Annotation guidelines for direct temporal relation

In this guideline, we describe how to annotate direct temporal relation between a TIMEX (a mention of time expression) and an EVENT (a mention of event). A TIMEX can have the type *date*, *time*, *duration*, or *frequency*, and an EVENT can have the type *problem*, *treatment*, or *test*.

1. The task

An annotator will be given a document with TIMEX, EVENT, and intra-sentential temporal relations between a TIMEX and an EVENT. The annotation task is as follows:

- For each intra-sentential temporal relation between a TIMEX and an EVENT, leave the relation if it is a direct temporal relation, delete it otherwise.

Section 2 and 3 further explain which pair of TIMEX and EVENT can form a direct temporal relation.

2. Basic definition of direct temporal relation

A temporal relation between a TIMEX and an EVENT is direct if one of the following conditions holds:

1) TIMEX modifies EVENT (or vice versa).
2) TIMEX and EVENT are arguments of the same predicate.

Section 2.1 and 2.2 further explains the two conditions above.

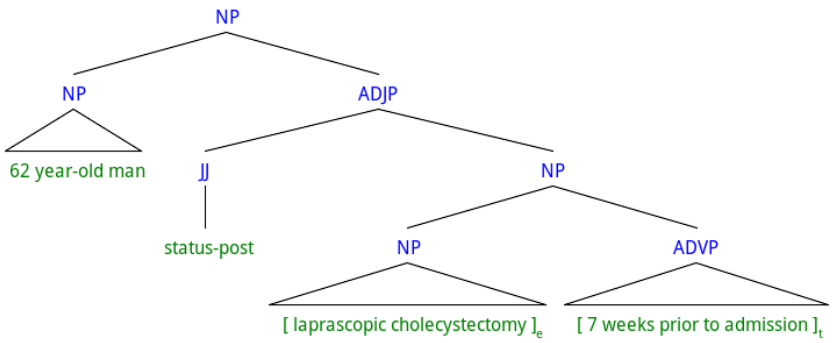
2.1 Direct temporal relation via modification

Modification is a concept in linguistics, which can be defined as follows:

- A syntactic construction where a grammatical element is accompanied (or modified) by another grammatical element to form a bigger grammatical element.

For instance, a noun phrase can be modified by a prepositional phrase to form a bigger noun phrase.

2.1.1 Example 1

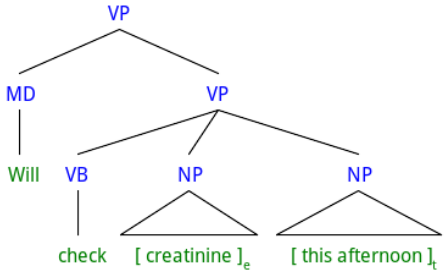


The example above shows the constituency parse tree of the example sentence “62 year-old man status-post laprascopic cholecystectomy 7 weeks prior to admission”. The target EVENT is “laprascopic cholecystectomy”, which is marked with square parenthesis and a subscript *e*. The target TIMEX is “7 weeks prior to admission”, which is marked with square parenthesis and a subscript *t*. The EVENT constitutes a noun phrase (NP), and the TIMEX constitutes an adverbial phrase (ADVP). The ADVP of TIMEX modifies the NP of EVENT to form a bigger NP “laprascopic cholecystectomy 7 weeks prior to admission”. Thus, the temporal relation between the TIMEX “7 weeks prior to admission” and the EVENT “laprascopic cholecystectomy” is direct.

2.2 Direct temporal relation via same predicate

In linguistics, a verb or a noun is often regarded as a predicate, whose meaning is completed by its arguments. The meaning of a predicate can be enriched by its adjuncts. Usually arguments can have semantic roles such as subject or object, and adjuncts provide additional information that is not necessary to make sentence grammatically correct.

2.2.1 Example 2



In this example, there is predicate with the verb “check”. This predicate has the NP of EVENT “creatinine” as its object. This predicate also has the NP of the time expression “this afternoon” serves as its adjunct. Thus, the temporal relation between the TIMEX “this afternoon” and the EVENT “creatinine” is direct.

