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When a clause contains more than one scope-taking element, the question always arises as to what determines their relative scope relations, especially when these scope relations are not reflected by their surface order. In this article, we discuss one such scopal interaction, namely the scopal relations between negation and deontic modals.

Existential deontic modals (‘ $\Diamond$ ’) in English and as far as we know in all languages scope under negation:

- However, some universal deontic modals (‘□’) scope over negation, whereas other universal modals scope under negation. This can be attested in English as well as in other languages:

- (5) a. Hans moet niet vertrekken  $\square > \neg^2$  Dutch  
Hans must NEG leave

<sup>2</sup> Not in every Dutch dialect *moeten* ('must') scopes over negation; in most southern and eastern varieties it scopes under negation (as in German).

'Hans musn't leave'

- b. ... dat Hans niet moet vertrekken  $\Box > \neg^3$   
 ... that Hans NEG must leave  
 '... that Hans musn't leave'
- (6) a. tumhen Dilli nahiiN jaa-naa hai. <sup>4</sup>  $\neg > \Box$  Hindi  
 you.DAT Delhi NEG go-INF be.PRES  
 'You don't have to go to Delhi.'
- b. tumhen Dilli nahiiN jaa-naa caahiye.  $\Box > \neg$   
 you.DAT Delhi NEG go-INF should  
 'You should not go to Delhi.' modal NEG
- (7) a. Hans muss nicht abfahren  $\neg > \Box$  German  
 Hans must NEG leave  
 'Hans does not have to leave'
- b. ... dass Hans nicht abfahren muss  $\neg > \Box$   
 ... that Hans NEG must leave  
 '... that Hans doesn't have leave'

In addition, there are universal deontic modals which must appear in the scope of negation, such as English *need*, Dutch *hoeven* and German *brauchen*. These modals are standardly taken to be NPIs (van der Wouden 1994 et seq):<sup>5</sup>

- (8) a. You need \*(not) leave<sup>6</sup>  
 b. No /\*every /\*some student need leave
- (9) a. Hans braucht \*(nicht) zu gehen  $\neg > \Box$  German

<sup>3</sup> Dutch speakers for whom *moeten* ('must') scopes over negation in main clauses generally allow the reverse reading in subordinate clauses to, i.e. (5)b can be ambiguous (see section 4.1 for more discussion).

<sup>4</sup> Data from Rajesh Bhatt p.c. in von Stechow and Iatridou 2007

<sup>5</sup> Are NPI Deontic modals a proper subset of the universal ones? For the languages we have investigated, this is definitely the case but what about other languages? Van der Auwera 2001 discusses one possible counterexample: Russian 'nel'zja', which consists of negation *ne* followed by the existential modal 'l'zja'. Van de Auwera says that this modal element requires the presence of negation and always scopes under it and the native speakers we consulted agreed with this. Is it an NPI then? Our Russian speakers also told us that nothing can intervene between negation and 'l'zja', not even the past tense marker, which can intervene between negation and other modals. Apparently, if one forcibly tries to insert past tense 'byl' between negation and 'l'zja', the result is like trying to infix something in a word. This means that 'l'zja' is not an NPI but 'nel'zja' is a word, much like English 'impossible' consists of negation attached to a low scoping existential modal, with the difference that 'l'zja', unlike 'possible' is not a word on its own.

<sup>6</sup> Note that NPI *need* differs from *need to* in lacking the marker *to*, as well as inflectional morphology and in that it linearly precedes negation:

- i. He need(\*s) not leave
- ii. He needs to leave
- iii. He does not need to leave

Hans need not go

- b. Kein/\*jeder/\*ein Student braucht zu gehen
- (10) a. Je hoeft \*(niet) weg te gaan.  $\neg > \Box$  Dutch  
 You need not away to go  
 b. Geen/\*iedere / \*een student hoeft weg te gaan

## 1.2 Polarity-sensitive modals

There are at least two previous types of accounts that have aimed to address the question of the scopal interaction between modals and negation. In one type the basic idea is that different modals are generated in different heights of the tree (some above negation; others below) and that differences between similar types of modals of similar quantificational force (like universal *need to* and *must*) are due to lexical idiosyncracies (Cormack and Smith 2002, Butler 2003).

