The Distribution of Noun-Modifying Adverbs in English

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ABSTRACT

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This paper investigates the distributions of adverbs in English. They are known to modify adjectives, adverbs, and verbs. However, we can find the cases in which an adverb modifies the head noun in an NP (e.g., *the use temporarily of Australian troops to defend Ceylon*). This kind of adverb modifications can be a problem for a syntactic analysis of the NPs based on X'-theory since the adjunct (*temporarily*) is placed in between the head noun (*use*) and its PP complement (*of Australian troops*). This configuration prevents the head noun from combining first with its PP complement. I argue in this paper that the NPs of the kind are not a problem for a constraint-based grammar and show that the distributions of the noun-modifying adverbs and other normal adverbs in English can be straightforwardly analyzed in the framework of HPSG (Head-driven Phrase Structure Grammar) (Pollard & Sag 1994; Sag *et al*. 2003).

1. Introduction

This paper investigates the distributions of adverbs in English: in what position adverbs occur and what they modify. This issue looks not very interesting since adverbs are already known to be able to modify adjectives, verbs or other adverbs. Some typical examples of English adverbs are given in the following:

(1)   a.   He is a [$_{AP}$ [$_{AdvP}$ highly] admirable] athlete.
        b.   Mary [$_{VP}$ [$_{AdvP}$ slowly] ran].
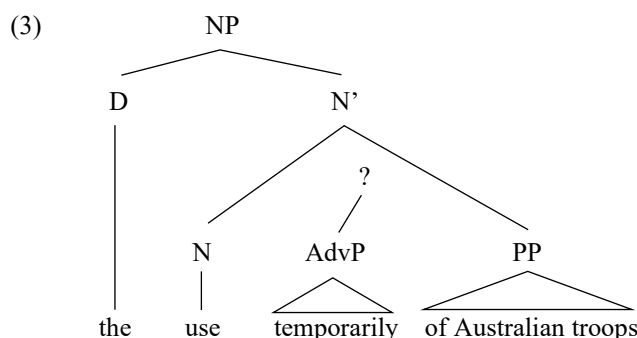   c.   Mary was [$_{AdvP}$ [$_{AdvP}$ very] highly] admired.

In (1) the adverbs appear before what they modify. It is generally assumed that an adverb does not modify a noun. Surprisingly, however, it has been reported in some papers that there are "adverbs" in English that can modify a noun (see Jespersen 1913: 292, 1940: 82-83, 109; Lee 1998: 139; Fu *et al*. 2001; Payne *et al*. 2010).[1] Consider the following examples:[2]

(2)   a.   In view of your decision regarding Burma the British Government was not making any formal request to you for [the <u>use</u> **temporarily** of Australian troops to defend Ceylon].
            (Payne *et al*. 2010: 42, (16))
        b.   [The unique <u>role</u> **globally** of the Australian Health Promoting Schools Association], as a non-government organization specifically established to promote the concept of the health promoting school, is described. (Payne *et al*. 2010: 43, (17a))
        c.   Earlham College's modern equestrian center will become even more impressive with [the <u>addition</u> **soon** of an indoor riding and show arena]. (Payne *et al*. 2010: 43, (17c))
        d.   The NHS and [other health <u>organisations</u> **internationally**] clearly need methodologies to support benefit analysis of merging healthcare organisations. (Payne *et al*. 2010: 43, (17b))

In each of the sentences in (2), the noun-modifying adverb appears right after the head noun that it modifies in the NP. For example, in (2a) the adverb *temporarily* modifies the head noun *use*; the NP seems to have almost the same meaning as that of *the temporal use of Australian troops to defend Ceylon*. Payne *et al*. (2014) collected the data of noun-modifying adverbs from the BNC (British National Corpus) and classified them according to the semantic properties of the adverbs (see section 2.1 below). However, the syntactic structure of the NPs with a noun-modifying adverb has been rarely discussed in the literature (cf. Fu *et al*. 2001); so in this paper I aim to provide a syntactic analysis of the NPs. Note that in particular NPs like (2a) can be a problem since the adverb (*temporarily*, which is an adjunct in the NP) is placed in between the head noun (*use*) and its PP complement (*of Australian troops*):

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[1] There is an issue about the categorial status of the adverbs in (2) since they modify a noun just like adjectives. For instance, Giegerich (2012) argues that adverbs with *-ly* are in fact inflected adjectives. I assume in this article that the noun-modifying expressions are adverbs and focus on analyzing the syntactic structure of the NPs with a noun-modifying adverb.
[2] The underlines and bold highlighting in the examples of the paper were added by the author.

(3)

```
                    NP
                 /      \
               D          N'
               |        /    \
               |       /      \
               |      /        ?
               |     /       /   \
               |    N    AdvP    PP
               |    |     /\     /\
              the  use  /    \  /    \
                     temporarily  of Australian troops
```

The PP *of Australian troops* in (3) corresponds to the direct object of the verb *use* in the sentence *The British Government temporarily used Australian troops*. This suggests that the PP is the complement of the head noun *use* in (3). Then, according to X'-theory, which requires a head to combine first with its complement rather than an adjunct, the head noun *use* must first combine with the PP complement, but the adjunct *temporarily* is placed in between them. So it is not clear how to analyze such NPs in a grammar that is based on X'-theory.[3] I argue in this paper, however, that analyzing such NPs is not a serious problem in HPSG (Head-driven Phrase Structure Grammar) (Pollard & Sag 1994; Sag *et al.* 2003) since the constraint-based grammar allows a head to first combine with an adjunct if some relevant constraints are satisfied (see (33) below).

Unlike the post-modifying adverbs in (2), the pre-modifying adverbs in NPs are assumed to be ungrammatical in Payne *et al.* (2010). Consider the following examples:

(4)　　a.　　*the **temporarily** <u>use</u> of Australian troops (Payne *et al.* 2010: 42)

　　　　b.　　*the unique **globally** <u>role</u> of the Australian Health Promoting Schools Association (Payne *et al.* 2010: 43)

　　　　c.　　*the **soon** <u>addition</u> of an indoor riding and show arena (Payne *et al.* 2010: 43)

　　　　d.　　*the government's **yet again** <u>refusal</u> to take the high road (Payne *et al.* 2010: 43)

However, we can find in the Web some examples of the pre-modifying adverbs in NPs (see more examples in section 3 below).

