

PP Extraposition and the Order of Adverbials in English

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In English, adverbials may intervene between the verb and a selected PP. We initially consider three analyses of this fact. The traditional account is that the PP shifts rightward across a right-adjoined adverbial (Stowell 1981). An alternative account is that the verb moves leftward across a left-adjoined adverbial (Pesetsky 1989, Johnson 1991). A third possibility is a hybrid account that assumes both extraposition and verb raising. We argue that the order of postverbal adverbials favors the extraposition analysis, provided this analysis is combined with the auxiliary hypothesis that certain adverbials can directly modify other adverbials (Rohrbacher 1994, Williams 2014). We then compare two instantiations of the extraposition analysis: the traditional account and an antisymmetric account that emulates PP-extraposition through a combination of PP-intrapolation and roll-up movement. While close to being notational variants, these accounts can be teased apart using the very strict locality requirement that holds of association with temporal *only*. The data then show that the symmetric account has the edge. We close with a brief discussion of the implications of our findings for the analysis of the English VP, with a focus on the circumstances under which the verb moves.

Keywords: PP extraposition, verb raising, adverbial hierarchy, scope, temporal *only*.

1. Introduction

In English, PP complements may be separated from the verb by adverbials, as (1) shows.

- (1) a. Susan looked at the telegram pensively.
b. Susan looked pensively at the telegram.

The aim of this paper is to determine the source (or sources) of this word order variation. Although the problem appears simple, there is a bewildering array of potential analyses to choose from, depending on one's view of the syntax of adverbials, verbs and PPs, and on the framework the analysis is couched in.

Our strategy for navigating this maze is as follows. The bulk of the paper (sections 2-7) will be devoted to a comparison of three analyses rooted in a traditional symmetric theory of phrase structure (that is, a theory that allows variation in the order of sister nodes). The first analysis assumes extraposition of the PP, the second assumes movement of the verb, and the third is a dual-source analysis that assumes both extraposition of the PP and movement of the verb. We argue for the extraposition analysis on the basis of structures containing two adverbials. We show, contra Pesetsky 1989 and in line with Rohrbacher 1994, that irrespective of the position of the PP the lower adverbial precedes the higher adverbial (as in (2)). The extraposition analysis provides the simplest account for this pattern.

(2) V <PP> Adv_{Low} <PP> Adv_{High} <PP>

We then outline, in section 8, an antisymmetric variant of the extraposition analysis. While the traditional symmetric theory of phrase structure allows a straightforward account of the order of adverbials in (2), the antisymmetric account must rely on an additional mechanism that takes as input a structure in which adverbials occupy designated specifier positions to the left of VP and delivers as output a structure in which the base order of VP and adverbials is reversed. The movement regime responsible for this order reversal is known as roll-up movement (see Barbiers 1995, Koopman and Szabolcsi 2000 and Cinque 2005, 2010). Once in place, roll-up movement permits a straightforward antisymmetric translation of the extraposition analysis, delivering an account of (2) that appears descriptively adequate.

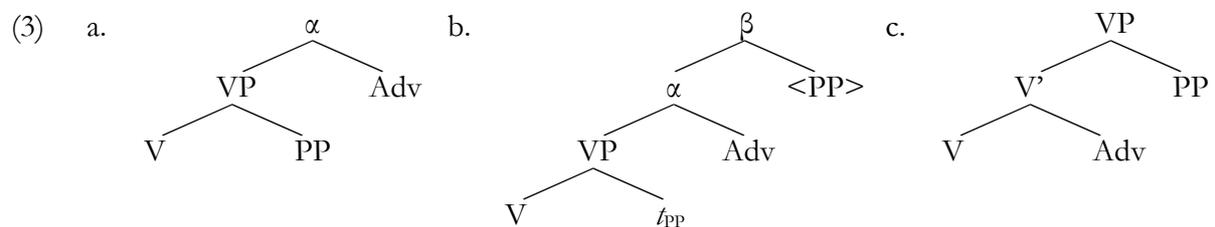
In order to force a choice between the symmetric and antisymmetric analyses of PP-extraposition, we explore the syntax of temporal *only* (as in *John promised to leave on Monday, but he only_T left on Tuesday*). We show that on the relevant interpretation of *only* this particle must immediately c-command the temporal expression it is associated with (*on Tuesday* in the above example). In this regard, temporal *only* differs from exclusive *only*, which permits association with a focused constituent across larger distances. The hyperlocality of association with temporal *only* allows us to construct an argument against the antisymmetric analysis of PP-extraposition, leaving

its symmetric counterpart as the only viable account of PP placement in English.

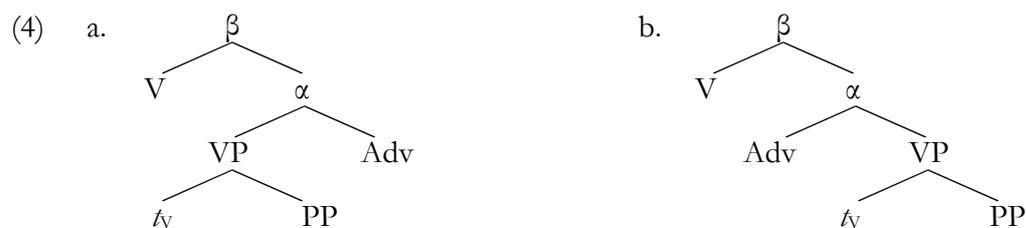
Section 9 explores the implications of the extraposition analysis, given the tension between our conclusions and the evidence for verb raising in Larson 1988 and subsequent work.

2. An overview of symmetric accounts of adverbial intervention

The traditional account of the alternation in (1), adopted explicitly in Stowell 1981, assumes that the position of the PP varies, either as a result of rightward movement (as in (3b)) or through base generation of the PP above the adverbial (as in (3c)). We will refer to this account as the *extraposition analysis*.



An alternative account is to keep the position of the PP constant and to attribute the alternation in (1) to two factors: verb raising and variation in the linearization of the adverb (see (4)). We will call this account the *verb raising analysis*.



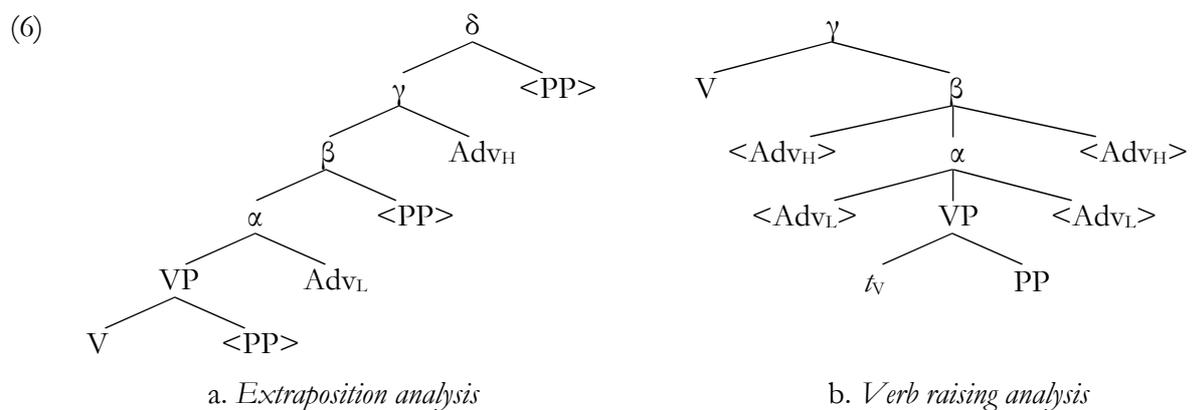
A third option is to assume that there are two sources for the order in (1b): extraposition of the PP, as in (3b,c), and raising of the verb, as in (4b). We will call analyses of this type *mixed analyses*.

The general idea that verb movement may be responsible for the intervention of adverbials between a verb and its complement goes back to Emonds (1976) and Pollock (1989). Its extension to examples like (1b) is due to Johnson (1991) and unpublished, but influential work by Pesetsky (1989).

The main criterion we use to decide between the various analyses is adverbial order in three conditions, as schematized in (5). In the *PP-initial condition*, both adverbials follow the PP. In the *PP-medial condition*, one adverbial precedes the PP and the other follows it. In the *PP-final condition*, both adverbials precede the PP. For each of these conditions one may ask whether the higher adverbial (Adv_H) precedes or follows the lower adverbial (Adv_L).

- (5) a. V PP Adv_L Adv_H vs. V PP Adv_H Adv_L PP-initial condition
 b. V Adv_L PP Adv_H vs. V Adv_H PP Adv_L PP-medial condition
 c. V Adv_L Adv_H PP vs. V Adv_H Adv_L PP PP-final condition

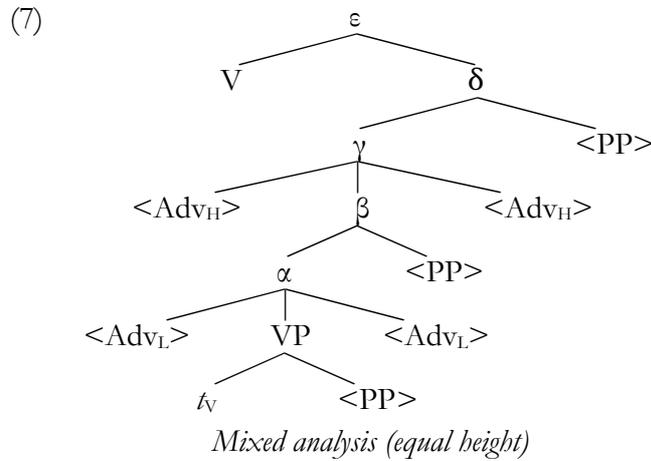
As already pointed out in Pesetsky 1989, the extraposition analysis predicts that if more than one adverbial intervenes between verb and PP the lower adverbial precedes the higher one (see (6a)). By contrast, the verb raising analysis predicts that in the PP-final condition the lower adverbial follows the higher one (see (6b)).



The predictions of the extraposition and verb raising analyses also diverge in the PP-medial condition, where the extraposition analysis predicts that the lower adverbial precedes the higher adverbial, while the verb raising analysis predicts variable order. (It must allow variation in the linearization of relevant adverbials, as any adverbial that can precede the PP can also follow it.) Finally, the extraposition and verb raising analyses both predict that in the PP-initial condition the lower adverbial will precede the higher adverbial.

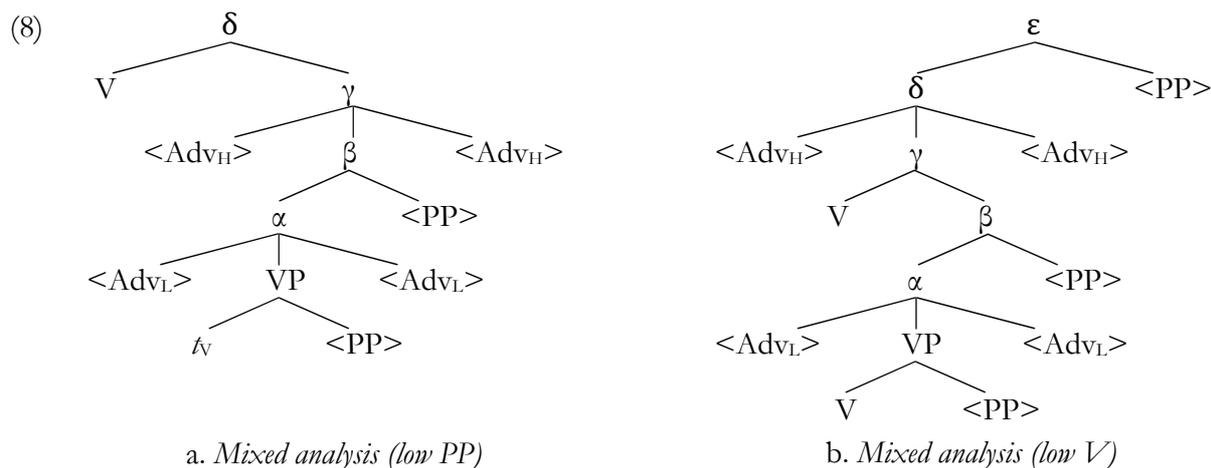
There is a range of mixed analyses that differ in the height of the landing sites for verb raising

and extraposition. A first option is that both movements can cross Adv_H , as in (7). We will call an account along these lines the *equal height analysis*.



The equal height analysis predicts that in the PP-initial condition the only order that can be generated is $\text{Adv}_L\text{-Adv}_H$. However, in the PP-medial and PP-final conditions both $\text{Adv}_H\text{-Adv}_L$ and $\text{Adv}_L\text{-Adv}_H$ are permissible orders, depending on whether the PP moves and whether the adverbs are left- or right-adjoined.

It is, of course, not a logical necessity that verb and PP move equally high. If the verb raises *above* Adv_H , while the PP's highest landing site is located *below* Adv_H , the expected word order patterns shift (see (8a)). This *low PP analysis* predicts that in the PP-initial condition the lower adverbial precedes the higher one, that in the PP-medial condition the adverbials come in variable order, and that in the PP-final condition the higher adverbial precedes the lower one. Conversely, it is possible that verb raising lands in a position below Adv_H , while the PP has access to a position above Adv_H (see (8b)). We refer to this account as the *low V analysis*. Like the extraposition analysis it predicts $\text{Adv}_L\text{-Adv}_H$ as the only permissible order in all three conditions.