3. Head-of-the-phrase rule and exceptions to it

Head-of-the-phrase rule further restricts what pair of EVENT and TIMEX can form a direct temporal relation in addition to the definition of direct temporal relation given in Section 2. Head-of-the-phrase rule can be stated as follows:

- **Head-of-the-phrase rule:** in order to form a direct temporal relation, the TIMEX and the EVENT should be the head of the phrase that modifies the other (or being modified by the other), or is the argument or the adjunct of a predicate.

Head of a phrase is defined as follows:

- A phrase inside of a bigger phrase that determines the syntactic type of the bigger phrase.

However, since head-of-the-phrase rule is too restrictive, we allow three types of exceptions to it, which are listed as follows:

- **Exception 1:** the TIMEX (or the EVENT) is inside a PP, which consist of a preposition (the head of the PP) and a NP. If the TIMEX (or the EVENT) is the head of the NP inside the PP, the TIMEX (or the EVENT) can form a direct temporal relation.
- **Exception 2:** the TIMEX (or the EVENT) is inside a coordinated NP, which consist of more than two smaller NPs (coordinates) and more than one conjunction words (e.g., "and", "or", ","). If the TIMEX (or the EVENT) is the head of one of the coordinates (smaller NPs), the TIMEX (or the EVENT) can form a direct temporal relation.
- **Exception 3:** the TIMEX (or the EVENT) is the head of a phrase P, and P is inside a bigger type-preserving phrase (see Section 3.1 for a list of example type-preserving phrase).

3.1 Type-preserving phrases

A type-preserving phrase is a phrase whose semantic type can be regarded as time (i.e., date, time, duration, or frequency) or clinical event (i.e., problem, test, or treatment). The followings are lists of type-preserving phrases. There are seven lists, each listing type-preserving phrases possible for different types of EVENT and TIMEX.

[p_s:EVENT-TREATMENT]

a. the first/the first course/six cycles/all/course/treatments of p_s
b. (maximum of) 1 unit/10mg/large doses/maximum caloric density/120 cc per kg per day/amount of p_s
c. degree of p_s
d. duration of p_s
e. introduction/placement/use/treatment of p_s
f. d/c of p_s
g. make p_s
h. to undergo/continue/complete/place p_s

i. $p_{s1}$with/by p_s [p_{s1}: EVENT-TREATMENT]
j. p_{s1}consisting of/including p_s [p_{s1}: EVENT-TREATMENT]
k. taking/having/completing/tolerating/starting p_s
l. p_s was placed/given
m. date of p_s

[p_s:EVENT-TEST]
a. the first of p_s
b. have/make p_s
c. $p_{s1}$with/via p_s [p_{s1}: EVENT-TEST]
d. undergoing p_s
e. showing p_s

[p_s:EVENT-PROBLEM]
a. a history/episodes/occurrence/onset/presence of p_s
b. complaints/signs/symptoms/notification of p_s
c. evidence/diagnosis of p_s
d. $p_{s1}$with p_s [p_{s1}: EVENT-PROBLEM]
e. to show/have/be/develop/notice p_s
f. having/being/complaining of/developing/feeling/experiencing p_s
g. becoming/demonstrating/revealing/representing/showing p_s
h. complaining of p_s
i. notable for p_s

[p_s:TIMEX-DURATION]
a. lasting p_s
b. continue for p_s
c. to complete p_s course
d. total/course/period of p_s

[p_s:TIMEX-DATE]
a. Admission/discharge on p_s
b. the day/the time of p_s
c. p_{s1}in p_s [p_{s1}: TIMEX-DATE]
d. the morning/week/evening/end/month of p_s
e. starting/beginning on p_s
f. dating back to p_s
g. undergoing p_s
h. Upon waking on p_s
i. When he was seen on/On an office visit on p_s
j. Once (S) on p_s