(5)　　a.　　You are working on a project requiring the **temporarily** <u>use</u> of cranes on a somewhat soft clay site. (https://www.chegg.com/homework-help/questions-and-answers/e6400-brewer-crane-rigging-grove-com-omk6400-orange-mc-85229-ca-28777-orange-pad-example-c-q75908538)

　　　　b.　　This could be the reason why RNA stopped fulfilling the **globally** <u>role</u> of both the catalyst and template during the later stages of evolution. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5507279/)

　　　　c.　　I think with the **soon** <u>addition</u> of Atlas we should get a good fist or sparring weapon. (https://www.reddit.com/r/Warframe/comments/3lwan8/i_think_with_the_soon_addition_of_atlas_we_should/)

　　　　d.　　The message of this demand is **yet again** <u>refusal</u> to end the conflict.

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[3] The same problem seems to occur in the DP hypothesis since the fact does not change that the complement of a head noun must appear closer to the noun than an adjunct.

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(https://www.jns.org/opinion/abbas-distorted-history-at-the-u-n/)

The data in (5) suggest that at least some people accept the pre-modifying adverbs in NPs. This raises the question of why the variation between (4) and (5) occurs. It may be due to dialectal or individual differences. Although this issue of variation looks interesting, I assume in this paper that the pre-modifying adverbs are possible and focus on accounting for the distributions of the pre- and post-modifying adverbs in NPs. I believe that this study of noun-modifying adverbs can contribute to discovering the nature of the modificational system in English.

This paper is organized as follows. In section 2, NPs with a post-modifying adverb are classified according to the syntactic properties of the NPs, and in section 3, I present the data of NPs with a pre-modifying adverb taken from the Web and also classify the NPs based on their syntactic properties. In section 4, an HPSG analysis of the NPs are provided and I conclude in section 5.

2. Post-modifying Adverbs

Payne *et al.* (2010: 48) classify the post-modifying adverbs collected from the BNC (British National Corpus) according to their meanings. The basic types and representative examples are given in the following:

(6) a. **TEMPORAL LOCATION: 6 (33%)** *recently* (x3), *immediately*, *initially*, *shortly*
         Another important factor benefiting freight customers was [the *arrival recently* of the Stena Antrim]. [BNC: AMH 698]
     b. **SPATIAL: 6 (33%)** *centrally* (x2), *nationally* (x2), *locally* (x2)
         What is noteworthy in the present context is that it was an initiative that was energetically directed by SED and it involved [the *preparation centrally* of curriculum materials for every area of work]. [BNC: CN5 489]
     c. **DOMAIN: 2 (11%)** *electorally*, *environmentally*
         The research focuses on the interactions between the political system and the industrial relations system; that is, the size of the public sector and the welfare state, [the *strength electorally* of social democratic and left parties], and the participation in government of left parties are all taken into account in trying to explain strike activity. [BNC: HJ0 8280]
     d. **DISTRIBUTIONAL: 2 (11%)** *generally* (x2)
         But, she went on: 'However, in the present era of instant world-wide communication, it would be unrealistic to seek to prevent, whether under existing or amending legislation, [the reporting in [the *media generally*] of statements emanating from illegal organisations], whether they purport to issue from Dublin or elsewhere.' [BNC: HJ4 4939]
     e. **REASON: 1 (6%)** *naturally*
         Part of [the *richness naturally* of American fiction] is erm that there are so many writers with so many different backgrounds, so many different ethnic backgrounds. [BNC: KRH 2343]
     f. **SERIAL ORDER: 1 (6%)** *again*
         But into this situation there is [the *intervention again* of Moscow], of Stalin. [BNC: F8R 41]

In this section, I provide a syntactic classification of the NPs with a post-modifying adverb. They can be classified into four types. First, a phrase (normally, PP) follows the post-modifying adverb in an NP and the phrase
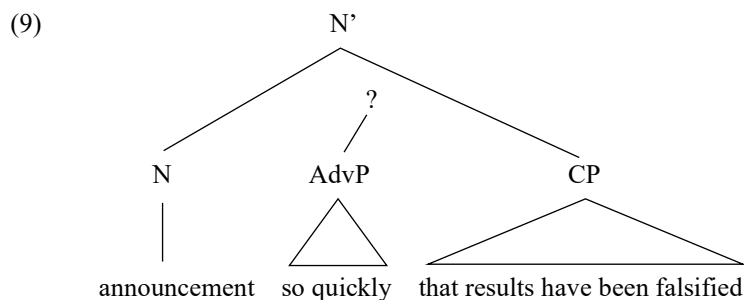
is the complement of the head noun; we can see in (7) that *of*-PPs in the NPs correspond to the direct objects of the verbs corresponding to the head nouns.

(7)　a.　In view of your decision regarding Burma the British Government was not making any formal request to you for [the <u>use</u> **temporarily** <u>of Australian troops</u> to defend Ceylon]. (Payne *et al*. 2010: 42, (16))
→ They **temporarily** <u>used</u> <u>Australian troops</u> to defend Ceylon.

　　　b.　Earlham College's modern equestrian center will become even more impressive with [the <u>addition</u> **soon** <u>of an indoor riding and show arena</u>]. (Payne *et al*. 2010: 43, (17c))
→ Earlham College's modern equestrian center will **soon** <u>add</u> <u>an indoor riding and show arena</u>.

　　　c.　Industrial action has also resulted in [the <u>withdrawal</u> **indefinitely** <u>of the Corran Vehicular Ferry Service</u>], which links the Lochaber mainland to Ardgour, Ardnamurchan. (Payne *et al*. 2010: 44, (18c))
→ It **indefinitely** <u>withdrew</u> <u>the Corran Vehicular Ferry Service</u>.

　　　d.　Our goal is the total freedom of the people and children and [the <u>destroying</u> **totally** <u>of the common enemy</u>]. (Payne *et al*. 2010: 46, (22d))
→ Our goal is to **totally** <u>destroy</u> <u>the common enemy</u>.

The correspondence between the PPs and the direct objects suggests that the PPs are the complements of the head nouns. The NPs in (7) all have *of*-PPs as their complements, but it is not required that the complement be an *of*-PP. For example, *to*-PP, *into*-PP, *that*-clause and *to*-infinitive can be the complements of the head nouns, as shown in (8).

(8)　a.　I think part of [the <u>reaction</u> **negatively** <u>to this</u>] is because sometimes it can be very confusing to the dog as to where they are allowed to go when outdoors and indoors are interchanged.
(Payne *et al*. 2010: 46, (23b))
→ The dog **negatively** <u>reacted</u> <u>to this</u>.

　　　b.　His <u>transformation</u> <u>into a werewolf</u> **so rapidly** was unnerving. (Fu *et al*. 2001: 555, (8a))
→ He <u>transformed</u> <u>into a werewolf</u> **so rapidly**.

　　　c.　The candidate's <u>announcement</u> **so quickly** <u>that results have been falsified</u> raised doubt on his credibility. (Fu *et al*. 2001: 578, (57a))
→ The candidate <u>announced</u> **so quickly** <u>that results have been falsified</u>.

　　　d.　I express my profound disappointment at [the government's <u>refusal</u> **yet again** <u>to take the high road and bring forth a motion to allow parliament to sit in committee of the whole</u>]. (Payne *et al*. 2010: 43, (17d))
→ The government <u>refused</u> **yet again** <u>to take the high road and bring forth a motion to allow parliament to sit in committee of the whole</u>.