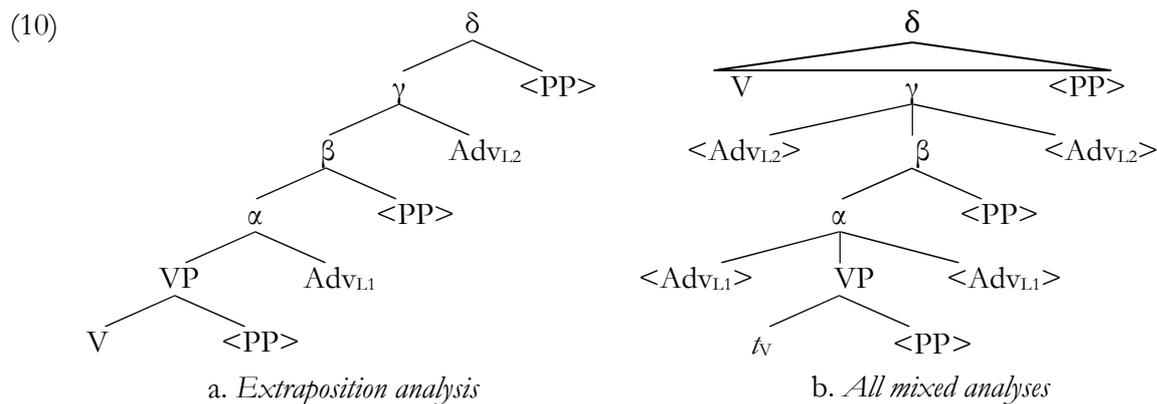
We summarize the predictions that the various analyses make in the table below (H stands for high adverbial and L for low adverbial):

(9)

	<i>Extrapolation</i>	<i>V-Raising</i>	<i>Eq. Height</i>	<i>Mixed Low PP</i>	<i>Low V</i>
V-PP-Adv-Adv	L-H	L-H	L-H	L-H	L-H
V-Adv-PP-Adv	L-H	L-H/H-L	L-H/H-L	L-H/H-L	L-H
V-Adv-Adv-PP	L-H	H-L	L-H/H-L	H-L	L-H

Various remarks are in order. First, all analyses predict the same order for the PP-initial condition. Inclusion of this condition in the tests we carry out will nonetheless be useful, as it gives us a general baseline for the strength of the ordering effect.

Second, the extrapolation analysis and the low V analysis seem empirically indistinguishable. This is true when we restrict discussion to Adv_H and Adv_L. However, if we consider two adverbials that the verb *can* move across on the low V analysis, the two accounts can be teased apart. Let us call these adverbials Adv_{L1} and Adv_{L2}, and assume that Adv_{L2} c-commands Adv_{L1}. The predictions of the extrapolation parallel those in (9): Adv_{L1} should precede Adv_{L2} in all three conditions (see (10a)). However, for pairs of low adverbials the low V analysis generates predictions on a par with the equal height analysis. This is because both verb raising and PP extraposition have access to landing sites higher than Adv_{L2} (see (10b)).



For concreteness's sake we list predictions for all five accounts in (11); those made by the extraposition analysis, the verb raising analysis and the equal height analysis remain constant, but in addition to those made by the low V analysis, those made by the low PP analysis shift (L1 stands for the lower of the two adverbials; L2 stands for the higher one).

(11)

	<i>Extraposition</i>	<i>V-Raising</i>	<i>Eq. Height</i>	<i>Mixed Low PP</i>	<i>Low V</i>
V-PP-Adv-Adv	L1-L2	L1-L2	L1-L2	L1-L2	L1-L2
V-Adv-PP-Adv	L1-L2	L1-L2/L2-L1	L1-L2/L2-L1	L1-L2/L2-L1	L1-L2/L2-L1
V-Adv-Adv-PP	L1-L2	L2-L1	L1-L2/L2-L1	L1-L2/L2-L1	L1-L2/L2-L1

Below, we report on two sets of data that can be used to test the predictions in (9) and (11). In section 3, we consider structures containing a time and a manner adverbial. As we will see, these behave as predicted by the extraposition and low V analyses (the latter captures the data on the assumption that verb raising can cross manner, but not time adverbials). In section 4, we consider structures with two low adverbials. It turns out that the data fit neither the extraposition nor the low V analysis. However, further exploration in sections 5 and 6 reveals an argument in favour of the extraposition analysis. (i) The extraposition analysis, but not the low V analysis, turns out to be compatible with an auxiliary hypothesis (adapted from Rohrbacher 1994, Ackema and Neeleman 2002 and Williams 2014) that captures the recalcitrant data. (ii) Where this auxiliary hypothesis does not apply, the data follow the predictions of the extraposition analysis in (11), rather than those of the low V analysis.

The main data points we discuss involve the order of adverbials, as well as scopal relations

between them. Where we explore scope, we rely on judgments from a panel of ten native-speaker linguists. Where we explore adverbial order, we base ourselves on experiments run on Amazon Mechanical Turk (AMT). Such experiments have been shown to be as rigorous as experiments run in a laboratory setting (Sprouse 2011). Aggregated grammaticality judgments from AMT should therefore allow us to compare sentences in a reliable way, revealing information that can help us decide between competing theories.

3. Time and manner adverbs

3.1 Preliminaries

The premise of our first set of word order experiments is that time adverbials are attached higher than manner adverbials, at the very least as a matter of preference (see Jackendoff 1972, Cinque 1999 and Ernst 2002). If so, it is possible to test the various analyses under consideration on the assumption that Adv_L is a position hosting manner adverbials, while Adv_H is a position hosting time adverbials. This yields the following predictions (M stands for manner adverbial, and T for time adverbial):

(12)		<i>Extraposition</i>	<i>V-Raising</i>	<i>Eq. Height</i>	<i>Mixed Low PP</i>	<i>Low V</i>
	V-PP-Adv-Adv	M-T	M-T	M-T	M-T	M-T
	V-Adv-PP-Adv	M-T	M-T/T-M	M-T/T-M	M-T/T-M	M-T
	V-Adv-Adv-PP	M-T	T-M	M-T/T-M	T-M	M-T

In designing the test, we must take into account the circumstances under which time and manner adverbials can surface in between a verb and a selected PP. While such PPs can uncontroversially follow manner adverbials, many speakers find extraposition of light PPs across time adverbials only marginally better than extraposition of light DPs. Both PP extraposition across a time adverbial and DP extraposition improve when the extraposed complement is heavy:

- (13) a. John looked <?yesterday> at the memorandum <yesterday>.
 b. John read <*yesterday> the new memorandum <yesterday>.

- c. John looked <yesterday> at the memorandum from the finance director <yesterday>.
- d. John read <yesterday> the new memorandum from the finance director <yesterday>.

These informal judgments are confirmed through a baseline experiment run on AMT (**experiment 1**). We recruited eighty participants, all native speakers of English with IP addresses in the United States. They judged five sets of eight test items that followed the scheme in (14):

- (14) a. V-PP_{Light}-Adv_T vs. V-Adv_T-PP_{Light} c. V-DP_{Light}-Adv_T vs. V-Adv_T-DP_{Light}
 b. V-PP_{Heavy}-Adv_T vs. V-Adv_T-PP_{Heavy} d. V-DP_{Heavy}-Adv_T vs. V-Adv_T-DP_{Heavy}

Each item was assigned a score on a seven-point Likert scale. The experiment had a Latin Square design, so subjects saw only one item per condition. The order of test sentences was randomized per subject and the test included both grammatical and ungrammatical fillers, as well as questions to check that participants were paying attention to the task. The results are summarized in (15). (Significance was calculated using post-hoc two-tailed t-tests, with $p < 0.05$ as the threshold; standard deviations are given between parentheses).

(15)	Light PP		Heavy PP		Light DP		Heavy DP	
	PP-Adv _T	Adv _T -PP	PP-Adv _T	Adv _T -PP	DP-Adv _T	Adv _T -DP	DP-Adv _T	Adv _T -DP
	6.56 (0.87)	3.78 (1.34)	5.80 (0.76)	5.09 (1.31)	6.73 (0.58)	2.76 (1.44)	5.73 (0.87)	5.01 (1.31)
	p<0.001		p<0.01		p<0.001		p<0.01	

Experiment 1: Acceptability of PPs/DPs preceding/following time adverbials (n=80)

A two-factor ANOVA (complement weight × adverb placement) applied to the PP data shows a significant main effect of complement weight ($F(1,79)=4.83$; $p < 0.05$), a significant main effect of adverb placement ($F(1,79)=197.55$; $p < 0.0001$), and crucially a significant interaction between complement weight and adverb placement ($F(1,79) = 69.4$; $p < 0.0001$). These findings parallel trends in the DP data, where a two-factor Anova (complement weight × adverb placement) also shows a significant interaction between complement weight and adverb placement ($F(3,237) = 84.18$; $p < 0.0001$), in addition to a significant main effect of complement weight ($F(1,79)=25.32$; $p < 0.0001$) and a significant main effect of adverb placement ($F(1,79)=355.52$; $p < 0.0001$).

The data in (15) suggest that PP extraposition across time adverbials may be an instance of

heavy XP shift. However, that cannot be the whole story. Light PP extraposition across temporal adverbials improves considerably in certain contexts, for example when the PP is followed by a coordinate clause that contains a coreferential pronoun, as in (16a). As (16b) shows, this is not the case for extraposition of light DPs.

- (16) a. John looked yesterday at the memorandum, and it made his blood boil.
 b. *John read yesterday the new memorandum, and it made his blood boil.

Our take on these data is that there are two distinct interpretations that license intervention of time adverbials. In one of these, the PP is in focus, and has possibly undergone heavy XP shift. The nature of the other interpretation is revealed by the intonation of examples like (16a): the PP must be destressed, suggesting that it represents given information and is most likely a continuing topic in the sense of Lambrecht (1994:132).

Again, the informal judgments in (16) can be replicated experimentally. We ran a second baseline experiment (**experiment 2**) with the same set-up as above, but now with each test item followed by a coordinate clause containing a coreferential pronoun, as in (16). This had a clear impact on acceptability scores:

(17)	Light PP		Heavy PP		Light DP		Heavy DP	
	PP-Adv _T	Adv _T -PP	PP-Adv _T	Adv _T -PP	DP-Adv _T	Adv _T -DP	DP-Adv _T	Adv _T -DP
	5.99 (1.12)	4.92 (1.73)	5.79 (0.74)	5.41 (1.25)	6.21 (0.92)	3.15 (1.83)	5.92 (1.32)	4.04 (1.70)
	p<0.001		p<0.05		p<0.001		p<0.001	

Experiment 2: Acceptability of PPs/DPs preceding/following time adverbials; coordinate condition (n=80)

There are two noticeable effects. The presence of the coordinate clause leads to an increase of the average score for light PP extraposition (which rises from 3.78 to 4.92). At the same time, it inhibits heavy DP shift, bringing the average score down from 5.01 to 4.04. Both effects are highly significant (p<0.001).

In sum, it appears that there are two basic processes by which adverbials can end up in between a verb and a selected PP. The first results in intervening manner adverbials; the second can additionally result in intervening time adverbials. Closer inspection of the data suggest that the

second process in turn has two variants: one with the PP in focus, the other with the PP a continuing topic.

Of the analyses under consideration, two can explain why intervention of manner adverbials and intervention of time adverbials should be different. On the low V analysis, the V-Adv_T-PP order must be derived by PP extraposition (as the verb cannot raise across time adverbials), while the V-Adv_M-PP order can be derived either by PP extraposition or by verb raising. On the extraposition analysis, one may assume that intervention of manner adverbials can result from base generation (as in (3b)), while intervention of time adverbials must result from rightward movement of the PP (as in (3c)) (a point that we return to in section 9). The other accounts have no obvious handle on the facts uncovered above, as far as we can tell.

3.2 The order of manner and time adverbials

As mentioned, the design of our word order test must take account of the circumstances in which PP extraposition across time adverbials is licit. We therefore constructed two word order experiments. In the first, the clause containing the PP was followed by a coordinate clause containing a pronoun coreferential with the preposition's complement (**experiment 3**). There were ten sets of test items, each consisting of a basic sentence and five alternations, as in (18) (given with our informal grammaticality judgments).

- (18) a. Bill talked to his neighbor <softly> last night <*softly>, and she told him some news.
b. Bill talked softly to his neighbor last night, and she told him some news.
c. *Bill talked last night to his neighbor softly, and she told him some news.
d. Bill talked <softly> last night <*softly> to his neighbor, and she told him some news.

The set-up was otherwise as in experiments 1 and 2: the experiment ran on AMT with eighty subjects who judged test items and fillers in a Latin Square design. The results are given in the table in (19). They show that in all three conditions there is a clear preference for orders in which manner adverbials precede time adverbials. This preference is apparently unaffected by the

position of the PP.

(19)		PP-initial	PP-medial	PP-final
	Adv _M – Adv _T	4.95 (1.63)	5.65 (0.98)	5.43 (1.36)
	Adv _T – Adv _M	3.94 (2.11)	4.81 (1.95)	4.26 (1.67)
		p<0.01	p<0.01	p<0.01

Experiment 3: Acceptability of adverbial order; manner and time adverbials; coordinate condition ($n=80$)

A two-factor ANOVA (adverb order \times sentence type) confirms this conclusion. It shows a significant main effect of sentence type ($F(2,79)=9.58$; $p<0.001$) and a significant main effect of adverb order ($F(1,79)=46.71$; $p<0.0001$). However, the interaction between sentence type and adverb order was not significant ($F(2,158)=0.41$; $p=0.664$).

We ran a second experiment (**experiment 4**), parallel to the previous one except that PPs were heavy and subsequent coordinate clauses were omitted, as in (20). As before, the experiment had a Latin Square design and was run on AMT with ten sets of test items and eighty subjects.