The second type of approach (Horn 1989, 2007, De Haan 1997) relates the scopal behavior that modals exhibit with respect to negation to the functional needs of a language to express negated modality. Since there is a functional need in languages to express both  $\neg > \Box$  and  $\Box > \neg$ , languages may have a different universal modal items for each scope relation. As a result of some pragmatic mapping principle each modal element is then specified for a particular scope relation.

The problem with both types of approaches is that they reduce the difference between the two types of universal modals to idiosyncracies: there is no principled difference that sets the two different types of modals apart. Moreover, under these approaches it is impossible for a modal that generally scopes over negation to scope under negation in particular cases. However, as will become clear in the next section, this is very well possible.

For these reasons, in Iatridou and Zeijlstra (2010) we took a completely different approach. We started from the assumption that since NPIs surface in the domain of deontic modality, we might also expect there to be Positive Polarity Items (PPIs)<sup>7</sup>, basing ourselves on the working hypothesis that any domain that has one class of polarity items also has the other (along the lines of Van der Wouden 1994).

In short, we analyzed modals that scope over negation, namely English *must*, *should*, *ought to*, Greek *prepi*, Hindi *caahiye* etc. as PPIs, a conclusion first suggested in Israel (1996) and also reached in Homer 2010 for English *must*. We called modals that scope under negation but do not require negation “neutral”. This means that in English, deontic modals group as follows:

	PPIs	Neutral	NPIs
Universal	<i>must, should, ought to, to be to</i>	<i>Have to, need to</i>	<i>Need</i>
Existential	-	<i>Can, may</i>	-

<sup>7</sup> PPIs are elements that cannot appear in the (immediate) scope of an anti-additive operator or the larger class of Downward Entailing operators.

Focusing on the universal modals, we see that immediately, three questions arise, which we will discuss in the following three sections:

- Q1:** To what extent do PPI modals and better-known PPIs exhibit the same distributional behavior?
- Q2:** How do modals take scope with respect to negation given their polarity requirements and their surface position?
- Q3:** How can the NPI/PPI properties of modals be captured?

It is these three questions that we will address in this article. Once we have good answers to these three questions it can safely be concluded that it is NPI and PPI properties of modals that underlie their scopal relations with respect to negation.

The article is set up as follows. In section 2, we address Q1 and we demonstrate that the distributional patterns of the alleged modal PPIs and other PPIs are virtually identical. In section 3, we will address Q2 and show that all non-PPI modals must reconstruct to a position below negation. In section 4, we will address Q3 and investigate to what extent current theories of negative and positive polarity can answer the question as to what particular property makes that modals like English *must* are PPIs, modals like English *need* NPIs and modals like English *have to* neutral. Section 5 concludes.

## **2. Q1. To what extent do PPI modals and better-known PPIs exhibit the same distributional behavior?**

The first question that arises is how it can be established that those modals that outscope negation are PPIs. Just saying that these are PPIs because they cannot take scope under negation is not sufficient. Are there additional arguments that those modals that outscope negation are indeed PPIs? We answer this question in the affirmative by comparing distributional properties of better known PPIs, such as English *some*, with distributional properties of modals that outscope negation. If the distributional properties of those modals that take scope over negation are similar to those of other PPIs (or if any differences between them receive independent explanation), we can conclude that the scopal properties of such modals follows from their PPI-hood.

The behavioral characteristics of PPIs distribute along three dimensions:

First, Szabolcsi (2004) and references cited there show that although PPIs are generally banned from negative contexts, there are actually three types of negative contexts in which all known PPIs, such as English PPI *some NP*, may surface under the scope of negation. We take these behavioral properties as diagnostics for PPI-hood and it will be shown in sections 2.1-3 in detail that according to these diagnostics modals outscoping negation are also PPIs.