As already mentioned above, the fact that the post-modifying adverb appear closer to the head noun than the complement is a problem for X'-theory since according to X'-theory a head noun first combines with its complement rather than its adjunct. For instance, the NP in (8c) faces the problem, as illustrated in (9).

(9)

```
                              N'
               ┌──────────────┼──────────────┐
               │              ?              │
               │              ╱              │
               N            AdvP             CP
               │             ╱╲             ╱  ╲
           announcement   so quickly   that results have been falsified
```

It is generally assumed that modifiers are a sister to what they modify. So the adverb phrase *so quickly* should combine with the head noun *announcement* in (9). But, according to X'-theory, the head noun *announcement* must combine first with its CP complement *that results have been falsified* rather than the adjunct *so quickly*. In order to solve this conflicting problem, one may assume that *so quickly* is not base-generated, but moved from another position in the sentence. In fact, post-modifying adverbs can appear after complements of head nouns, as shown in (10).

(10)   a.   (While) the <u>removal</u> <u>of evidence</u> **purposefully** (is a crime), the removal of evidence *unintentionally* (is not). (Fu *et al*. 2001: 554, (6a))
            → While he **purposefully** <u>removed</u> <u>evidence</u>, she unintentionally removed evidence.
       b.   His <u>transformation</u> <u>into a werewolf</u> **so rapidly** was unnerving. (Fu *et al*. 2001: 555, (8a))
            → He <u>transformed</u> <u>into a werewolf</u> **so rapidly**.
       c.   The committee's <u>destruction</u> <u>of these documents</u> **individually** (casts doubt on the validity of the process). (Fu *et al*. 2001: 564, (28a))
            → The committee <u>destroyed</u> <u>these documents</u> **individually**.

Assuming that an adverb can modify a nominal expression, the syntactic structure of, for example, the NP (*the removal of evidence purposefully*) in (10a) can be represented as in (11).

(11)

```
                    NP
            ┌───────┴───────┐
            D              N'
            │        ┌──────┴──────┐
            │       N'            AdvP
            │     ┌──┴──┐          ╱╲
            │     N    PP        ╱    ╲
            │     │    ╱╲       ╱      ╲
           the  removal of evidence  purposefully
```
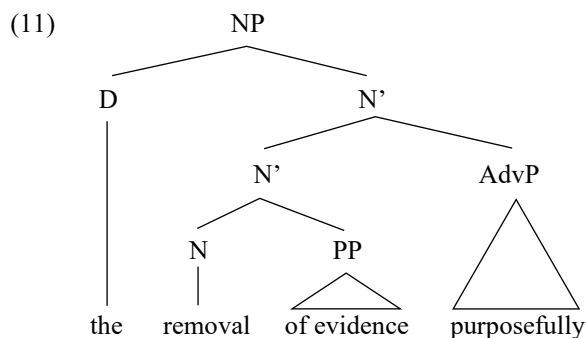
One may argue then that the NP (e.g., *announcement so quickly that results have been falsified*) is derived from moving the adverb phrase (*so quickly*) to the position between the head noun (*announcement*) and the complement (*that results have been falsified*). However, this analysis requires an independent motivation for the movement of the adverb phrase to the position. In addition, it is still not clear what plausible structure can be assigned to the NP

after the movement.[4]

Second, an *of*-PP follows the post-modifying adverb in an NP and the PP is not a complement of the head noun. Rather, it corresponds to the possessive determiner of the noun. Consider the following examples:

(12)   a.   Another important factor benefiting freight customers was [the <u>arrival</u> **recently** <u>of the Stena Antrim</u>]. [BNC: AMH 698] (Payne *et al*. 2010: 48, (25a))
           → <u>the Stena Antrim's</u> **recent** <u>arrival</u>/<u>The Stena Antrim</u> **recently** <u>arrived</u>.
       b.   [The <u>argument</u> **collectively** <u>of these media moguls</u>] was 'efficiency' and the threat of alternate media sources, the Internet and cable industry in particular. (Payne *et al*. 2010: 45, (21b))
           → <u>these media moguls'</u> **collective** <u>argument</u>
       c.   [The unique <u>role</u> **globally** <u>of the Australian Health Promoting Schools Association</u>], as a non-government organization specifically established to promote the concept of the health promoting school, is described. (Payne *et al*. 2010: 43, (17a))
           → <u>the Australian Health Promoting Schools Association's</u> unique **global** <u>role</u>
       d.   Indeed, [the <u>opinion</u> **generally** <u>of the doctors who appeared at the hearing</u>] was that each day of delay would further endanger the child. (Payne *et al*. 2010: 45, (21c))
           → <u>the doctors who appeared at the hearing's</u> **general** <u>opinion</u>

In (12) the *of*-PPs can be changed to the possessive determiners.[5] Note that when the head noun is an event noun as in (12a), the *of*-PP serves as the semantic subject of the noun; so the NP *the arrival recently of the Stena Antrim* is virtually synonymous with the sentence *The Stena Antrim recently arrived*. If the *of*-PP is semantically the subject of the head noun, we can assume that the *of*-PP is an adjunct of the head noun just like *by*-NP in passive sentences, which is the semantic subject but considered as an adjunct of the passive participles.[6] With this assumption, the structure of the NP in (12a) would look like the following:

(13)

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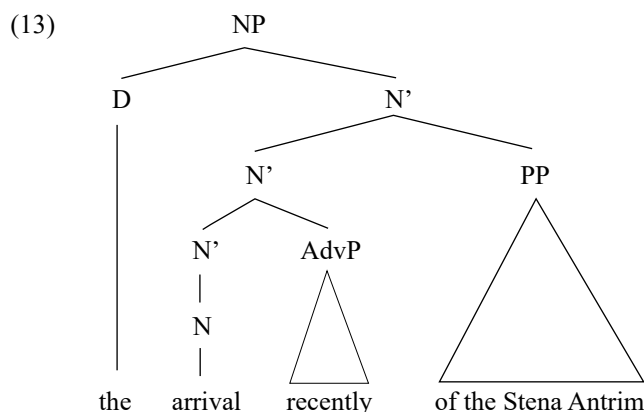
   [4] These problems do not necessarily mean that it is impossible for transformational analysis to deal with the NPs. But any transformational account must solve the problems.

   [5] A reviewer pointed out that the *of*-PPs can also correspond to the post-nominal genitive *of*-PPs (e.g., this car <u>of Bob's</u>). This further suggests that the *of*-PPs are adjuncts in the NPs.