- (20) a. Bill talked to a very shy neighbor of his <softly> last night <*softly>.
 b. Bill talked softly to a very shy neighbor of his last night.
 c. *Bill talked last night to a very shy neighbor of his softly.
 d. Bill talked <softly> last night <*softly> to a very shy neighbor of his.

The results are given in (21). They show that in all three conditions there is a significant preference for orders in which manner adverbials precede time adverbials.

(21)		PP-initial	PP-medial	PP-final
	Adv _M – Adv _T	4.39 (1.51)	5.36 (1.03)	5.70 (0.64)
	Adv _T – Adv _M	3.16 (1.81)	3.01 (1.91)	5.10 (0.54)
		p<0.001	p<0.001	p<0.001

Experiment 4: Acceptability of adverbial order; manner and time adverbials; heavy PP ($n=80$)

Nonetheless, it is somewhat unexpected that the score for Adv_T–Adv_M in the PP-final condition is as high as it is (in comparison to the PP-initial and PP-medial conditions). The resulting overall pattern does not fit any of the accounts under consideration, as none predicts variable order in the PP-final condition and Adv_M–Adv_T elsewhere (which is what the average scores suggest).

That there is something to be explained here is confirmed by a two-factor ANOVA (adverb order \times sentence type), which shows a significant interaction of sentence type and adverb order ($F(2,158)=15.37$; $p<0.0001$) (alongside a significant main effect of sentence type ($F(2,79)=61.27$; $p<0.0001$) and a significant main effect of adverb order ($F(1,79)=121.43$; $p<0.0001$)).

Our suggestion is that the prosodic break preceding constituents that have undergone heavy XP shift facilitates a parenthetical reading of the manner adverbial immediately preceding the moved PP, something excluded in the PP-initial and PP-medial conditions, which lack such a break. In order to find out whether this is indeed the explanation of the anomaly, we reran experiment 4, but now with each test item introduced by a *wh*-question which was answered by the manner adverbial, as in (22) (**experiment 5**).

- (22) a. How did Bill talk to a very shy neighbor of his last night?
 Bill talked to a very shy neighbor of his <softly> last night <*softly>.
- b. How did Bill talk to a very shy neighbor of his last night?
 Bill talked softly to a very shy neighbor of his last night.
- c. How did Bill talk last night to a very shy neighbor of his?
 *Bill talked last night to a very shy neighbor of his softly.
- d. How did Bill talk last night to a very shy neighbor of his?
 Bill talked <softly> last night <*softly> to a very shy neighbor of his.

As parentheticals cannot answer *wh*-questions, this should have the effect that the scores in the PP-final condition fall in line. The results are as expected:

(23)	PP-initial	PP-medial	PP-final
Adv _M – Adv _T	5.51 (1.65)	5.71 (1.07)	5.98 (0.73)
Adv _T – Adv _M	3.54 (1.57)	3.65 (1.94)	3.91 (1.24)
	$p<0.01$	$p<0.001$	$p<0.001$

Experiment 5: Acceptability of adverbial order; manner and time adverbials; heavy PP; *wh*-context ($n=80$)

A two-factor Anova (adverb order \times sentence type) shows a significant main effect of sentence type ($F(2,79)=4.34$; $p<0.05$) and a significant main effect of adverb order ($F(1,79)=235.97$;

$p < 0.0001$). However, the interaction between sentence type and adverb order was no longer significant ($F(2, 158) = 0.23$; $p = 0.79$).

All in all, our findings show a consistent preference for Adv_M-Adv_T order across all three conditions. This is as predicted by the extraposition analysis and the low V analysis. Our results falsify the verb raising analysis and the remaining mixed analyses, which incorrectly predict that in the PP-medial condition and/or the PP-final condition there should not be a preference for manner adverbials to precede time adverbials.

3.3 *An aside on PP-modifiers*

We close this section with a brief discussion of another aspect of our findings. While the pattern in (19) and (23) is robust, the difference in average scores between the two adverbial orders is relatively modest (1.5 on average across all conditions; 1.49 on average in the PP-initial condition, where the predictions of all accounts converge). This is partly a fact about violations of the adverbial hierarchy: many produce only a limited penalty. But there is a second factor at play. Test sentences with multiple adverbs often appear to be reduced in acceptability, which in effect compresses the Likert scale when participants judge adverbial orders (see Payne 2018 for discussion). We can demonstrate the effect by considering the influence of category on the acceptability of sentences with a time and a manner adverbial, as in (24).

- (24) a. Bill spoke [Adv_P eloquently] today. c. Bill spoke [PP with eloquence] today.
b. ??Bill spoke today [Adv_P eloquently]. d. Bill spoke today [PP with eloquence].

We ran a test with ten sets of example sentences modelled on (24) (**experiment 6**). Each set contained two items in which manner was expressed by an adverb and two in which it was expressed by a PP. Time was always expressed by an adverb or a DP. As it turned out, scores were consistently higher if the manner adverbial was a PP, which suggests that sequences of adverbs indeed come at a cost:

(25)

	Manner–Time	Time–Manner	
M = AdvP	5.20 (0.85)	4.60 (1.37)	p<0.01
M = PP	6.09 (0.75)	6.30 (0.93)	n.s.
	p<0.001	p<0.001	

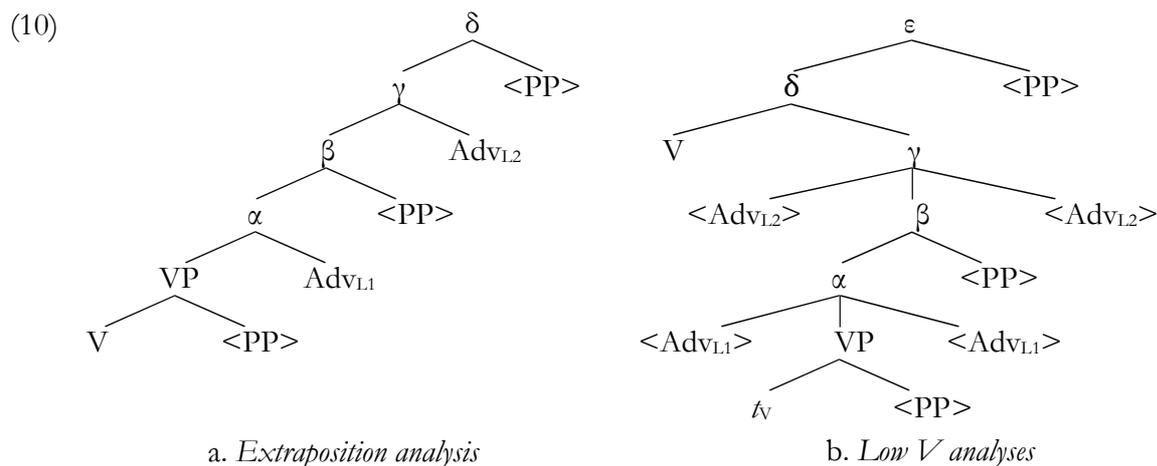
Experiment 6: Acceptability of adverbial order; time expressed by AdvP/DP ($n=80$)

Given these effects, one may think that it would be better to run word order tests with manner PPs. However, the data also show that a violation of the adverbial hierarchy reduces the score in the multiple adverb condition, but not in the adverb-PP condition. This is confirmed by a two-factor ANOVA (modifier order \times manner category), which shows a significant interaction between modifier order and the category of the manner modifier ($F(1,79)=13.16$; $p<0.001$), alongside a significant main effect of ($F(1,79)=133.4$; $p<0.0001$) of category. (The main effect of modifier order was not significant ($F(1,79)=2.99$; $p=0.08$), presumably because order is free in the adverb-PP condition).

We would suggest that this pattern is found because PP adverbials can be extraposed from an underlying position in which they satisfy the adverbial hierarchy. Whatever the value of that suggestion, it is clear that the best test for effects of the adverbial hierarchy avoids PP adverbials, as was the case in experiments 3, 4 and 5.

4. Intentionally Twice and Again Continuously

From here onward, we restrict discussion to the extraposition and low V analyses, which are the only accounts compatible with the results in section 3. In order to force a decision between these two analyses, we must consider structures with two adverbials low enough for the verb to move across them (if it does move). As explained in section 2, the predictions generated by the extraposition analysis remain constant: irrespective of the position of the PP, the lower of the two adverbs must precede the higher one (see (10a), repeated below for convenience). However, the predictions of the low V analysis shift towards the equal height analysis. In the PP-initial condition, the higher adverbial must still follow, but in the PP-medial and PP-final conditions, either the lower or the higher adverbial may precede (see (10b)).



Reversible adverb pairs provide one way to test these predictions. (Indeed, the behaviour of such adverb pairs is among the strongest evidence for verb raising in Pesetsky 1989.) As c-command relations between reversible adverbs are not fixed (see (26)), we cannot test the extraposition and low V analyses by looking at word order: both theories predict free word order in all three conditions. However, we can consider scope. The extraposition analysis predicts right-to-left scope across the board (see (10a), where c-command between Adv_{V2} and Adv_{V1} is right-to-left). The low V analysis predicts ambiguity in the PP-medial and PP-final conditions, because c-command between Adv_{V2} and Adv_{V1} can be left-to-right or right-to-left; see (10b). In the PP-initial condition, however, c-command and therefore scope between Adv_{V2} and Adv_{V1} is exclusively right-to-left.

(26) John <intentionally> twice <intentionally> knocked on the door.

As mentioned in section 2, we rely for scope judgments on a panel of ten native-speaker linguists, all speakers of American English and all trained at PhD level. We asked them for their judgments on adverbial scope in three sets of three pairs of sentences (**scope test 1**). Each pair corresponded to one of the conditions under discussion, with variation in the order of the adverbs, as in (27). Each set had a different combination of reversible adverbs.

- (27) a. John knocked on the door <intentionally> twice <intentionally>.
 b. John knocked intentionally on the door twice.
 b'. John knocked twice on the door intentionally.

- c. John knocked <intentionally> twice <intentionally> on the door.

A clear consensus emerged. When the adverbs are adjacent, scope is variable, but when they are separated by the PP, scope is right-to-left (see (28)). Neither analysis predicts this pattern. The extraposition analysis makes the wrong predictions for the PP-initial and PP-final conditions, while the PP-initial and PP-medial conditions are problematic for the low V analysis.¹

(28)

PP-initial			PP-medial			PP-final		
L > R	L <> R	L < R	L > R	L <> R	L < R	L > R	L <> R	L < R
1	9	0	0	1	9	0	10	0

Scope test 1: Scope among pairs of reversible adverbs (n=10)

These findings are corroborated by further data involving *again*. While this adverb can be merged very low indeed, it cannot appear in the scope of manner adverbs like *continuously*. This means that the extraposition and low V analyses make diverging predictions for sentences containing a manner adverb and *again*. The extraposition analysis predicts that the manner adverb will systematically precede *again* (see (10a)). The low V analysis predicts that in the PP-initial condition *again* should follow the manner adverb, as c-command among the adverbials is right-to-left(see (10b)). However, it predicts free order in the PP-medial and PP-final conditions, where c-command between the adverbials is variable. We tested these word order predictions through an AMT experiment. We recruited eighty subjects who judged five sets of sentences of the type in (29) in the same set-up as before (**experiment 7**).

- (29) a. John knocked on the door <continuously> again <continuously>.
 b. John knocked continuously on the door again.
 b'. John knocked again on the door continuously.
 c. John knocked <continuously> again <continuously> on the door.

¹ The data regarding the PP-initial condition go against the long-standing claim that scope among sentence-final adverbs is right-to-left; see Andrews 1983 and much subsequent work. However, this generalization has been called into doubt before, most recently by Bobaljik 2017. Our findings corroborate Bobaljik's assessment of the data.

Again, the results were not as expected. When the adverbs are separated by the PP, there is a preference for Adv_M -*again* (as predicted by the extraposition analysis), but when they are adjacent, the data are problematic for both the extraposition and low V analyses: in the PP-initial condition, both orders are on a par, while in the PP-final condition there is a preference for *again*- Adv_M :

(30)

	PP-initial	PP-medial	PP-final
Adv_M – <i>again</i>	4.53 (1.15)	5.81 (0.75)	4.30 (1.04)
<i>again</i> – Adv_M	4.89 (1.16)	5.21 (0.75)	4.90 (1.45)
	n.s.	p<0.01	p<0.01

Experiment 7: Acceptability of adverbial order; again and manner adverbials (n=80)

That adjacency may be the factor behind this unexpected data pattern is confirmed by a two-factor ANOVA (adverbial order \times adverbial adjacency), which shows a significant main effect of adverbial adjacency ($F(1,79)=60.72$; $p<0.0001$) and a significant interaction between adverbial adjacency and adverbial order ($F(1,79)=24.03$; $p<0.0001$). The main effect of adverbial order was not significant ($F(1,79)=1.35$; $p=0.25$).