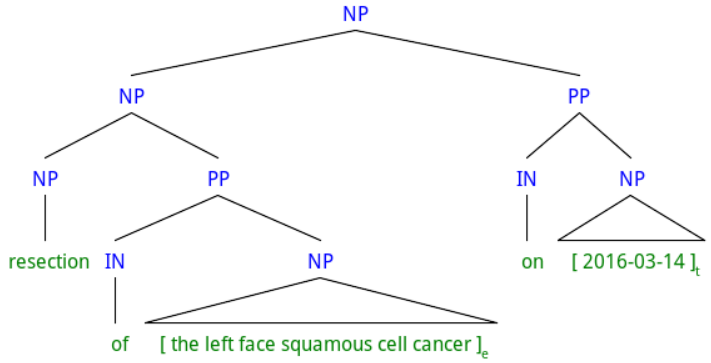
[p_s:TIMEX-TIME]
a. When (S) at p_s

b. Starting at p_s

[p_s:GENERAL]
a. subsequent to p_s
b. followed by/following p_s
c. including p_s
d. in association/combination with p_s
e. associated with p_s
f. a combination of p_s and p_{s1}

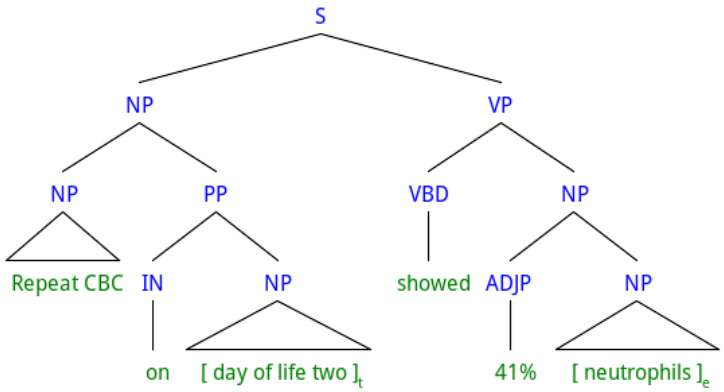
3.2 Examples

3.2.1 Example 3 – a non-direct temporal relation



The TIMEX "2016-03-14" is inside a prepositional phrase (PP) "on 2016-03-13". The EVENT "the left face squamous cell cancer" is inside a NP "resection of the left face squamous cell cancer". The NP is modified by the PP, but the EVENT is not the head of the NP ("resection" is the head). Therefore, the TIMEX and the EVENT cannot form a direct temporal relation.

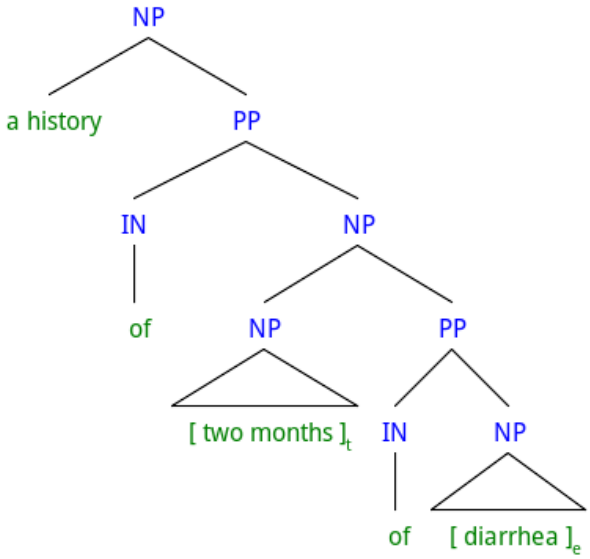
3.2.2 Example 4 – a non-direct temporal relation



The TIMEX "day of life two" is inside a NP "repeat CBC on day of life two". The EVENT "neutrophils" is inside a NP "41% neutrophils". The first NP is a subject of a verb predicate