   [6] Note that Sag *et al*. (2003) assumes that the *by*-phrase of a passive sentence is a complement, but Carnie (2013) assumes that it is an adjunct. Thus the correspondence between *of*-PP and *by*-PP may not be strong evidence for the adjuncthood of the *of*-PP.

Note that the subjects and possessive determiners are the specifiers of VPs and NPs, respectively. Based on this commonality, I assume here that the other three NPs in (12) have a structure like (13). Note also that the post-modifying adverbs can appear after *of*-PPs:

(14)   The <u>occurrence</u> <u>of the accident</u> **suddenly** (disqualified her). (Fu *et al*. 2001: 549, (2a))
        → <u>The accident</u> **suddenly** <u>occurred</u>.

The NP in (14) has the similar structure to that in (13) since both the PP (*of the accident*) and the post-modifying adverb (*suddenly*) are adjuncts of the head noun (*occurrence*):

(15)

```
                        NP
                   /          \
                  D            N'
                  |         /      \
                  |       N'        AdvP
                  |     /    \        △
                  |   N'      PP       \
                  |   |      /  \       \
                  |   N     /    \       \
                  |   |    /      \       \
                the  occurrence  of the accident  suddenly
```
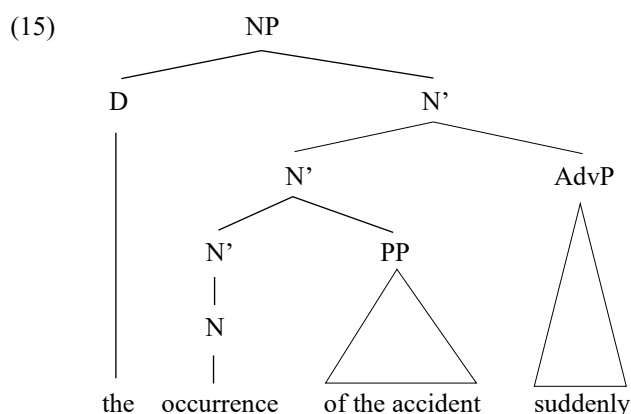
Third, a modifying PP follows the post-modifying adverb in an NP, as exemplified in (16).

(16)   In comparing the infection of humans with BSE and the possibility of infection from CWD we can look at [the <u>situation</u> **recently** <u>in England with the Mad Cow Disease outbreak</u>]. (Payne *et al*. 2010: 44, (18a))

In (16) the adverb (*recently*) and the PP (*in England with the Mad Cow Disease outbreak*) are both adjuncts of the head noun (*situation*). So NPs like that in (16) should have a structure like (13).
    Fourth, nothing follows the post-modifying adverbs in NPs, as illustrated in (17).

(17)   a.   The NHS and [other health <u>organisations</u> **internationally**] clearly need methodologies to support benefit analysis of merging healthcare organisations. (Payne *et al*. 2010: 43, (17b))
        b.   During the early 1990s [a <u>timber shortage</u> **internationally**] led to an increase in timber prices and export opportunities for premium timber grades. (Payne *et al*. 2010: 44, (19b))
        c.   There have been very few fishing opportunities on the west coast due to [the <u>weather</u> **recently**]. (Payne *et al*. 2010: 47, (24c))
        d.   [The <u>news</u> **lately**] has been depressingly full of stories about federal mismanagement of our federal lands. (Payne *et al*. 2010: 47, (24d))

In (17) the post-modifying adverbs in the NPs must modify the head nouns, and they should have the syntactic structure like the following:

(18)

```
                    NP
                  /    \
                 D      N'
                 |     /  \
                 |    N'   AdvP
                 |    |     /\
                 |    N    /  \
                 |    |   /    \
                the  news  lately
```
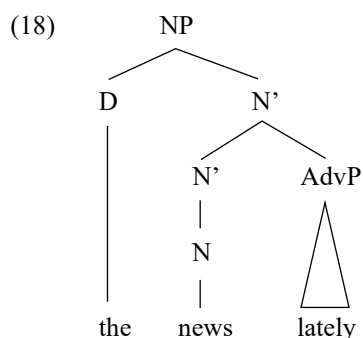
This structure also lacks the syntactic problem in (9). The four types of NPs with a post-modifying adverb can be summarized, as in (19).

(19)   a.   A head noun is followed by an adverb and a complement of the head noun.
       b.   A head noun is followed by an adverb and an adjunct (corresponding to the possessive determiner) of the head noun.
       c.   A head noun is followed by an adverb and an adjunct (modifier) of the head noun.
       d.   A head noun is followed only by an adverb.

In addition to post-modifying adverb, I show in the following section that NPs can have a pre-modifying adverb.

3. Pre-modifying Adverbs

According to Payne et al. (2010), adverbs cannot appear before a head noun that they modify. Consider the examples in (4), repeated in (20).

(20)   a.   *the **temporarily** use of Australian troops (Payne *et al*. 2010: 42)
       b.   *the unique **globally** role of the Australian Health Promoting Schools Association (Payne *et al*. 2010: 43)
       c.   *the **soon** addition of an indoor riding and show arena (Payne *et al*. 2010: 43)
       d.   *the government's **yet again** refusal to take the high road (Payne *et al*. 2010: 43)

However, in this section, I show with the data from the Web that noun-modifying verbs are not restricted to the post-head position and they can appear before the head nouns that they modify.[7] The NPs with a pre-modifying adverb can also be classified into four types just like those with a post-modifying adverb. First, a phrasal expression following the head noun functions as the complement of the noun:

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[7] I am not saying that the unacceptability judgments about the NPs in (20) are wrong, of course; what the corpus data show in this section is that the pre-modifying adverbs in NPs are acceptable and actually used by some people. But, as a reviewer pointed out, since the Web data is not necessarily reliable, experimental research would be helpful or required to get more reliable data. I leave this to future work.

(21)   a.   While we know that a **temporarily** <u>closure</u> <u>of Bethesda Station</u> is inconvenient, please understand that your safety is our absolute highest priority.
(https://www.wmata.com/rider-guide/stations/bethesda-escalators-2015-11.cfm)
→ We **temporarily** <u>closed</u> <u>Bethesda Station</u>.

   b.   One of the **immediately** <u>benefits</u> <u>of being able to detect gravitational waves</u> is being able to create new and infinitely more powerful telescopes that can see back in time very close to the beginnings of the universe. (http://www.unmuseum.org/soearch/over0416.htm)
→ We **immediately** <u>benefited</u> <u>being able to detect gravitational waves</u>.

   c.   With the **soon** <u>addition</u> <u>of our Used Car Superstore</u>, we will be the busiest and most dynamic dealership on South Tacoma Way. (https://lensa.com/automotive-sales-associate-jobs/tacoma/jd/63a138c89bdc51687a046cc7da551309)
→ We will **soon** <u>add</u> <u>our Used Car Superstore</u>.

   d.   The message of this demand is **yet again** <u>refusal</u> <u>to end the conflict</u>.
(https://www.jns.org/opinion/abbas-distorted-history-at-the-u-n/)
→ We **yet again** <u>refused</u> <u>to end the conflict</u>.