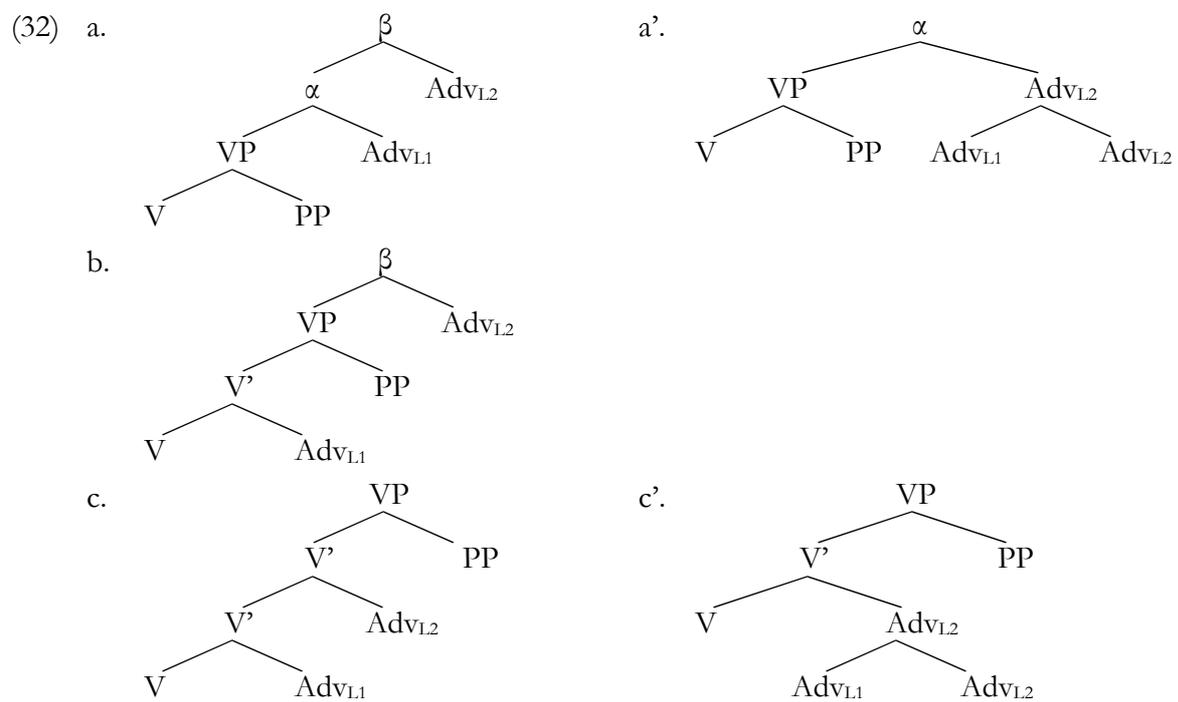
In sum, neither the extraposition analysis nor the low V analysis predict the patterns found with pairs of low adverbs. Both accounts will therefore need to invoke some auxiliary hypothesis to capture the findings in (28) and (30). In sections 5 and 6, we will consider what amendments are available under the extraposition and low V analyses. We argue that on closer inspection the data support PP extraposition.

5. Amending the extraposition analysis: Adverbial clustering

One auxiliary hypothesis compatible with the extraposition analysis is that some adverbials may left-adjoin to other adverbials (as argued previously in Rohrbacher 1994 and Ackema and Neeleman 2002; see also Williams 2014). Such direct modification is not in itself controversial. It is generally assumed, for example, that *only* may be associated with another category at a distance, as in (31a), or be directly attached to it, as in (31b) (see Rooth 1985).

- (31) a. John only invited MARY. b. Only MARY did John invite.

Thus, our claim is simply that direct modification is available for a larger class of adverbials than usually assumed. The problematic data then follow if we assume that the adjoined adverbial takes scope over and precedes its host.² When the adverbs are adjacent, they may have merged independently, yielding right-to-left scope (see (32a,c)), or the first may have merged with the second, yielding left-to-right scope (see (32a',c')). When the adverbs are separated by the PP, however, they must have been attached independently, so that only right-to-left scope is available (see (32b)).



This is enough to capture the variation in scope in the PP-initial and PP-final conditions in (28), as well as the scope rigidity in the PP-medial condition.

The data in (30) show not just optionality, but a slight preference for left-to-right scope in the PP-final condition. This may be the result of a general aversion, already mentioned in section 3.3, against sentences containing multiple adverbials. If the first adverb is adjoined to the second, the

² We do not know why adverbs should precede adverbs they are adjoined to. However, notice that the same restriction holds of adverbs that are adjoined to adjectives:

(i) He saw his face in the mirror – sad and [_{<suddenly>} old _{<*>}suddenly].

result is a single complex modifier, rather than a sequence of simplex modifiers.

An evaluation of the extraposition analysis in conjunction with the auxiliary hypothesis of direct adverbial modification must address three core issues. The first is whether there is any empirical evidence for adverbial clustering (see section 5.1), the second is how adverbial clusters are interpreted (see sections 5.2 and 5.3), and the third is how adverbial clustering can be constrained so as to preserve the account of the data discussed in section 3 (see section 5.4).

5.1 Basic evidence

An observation that bears on the first of these these questions comes from clefting. While a combination of a time adverbial and a manner adverbial resists clefting (see (33a)), *intentionally twice* can be clefted (see (33b)). This suggests that *intentionally twice*, but not *last night desperately* can comprise a syntactic unit. Note that, in line with expectations, *intentionally* must take scope over *twice* when clefted: (33b) implies that John had the intention to knock twice on the door. (Where judgments were checked with our panel of native speaker linguists, we will from now on indicate this as a fraction that expresses how many panelists accepted a given example or a given reading).

- (33) a. *It was last night DESPERATELY that Mary looked for her puppy. (0/10)
b. It was intentionally TWICE that John knocked on the door. (10/10)

It is also predicted, correctly as it turns out, that *again continuously* can undergo clefting. However, what we can conclude from this observation is not immediately clear, as *again* in (34) could be an independent modifier in the top part of the cleft, something that is unlikely to be true of *intentionally* in (33b). In section 5.3 we will show, though, that examples like (34) are grammatical on exactly the reading in which *again* modifies *continuously*;

- (34) It was again CONTINUOUSLY that John knocked on the door. (10/10)

A second way to test our auxiliary hypothesis is to replace the initial adverb in a pair of adverbs that permit post-verbal left-to-right scope with a near-synonymous PP. While we have hypothesized that in the structures at hand the adjoined adverbial must precede the category it

attaches to, PP modifiers tend to follow in almost all circumstances. Therefore, judgments are predicted to change when a PP replaces the first modifier in an adverb-adverb sequence. When adverbial clustering is ruled out, a pattern of judgments should emerge that is reminiscent of judgments for pairs of time and manner adverbials.

Indeed, when *intentionally* in (33) is replaced by *with intention*, the result is degraded:

(35) *It was with intention TWICE that John knocked on the door. (0/10)

The effect extends to adverbial scope in the PP-initial, PP-medial and PP-final conditions. We asked our panel of native-speaker linguists to judge scope between a PP modifier and an adverb in three sets of three examples, one of which is given in (36) (**scope test 2**). The expected change in judgments was evident, as all ten reported that they could only get right-to-left scope, irrespective of condition (see (37)). This is of course exactly the pattern predicted by the amended extraposition analysis. (N.B. The number of test sentences was relatively low, as there are few PPs whose meaning sufficiently approximates that of the relevant adverbs.)

- (36) a. John knocked with intention twice on the door.
 b. John knocked with intention on the door twice.
 c. John knocked on the door with intention twice.

(37)

PP-initial			PP-medial			PP-final		
L > R	L <> R	L < R	L > R	L <> R	L < R	L > R	L <> R	L < R
0	0	10	0	0	10	0	0	10

Scope test 2: Scope judgments for PP_{mod}-adverb pairs (n=10)

A second time is an expression whose interpretation approximates *again*, but which cannot directly modify other adverbials, as shown by the ungrammaticality of (38).

(38) *It was a second time CONTINUOUSLY that John knocked on the door. (0/10)

The amended extraposition analysis therefore predicts that when *again* in the examples in (29) is replaced by *a second time* only the orders that do not rely on adverbial clustering will survive. Informal judgments suggest that this is correct. Irrespective of condition, *continuously a second time*

is the only acceptable order for the native speakers we have consulted:

- (39) a. John knocked on the door <continuously> a second time <*continuously>.
 b. John knocked continuously on the door a second time.
 b'. *John knocked a second time on the door continuously.
 c. John knocked <continuously> a second time <*continuously> on the door.

In order to validate these judgements, we ran a version of experiment 7 (**experiment 8**) in which *again* was replaced by *a second time*. Otherwise the set-up with was unchanged. The results show that there is a significant preference in all conditions for the order in which *a second time* follows the adverb, as predicted by the extraposition analysis (see (10a)):

(40)	PP-initial	PP-medial	PP-final
Adv _M – <i>a second time</i>	4.8 (1.26)	4.74 (1.73)	4.28 (1.05)
<i>a second time</i> – Adv _M	3.8 (1.94)	3.45 (1.71)	3.38 (1.54)
	p<0.01	p <0.01	p<0.01

Experiment 8: Acceptability of adverbial order; manner adverbial and *a second time* (n=80)

As predicted, the effects of adverbial adjacency disappeared in experiment 8. A two-factor ANOVA (adverb order × adjacency) shows no significant main effect of adverbial adjacency (F1(1,79)=0.04; p=0.84), and no significant interaction between adverbial order and adverbial adjacency (F1(1,79)=1.23; p=0.27). However, the main effect of adverbial order was significant, as expected (F1(1,79)=54.65; p<0.0001).

We conclude (i) that there is sufficient empirical support for adverbial clustering, and (ii) that where adverbial clustering is ruled out, the data are as predicted by the extraposition analysis, rather than the low V analysis.³

³ Pesetsky (1989) claims that reducing the weight of the extraposed PP favors left-to-right scope among adverbials sandwiched between it and the verb. If so, we would suggest an explanation based on prosody. Consider the examples in (i) (where breaks and primary and secondary stress are indicated).

- (i) a. {John knocked **continuously** again} {on the **DOOR**}

5.2 Interpretive effects: Intentionally twice

We now turn to the semantic effects of attaching one modifier directly to another, starting with adverbial clusters introduced by an adverb like *intentionally* (as in *intentionally twice*). We propose that *intentionally* and its kin allow association with focus. This is not a novel claim. Williams (2014) argues the point in some detail. The effect is easy to see with *accidentally*, the antonym of *intentionally* and the adverb we concentrate on below. Take an example like *John accidentally murdered BILL*. Murder is an intentional act, and so one would expect this sentence to be a contradiction. Its coherence is due to *accidentally* associating with *BILL*. The ordinary value of the sentence is that John murdered Bill; its focus value consists of the presupposition that there is an alternative x to Bill, such that John intended to kill x .

The role of focus can be further illustrated with the examples in (41).

- (41) a. Susan accidentally gave Bill A SCI-FI NOVEL.
b. Susan accidentally gave BILL a sci-fi novel.

The sentence in (41a) permits the interpretation in (42a), but not that in (42b). Conversely, the sentence in (41b) permits the interpretation in (42b), but not that in (42a). (There are other interpretations of these examples that are not relevant here; they could, for instance, be used when speaker and addressee know that Bill hates sci-fi novels, but Susan was not aware of this.)

- (42) a. (i) Susan gave Bill a sci-fi novel; (ii) $\exists x, x$ an alternative to a sci-fi novel, Susan intended to give Bill x .

-
- b. {John knocked} {again **continuously**} {on the **DOOR**}

In (ia), *continuously* and *again* are merged independently, yielding right-to-left scope. In (ib), the adverbs cluster, yielding left-to-right scope. The thing to note is that the second example has a more balanced prosody than the first, where the PP follows a large prosodic unit. This would favour adverbial clustering if the PP is light.

- b. (i) Susan gave Bill a sci-fi novel; (ii) $\exists x$, x an alternative to Bill, Susan intended to give x a sci-fi novel.

The same pattern can be observed in examples more directly relevant to the question under discussion. On a parse of the examples in (43) in which *accidentally* takes scope over *twice*, (43a) comes with the presupposition that Susan intended to knock twice on something other than the door, while (43b) presupposes that Susan intended to knock on the door, but either fewer or more times than two.

- (43) a. Susan accidentally [knocked on the DOOR twice].
 b. Susan accidentally [knocked on the door TWICE].

Adverbials that associate with focus may often directly attach to the focused constituent (as already illustrated for *only* in (31)). We suggest that this is what lies behind adverbial clustering with *accidentally*: this adverb may merge with a second adverbial if the latter comprises its associated focus. Thus, when *accidentally* is merged with *twice* in (44a), the interpretation that obtains is parallel to that in (43b) (see (44b); for related discussion, see Bobaljik 2017).

- (44) a. Susan knocked <on the door> [accidentally twice] <on the door>.
 b. (i) Susan gave two knocks on the door; (ii) $\exists n$, n an alternative to 2, Susan intended to give n knocks on the door.

Again, we follow Williams (2014) here. Williams argues explicitly that focus-sensitive adverbs may either be merged in their scopal position or attach to the associated focus.⁴

The hypothesis that *accidentally* is a focus-sensitive adverb makes an important prediction: if it

⁴ Notice that there are syntactic restrictions on attachment to the focus. As argued in the main text, *accidentally* can form an adverbial cluster with *twice*. However, it cannot attach to a DP argument (cf. **John murdered [accidentally BILL]*). We do not know whether this should be captured through a selectional requirement, or can be derived from more general principles.

attaches to a second adverb, this has a disambiguating effect, as it precludes any other element in the clause from acting as the associated focus. In order to show that this prediction is correct, we must first establish what interpretation (44) has when *accidentally* and *twice* are merged independently, as in (45). In this structure, *accidentally* does not take scope over *twice*, and therefore it cannot generate a presupposition about the intended number of knocks on the door. Rather, it triggers the presupposition that Susan twice intended to perform an action other than knocking on the door (the nature of which is partly dependent on where stress is placed within *knock on the door*):

- (45) a. Susan [[knocked <on the door> accidentally] twice] <on the door>.
 b. (i) On two occasions, Susan knocked on the door; (ii) on each occasion $\exists a$, a an alternative to *knock on the door*, Susan intended to perform a .

