indicators, a non-result path requires an ENDEAVOR annotation, as in 80d. But, if there is a completive aspectual marker, as in 80e, or a container adverbial, as in 80f, both indicators that an event has reached a distinct result state, then the event is annotated as PERFORMANCE.

In the absence of any of the aspectual indicators listed above, events that have made it to this point in the decision tree are annotated as PERFORMANCE.

Both ENDEAVOR and PERFORMANCE have more fine-grained aspectual distinctions which may optionally be annotated. Endeavors may be specified with UNDIRECTED ENDEAVOR, DIRECTED

ENDEAVOR, and SEMELFACTIVE. The UNDIRECTED ENDEAVOR and DIRECTED ENDEAVOR values correspond to UNDIRECTED ACTIVITY and DIRECTED ACTIVITY; they differ in that the event has come to an end. Semelfactives refer to punctual events that happen once before reverting back to the base state (these are similar to POINT STATE, but refer to a process), as in 81c.

- (81) a. The cat **meowed** for two hours until I woke up. (m / meow
ASPECT: UNDIRECTED ENDEAVOR)
- b. The soup **cooled** for an hour before we ate it. (c / cool
ASPECT: DIRECTED ENDEAVOR)
- c. The cat **meowed** (once). (m / meow
ASPECT: SEMELFACTIVE)

The finer-grained annotations for PERFORMANCE distinguish between punctual events (DIRECT ACHIEVEMENT) and durative events (INCREMENTAL ACCOMPLISHMENT, NONINCREMENTAL ACCOMPLISHMENT), with even finer-grained categories based on the type of change.

Achievements are punctual events, meaning that are conceptualized as occurring at a single point in time (like POINT STATE and SEMELFACTIVE). Unlike POINT STATE and SEMELFACTIVE, achievements don't revert back to the base state, which is why they're considered a finer-grained type of PERFORMANCE. The DIRECTED ACHIEVEMENT annotation can be further specified based on whether the change is reversible or irreversible. In 82a, the change that the door undergoes can be reversed in that the door can be closed; therefore this is annotated as REVERSIBLE DIRECTED ACHIEVEMENT. In 82b, the change that the window undergoes cannot be reversed; therefore this is annotated as IRREVERSIBLE DIRECTED ACHIEVEMENT.

Accomplishments are durative events that can be categorized based on whether the change occurs incrementally or nonincrementally; this is similar to the difference between directed and undirected activities and endeavors. With INCREMENTAL ACCOMPLISHMENT, the change occurs incrementally along the qualitative dimension; in 82c, the pancake is eaten piece-by-piece and each subsequent bite brings the event closer to completion. With NONINCREMENTAL ACCOMPLISHMENT, the change ends up at a distinct result state (as with all types of Performances), but it may not get there in a linear/incremental fashion. In 82d, the computer does not necessarily get progressively more repaired with each action. Harry may try one tactic unsuccessfully to fix the computer; he may even make the problem worse at some point, but eventually succeeds in repairing the computer.

- (82) a. The door **opened**. (o / open
ASPECT: REVERSIBLE DIRECTED
ACHIEVEMENT)
- b. The window **shattered**. (s / shatter
ASPECT: IRREVERSIBLE DIRECTED
ACHIEVEMENT)
- c. I **ate** an apple pancake. (a / ate
ASPECT: INCREMENTAL ACCOMPLISH-
MENT)
- d. Harry **repaired** the computer. (r / repair
ASPECT: NONINCREMENTAL ACCOM-
PLISHMENT)

A English modals

This list gives the modal strength value associated with common English modal constructions (this is certainly not an exhaustive list). For modal predicates that are identified as their own event node (e.g., deontic predicates), the modal strength value characterizes the link between the modal predicate node and its child event. For example, *want* is in the `Neut (ral)` list, which indicates that there is a `Neut` link between the `want` node and its complement event node.