Second, the *of*-PP following the head noun in an NP corresponds to the possessive determiner, as illustrated in (22).

(22)   a.   However, the chances are that Angel Di Maria would've been left out of the team due to the **recently** <u>arrival</u> <u>of James Rodriguez</u>, and we all know that Madrid's policy means they have to sell big as well as buy big – thats their business model. (https://oldtraffordfaithful.com/angel-di-maria-moved-to-manchester-united-for-the-money-claims-ancelotti/)
→ <u>James Rodriguez's</u> **recent** <u>arrival</u> / <u>James Rodriguez</u> **recently** <u>arrived</u>.

   b.   Major Murphy believes that the **collectively** <u>experiences</u> <u>of the participants</u> will lend itself to many interesting discussions on how to best effectively with the threat of terrorism.
(https://www.chds.us/c/item/636)
→ <u>the participants'</u> **collective** <u>experiences</u>

   c.   This could be the reason why RNA stopped fulfilling the **globally** <u>role</u> <u>of both the catalyst and template</u> during the later stages of evolution.
(https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0180827)
→ <u>Both the catalyst and template's</u> **global** <u>role</u>

   d.   What's the **generally** <u>opinion</u> <u>of the writer</u>? (https://barbelith.iamcal.com/topic/27970)
→ <u>the writer's</u> **general** <u>opinion</u>

Third, a phrasal expression following the head noun in an NPs is a modifier of the noun:

(23)   a.   During a **recently** <u>event</u> <u>in Ventura</u>, I stopped in Tipps Thai.
(https://www.tripadvisor.com/ShowUserReviews-g60769-d812182-r18582006-Tipps_Thai_Cuisine-Ventura_California.html)
→ During a **recent** <u>event</u> <u>in Ventura</u>, I stopped in Tipps Thai.

   b.   Hello! I had a **recently** <u>accident</u> <u>in Bali</u> with my gopro hero 4 black.
(https://ko.ifixit.com/Answers/View/603334/Gopro+wet+-+Salt+water)
→ Hello! I had a **recent** <u>accident</u> <u>in Bali</u> with my gopro hero 4 black

Fourth, nothing follows the head noun in an NP, as illustrated in (24).

(24)   a.   I asked the students whether they knew the **recently** <u>issue</u>, i.e. global warming, "I believe you have
            heard the 'global warming' issue.
            (http://eprints.uny.ac.id/18472/1/Adi%20Kurniawan%2007202241049.pdf)
            → I asked the students whether they knew the **recent** <u>issue</u>.
       b.   It is visible the contrast on her face and that was caused by a **suddenly** <u>accident</u>.
            (Aesthetic Facial Surgery edited by Juarez M. Avelar)
            → It is visible the contrast on her face and that was caused by a **sudden** <u>accident</u>.

The NPs with a pre-modifying adverb are not a problem for X'-theory since the head nouns can first combine with a following expression whether it be complement or not. For instance, the structure of the NP in (21a) (*a temporarily closure of Bethesda Station*) can be represented as in (25).

(25)

```
                    NP
                   /  \
                  D     N'
                  |    /  \
                  |  AdvP   N'
                  |   /\   /  \
                  |  /  \  N    PP
                  | /    \ |   /  \
                  a temporarily closure of Bethesda Station
```
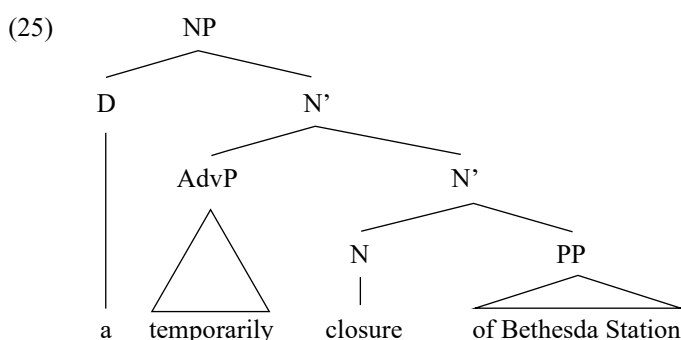
In summary, both the pre- and post-modifying adverbs can modify the head nouns in NPs, and some NPs with a post-modifying adverb are not compatible with X'-theory. I show in the following section that a constraint-based grammar can naturally account for the NPs with a noun-modifying adverb.

4. A Syntactic Analysis of the NPs

4.1 Lexical items and syntactic rules

Although I focus on the noun-modifying adverbs in this paper, we should also take into account the distributions of normal adverbs for an ideal analysis of adverbs. So first we can summarize that when an adverb is used as a pre-modifier, it can modify adjectives, adverbs, verbs and nominal expressions. Consider the following examples repeated from above:

(26)   a.   the [AP [AdvP highly] admirable] athlete
       b.   Mary [VP [AdvP slowly] [ran]].
       c.   Mary was [AdvP [AdvP very] highly] admired.
       d.   a [N' [AdvP temporarily] [N' closure of Bethesda Station]]

The pattern we can observe in (26) is that what is modified by the pre-modifying adverb does not need a complement: the heads, *admirable*, *ran*, and *highly*, do not require a complement from the beginning. In (26d) the head noun (*closure*) first combines with its PP complement (*of Bethesda Station*), so the resulting phrase *closure of Bethesda Station* does not need a complement anymore. No requirement of a complement can be represented with [COMPS < >] (the value of the feature COMPS is empty). That is, the pre-modifying adverb should modify an expression (adjective, adverb, verb or noun) which has [COMPS < >]. This is related to the fact that English is a head-initial language; since a complement follows a head, any pre-modifier does not occur between them. However, a post-modifier can occur between a head and its complement, as shown in the examples above. The pre- and post-modifiers can differ in terms of the complement requirement of what they modify. Thus I assume that in general there are two lexical items for an adverb. For example, *temporarily* is assumed to have the two lexical items, as illustrated in (27).