Thus, we predict that *Susan knocked accidentally twice on the door* and *Susan knocked on the door accidentally twice* are ambiguous between the readings in (44b) and (45b), but do not permit an interpretation on a par with (43a), where *accidentally* triggers the presupposition that Susan intended to give two knocks on some object other than the door. This is because *accidentally* precedes *twice* and so can only take scope over *twice* if it is attached to it, as in (44). But if it is attached to it, *twice* must be the associated focus, which precludes association with *the door*. The relevant reading is indeed unavailable, as confirmed by the unanimous judgment of our panel of ten native-speaker linguists (0/10).

5.3 Interpretive effects: Again continuously

We next consider adverbial clusters introduced by *again* (such as *again continuously*). Like *accidentally*, *again* triggers a presupposition. As argued extensively in the literature, one crucial factor that governs the nature of this presupposition is the c-command domain of the adverb. Of particular

interest here is the contrast in the interpretation of (46a) and (46b).^{5,6}

- (46) a. Oliver [again [showed the second book to Louise]].
b. Oliver showed the second book [again [to Louise]].

Suppose that Oliver is a rare-book seller who has two antique tomes on offer. He shows these to a select group of customers, one of whom is Louise. In that context, (46a) can have the interpretation in (47a), but not that in (47b). By contrast, (46b) has the interpretation in (47b), as well as that in (47a), albeit that the latter is harder to access. (Our panellists were unanimous in these judgments).

- (47) a. (i) Oliver showed the second book to Louise; (ii) Oliver previously showed the second book to Louise.
b. (i) Oliver showed the second book to Louise; (ii) Oliver previously showed the first book to Louise.

The example in (46a) is unremarkable. *Again* is attached to the bracketed constituent, and therefore triggers the presupposition that someone (possibly Oliver) previously carried out the action described by this constituent. We assume that in (46b) *again* is attached to *to Louise*. This means that the VP is not part of *again*'s c-command domain, so that the presupposition triggered is that Oliver previously performed some unspecified action directed towards Louise. In the context at

⁵ Although there is an extensive literature on *again*, the readings of interest here are rarely discussed (and deserve further exploration). There is general agreement, however, that the attachment site of *again* (co-)determines the presupposition it triggers. For discussion and references, see Beck and Johnson 2004 and Pedersen 2015.

⁶ The string in (46b) can also be derived by rightward extraposition of *to Louise*.

- (i) Oliver [[[showed the second book] again] to Louise]

This, however, would not yield the interpretation discussed below, but rather one in which Oliver showed the second book to Louise and previously showed the second book to someone other than Louise (on a par with *Oliver showed the second book again, this time to Louise*).

hand, this action is most easily construed as *show the first book*. It may also be construed as *show the second book*, but this is pragmatically odd, as that construal is explicitly encoded by (46a).

The underspecified nature of the presupposition triggered by *again* in examples like (46b) is brought to the fore by the contrast in (48).

- (48) Oliver seems to be showering Louise with attention and ignoring everyone else. He introduced himself to Louise. Then he read a poem to Louise.
- a. #And then he [again [showed pictures of a romantic sunset to Louise]] (0/10).
 - b. And then he showed pictures of a romantic sunset [again [to Louise]] (10/10).

The sentence in (48a) requires accommodation of some sort, as the context does not provide an earlier instance of *show pictures of a romantic sunset to Louise*. There is no such effect in (48b), where *again* merely signals that Oliver previously performed actions directed towards Louise, a presupposition supported by the context given.

Clefts can be used to show that clustering is necessary to get the interpretive effect observed in (48). In the context at hand, the cleft in (49a) is awkward and requires accommodation, but the one in (49b), where *again* and *to Louise* presumably form a cluster, is fully acceptable.

- (49) a. #And it was to Louise that he showed pictures of a romantic sunset <again>. (0/10)
- b. And it was again to Louise that he showed pictures of a romantic sunset. (10/10)

It is a small step to assume that adverbial clustering with *again* is motivated by the same interpretative effect. If so, we expect that structures whose wellformedness relies on clustering will not imply that there is a previous instance of the action described by VP. This crucial prediction is correct. Suppose that Field Commander Cohen was our most important spy, and that in the course of one of his adventures he agreed to knock on two doors in a particular manner to signal whether the coast was clear. In this context, (50a) can have the interpretation in (50b).

- (50) a. Cohen knocked <on the second door> [again continuously] <on the second door>.

- b. (i) Cohen knocked on the second door continuously; (ii) Cohen previously knocked on the first door continuously. (10/10)

In fact, because Cohen's earlier actions are left unspecified, the following is also felicitous:

- (51) Cohen talked continuously for an hour. Then he played the piano continuously for 45 minutes. And then he knocked <on the door> [again continuously] <on the door>. (10/10)

These examples can be contrasted with examples in which *continuously* and *again* are merged separately. In such examples, the VP is part of the c-command domain of *again* and must therefore be mapped to the presupposition. Thus, (52a) requires that Cohen previously knocked on the second door continuously, as in (52b). The sentence cannot presuppose that Cohen continuously knocked on the *first* door, as in (52b').

- (52) a. Cohen [<again> [knocked on the second door continuously] <again>].
 b. (i) Cohen knocked on the second door continuously; (ii) Cohen previously knocked on the second door continuously. (10/10)
 b'. (i) Cohen knocked on the second door continuously; (ii) Cohen previously knocked on the first door continuously. (0/10)

In line with this, the final sentence in (53) is awkward and requires accommodation.

- (53) Cohen talked continuously for an hour. Then he played the piano continuously for 45 minutes. #And then he [<again> [knocked on the door continuously] <again>]. (0/10)

Clefts confirm that the interpretive effect required by the context in (51)/(53) relies on clustering, as predicted. The cleft in (54a) is infelicitous in the relevant context, but the one in (54b) is perfectly natural.

- (54) a. #And it was continuously that he knocked on the door again. (0/10)
 b. And it was again continuously that he knocked on the door. (10/10)

The examples of independent attachment of *again* and *continuously* all involve structures without PP

extraposition. However, it is important to also look at structures with PP extraposition, as this may place the PP outside the c-command domain of *again*, thereby removing the obligation to map it to the presupposition. Thus, in the scenario sketched above, (55a) permits either of the interpretations in (55b,b').

- (55) a. Cohen [<again> [knocked continuously] <again>] on the second door.
- b. (i) Cohen knocked continuously on the second door; (ii) Cohen previously knocked continuously on the second door. (10/10)
- b'. (i) Cohen knocked continuously on the second door; (ii) Cohen previously knocked continuously on the first door. (10/10)

This implies that the data in (50) provide evidence for the interpretive effects of adverbial clustering in the PP-initial condition, but not in the PP-final condition. For that, we must consider whether the *verb* is obligatorily mapped onto the presupposition. This should be the case under independent attachment of *again* and *continuously*, but not under adverbial clustering. The data in (56) are in line with this: the final sentence in (56a) requires accommodation, but the final sentence in (56b) does not.

- (56) a. Cohen knocked continuously on the window. #Then he [<again> [banged continuously] <again>] on the door. (0/10)
- b. Cohen knocked continuously on the window. Then he banged [again continuously] on the door. (10/10)

In sum, there is a signature interpretive effect that is found in all examples whose grammaticality relies on *again* clustering with a second adverbial.

5.4 Time adverbials

The conclusion from sections 5.2 and 5.3 is that there are clear interpretive effects of adverbial clustering with *accidentally* and *again* that have to do with the presuppositions triggered by these elements. We propose that it is these effects that license adverbial clustering in the first place.

This means that we are now in a position to consider whether the extraposition analysis can still account for the data of section 3 if combined with the auxiliary hypothesis that adverbials may cluster. This hypothesis explained the existence of left-to-right scope in the PP-initial and PP-final conditions with adverbs like *accidentally* and *again*.

The data in section 3 involved pairs of time and manner adverbials, and the core observation was that time adverbials follow manner adverbials irrespective of condition (that is, whether the adverbials are sandwiched between V and PP, are separated by the PP, or appear sentence-finally). In order to account for this, we must assume that time adverbials cannot adjoin to other adverbials to form an adverbial cluster. We have already seen, in (33a), that this assumption is correct.

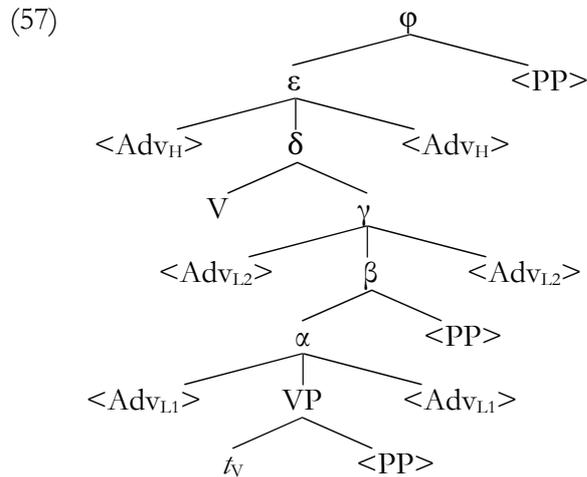
The findings of sections 5.2 and 5.3 give a clear sense of *why* time adverbials should resist adverbial clustering. Such adverbials do not trigger the kind of presuppositions associated with *accidentally* and *again*; they simply specify the time at which a proposition holds. Therefore, they cannot have the kind of privileged relationship with a second adverbial that *accidentally* and *again* may enter into. And in the absence of an interpretive license for adverbial clustering, temporal adverbials must be merged with an appropriate category in the extended verbal projection, yielding the predictions tested in section 3.

6. Amending the low V analysis

The unamended extraposition analysis made incorrect predictions in the PP-initial and PP-final conditions for pairs of two manner adverbs or a manner adverb and *again*. A single auxiliary hypothesis could fix these problems, as the relevant conditions are similar in one important respect: the adverbials are adjacent. The low V analysis makes incorrect predictions for the same pairs of adverbs in the PP-initial and PP-medial conditions. As there is no obvious factor shared by these conditions (to the exclusion of the PP-final condition), it is hard to make do with a single auxiliary hypothesis.

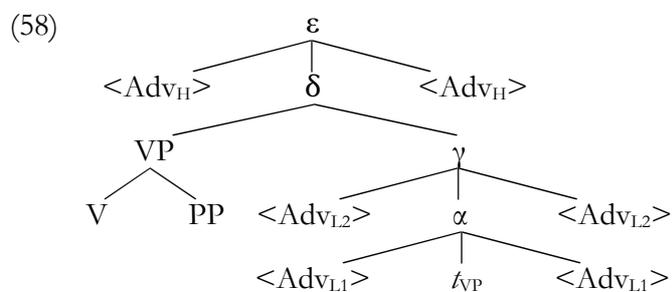
Recall the basic shape of the account. (i) There are three (relevant) adverbial attachment sites

(Adv_{L1}, Adv_{L2}, Adv_H in (57)), each of which may in principle be linearized to the left or right of its sister. (Time adverbials occupy the Adv_H position; manner adverbials and the like occupy the Adv_L positions.) (ii) The PP may extrapose across any of these adverbial positions. (iv) The verb moves across Adv_{L2}, but not across Adv_H.



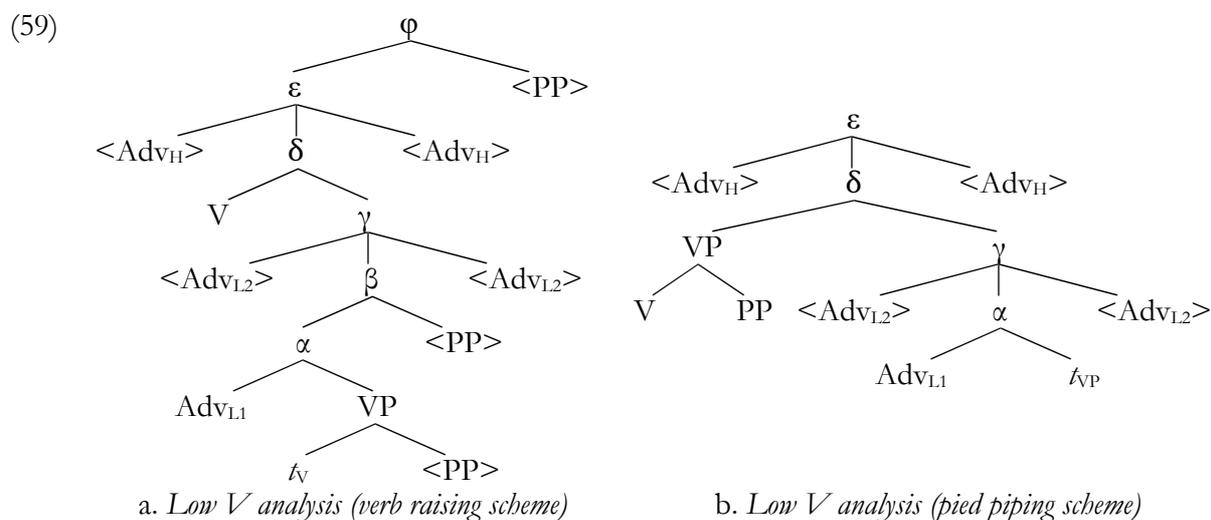
This correctly predicts the distribution of time adverbials, but does not capture the existence of descending pairs of low adverbs in the PP-initial condition, nor the absence of such pairs in the PP-medial condition – if the left instance of Adv_{L2} and the right instance of Adv_{L1} are chosen and if the PP remains in situ, the resulting order is V-Adv_{L2}-PP-Adv_{L1}.