Aff (full affirmative)

- ◇ Simple assertions: declarative sentences
- ◇ Certainty: *certainly, be sure, definitely, necessarily*
- ◇ Predictive future: *will*, non-intentional *be going to*
- ◇ Factual predicates: *manage to, finished*

Prt (partial affirmative)

- ◇ Strong epistemic modals: *must/must have, have to, expect that, deduce*
- ◇ Strong epistemic adverbs/adjectives: *probably/be probable that, likely/be likely that*
- ◇ Strong deontic modals:
 - ◇ Intention: *intend, plan, intentional be going to, decide, be slated to*
 - ◇ Obligation: imperative, deontic *must, have to, should, ought to, be required to, need; order to, tell to, demand*
 - ◇ Purpose clauses/purposive event nominals: *(in order) to VERB, for EVENT.NOM*

Neut (neutral affirmative)

- ◇ Weak epistemic modals: *may, might/might have, could have*
- ◇ Weak epistemic adverbs/adjectives: *maybe, possibly/be possible that*
- ◇ Conditionals
- ◇ Hope/Fear: *hope, fear, worry, dread*
- ◇ Weak deontic modals
 - ◇ Desire: *want, prefer, would like to*
 - ◇ Permission: *let, permit, allow*

NeutNeg (neutral negative)

- ◇ Doubt: *doubt, call into question, be dubious that, be skeptical that*
- ◇ Combination of (some) `Neut` lexical items with negation

PrtNeg (partial negative)

- ◇ Strong negative deontics: *forbid, ban, disallow*
- ◇ Negative imperatives

- ◇ Combination of (some) `Prt` lexical items with negation

Neg (full negative)

- ◇ Negation: *not*, *never*, *no* + noun phrase
- ◇ Negative complement taking predicates that entail that the event didn't happen: *deny*, *prevent*, *prohibit*, *block*, *cease*, *it is impossible that*, *avoid*
- ◇ Counterfactuals
- ◇ Wishes: *wish*

B Verbs and participant roles

(Change of) State		
Verb	Microrole	Annotation
Change of State		
eat	eater	ACTOR
	eaten food	UNDERGOER
wash	washer	ACTOR
	washed entity	UNDERGOER
break	breaker	ACTOR
	broken thing	UNDERGOER
	breaking instrument	INSTRUMENT
kill	killer	ACTOR
	killee	UNDERGOER
	killing instrument	INSTRUMENT
beat	beater	ACTOR
	beatee	UNDERGOER
	beating instrument	INSTRUMENT
cut	cutter	ACTOR
	cut thing	UNDERGOER
	cutting instrument	INSTRUMENT
grind	grinder	ACTOR
	ground thing	UNDERGOER
cook	cooker	ACTOR
	cooked food	UNDERGOER
drink	drinking person	ACTOR
	drunken thing	UNDERGOER
cover	coverer	ACTOR
	cover	INSTRUMENT
	covered thing	UNDERGOER
fill	filler	ACTOR
	filling material	INSTRUMENT
	filled container	UNDERGOER
wipe (cos)	wiper	ACTOR
	wiped surface	UNDERGOER
peel (cos)	peeler	ACTOR
	peeled object	UNDERGOER
Contact		
hit	hitter	ACTOR
	hittee	UNDERGOER
	hitting instrument	INSTRUMENT
touch	toucher	ACTOR
	touchee	UNDERGOER
	touching instrument	INSTRUMENT
push	pusher	ACTOR
	pushee	UNDERGOER

(Change of) State		
Verb	Microrole	Annotation
Inactive S		
die	dieer	UNDERGOER
be sad	sad person	UNDERGOER
be hungry	hungry person	UNDERGOER
sink	sunken entity	UNDERGOER
burn	burnt thing	UNDERGOER
be dry	dry thing	UNDERGOER
boil	boiled thing	UNDERGOER
be ill	sick person	UNDERGOER
cry	crier	UNDERGOER
fall	fallee	UNDERGOER
rain	rain	UNDERGOER
Reflexive-y Reciprocal-y		
dress	dresser	ACTOR
	dressee	UNDERGOER
shave (a body part)	shaver	ACTOR
	shaved body part	UNDERGOER
help	helper	ACTOR
	helpee	UNDERGOER
follow	follower	ACTOR
	followee	UNDERGOER
meet	meeter	ACTOR
	met person	UNDERGOER
hug	hugger	ACTOR
	huggee	UNDERGOER
Partly-unrealized		
search for	searcher	ACTOR
	searched thing	UNDERGOER
hunt (for)	hunter	ACTOR
	hunted thing	UNDERGOER
Creation		
build	builder	ACTOR
	built thing	UNDERGOER
	building material	MATERIAL
make	maker	ACTOR
	made thing	UNDERGOER