(27)   a.   *temporarily-1*:

$$
\begin{bmatrix}
\text{PHON} \langle\, temporarily \,\rangle \\
\text{HEAD} \mid \text{POS}\ pre-mod-adv \\
\text{COMPS} < \ > \\
\text{MOD} \left\langle \begin{bmatrix} \text{HEAD} \mid \text{POS}\ adj \vee adv \vee verb \vee noun \\ \text{COMPS} < \ > \end{bmatrix} \right\rangle
\end{bmatrix}
$$

   b.   *temporarily-2*:

$$
\begin{bmatrix}
\text{PHON} \langle\, temporarily \,\rangle \\
\text{HEAD} \mid \text{POS}\ post-mod-adv \\
\text{COMPS} < \ > \\
\text{MOD} \left\langle \begin{bmatrix} \text{HEAD} \mid \text{POS}\ noun \end{bmatrix} \vee \begin{bmatrix} \text{HEAD} \mid \text{POS}\ verb \\ \text{COMPS} < \ > \end{bmatrix} \right\rangle
\end{bmatrix}
$$

When *temporarily* is used as a pre-modifying adverb as in (27a), it can modify an expression whose part-of-speech is adjective, adverb, verb or noun and which has no requirement of complement (i.e., [COMPS < >]). However, when *temporarily* is used as a post-modifying adverb as in (27b), it can modify a nominal expression which is unspecified for the requirement of complement (e.g., *the use temporarily of Australian troops*, *the removal of evidence purposefully*), or a verbal expression which does not need a complement (i.e., [COMPS < >]) (e.g., *He read slowly the book* vs. *He read the book slowly*). According to the position of the adverb, what it can modify differ and so modifiers can be classified into two types: pre-modifier and post-modifier. This distinction is reflected in the following type hierarchy of part-of-speech:

(28)
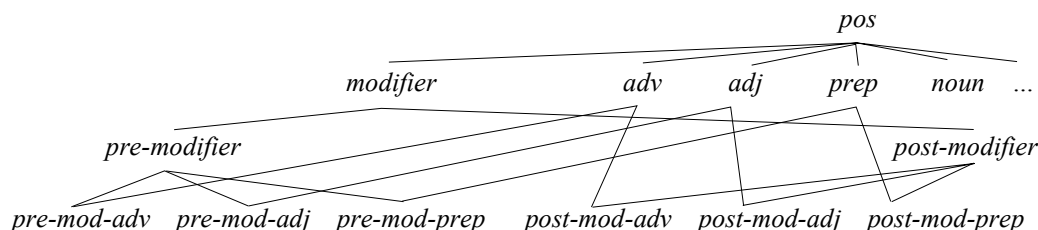
For instance, the type *pre-mod-adv* is a subtype of the supertypes *pre-modifier* and *adv(erv)*, and they are subtypes of *modifier* and *pos* (part-of-speech), respectively. This type hierarchy represents generalizations and specifications among types in the hierarchy.

In addition to the adverbs like (27), the lexical items of, for instance, *use* and *of* are given in the following:

(29) a. *use*:

$$
\begin{bmatrix}
\text{PHON} < use > \\[4pt]
\text{HEAD} \mid \text{POS} \ \ noun \\[4pt]
\text{COMPS} \left\langle \begin{bmatrix} phrase \\ \text{FORM} < of > \end{bmatrix} \right\rangle
\end{bmatrix}
$$

b. *of*:

$$
\begin{bmatrix}
\text{PHON} < of > \\[4pt]
\text{HEAD} \begin{bmatrix} \text{POS} \ \ post-mod-prep \\ \text{FORM} \ \ of \end{bmatrix} \\[4pt]
\text{COMPS} \left\langle \begin{bmatrix} phrase \\ \text{HEAD} \mid \text{POS} \ \ noun \end{bmatrix} \right\rangle \\[4pt]
\text{MOD} \left\langle \begin{bmatrix} \text{HEAD} \mid \text{POS} \ \ noun \\ \text{COMPS} < \ > \end{bmatrix} \right\rangle
\end{bmatrix}
$$

In (29a) the noun *use* requires as a complement a PP whose FORM value is *of* (e.g., *of Australian troops*). In (29b) the post-modifying preposition *of* requires an NP as its complement and it can modify a nominal expression whose COMPS value is empty. This prevents *of* from modifying, for instance, the head noun *use* (whose value of COMPS is not empty as in (29a)) in *use of Australian Troops*; the preposition *of* must first combine with its NP complement, *Australian Troops*.

The following phrasal rules are adapted from the general Head-Modifier Rule (Sag *et al.* 2003). The two rules allow the combinations of a pre- or post-modifier with an expression:

(30) a.

$$
\begin{bmatrix} post\text{-}mod\text{-}ph \end{bmatrix} \rightarrow \boxed{1}\mathbf{H} \begin{bmatrix} \text{HEAD} \mid \text{POS} \ post\text{-}modifier \\ \text{COMPS} < \ > \\ \text{MOD} < \boxed{1} > \end{bmatrix}
$$

b.

$$
\begin{bmatrix} pre\text{-}mod\text{-}ph \end{bmatrix} \rightarrow \begin{bmatrix} \text{HEAD} \mid \text{POS} \ pre\text{-}modifier \\ \text{COMPS} < \ > \\ \text{MOD} < \boxed{1} > \end{bmatrix} \boxed{1}\mathbf{H}
$$

In addition to head-modifier rules, we need the following rule adapted from the Head-Complement Rule (see Sag *et al.* 2003, Kim 2016) to license the combinations of a head noun and its complement:

(31) $\begin{bmatrix} hd\text{-}comp\text{-}ph \end{bmatrix} \rightarrow \mathbf{H} \begin{bmatrix} \text{COMPS} <..., \boxed{1}, ... > \end{bmatrix} \quad \boxed{1}$

Note that it is not required that the head-complement rule in (31) should apply before the head-modifier rules in (30). This flexibility allows an adverb to occur between head and complement.

4.2 Licensing of nominal expressions

With the relevant lexical items and syntactic rules given above, we can now generate the following nominal expressions with a noun-modifying adverb.

(32) a. <u>use</u> **temporarily** <u>of Australian troops</u>
      b. <u>removal</u> <u>of evidence</u> **purposefully**
      c. <u>argument</u> **collectively** <u>of these media moguls</u>
      d. <u>news</u> **lately**
      e. **temporarily** <u>closure</u> <u>of Bethesda Station</u>

In (32a) the adverb (*temporarily*) occurs between the noun (*use*) and its complement (*of Australian troops*). In (32b) the noun (*removal*) combines with the complement (*of evidence*) and the resulting phrase is modified by the adverb (*purposefully*). In (32c) both the adverb (*collectively*) and the PP (*of these media moguls*) are used as modifiers of the noun (*argument*). In (32d) only the adverb (*lately*) follows the noun (*news*). Finally, in (32e) the noun (*closure*) first combines with its complement (*of Bethesda Station*) and the resulting phrase is modified by the adverb (*temporarily*). First, (32a) and (32b) can be licensed as in (33) and (34), respectively.