There is a way to reconcile the low V analysis with the facts of section 3. To begin with, one could allow verb raising to pied-pipe the PP complement, as in (58). This has the consequence that descending pairs of non-time adverbials may now appear sentence-finally, which fixes the problem with the PP-initial condition (as V-PP-Adv_{L2}-Adv_{L1} can now be generated).



A second auxiliary hypothesis is required for the PP-medial condition. A simple way of ruling out descending pairs of adverbs in this condition is to remove one of the adverbial positions in (57)

and (58), namely the right instance of Adv_{L1} . This yields the following schemes for bare verb raising and pied-piping, respectively:



The resulting analysis captures the problematic data.

However, this is not enough. Our discussion of adverbial clustering has uncovered several new facts. Since these fall out from the amended PP extraposition analysis, it is reasonable to ask whether they also have a place in the amended low V analysis.

If one accepts our conclusion that there is adverbial clustering, one should reject the low V analysis. This is because adverbial clustering removes the evidence for verb raising by providing an alternative explanation of descending adverbial pairs in the PP-final condition. Therefore, the low V analysis requires a substitute account of the data in sections 5.1–5.3.

We will not discuss this matter in detail, but simply note that finding such an alternative account may not be straightforward. As an example of the difficulties that present themselves, consider how the following sentences are analyzed on the the amended low V analysis ((60b) is a variant of (50a)):

- (60) a. Cohen knocked [[continuously [t_V on the second door]] again].
 b. Cohen [t_{VP} knocked on the second door] [again [t_{VP} continuously]].

The sentence in (60a) is a verb raising structure, with *continuously* in Adv_{L1} and *again* in the right instantiation of Adv_{L2} . The sentence in (60b) is derived by raising of VP; *continuously* still appears

in Adv_{V1}, while *again* now appears in the *left* instantiation of Adv_{V2}. Thus, the sentences are identical in terms of their underlying syntax; they differ only in the linearization of *continuously* and in whether or not PP is pied-piped. As linearization and pied-piping are typically irrelevant for interpretation, one would expect the two sentences to have the same meaning. That is not the case, however: (60a) triggers the presupposition that Cohen previously knocked continuously on the second door, but as shown in section 5.3, (60b) does not. Contrasts of this type remain unexplained and therefore require additional assumptions.

7. Interim Conclusion

We have shown that, if suitably amended, both the extraposition and the low V analysis can capture the order of adverbials in the PP-initial, PP-medial and PP-final conditions as described in section 2.2 and 2.3. The extraposition analysis must be combined with an auxiliary hypothesis of adverbial clustering:

- (61) a. PP complements can extrapose across right-adjoined adverbials.
 b. Adverbs may left-adjoin to other adverbials (if there is an interpretive license).

The low V analysis is a mixed analysis that assumes verb raising, as well as PP extraposition. In addition, in order to capture the data in sections 2.2 and 2.3, it must rely on two auxiliary hypothesis, given in (62c) and (62d)).

- (62) a. The verb moves leftward across manner, but not time adverbials.
 b. PP complements can extrapose across right-adjoined adverbials.
 c. Verb raising may pied-pipe PP complements.
 d. The lowest VP-external adverbial position precedes VP.

As things stand, the data in section 5 receive an explanation under the (amended) extraposition analysis, but not under the low V analysis.

Two conclusions may be drawn regarding symmetric analyses of adverbial intervention. First, the fact that certain adverbial pairs can come in descending order in the PP-final condition does

not provide evidence for verb raising, as a plausible alternative analysis is available. Second, of the two analyses that can capture the data, the PP extraposition analysis demonstrably covers more ground using fewer assumptions, and must therefore be assumed to be correct unless evidence to the contrary is uncovered.

8. Extraposition through roll-up movement

8.1 *An antisymmetric translation of the extraposition analysis*

The pattern uncovered in the previous sections is summarized in the scheme in (63): the order of postverbal adverbials corresponds with increasing scope or increasing height on the adverbial hierarchy, irrespective of the position of the selected PP.

(63) V <PP> Adv_{VL1} <PP> Adv_{VL2} <PP> Adv_{VH} <PP>

Syntactic structure is traditionally taken to be symmetric: the order between sister nodes is subject to cross-linguistic and language-internal variation. This allows a straightforward account of the fact that in (63) higher adverbials follow lower adverbials. Following the verb's base position, linear order corresponds with increased height of attachment as a matter of course. The fact that adverbial order is not affected by the position of the PP then follows from the extraposition analysis, as the PP can be shifted rightwards and upwards.

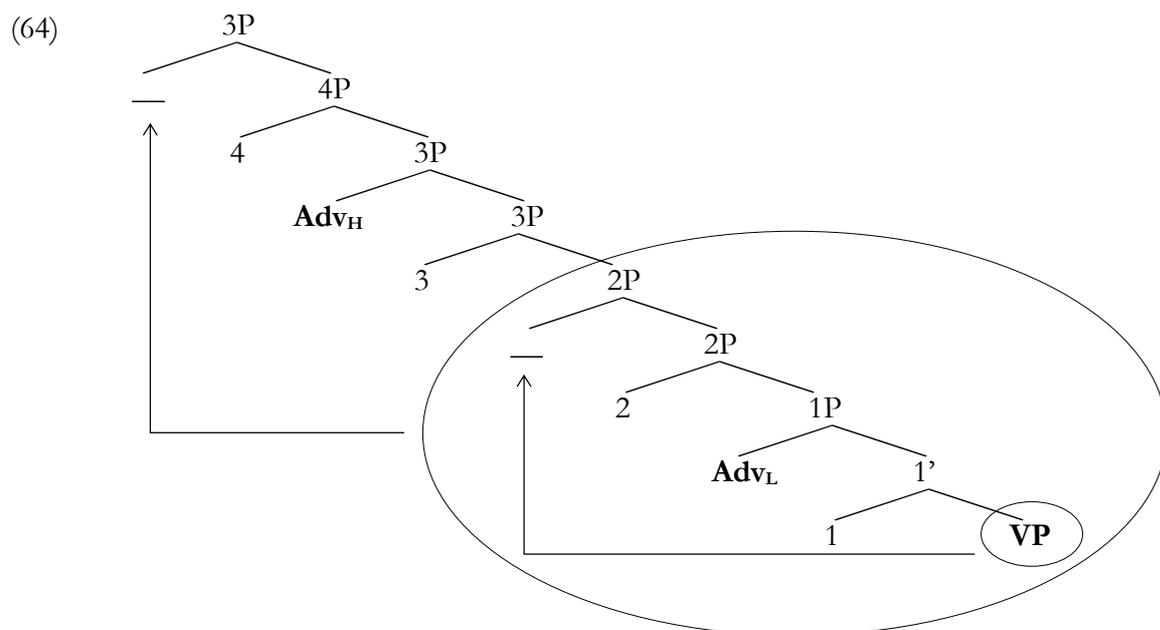
In this section, we consider an alternative version of the extraposition analysis that rejects the assumption of symmetry. The background to this is the rise in the 1990s of theories postulating that syntactic structure is fundamentally asymmetric, with constituents further to the right systematically located lower in the tree. The best-known proposal of this type is the antisymmetry framework developed in Kayne 1994.⁷

Antisymmetric analyses of word order cannot account for the order of postverbal

⁷ Other important work in the same vein can be found in Haider 2010, 2013 and Larson 2014. For reason of space we cannot discuss this here.

adverbials through base generation in an ascending structure. They must postulate an alternative mechanism that explains why higher adverbials follow lower adverbials. The hypothesis most commonly pursued makes use of so-called roll-up movement (see Barbiers 1995, Koopman and Szabolcsi 2000 and Cinque 2005, 2010)).

Cinque (1999) argues that adverbials are specifiers in a uniformly descending base structure. As specifiers precede the node they combine with, the position of postverbal adverbials is the result of movement. The relevant movement regime reverses the order of verb and adverbials. For example, a sequence of two ascending postverbal adverbials can be generated by VP moving across the lower adverbial, followed by movement across the higher adverbial of a constituent containing VP and the lower adverbial. Thus, the base structure is ‘rolled up’:



Roll-up movement makes available a straightforward translation of the extraposition analysis. For concreteness' sake, let us assume that selected PPs surface in the specifier of a functional projection IIP, whose position with respect to functional projections hosting adverbials is variable. (It is immaterial for our current purposes whether PPs move to spec-IIP. It is also immaterial whether IIP is decomposed into a range of functional projections, each with a fixed position in the verbal spine.) The antisymmetric version of the extraposition analysis combines these assumptions (which are summarized in (65i)), with the movement rules in (65ii) and (65iii):

- (65) (i) Roll-up movement around adverbials is optional.
(ii) Roll-up movement around PPs is obligatory.
(iii) Selected PPs can shift (leftward) across manner and time adverbials.

Given an input structure [Adv_H [Adv_L [PP VP]]], roll-up movement around the PP and the adverbials generates the surface representation in (66a). Given an input structure [Adv_H [PP [Adv_L VP]]], roll-up movement generates (66b). Finally, given an input structure [PP [Adv_H [Adv_L VP]]], roll-up movement creates (66c).

- (66) a. [_{5P} [_{3P} [_{1P} **VP** [_{1IP} **PP** t_{VP}]]] [_{2P} **Adv_L** t_{1P}]] [_{4P} **Adv_H** t_{3P}]]
b. [_{5P} [_{3P} [_{2P} **VP** [_{1P} **Adv_L** t_{VP}]]] [_{1IP} **PP** t_{2P}]] [_{4P} **Adv_H** t_{3P}]]
c. [_{5P} [_{4P} [_{2P} **VP** [_{1P} **Adv_L** t_{VP}]]] [_{3P} **Adv_H** t_{2P}]] [_{1IP} **PP** t_{4P}]]

Thus, the analysis in (65), like its symmetric counterpart, predicts ascending order for any pair of adverbs in the PP-initial, PP-medial and PP-final conditions.

8.2 Pas

As things stands, the extraposition analysis and its antisymmetric counterpart appear to be identical in empirical content. This conclusion is strengthened by the observation that the gross constituency of roll-up structures is identical to traditional left-branching VPs (see Abels and Neeleman 2009 for detailed discussion). The structures in (66) group overt material together in the same way as those in (67).

- (67) a. [[[V **PP**] **Adv_L**] **Adv_H**] b. [[[V **Adv_L**] **PP**] **Adv_H**] c. [[[V **Adv_L**] **Adv_H**] **PP**]

However, an argument can be constructed in favour of the view that postverbal adverbials are part of a traditional left-branching structure. The argument is a replication of an argument to the same effect developed in Neeleman 2017 for Dutch. While Dutch is a head-final language, it allows PPs to surface to the right of the verb, in an order suggestive of an ascending structure (see Koster 1974, Barbiers 1995 and Neeleman 2017). Thus, the same question that we asked for English is pertinent for Dutch: are postverbal PPs generated in a traditional left-branching structure, or is

surface order the result of roll-up movement?

An answer to this question can be based on the distribution of the particle *pas*. This particle can associate with a temporal expression to indicate that the event described took place at a time later than expected (see Barbiers 1995 for discussion). Thus, the example in (68) implies that the speaker would have expected Karl to see the import of the relevant facts earlier than on Sunday, in line with the context given. (Here and below, we indicate association with *pas* through underlining.)

(68) [Karl has been working on this problem for years.]

Hij heeft het belang van deze feiten pas op zondag begrepen.

he has the import of these facts PAS on Sunday understood

‘He understood the imports of these facts only on Sunday’

The interest of *pas* for our current purposes lies in the extreme locality required for association with a temporal modifier. Barbiers (1995) and Neeleman (2017) argue that *pas* must immediately c-command its associate, as stated in (69).⁸ (The notion of asymmetric c-command in (69) is defined as follows: α asymmetrically c-commands β iff α c-commands β , and β does not c-command α):

(69) *Pas* must c-command its associate XP, and there can be no YP such that *pas* asymmetrically c-commands YP, and YP asymmetrically c-commands XP.

The main evidence for the immediate c-command condition is that *pas* must be adjacent to its associate in examples like (68). Thus, there is a sharp contrast between (68) and (71a) on the one hand, and (71b) on the other.

⁸ Barbiers in fact argues that *pas* must immediately c-command its semantic argument, which in turn must contain its associate. This distinction is not relevant for the data discussed in the main text.

(70) a. Hij heeft pas op zondag het belang van deze feiten begrepen.

he has PAS on Sunday the import of these facts understood

b. *Hij heeft pas het belang van deze feiten op zondag begrepen.

he has PAS the import of these facts on Sunday understood

The adjacency requirement between *pas* and a preverbal associate holds quite generally. For instance, a so-called R-pronoun extracted from a PP can land above *pas* or below its PP associate, but not in between the two (see (71)). Similarly, contrastively focused PP cannot move to a position in between *pas* and its associate (see (72)).

(71) a. Jan heeft er pas [na drie jaar] wat t_R over gelezen.

John has there PAS after three year something about read

‘John has only read something about that after three years’

b. *Jan heeft pas er [na drie jaar] wat t_R over gelezen.

John has PAS there after three year something about read

c. Jan heeft pas [na drie jaar] er wat t_R over gelezen.

John has PAS after three year there something about read

(72) a. Jan heeft daar-over pas [na drie jaar] wat t_{PP} gelezen.