Second, it is also attested that, just like NPIs, PPIs may vary with respect the exact logical properties of their licensing contexts: some PPIs are banned in all downward-entailing contexts (so-called strong PPIs), whereas other PPIs are banned in anti-additive or anti-morphic

contexts only (PPIs of medium strength or weak PPIs respectively). In section 2.4 it will turn out that the same kind of variation is also attested amongst PPI modals.<sup>8</sup>

Third, it is known that those PPIs that count as weak PPIs or PPIs of medium strength are fine under negation once that negation itself is embedded in a downward entailing context. Strong PPIs, by contrast, cannot appear in such contexts. We will see in section 2.5 that this contrast also applies to PPI modals.

Given that the distributional patterns discussed above are the same for better known PPIs and for modals that take scope over negation, we conclude that those modals are PPIs indeed.<sup>9</sup>

## 2.1. Metalinguistic/contrastive negation

PPIs may appear under the scope of metalinguistic negation and/or contrastive negation (cf. Szabolcsi 2004 and references therein), as is shown for English *something* below:

- (11) You didn't do SOMETHING wrong, you did everything wrong!
- (12) If you push the red button, you will see something, but if you press the blue button you WON'T see something.<sup>10</sup>

It is thus predicted that if modals such as Dutch *moeten*, Greek *prepi* or English *must* are PPIs, they should also be fine under the scope of metalinguistic negation and/or contrastive negation. For Greek *prepi* and Dutch *moeten* this straightforwardly appears to be the case, as is shown in (13) and (14).

- (13) Se afto to scholio prepi na dhiavazis poli. Se ekino to scholio then  
In this the school, must read much. In that the school neg  
prepi na dhiavazis poli  
must read much  
'If you go to this school you will must to study a lot. If you go to that school you  
mustn't study a lot.'
- (14) Op deze school moet je hard werken; maar op die school moet je niet hard werken  
At this school must you hard work; but at that school must you NEG hard work  
'At this school you must work hard; but at that school you mustn't work hard'

<sup>8</sup> Anti-additive functions are a subset of D(ownward) E(ntailing) functions. A function  $f$  is anti-additive iff  $f(X \vee Y) \Leftrightarrow f(X) \wedge f(Y)$ . The left-to-right direction is automatic for DE functions: the set of things which are either X-s or Y-s is a superset of the set of X-s and the set of Y-s, so if inferences to subsets are guaranteed, as they are with DE operators, then  $f(X \vee Y) \Rightarrow f(X) \wedge f(Y)$ . What is crucial for anti-additivity, and is *not* true for all DE functions, is the other direction,  $f(X) \wedge f(Y) \Rightarrow f(X \vee Y)$ .

*No professor* is anti-additive because *No professor drinks and no professor smokes*  $\Rightarrow$  *No professor drinks or smokes*. On the other hand, *at most one professor* is not anti-additive, though it is DE: if *At most one professor drinks and every professor smokes*, it does not follow that necessarily *At most one professor drinks or smokes* (we are interested only in the reading where *at most one* scopes over disjunction). It may be that one professor drinks, and another one smokes, in which case it is not true that *At most one professor drinks or smokes*.

<sup>9</sup> Homer (2010), who has independently and for different reasons reached the conclusion that English *must* is a PPI already provided a series of additional arguments, adopting the diagnostics provided by Szabolcsi (2004), which show that *must* indeed is a PPI.

<sup>10</sup> Based on an example by R. Szwarcchild (p.c. to Szabolcsi)

Similarly, as observed in Iatridou and Sichel (2011), contrastive focus on the modal itself in Greek (and also in Dutch) permits modals that normally scope over negation to scope under it:

- (15) A: o Kostas prepi na grapsi 2 arthra fetos  
The Kostas must write 2 article this year  
'Kostas must write 2 articles this year'
- B: dhen PREPI na grapsi 2 ala kala tha itan.  $\neg > \square$   
Neg MUST write 2 but good fut be-pst  
'He doesn't have to but it would be good'
- (16) A: Theresa moet op negatie werken  
Theresa must on negation work  
'Theresa must work on negation'
- B: Ze MOET niet op negatie werken,  $\neg > \square$   
She must neg on negation work  
ze wordt hooguit aangemoedigd  
she is at best encouraged  
'She doesn't have to work on negation; she is at best encouraged'

On the other hand, English *must* cannot be contrastively focused when it appears in a sentence with a negative marker:

- (17) A: He must read 5 books  
B: # He MUST not read 5 books but he is encouraged to do so

However, this is due to an independent property of English contrastive focus. Following Jackendoff's (1972) discussion on licensing of focus, if negation licenses focus, it must c-command the focus already at S-structure.<sup>11</sup> This explains why (17)B is ruled out.