(33)

$$
\begin{bmatrix}
\text{hd-comp-ph} \\
\text{PHON} < use\ temporarily\ of\ Australian\ Troops > \\
\text{HEAD | POS } noun \\
\text{COMPS} < \ >
\end{bmatrix}
$$

Tree structure:

Mother node above branches into two daughters:

Left daughter:
$$
\begin{bmatrix}
\text{post-mod-ph} \\
\text{PHON} < use\ temporarily > \\
\text{HEAD | POS } noun \\
\text{COMPS} < \boxed{1}\,\text{PP}[of]\ >
\end{bmatrix}
$$

Right daughter:
$$
\boxed{1}\begin{bmatrix}
\text{hd-comp-ph} \\
\text{PHON} < of\ Australian\ Troops > \\
\text{HEAD}\begin{bmatrix} \text{POS } post\text{-}mod\text{-}prep \\ \text{FORM } of \end{bmatrix} \\
\text{COMPS} < \ > \\
\text{MOD} \langle\, [\text{COMPS} < \ >]\, \rangle
\end{bmatrix}
$$

The post-mod-ph branches into two daughters:

$$
\boxed{2}\begin{bmatrix}
\text{PHON} < use > \\
\text{HEAD | POS } noun \\
\text{COMPS} < \boxed{1}\,\text{PP}[of]\ >
\end{bmatrix}
\qquad
\begin{bmatrix}
\text{PHON} \langle temporarily \rangle \\
\text{HEAD | POS } post\text{-}mod\text{-}adv \\
\text{COMPS} < \ > \\
\text{MOD} \left\langle \begin{matrix} \boxed{2}[\text{HEAD | POS } noun]\ \vee \\ \begin{bmatrix}\text{HEAD | POS } verb \\ \text{COMPS} < \ >\end{bmatrix} \end{matrix} \right\rangle
\end{bmatrix}
$$

use   temporarily   of Australian troops

(34)

$$
\begin{bmatrix}
\textit{post-mod-ph} \\
\text{PHON} < \textit{removal of evidence purposefully} > \\
\text{HEAD | POS } \textit{noun} \\
\text{COMPS } < \ >
\end{bmatrix}
$$

$$
\boxed{2}\begin{bmatrix}
\textit{hd-comp-ph} \\
\text{PHON} < \textit{removal of evidence} > \\
\text{HEAD | POS } \textit{noun} \\
\text{COMPS } < \ >
\end{bmatrix}
$$

$$
\begin{bmatrix}
\textit{post-mod-adv} \\
\text{PHON} < \textit{purposefully} > \\
\text{HEAD | POS } \textit{post-mod-adv} \\
\text{MOD} \left\langle \boxed{2}[\text{HEAD | POS } \textit{noun}] \vee \begin{bmatrix} \text{HEAD | POS } \textit{verb} \\ \text{COMPS } < \ > \end{bmatrix} \right\rangle
\end{bmatrix}
$$

$$
\begin{bmatrix}
\text{PHON} < \textit{removal} > \\
\text{HEAD | POS } \textit{noun} \\
\text{COMPS} < \boxed{1}\text{PP}[\textit{of}] \ >
\end{bmatrix}
$$

$$
\boxed{1}\begin{bmatrix}
\textit{hd-comp-ph} \\
\text{PHON} < \textit{of evidence} > \\
\text{HEAD} \begin{bmatrix} \text{POS } \textit{post-mod-prep} \\ \text{FORM } \textit{of} \end{bmatrix} \\
\text{COMPS } < \ > \\
\text{MOD} \langle [\text{COMPS} < \ >] \rangle
\end{bmatrix}
$$

removal   of evidence   purposefully

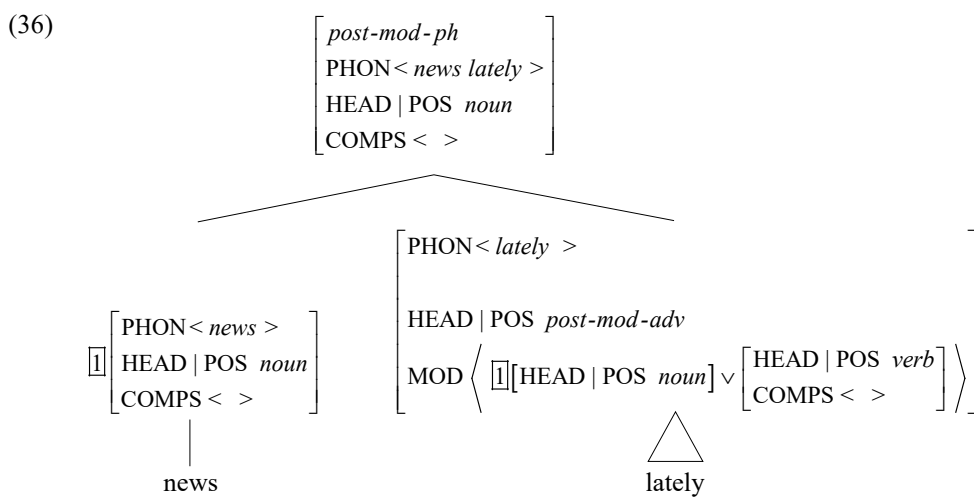A PP[*of*] is the complement of the head noun in (33) and (34). In (33) *temporarily* combines with *use* by the post-modifying rule in (30a). In (34), assuming that the relevant lexical items of *removal*, *evidence*, and *purposefully* are posited in the lexicon, *purposefully* combines with *removal of evidence* by the same post-modifying rule in (30a). (32c) (*argument collectively of these media moguls*) is generated below:

(35)

$$
\begin{bmatrix}
\textit{post-mod-ph} \\
\text{PHON} < \textit{argument collectively of these media moguls} > \\
\text{HEAD} \mid \text{POS } \textit{noun} \\
\text{COMPS} < \; >
\end{bmatrix}
$$

- Left daughter:

$$
\boxed{2}
\begin{bmatrix}
\textit{post-mod-ph} \\
\text{PHON} < \textit{argument collectively} > \\
\text{HEAD} \mid \text{POS } \textit{noun} \\
\text{COMPS} < \; >
\end{bmatrix}
$$