John has there-about PAS after three years something read

‘John has only read something about that after three years’

b. *Jan heeft pas daar-over [na drie jaar] wat t_{PP} gelezen.

John has PAS there-about after three year something read

c. Jan heeft pas [na drie jaar] daar-over wat t_{PP} gelezen.

John has PAS after three year there-about something read

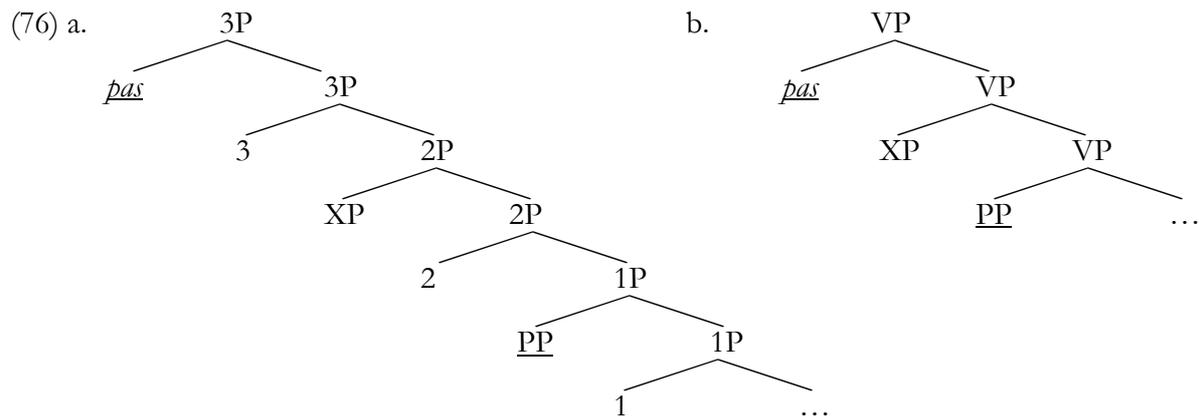
Strikingly, *pas* can associate with a postverbal PP, even if other material intervenes:

- b. dat Gordon een gerecht pas vaak voor gasten bereidt na twee geslaagde pogingen

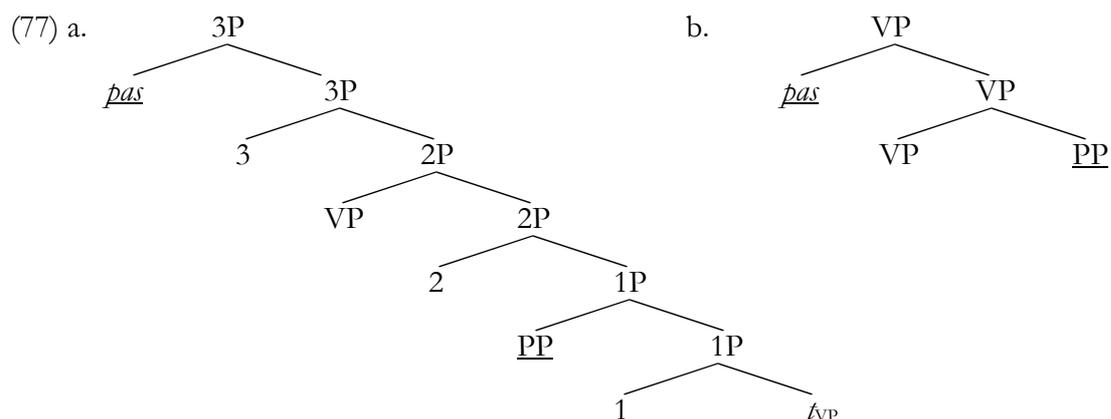
that Gordon a course PAS often for guests prepares after two successful trials

*often > after two trials; after two trials > often

We are now in a position to put together the argument against an antisymmetric analysis of PP extraposition in Dutch. We first consider the ungrammaticality of structures in which *pas* is separated from a preverbal associate (as in (70b), (71b) and (72b)). Both the traditional and the antisymmetric analysis of Dutch word order can capture this data point. In the antisymmetric representation in (76a), the intervening element induces a violation of the immediate c-command condition: *pas* asymmetrically c-commands XP, and XP asymmetrically c-commands PP. The same holds of the more traditional representation in (76b).



We next consider the cases in which *pas* associates with a postverbal associate (as in (73) and (75)). The traditional account faces no problem here. The relevant examples have a structure in which *pas* immediately c-commands the temporal PP (see (77b)), which explains why association is possible. As it turns out, however, the antisymmetric account assigns (73) and (75) a structure that violates (69): in (77a) *pas* asymmetrically c-commands the fronted VP, and that VP asymmetrically c-commands PP. Thus, antisymmetry fails to distinguish the grammatical examples in (73) and (75) from the ungrammatical ones in (70)-(72).



It hard to see what could remedy this difficulty.⁹ As the structures in (76a) and (77a) are isomorphic, any attempt to accommodate the grammaticality of (77a) is likely to also incorrectly permit (76a).

8.3 *Temporal* only

English does not have an unambiguous counterpart of *pas*. However, *only* can associate with a temporal modifier to yield a reading in which the event described takes place later than expected. For example, the most natural interpretation of (78) is that Sunday was late for Susan to understand the central question of the paper she was studying, in contradistinction to the more common exclusive interpretation of *only*, which in the case at hand would imply that Sunday was the only day on which Susan understood the paper’s central question (she understood it neither before nor after; compare *she only_{EXCL} ate fish on SUNDAY*, which implies that she didn’t eat fish on any other day). Here and below, we will refer to this *pas*-like use of the focus-sensitive particle as ‘temporal *only*’.

(78) [Susan has been studying this paper for months.]

She only_T understood its central question last Sunday.

There is reason to think that the immediate c-command condition in (69) extends to temporal *only*.

⁹ Barbiers (1995) develops an unconventional way of rolling up structures that avoids this difficulty, but faces others (see Neeleman 2017 for discussion).

expresses that only after two successful trials will Gordon regularly prepare a dish for guests (the numbers between brackets indicate how many of our panel allowed the relevant reading).

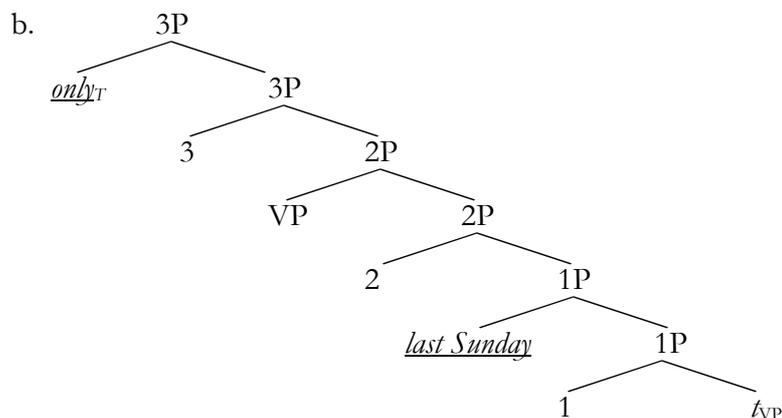
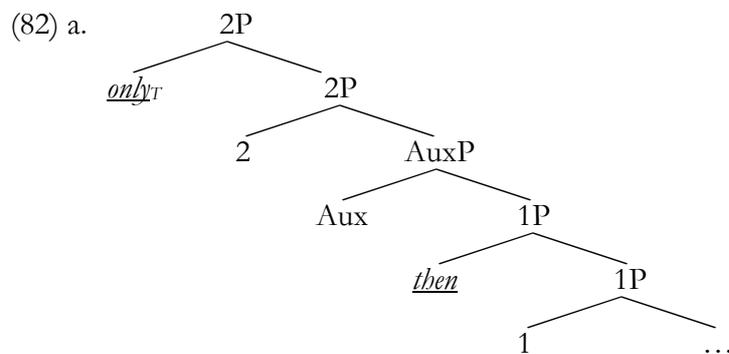
(81) a. Gordon often only_T prepares a dish for guests after two successful trials.

often > after two trials (10/10); *after two trials > often (1/10)

b. Gordon only_T often prepares a dish for guests after two successful trials.

*often > after two trials (1/10) ; after two trials > often (9/10)

If the immediate c-command condition indeed extends to temporal *only*, then the argument against roll-up movement based on Dutch can be replicated for English. On a standard symmetric view of phrase structure, *only*_T immediately c-commands its associate in examples like (78), but not in examples like (80c) (where *have* is a closer c-commanding category). By contrast, an analysis in which the generation of postverbal modifiers involves roll-up movement cannot make the right cut. If anything, temporal *only*_T is closer to its associate in (82a) (which represents (78)) than it is in (82b) (which represents (80c)). Therefore, both configurations violate the immediate c-command condition.



Given this difficulty, it is doubtful that antisymmetry can provide an adequate account of the order of postverbal adverbials. By implication, this means it cannot shed much light on the core observations established in sections 3-5 either, leaving the symmetric version of the extraction analysis as the more successful contender.

9. The bigger picture: Verb movement in English

The main conclusion that can be drawn from the preceding sections is that if an adverbial intervenes between a verb and a selected PP, this is a consequence of PP extraposition, rather than the result of the verb moving away from the PP. This conclusion creates a curious problem: how can the verb raising analysis be wrong, given the widely acknowledged evidence for verb movement elsewhere?¹⁰ In double-object constructions, for instance, it is very likely that the verb moves across the indirect object (see Larson 1988 and much subsequent work):¹¹

(83) I gave [_{VP} William [_{V'} *t*_V [a copy of *War and Peace*]]].

One way to resolve the tension between our findings and the evidence from double object constructions, etc., is to assume that there are no adverbial attachment sites below the position in which the verb lands. This would make it impossible for verb raising to generate V-Adv-PP orders. We will show, however, that an account along these lines is unlikely to be correct (see experiments

¹⁰ The discussion in this section abstracts away from the notion that a verb consists of an acategorial root and a categorizing functional head (see Marantz 2001 and much subsequent work). Our conclusions can be reconciled with this hypothesis as long as the categorizer combines with the root before any arguments are merged.

¹¹ Larson (1988) uses binding asymmetries and related data to argue for VP-shell structures (basing himself on Reinhart's (1976) claim that binding is conditioned by c-command). There is reason to think, however, that binding is not always a reliable structural diagnostic (for relevant discussion, see Williams 1997, Hoeksema 2000, Barker 2012, Janke and Neeleman 2012, and Bruening 2014). A criterion that has more appeal to us is based on the observation that in OV languages indirect objects precede direct objects in unmarked word order. If this is a function of the preferred order of merger (such that direct objects are merged before indirect objects), then English double object constructions must have a VP-shell structure.

9 and 10 below).

An alternative solution would be to argue that verb raising does not take place across the board, but is restricted to specific environments. It takes place in double object constructions, for example, but not in structures of PP complementation.

A proposal that makes this cut can be found in Janke & Neeleman 2012. It is based on two assumptions, neither of which is particularly controversial. The first is that objects must meet a condition of Case Adjacency, as already argued in Stowell 1981. The second is that objects do not have to be sisters to the verb, but can in fact be structurally separated from it by elements that may be merged sufficiently low.

This rejection of verb-object sisterhood is in line with our earlier suggestion (in section 3.1) that PP extraposition across manner adverbials can be the result of base generation. We may simply assume that there is variation in the base position of PP complements with respect to manner adverbials, which may occupy the position marked XP in (84).



Evidence for this analysis comes from *do so* ellipsis. Crucially, the constituent replaced by *so* cannot contain a trace bound from outside the ellipsis site (see Haddican 2007 and references mentioned there). We illustrate this restriction for *wh*-movement in (85a) and for heavy XP shift in (85b). But if *so* cannot contain a trace, the PP in (85c) cannot have escaped the ellipsis site through movement – it must have been base-generated outside of it (data from Janke and Neeleman 2012).

- (85) a. A: I [read a novel]₁ every week without fail.
 B: Really? *So, [which novel] did you do [so]₁ last week?
- b. *John [read *t*₂ carefully]₁ [most of Ecclesiastes]₂ and Bill did [so]₁ [the entire Song of Solomon].

- c. Jordan [met secretly]₁ [with his lawyer], and William did [so]₁ [with his accountant].

If so, we would expect it to be possible to also generate a structure in which a DP object is structurally separated from the verb, as in (86b).

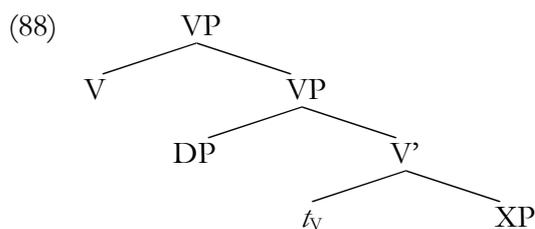


Note, however, that while (86a) satisfies Case Adjacency, the alternate structure in (86b) does not. Janke and Neeleman formulate this constraint as in (87); it is violated in (86b) because DP is preceded by XP in its assignment domain, <XP, DP>.

(87) *Case Adjacency*

- a. The assignment domain of a case-marked DP consists of that DP and any category linearly intervening between it and the case-assigning head.
- b. No XP can precede DP in its assignment domain.