However, it is possible to find cases in English where *must* appears in the scope of contrastive negation, while preceded at surface structure Iatridou & Sichel (2011) point out that negative subjects scope in exactly the same way with respect to modals as plain negative markers do, while at the same time preceding the modal at S-structure. Therefore the negation in a negative subject is expected to license the modal's focus. Consequently, a modal like *must* should be allowed to take scope under contrastive negation induced by a negative subject. This is indeed the case, as is shown in (18). Predictably, negation contained in an object cannot focus the modal, for the same reason that sentential negation fails to do so (see (19)).

<sup>11</sup> Note that the application of this criterion is not universal, as one could have guessed already from the fact that the Dutch (14) is OK, unlike the English (17). In Dutch and German V2 constructions verbs can be focused from a lower negation. In non-V2 cases, precedence conditions similar to what we saw for English apply (cf. Jacobs 1980 and others). In sections 3 and 4 we will come back to the V2 vs. non-V2 distinction.

- (18) A: Everybody must read 5 articles on the topic  
 B: Nobody MUST read 5 articles on the topic but they are encouraged to do so.
- (19) A: He must read certain articles on the topic  
 B: # He MUST read no article on the topic but he is encouraged to do so.

Thus, English *must* can appear under the scope of metalinguistic and/or contrastive negation as well, thus meeting the first criterion of PPI-hood too.

## 2.2 *Intervention effects*

A sentence with a PPI in the immediate scope of an anti-additive operator is bad (cf. Szabolcsi 2004 and references therein). However, when the PPI is not in the immediate scope of an anti-additive operator, since some other intervening element takes scope between the anti-additive operator and the PPI, the sentence is fine again (cf. Kroch 1979).<sup>12</sup> This is illustrated in the following examples taken from Szabolcsi (2004).

- (20) a. John didn't offend someone because he was malicious (but because he was stupid).  $\sqrt{\text{not} > \text{because} \dots > \text{some}}$   
 b. Not every student said something.  $\sqrt{\text{not} > \text{every} > \text{some}}$   
 c. John didn't say something at every party.  $\sqrt{\text{not} > \text{every} > \text{some}}$   
 d. John doesn't always call someone.  $\sqrt{\text{not} > \text{always} > \text{some}}$   
 e. John didn't show every boy something.  $\sqrt{\text{not} > \text{every} > \text{some}}$

Again, it is predicted that if a modal that outscopes negation is a PPI, it can appear under the scope of an anti-additive operator as long as some other scope-taking element intervenes between that operator and that modal.

This is indeed the case. As is shown below, the intervention tests straightforwardly apply for Greek *prepi* and Dutch *moeten*, and as is indicated by the translations, for English *must* as well. The readings that (21)-(22) give rise to have the scopal relations: negation > because > must; the readings of (23) and (24) are: negation > always > must.<sup>13</sup>

- (21) Dhen prepi na ton pandrefti epidhi ine oreos ala epidhi ine eksipnos  
 Neg must him marry because is handsome but because is smart  
 'She must not marry him because he is handsome but because he is smart'

<sup>12</sup> Note that this is similar to the Immediate Scope Constraint that states that NPIs are banned from contexts where another element takes scope in between the NPI and its licenser (cf. Linebarger 1980, 1987).

<sup>13</sup> Though to get this reading in example (23B) it is preferred to use the NPI *hoeven* instead of *moeten*.