  - Daughters:

$$
\boxed{1}
\begin{bmatrix}
\text{PHON} < \textit{argument} > \\
\text{HEAD} \mid \text{POS } \textit{noun} \\
\text{COMPS} < \; >
\end{bmatrix}
\qquad
\begin{bmatrix}
\text{PHON} < \textit{collectively} > \\
\text{HEAD} \mid \text{POS } \textit{post-mod-adv} \\
\text{MOD} \left\langle
\boxed{1}[\text{HEAD} \mid \text{POS } \textit{noun}] \vee
\begin{bmatrix}
\text{HEAD} \mid \text{POS } \textit{verb} \\
\text{COMPS} < \; >
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

    argument   collectively

- Right daughter:

$$
\begin{bmatrix}
\textit{hd-comp-ph} \\
\text{PHON} < \textit{of these media moguls} > \\
\text{HEAD}
\begin{bmatrix}
\text{POS } \textit{post-mod-prep} \\
\text{FORM } \textit{of}
\end{bmatrix} \\
\text{COMPS} < \; > \\
\text{MOD} \left\langle \boxed{2}
\begin{bmatrix}
\text{HEAD} \mid \text{POS } \textit{noun} \\
\text{COMPS} < \; >
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

    of these media moguls

In (35) the post-modifying rule is used for the two combinations. The PP (*of these media moguls*) is licensed by the head-complement rule. (32d) (*news lately*) is licensed below:

(36)

$$
\begin{bmatrix}
\textit{post-mod-ph} \\
\text{PHON} < \textit{news lately} > \\
\text{HEAD} \mid \text{POS } \textit{noun} \\
\text{COMPS} < \; >
\end{bmatrix}
$$

  - Daughters:

$$
\boxed{1}
\begin{bmatrix}
\text{PHON} < \textit{news} > \\
\text{HEAD} \mid \text{POS } \textit{noun} \\
\text{COMPS} < \; >
\end{bmatrix}
\qquad
\begin{bmatrix}
\text{PHON} < \textit{lately} > \\
\text{HEAD} \mid \text{POS } \textit{post-mod-adv} \\
\text{MOD} \left\langle \boxed{1}[\text{HEAD} \mid \text{POS } \textit{noun}] \vee
\begin{bmatrix}
\text{HEAD} \mid \text{POS } \textit{verb} \\
\text{COMPS} < \; >
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

    news   lately

Again the post-modifying rule is used to combine *news* with *lately*. Finally, an analysis of (32e) (*temporarily*

closure of Bethesda Station) is presented in the following:

(37)
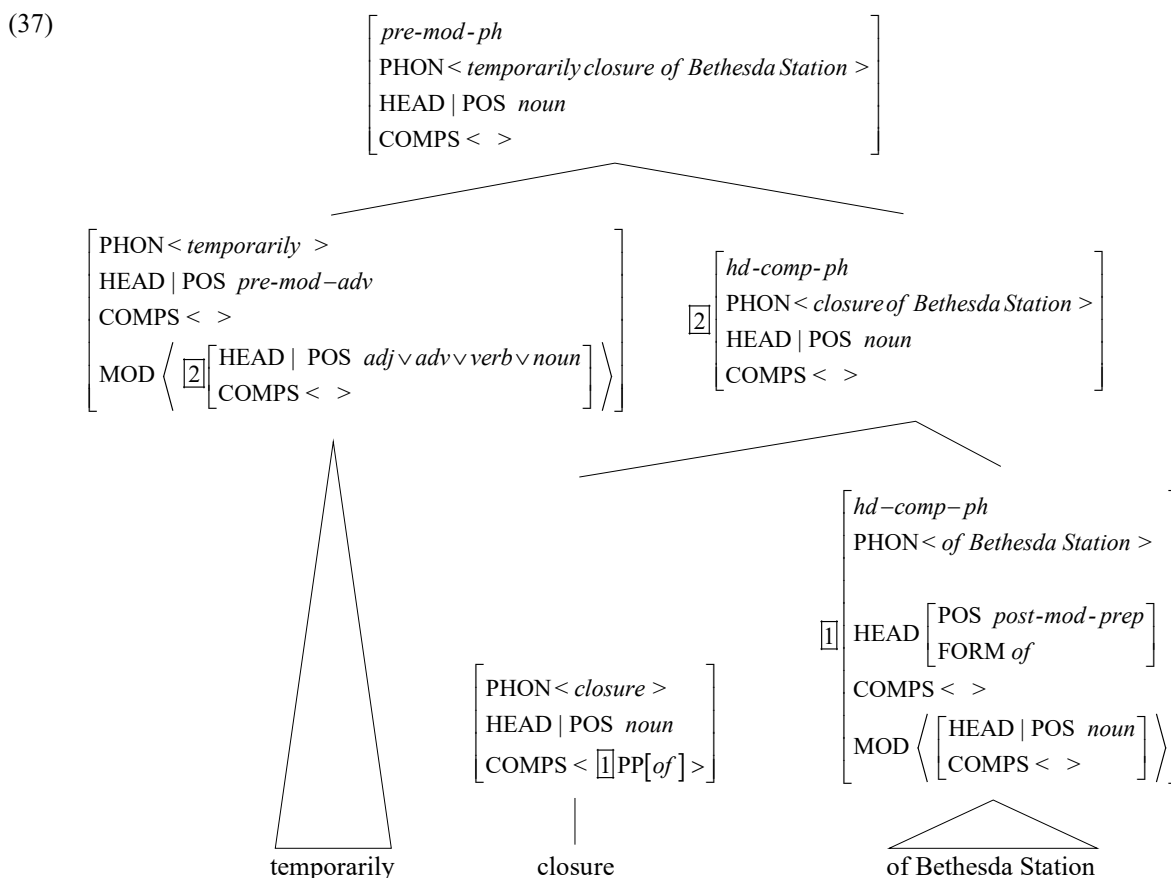
In (37) the pre-modifying adverb (*temporarily*) combines with *closure of Bethesda Station* by the pre-modifying rule in (30b).

5. Conclusion

　　In this paper I have discussed the distributions of English adverbs focusing on noun-modifying adverbs. They can be classified into two types, pre-modifying adverbs and post-modifying adverbs. NPs with a post-modifying adverb are classified into four types: i) [N AdvP XP] where XP is the complement of the head noun N, ii) [N AdvP XP] where XP corresponds to the possessive determiner of the head noun N, iii) [N AdvP XP] where XP is a modifier, and iv) [N AdvP] where nothing follows the AdvP in the NP. Similarly, NPs with a pre-modifying adverb are divided into four types: i) [AdvP N XP] where XP is the complement of the head noun N, ii) [AdvP N XP] where XP corresponds to the possessive determiner of the head noun N, iii) [AdvP N XP] where XP is a modifier, and iv) [AdvP N] where nothing follows the head noun N in the NP. I have provided an HPSG analysis of the NPs with a noun-modifying adverb; in particular, I have argued that [N AdvP XP(complement)], which is a problem for X'-theory since AdvP (adjunct) is placed in between the head noun and its complement, can be naturally accounted for by the constraint-based grammar.

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Examples in: English
Applicable Languages: English
Applicable Level: Tertiary