Motion / Location		
Verb	Microrole	Annotation
Active S		
climb	climber	ACTOR
	climbing goal	UNDERGOER
run	runner	ACTOR
sit	sitter	ACTOR
	sitting place	PLACE
sit down	sit downer	ACTOR
	sitting-down place	GOAL
jump	jumper	ACTOR
go	goer	ACTOR
	going goal	GOAL
leave	leaver	ACTOR
	left person	SOURCE
live	liver	ACTOR
	living place	PLACE
roll	roller	ACTOR
blink	blinker	ACTOR
cough	cougher	ACTOR
laugh	laugher	ACTOR
play	player	ACTOR
sing	singer	ACTOR
dig	digger	ACTOR
Application		
put	putter	ACTOR
	put thing	THEME
	putting goal	GOAL
pour	pourer	ACTOR
	poured substance	THEME
	pouring goal	GOAL
load	loader	ACTOR
	loaded thing	THEME
	loading place	GOAL
tie	tier	ACTOR
	tied thing	THEME
	tying goal	GOAL
Removal		
taker	taker	ACTOR
	taken thing	THEME
	taking source	SOURCE
tear	tearer	ACTOR
	torn thing	THEME
	tearing source	SOURCE
wipe (motion)	wiper	ACTOR
	wiped material	THEME
	wiped surface	SOURCE
peel (motion)	peeler	ACTOR
	peel	THEME
	peeled object	SOURCE

Experiential		
Verb	Microrole	Annotation
look at	looker	EXPERIENCER
	looked at entity	STIMULUS
see	seer	EXPERIENCER
	seen entity	STIMULUS
smell	smeller	EXPERIENCER
	smelled entity	STIMULUS
fear	fearer	EXPERIENCER
	fear stimulus	STIMULUS
frighten	frightenee	EXPERIENCER
	frightener	STIMULUS
like	liker	EXPERIENCER
	liked entity	STIMULUS
know	knower	EXPERIENCER
	known thing/person	STIMULUS
think	thinker	EXPERIENCER
	thought content	STIMULUS
hear	hearer	EXPERIENCER
	heard sound	STIMULUS
feel pain	pain-feeler	EXPERIENCER
	pain locus	STIMULUS
appear	appearer	STIMULUS
want	wanter	EXPERIENCER
	wanted thing	STIMULUS

Transfer		
Verb	Microrole	Annotation
Transfer		
give	giver	ACTOR
	gift	THEME
	giving recipient	RECIPIENT
send	sender	ACTOR
	sent thing	THEME
	sending recipient	RECIPIENT
carry	carrier	ACTOR
	carried thing	THEME
	carrying goal	GOAL
throw	thrower	ACTOR
	thrown thing	THEME
	throwing goal	GOAL
bring	bringer	ACTOR
	brought thing	THEME
	bringing recipient	RECIPIENT
steal	stealer	ACTOR
	stolen thing	THEME
	stealing source	AFFECTEE
get	receiver	RECIPIENT
	received thing	THEME
Communication		
talk	talker	ACTOR
	talked about content	THEME
	talked to person	RECIPIENT
ask for	asker	ACTOR
	requested thing	THEME
	askee	RECIPIENT
shout at	shouter	ACTOR
	shoutee	RECIPIENT
tell	teller	ACTOR
	told content	THEME
	tellee	RECIPIENT
show	shower	ACTOR
	shown thing	THEME
	showing addressee	RECIPIENT
hide	hider	ACTOR
	hidden thing	THEME
	hiding affectee	AFFECTEE
scream	screamer	ACTOR
teach	teacher	ACTOR
	taught content	THEME
	teachee	RECIPIENT
say	sayer	ACTOR
	said content	THEME
	saying addressee	RECIPIENT
name	namer	ACTOR
	name	THEME
	namee	RECIPIENT

C Annotation Quick Reference

This “cheat sheet” summarizes the key points for aspect and participant roles, and gathers the most helpful tables and figures in one place.