- (22) Ze moet niet met hem trouwen omdat hij er goed uit ziet,  
 She must NEG with him marry because he there goed out looks  
 maar omdat hij een goede taalkundige is  
 but because he a good linguist is  
 'She must not marry him because he looks smart but because he is a good linguist'
- (23) A: Panda esi prepi na vgazis ta skupidia?  
 always you must take-out the garbage  
 'Must you always take out the garbage'
- B: dhen prepi na ta vgazo panda. Polles fores ta vgazi o yios mu  
 NEG must always take out the garbage. Many times it take-out the son my  
 'I mustn't always take the garbage outside. Many times my son does that'
- (24) A: Moet je altijd het vuilnis buiten zetten?  
 Must you always the garbage outside put  
 'Must you always put the garbage outside?'
- B: Nee, ik moet niet altijd het vuilnis buitenzetten; vaak doet Jan het  
 No I must NEG always the garbage outside-put; often does Jan it  
 'No I mustn't always take the garbage outside; Jan often does that'

So English *must*, Greek *prepi* and Dutch *moeten* also obey this second criterion of PPI-hood.

### 2.3 *Clause-external negation*

A third property of PPIs is that they are fine in the scope of negation if the latter is extra-clausal (Szabolcsi 2004: 24-27), as illustrated in (25):

- (25) a. I don't think that John called someone. not > [CP/IP some  
 b. No one thinks/says that John called someone. no one > [CP/IP some  
 c. I regret that John called someone. regret > [CP/IP some  
 d. Every boy who called someone got help. every [CP/IP some

As expected, clause-external negation is also able to scope above Greek *prepi*, English *must* and Dutch *moeten*, showing one more environment where these behave like better known PPIs.

- (26) Dhen nomizo oti prepi na figi  
 neg think that must leave  
 'I don't think that s/he must leave'
- (27) Ik denk niet dat ze moet vertrekken  
 I think NEG that she must leave



‘I don’t think that she must leave’

## 2.4 Variation amongst PPIs

A fourth well-known observation about PPIs is that PPIs may differ with respect to the logical properties of their licensing contexts. Van der Wouden (1994) calls PPIs that are only banned from anti-morphic contexts weak PPIs. So-called PPIs of medium strength may not appear under the direct scope of an anti-additive operator and, finally, strong PPIs are banned from all downward entailing contexts. This is shown in table 1 for three Dutch PPIs, based on Van der Wouden (1994).

**TABLE 1: VAN DER WOUDE 1994:**

Weak PPI (only blocked in anti-morphic <sup>14</sup> contexts)	“nog” (yet)	*De monnik is niet nog gelukkig <i>The monk isn't yet happy</i> Niemand is nog gelukkig <i>Nobody is yet happy</i> Weinig monniken zijn <b>nog</b> gelukkig <i>Few monks are yet happy</i>
PPI of medium strength (blocked in all anti-additive contexts)	“een beetje” (a bit)	*De monnik is niet <b>een beetje</b> gelukkig *Niemand is <b>een beetje</b> gelukkig Weinig monniken zijn <b>een beetje</b> gelukkig
Strong PPI (blocked in all downward-entailing contexts)	“allerminst” (not in the least)	*De monnik is niet <b>allerminst</b> gelukkig *Niemand is <b>allerminst</b> gelukkig *Weinig monniken zijn <b>allerminst</b> gelukkig

If such variation is attested amongst 'plain' PPIs, it is expected that such variation is also attested in the domain of modals outscoping negation if these are taken to be PPIs. Again, this is indeed the case. *Should*, for instance, is a PPI, which cannot appear in the direct scope of any downward entailing context. *Must* and *to be to*, by contrast, are a weaker type of PPI, since they may appear in those contexts that are downward entailing but not anti-additive:

- |      |    |                                |   |
|------|----|--------------------------------|---|
| (28) | a. | Few students should leave      | Should > few; *Few > should                             |
|      | b. | Few students must leave        | Must > few; Few > must                                  |
|      | b. | Few students are to leave      | Are to > few; Few > are to                              |
| (29) | a. | Not every student should leave | Should > not every <sup>15</sup><br>*Not every > should |

<sup>14</sup> A function  $f$  is anti-morphic iff it is anti-additive ( $f(X \vee Y) \Leftrightarrow f(X) \wedge f(Y)$ ) and anti-multiplicative ( $f(X \wedge Y) \Leftrightarrow f(X) \vee f(Y)$ ). An anti-morphic function is an even stronger restriction than being anti-additive, and basically the only operator which is anti-morphic is the classical negation.