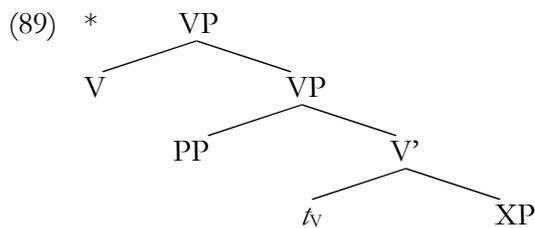
The problem with Case Adjacency can be solved by merger of the accusative DP to the left of V', followed by verb movement across it. In the VP-shell structure thus derived, the DP is right-adjacent to the verb, so that it comes first in its (trivial) case domain <DP>.¹²



On this analysis, VP shell formation is case-driven: the verb moves if and only if a case-marked internal argument is not the first constituent to merge with it. In all other circumstances, verb raising is blocked by economy considerations. This is of course relevant to structures of PP complementation, as PPs do not require case licensing. The structure in (89) is blocked by the

¹² In the double-object construction, XP is a DP case-marked by the verb's trace, in line with (87).

more economical structure in (84b) (which is derived without movement and is characterized by the same hierarchy, PP > XP > V).



As verbs whose sole argument is a prepositional complement are predicted to remain in situ, the above is sufficient to reconcile our case against the verb raising analysis of V-Adv-PP orders with the case for short verb movement in VP-shell structures.

The distribution of particles provides independent evidence for the conclusion that verbs may move in the context of selected DPs, but not in the context of selected PPs. It is widely assumed that separation of verb and particle is a function of verb raising (see Koster 1975 and much subsequent work; see Larsen 2014 for an overview of recent literature on particle constructions). If so, the contrast in (90) seems highly relevant:

- (90) a. John looked <up> the information <up>.
 b. John walked <out> on Mary <*out>.

Janke and Neeleman develop the argument as follows. They assume (i) that particles form a complex predicate with the verb (see Johnson 1991 and Roeper & Keyser 1992), and (ii) that particles project optionally. This allows for two structures, [V Prt] and [V PrtP], each of which can merge with a selected DP or PP. If a particle verb selects a DP and the particle does not project, as in (91a), case adjacency is satisfied (notice that the DPs case assignment domain in (91a) is <Prt, DP>; (87) specifically mentions XPs, which implies that only intervening maximal projections violate Case Adjacency). If in the same structure the particle were to project, case adjacency would be violated (the case assignment domain in (91b) is <PrtP, DP>). As before, English responds to this threat by moving the verb in a VP-shell structure (see (91c)).

- (91) a. John [_{VP} [_V looked up_{Prt}] [_{DP} the information]].

- b. *John [VP [V looked up_{PrtP}] [DP the information]].
- c. John [_{V'} looked [VP [DP the information [V *t*_V up_{PrtP}]]]].

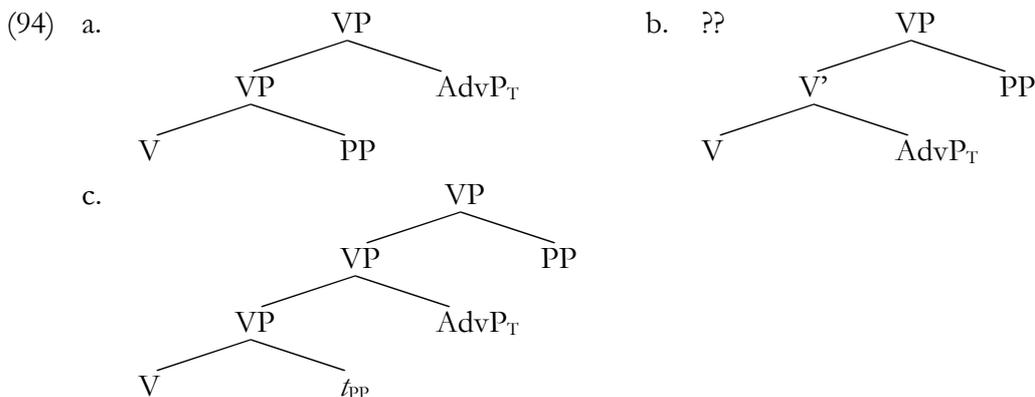
As only particles that project can host modifiers and complements, it follows that any such extra material is excluded in the V-Prt-DP order, but permitted in the V-DP-PrtP order. This well-known fact is illustrated below using the prepositional modifier *right* (see Den Dikken 1995):

- (92) a. *John [VP [V looked [PrtP right up]] the information].
- b. John [_{V'} looked [VP the information [V *t*_V [PrtP right up]]]].

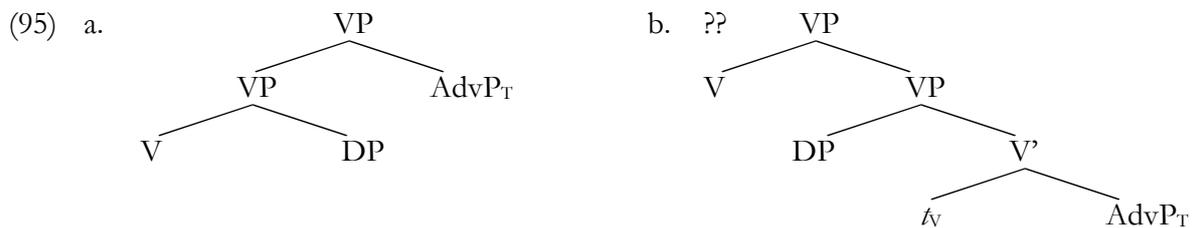
If a particle verb selects a PP, case adjacency does not come into play. This has two implications. First, there is no longer a trigger for verb movement, not even when the particle projects. In the absence of a trigger, verb movement is blocked, so that the particle must surface adjacent to the verb. Second, modification of the particle is unproblematic, even though it appears between the verb and a selected category:

- (93) a. John [VP [V walked (right) out] on Mary]].
- b. *John [_{V'} walked [VP on Mary [V *t*_V (right) out]]].

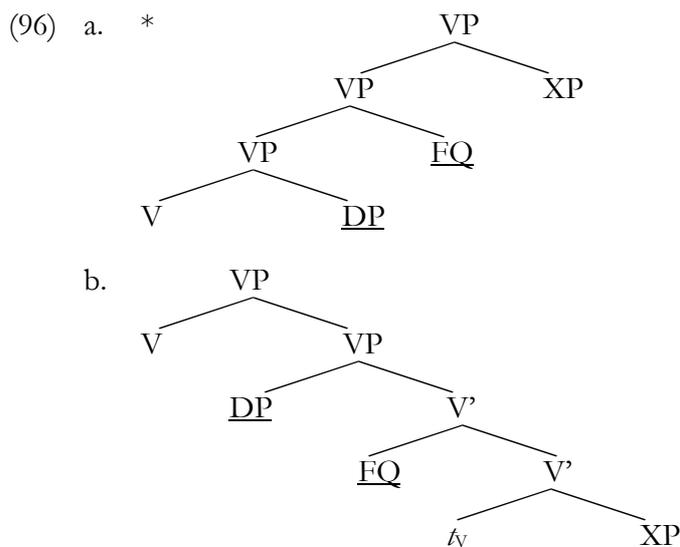
In section 3.1, we suggested that time adverbials differ from manner adverbials in that they resist merger below selected PPs, so that the V-Adv_T-PP order does not result from base generation, as in (94b), but from movement, as in (94c). (We adopted this account because PP extraposition across time adverbials requires an interpretive license, while PP extraposition across manner adverbials does not.)



If so, we would also expect that time adverbials, unlike manner adverbials, resist merger below an object in a VP-shell structure:



This prediction can only be tested if there is a way of forcing a VP-shell structure. Janke and Neeleman (2012) argue that this can be achieved through insertion of an object-oriented floating quantifier. These can appear in VP-shell structures, but not in traditional ascending VPs, because floating quantifiers must be c-commanded by their antecedent DP and (as a language-specific property of English) precede the node they are merged with:



The claim that VP-shell formation is necessary to license object-oriented floating quantifiers captures an observation by Maling (1976). Maling notes that object-oriented floating quantifiers are grammatical only if followed by some other element (say, a manner adverb):

(97) Mary read the books both *(carefully)

This follows, as VP-shell formation takes place in order to circumvent a potential violation of Case Adjacency. If the only element following the verb is the object, verb-object adjacency is guaranteed, and VP-shell formation is blocked. (Recall that floating quantifiers precede the node

they combine with, and can therefore not motivate VP-shell formation).

VP topicalization can be used to show that the element that ‘saves’ the floating quantifier must be merged low. The structures in (86a) and (88) differ in that (86a) allows XP to be stranded under VP topicalization, but (88) does not, as verb and object do not form a constituent. If object-oriented floating quantifiers indeed require VP-shell formation, it is predicted that the presence of such an element blocks stranding of XP. This turns out to be correct. Consider the case where XP is a manner adverbial. The examples in (98) show that VP topicalization can strand or pied-pipe a manner adverbial.

- (98) a. Mary promised she would read the two books I sent,
and read both books she did carefully. (10/10)
- b. Mary promised she would carefully read the two books I sent,
and read both books carefully she did. (10/10)

Insertion of an object-oriented floating quantifier leads to a sharp drop in the acceptability of the stranding derivation (see (99a,b)). By contrast, pied-piping remains possible (see (99c)).

- (99) a. *Mary promised she would read the two books I sent,
and read the books both she did carefully. (0/10)
- b. *Mary promised she would read the two books I sent,
and read the books she did both carefully. (0/10)
- c. Mary promised she would carefully read the two books I sent,
and read the books both carefully she did. (9/10)

If object-oriented floating quantifiers indeed diagnose VP-shell structures, then the hypothesis that temporal adverbials resist merger below selected categories predicts that there should be a contrast between the acceptability of (100a) and (100b), on a par with the contrast between PP extraposition across manner and time adverbials.

- (100) a. John studied the letters both carefully.

- b. ??John studied the letters both yesterday.

In order to test this prediction, we ran an AMT experiment (**experiment 9**) in which participants were asked to judge ten pairs of test sentences modelled on (100) (as before, the test had a Latin Square design and included fillers and questions to check that participants were paying attention to the task). The results show that, as expected, object-oriented floating quantifiers are less acceptable when followed by a time adverbial:

(101)	V-DP-FQ-Adv _M	V-DP-FQ-Adv _T
	4.29 (1.05)	3.11 (1.58)
	p<0.0001	

Experiment 9: Acceptability of FQs followed by a manner/time adverbial ($n=80$).

A one-factor ANOVA confirms that the main effect of adverb type is significant ($F(1,79)=30.68$; $p<0.0001$).

There is a second set of data that confirm that manner adverbials, but not time adverbials may appear within VP. The former may appear in pre-particle particle position, for instance in dative constructions, but the latter may not. By contrast, both manner and time adverbials may appear in between the particle and the dative PP.

- (102) a. Matt passed the sharp tools foolishly down to Raven.
 b. Matt passed the sharp tools down foolishly to Raven.
 c. *Matt passed the sharp tools yesterday down to Raven.
 d. Matt passed the sharp tools down yesterday to Raven.

The pre-particle attachment site is located below an internal argument and should therefore only be able to host low adverbials. By contrast, strings in which an adverbial surfaces between the particle and the PP complement are generated by PP extraposition. As extraposition can cross time adverbials (with the provisos discussed in section 3.1), we expect post-particle adverbial attachment to be more liberal than pre-particle attachment. In order to test these predictions, we ran an experiment on Amazon Mechanical Turk (**experiment 10**). The experiment had a Latin

Square design, with eighty participants who judged ten sets of four test sentences that differed in the order of manner and time adverbials with respect to particles..

The results confirm our predictions:

	Prt-Adv _M	Adv _M -Prt	Prt-Adv _T	Adv _T -Prt
(103)	4.06 (2.06)	3.91 (2.16)	4.43 (2.15)	3.04 (1.76)

Experiment 10: Word order preferences for time and manner adverbials with respect to particles in dative constructions ($n=80$).

A two-factor ANOVA (adverbial type \times particle-adverb order) shows that there is no significant main effect of adverbial type ($F(1,79)=1.27$, $p=0.26$). However, there is a significant main effect of particle-adverb order ($F(1,79)=11.39$, $p<0.001$) and, as predicted, a significant interaction between adverbial type and particle-adverb order ($F(1,79)=7.38$, $p<0.001$). Post-hoc t-tests confirm the nature of the interaction: the two orders of manner adverbials with respect to particles do not attract significantly different scores ($p=0.65$), but there is a clear preference for placing time adverbials in post-particle position ($p<0.0001$).

That manner adverbials can be merged VP-internally is relevant not just for the analysis of PP extraposition, but crucially also for the issue of verb raising. As already mentioned, the tension between our findings regarding PP extraposition and the standard view that verbs in English uniformly raise to some low functional head could be resolved if the position in which the verb lands were located below the lowest adverbial attachment site. However, this cannot be true. As experiments 9 and 10 show, there are adverbial attachment sites low enough for the verb to move across.

We conclude, then, that that English has verb raising in some structures but not others. One way to make the right cut is to treat VP-shell formation as triggered by case. The verb remains in situ unless there is a case-marked internal argument merged subsequently to a postverbal XP.¹³

¹³ This account would in principle allow for raising-to-object and verb movement in AcI constructions (see Postal 1974, Johnson 1991, Runner 1998, and Lasnik 1999, among many others). That is, one could hypothesize that in

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examples like *John believed Mary sincerely to be the winner*, the embedded subject raises into the main clause, and that the matrix verb subsequently moves across it to license its case (see (i)). However, Neeleman and Payne (2019) demonstrate that such an analysis is defeated by an alternative in which the embedded subject and the matrix verb remain in situ and intervention of matrix material results from extraposition of the embedded predicate, as in (ii).

(i) John [believed [Mary [sincerely [_V [_S _t_{DP} to be the winner]]]]].

(ii) John [[[believed [_S Mary _t_{II}]] sincerely] [_{II} to be the winner]].

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