Annotation target ID

Identify as an event if:

- the semantic type is process/action OR
- the information-packaging type is predication.

Identify as a participant if:

- it is dependent on an event.

Note that the same thing can (and often will be) identified as both an event and a participant.

Label the annotation target with:

- Nonverbal clause UMR predicate, if applicable (see Table 7 repeated below), ELSE
- Frame file sense, if available, ELSE
- Lemmatized form of the word

Clause type	UMR Predicate	ARG0	ARG1
thetic/presentational possession	have-03	<i>possessor</i>	<i>possession</i>
predicative possession	belong-01	<i>possession</i>	<i>possessor</i>
thetic/presentational location	exist-91	<i>location</i>	<i>theme</i>
predicative location	have-location-91	<i>theme</i>	<i>location</i>
property predication	have-mod-91	<i>theme</i>	<i>property</i>
object predication	have-role-91	<i>theme</i>	<i>object category</i>
equational	identity-91	<i>theme</i>	<i>equated referent</i>

Participant role annotation

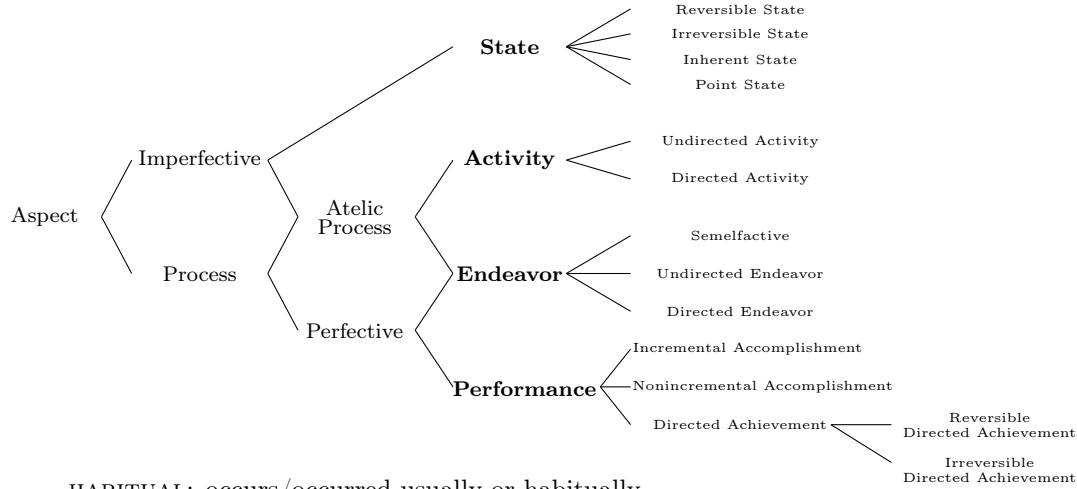
Each participant is linked to an event with a participant role label. The definition of each label is repeated below, along with the table which categorizes the roles.