The paradigm in the examples contains three “levels” of being negative: sentential negation is anti-morphic, *nobody* is anti-additive, and *few people* is simply downward entailing.

<sup>15</sup> Homer (2011), following Horn (1989), takes the differences between *must* and *should* in the scope of negative universals like 'not everyone' is due to the fact that *should*, but not *must*, is a neg-raiser as well. However, this



- (34) a. The doctor doesn't think that Peter must stop smoking       $\neg > \text{must}$   
 b. The doctor doesn't think that Peter should stop smoking       $\neg > \text{should}$   
 b. The doctor doesn't think that Peter is to stop smoking       $\neg > \text{is to}$

So English at least exhibits variation between strong and less strong PPIs. This kind of variation can also be attested in Greek and Dutch. It should be noted though, that the Greek and Dutch modals that are comparable with *should*, are composites of the regular universal modal (*prepi/moeten*) and counterfactual morphology (In Greek, future plus past imperfective; in Dutch, a past future auxiliary, cf. Iatridou 2000; Von Stechow & Iatridou 2007):

- |      |   |       |
|------|---|-------|
| (35) | tha eprepe<br>fut must+past <sup>17</sup><br>'should', 'ought to' | Greek |
| (36) | zou moeten<br>would must<br>should', 'ought to'                   | Dutch |

As is shown below, the Greek and Dutch modals expressing *should* cannot take scope between downward entailing, but non-anti-additive operators, such as 'few' and 'only', whereas the regular universal modals *prepi* and *moeten* can.

- (37) a. Ligi fitites prepi na figun  
Few students must NA leave  
'Few students must leave'  
Must > few; Few > must
- b. Ligi fitites tha eprepe na figun  
Few students FUT must NA leave  
'Few students should leave'  
Should > few; \*Few > should
- (38) a. Mono o Iannis prepi na figi  
Only Iannis must NA leave  
'Only Iannis must leave'  
Must > only; Only > must
- b. Mono o Iannis tha eprepe na figi  
Only Iannis FUT must NA leave  
'Only Iannis should leave'  
Should > only; \*Only > should

<sup>17</sup> The verb 'prepi' is in a small class of verbs for which there is no perfective/imperfective distinction.

- (39) a.    Weinig studenten moeten vertrekken  
           Few students must leave  
           'Few students must leave'  
           Must > few; Few > must
- b.    Weinig studenten zouden moeten vertrekken  
           Few students would must leave  
           'Few students should leave'  
           Should > few; \*Few > should
- (40) a.    Alleen Jan moet vertrekken  
           Only Jan must leave  
           'Only John must leave'  
           Must > only; Only > must
- b.    Alleen Jan zou moeten vertrekken  
           Only Jan would must leave  
           'Only John should leave'  
           Should > only; \*Only > should

Moreover, it turns out that this is not the only type of variation that is attested amongst modals with respect to their PPI strength. Whereas *to be to* must always outscope negation and negative indefinites, as shown in (41), English exhibits variation amongst speakers with respects to the strength of *must* (42). While speakers agree on *must* having scope over the sentential negative marker, speakers differ in their judgments on sentences with *must* that contain a negative indefinite subject (cf. Iatridou and Sichel 2011): whereas all speakers assign a reading  $\Box > \neg > \exists$  to sentences like (42), some speakers of English also permit  $\neg > \exists > \Box$ . We refer these two varieties of English as “English A” and “English B”.