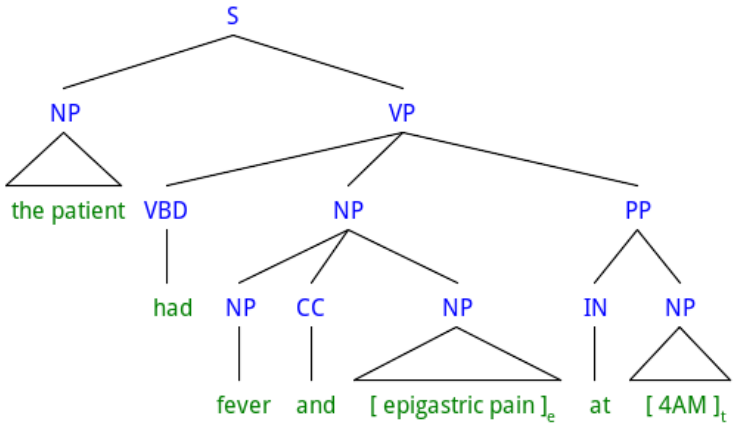
"showed", and the second NP is the object of the same verb predicate. However, the TIMEX is not the head of the first NP ("repeat CBC" is the head). Therefore, the TIMEX and the EVENT cannot form a direct temporal relation.

3.2.3 Example 5



The TIMEX "two months" itself constitutes a NP. This NP is modified by a PP "of diarrhea", which contains the EVENT "diarrhea". Here, the EVENT is not the head of the PP (the preposition "of" is the head). However, it is the head of the NP inside the PP "diarrhea". Therefore, by exception 1, this pair can form a direct temporal relation.

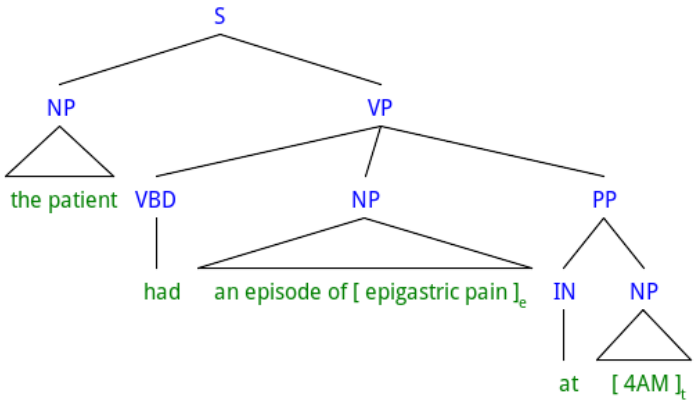
3.2.4 Example 6



The EVENT "epigastric pain" is contained in a coordinated NP "fever and epigastric pain", and this coordinated NP serves as an argument of a verb predicate "had". The TIMEX "4AM" is inside a PP "at 4AM", and this PP serves as an adjunct of the same verb predicate "had". The EVENT is not the head of the coordinated NP "fever and epigastric pain", but it is the head of one of the coordinates, "epigastric pain". The TIMEX is not the head of the PP "at 4AM", but it

is the head of the NP inside the PP, “4AM”. Thus, by exception 1 and 2, the EVENT and TIMEX can form a direct temporal relation.

3.2.5 Example 7



The EVENT “epigastric pain” is contained in a NP “an episode of epigastric pain”, and this NP serves as an argument of a verb predicate “had”. The TIMEX “4AM” is inside a PP “at 4AM”, and this PP serves as an adjunct of the same verb predicate “had”. The EVENT is not the head of the NP “an episode of epigastric pain”, but this NP is a type-preserving phrase that preserves the type of the EVENT “epigastric pain”, *problem*. The TIMEX is not the head of the PP “at 4AM”, but it is the head of the NP inside the PP, “4AM”. Thus, by exception 1 and 2, the EVENT and TIMEX can form a direct temporal relation. Thus, by exception 1 and 3, the EVENT and TIMEX can form a direct temporal relation.

4. Miscellaneous guidelines

- Resolve relative pronoun

Ex) The patient was on [FK 2]$_e$ that was started on [postoperative day number 2]$_t$.
→ In this example, there’s a direct relation between the EVENT and TIMEX.

- Treat parenthesis as coordination, if the phrase inside the parenthesis has the same semantic type as the phrase immediately preceding the parenthesis.

Ex) 05-23 (day of life 18) → TIMEX (TIMEX)

- Treat parenthesis as modification, if the phrase inside the parenthesis has the same semantic type as the phrase immediately preceding the parenthesis.

Ex) Tamoxifen (May 2000) → EVENT (TIMEX)