External Cause	Central Event	Circumstantial
ACTOR COMPANION INSTRUMENT FORCE CAUSER	(CHANGE OF) STATE:	AFFECTEE
	MATERIAL, UNDERGOER	PLACE
	MOTION/LOCATION:	MANNER
	THEME, GOAL, START, SOURCE, PLACE	PURPOSE
	TRANSFER:	REASON
	THEME, RECIPIENT	CAUSE
	EXPERIENTIAL:	TEMPORAL
	EXPERIENCER, STIMULUS	EXTENT

UMR Annotation	Definition	Example
ACTOR	animate entity that initiates the action	the doctor laughed the boy ate a salad
UNDERGOER	entity (animate or inanimate) that is affected by the action	the papers burned he burned the onions
THEME	entity (animate or inanimate) that moves from one entity to another entity, either spatially or metaphorically	she put the books on the shelf she tore a page from the book he gave a sandwich to me she told him a story
RECIPIENT	animate entity that gains possession (or at least temporary control) of another entity	he gave a sandwich to me she told him a story
FORCE	inanimate entity that initiates the action	the wind knocked down the tree
CAUSER	animate entity that acts on another animate entity to initiate the action	the mother made her child eat the broccoli
EXPERIENCER	animate entity that cognitively or sensorily experiences a STIMULUS	the dog heard a sound
STIMULUS	entity (animate or inanimate) that is experienced by an EXPERIENCER	the dog heard a sound
INSTRUMENT	inanimate entity that is manipulated by an external causer in order to initiate the action	she hit him with a broom
COMPANION	animate entity that acts with the ACTOR to initiate the action	he cooked dinner with his wife
MATERIAL	entity (inanimate) that is transformed into a new entity	he made a roux with flour and butter
SOURCE	entity from which the THEME detaches	he plucked a flower from the the bush
PLACE	location at which the action takes place	he read a book in the garden
START	location at which a motion event begins	she biked from her house
GOAL	location at which the action ends, the end point at which the THEME arrives	she put the books on the shelf
AFFECTEE	animate entity which the action has a positive or negative influence on, i.e. beneficiary or maleficiary	he made a cake for the dog she stole a watch from the CEO
CAUSE	inanimate entity that causes the action to happen	he was late because of the fire
MANNER	manner in which the action takes place	she exercised by lifting weights
REASON	motivation for the ACTOR to initiate the action	they got married because they are in love
PURPOSE	intended event that results from the action	they dropped water in order to fight the fires
TEMPORAL	event that has a temporal relation with the action	she left after dinner
EXTENT	measurement phrase	he ran seven miles
OTHER	this role can be used when an annotator is unsure of which role is appropriate	

Aspect annotation

Each event receives an aspect value. The lattice and definitions of the values is repeated below.



HABITUAL: occurs/occurred usually or habitually

IMPERFECTIVE: ambiguous between state and process

PROCESS: unspecified type of process

ATELIC PROCESS: process that does not reach a result state

PERFECTIVE: process that comes to an end

STATE: unspecified type of state

REVERSIBLE STATE: acquired state that is not permanent

IRREVERSIBLE STATE: acquired state that is permanent

INHERENT STATE: state that is not acquired and permanent

POINT STATE: state that is acquired and reversed at a single point in time

ACTIVITY: process that does not end

UNDIRECTED ACTIVITY: process that does not end and does not progress linearly along a scale

DIRECTED ACTIVITY: process that does not end and does progress linearly along a scale

ENDEAVOR: process that ends without reaching a result state

SEMELFACTIVE: process that ends without reaching a result state and happens at a single point in time

UNDIRECTED ENDEAVOR: process that ends without reaching a result state and does not progress linearly along a scale

DIRECTED ENDEAVOR: process that ends without reaching a result state and progresses linearly along a scale

PERFORMANCE: process that ends and reaches a result state

INCREMENTAL ACCOMPLISHMENT: process that ends and reaches a result state, and progresses linearly along a scale

NONINCREMENTAL ACCOMPLISHMENT: process that ends and reaches a result state, and does not progress linearly along a scale

DIRECTED ACHIEVEMENT: process that ends and reaches a result state within a single point in time, and progresses linearly along a scale

REVERSIBLE DIRECTED ACHIEVEMENT: process that ends and reaches a result state, which is not permanent, within a single point in time, and progresses linearly along a scale

IRREVERSIBLE DIRECTED ACHIEVEMENT: process that ends and reaches a result state, which is permanent, within a single point in time, and progresses linearly along a scale