- (41) Nobody is to leave                   a.     $\sqrt{\Box} > \neg > \exists$ ,  $*\neg > \exists > \Box$     (English A and B)
- (42) Nobody must leave                   a.     $\sqrt{\Box} > \neg > \exists$ ,  $*\neg > \exists > \Box$     (English A)
- b.     $\sqrt{\Box} > \neg > \exists$ ,  $\sqrt{\neg} > \exists > \Box$     (English B)

Since *must* behaves the same in all the other diagnostics for both varieties of English, it follows that for speakers of English A *must* is a PPI of medium strength, so it cannot take scope in anti-additive contexts (like *nobody*). However, for speakers of English B, *must* is only banned in the direct scope of the negative marker. I.e., *must*, for those speakers, is a weak PPI, which is therefore fine in the complement of negative indefinites.

What we see, thus far, is that the landscape of PPIs that was presented in Table I for non-modal PPIs, naturally extends to modal PPIs, as is depicted in Table II below. This further strengthens our conclusion that it is PPI-hood that underlies the scopal properties of modals with respect to negation.

**TABLE II: DIFFERENT KINDS OF MODAL PPIs**

Weak PPI	Must (English B),	He mustn't leave Nobody must leave Few people must leave	*: $\neg > \square$ OK: $\neg > \exists > \square$ OK: $\text{few} > \square$
PPI of medium strength	Must (English A), to be to	He mustn't leave He isn't to leave Nobody must leave Nobody isn't to leave Few people must leave Few people aren't leave	*: $\neg > \square$ *: $\neg > \exists > \square$ OK: $\text{few} > \square$
Strong PPI	Should	He shouldn't leave Nobody should leave Few people should leave	*: $\neg > \square$ *: $\neg > \exists > \square$ *: $\text{few} > \square$

## 2.5 *Baker/ Szabolcsi facts*

A striking fact about PPIs is that whereas PPIs cannot be in the immediate scope of a clausemate negation/anti-additive operator, this configuration becomes licit when it is in the scope of an NPI licensing environment. This has been first observed by Baker (1970) and is also discussed at length in Szabolcsi (2004), for whom they are crucial to her explanation of PPI-hood (Szabolcsi 2004: 35-41). For this reason, we refer to these facts as the *Baker/Szabolcsi facts*. The relevant configurations of the Baker/Szabolcsi facts are represented and illustrated below:

- (43) a. \*Neg>PPI  
b.  $\sqrt{\text{NPI licenser}} > \text{Neg} > \text{PPI}$
- (44) a. I am surprised that John didn't call someone.  $\sqrt{\text{surprise}} > \text{not} > \text{some}$   
b. I regret that John didn't call someone.  $\sqrt{\text{regret}} > \text{not} > \text{some}$   
c. If we don't call someone, we are doomed.  $\sqrt{\text{if}} [\text{not} > \text{some}]$   
d. Every boy who didn't call someone...  $\sqrt{\text{every}} [\text{not} > \text{some}]$   
e. Only John didn't call someone.  $\sqrt{\text{only}} > \text{not} > \text{some}$   
f. Few boys didn't call someone.  $\sqrt{\text{few}} > \text{not} > \text{some}$   
g. Few boys thought that you didn't call someone.  $\sqrt{\text{few}} > \text{not} > \text{some}$

It turns out that the Baker/Szabolcsi facts do not apply to all PPIs, but only to those PPIs that are either weak or of medium strength. Strong PPIs cannot appear in the scope of a negation embedded in a downward entailing context. This is shown in (45)-(46) below for a number of Dutch strong PPIs.

- (45) a. \*Hij is niet {allerminst / inderdaad / verre van} tevreden

He is not not.in.the.least / indeed / far from happy

- b. \*Niemand is {allerminst / inderdaad / verre van} tevreden  
Nobody is not.in.the.least / indeed / far from happy
- c. \*Weinig mensen {allerminst / inderdaad / verre van} van tevreden  
Few people are not.in.the.least / indeed / far from happy
- (46) a. \*Ik ben verbaasd dat je niet {allerminst / inderdaad / verre van} tevreden bent  
I am surprised that you are not not.in.the.least / indeed / far from happy
- b. \*Het spijt me dat Jan niet {allerminst / inderdaad / verre van} tevreden is  
I regret that you are not not.in.the.least / indeed / far from happy
- c. \*Als we niet {allerminst / inderdaad / verre van} tevreden zijn, gaat het mis  
If we are not not.in.the.least / indeed / far from happy, goes it wrong
- d. \*Iedereen die niet {allerminst / inderdaad / verre van} tevreden is, ...  
Everybody, who is not not.in.the.least / indeed / far from happy, ...
- e. \*Alleen Jan is niet {allerminst / inderdaad / verre van} tevreden  
Only John is not not.in.the.least / indeed / far from happy
- f. \*Weinig mensen zijn niet {allerminst / inderdaad / verre van} tevreden  
Few people are not not.in.the.least / indeed / far from happy
- g. \*Weinig jongens dachten dat jij niet {allerminst / inderdaad / verre van} tevreden was  
Few boys thought that you not not.in.the.least / indeed / far from happy were

If modals outscoping negation are indeed PPIs, it is expected that exactly those PPIs that are weak or of medium strength, like English *must* or *to be to*, can occur under the scope of negation embedded in a downward entailing contexts, but that strong PPIs, such as English *should*, cannot. This is indeed the case, as is shown for English in (47)-(52) below.<sup>18</sup>

- (47) a. If he must not work tonight he is allowed to go out with his girlfriend  
 $\checkmark \neg > \text{must}$

---

<sup>18</sup> Homer (2011) argues that, just as with the examples with *should* and *must* in 2.4, that *should* takes scope over the negation and *must* does not, due to *should* being a neg-raiser and *must* not. Again, this predicts that *should* is still fine under negation (since for Homer its PPI-hood it is not different from *must*), contrary to fact. Homer (2011: 18) presents one example where *should* can appear under two negations:

(i) The coroner does nothing that shouldn't be done over again, he is so unbelievably incompetent.

However, this may quite likely be a case of contrastive negation, given that it is an instance of double negation, and double negation generally gives rise to contrastive focus readings (cf. Liberman & Sag 1974, Corblin et al. 2004).

- b. If he is not to work tonight he is allowed to go out with his girlfriend  
 $\sqrt{\neg} > \text{is to}$
- c. If he should not work tonight he is allowed to go out with his girlfriend  
 $* \neg > \text{should}$
- (48) a. Every boy who must not work tonight is allowed to go out with his girlfriend  
 $\sqrt{\neg} > \text{must}$
- b. Every boy who is not to work tonight is allowed to go out with his girlfriend  
 $\sqrt{\neg} > \text{is to}$
- c. Every boy who should not work tonight is allowed to go out with his girlfriend  
 $* \neg > \text{should}$
- (49) a. Only John must not work tonight  
 $\sqrt{\neg} > \text{must}$
- b. Only John is not to work tonight  
 $\sqrt{\neg} > \text{is to}$
- c. Only John should not work tonight  
 $* \neg > \text{should}$
- (50) a. Very few doctors must not work tonight. Most of them are on duty  
 $\sqrt{\neg} > \text{must}$
- b. Very few doctors are not to work tonight.  
 $\sqrt{\neg} > \text{are to}$
- c. Very few doctors should not work tonight.  
 $* \neg > \text{should}$
- (51) a. I regret that John must not write a paper on that topic  
 $\sqrt{\neg} > \text{must}$
- b. I regret that John is not to write a paper on that topic  
 $\sqrt{\neg} > \text{is to}$
- c. I regret that John should not write a paper on that topic  
 $* \neg > \text{should}$
- (52) a. I am surprised that he must not write a paper about the Romans  
 $\sqrt{\neg} > \text{must}$
- b. I am surprised that he is not to write a paper about the Romans  
 $\sqrt{\neg} > \text{is to}$
- c. I am surprised that he should not write a paper about the Romans  
 $* \neg > \text{should}$

Finally, the Baker/Szabolcsi-facts also extend to Greek and Dutch modals. Greek *prepi* (the equivalent of English *must*) is fine in Baker/Szabolcsi contexts, but the Greek modal construction expressing *should* (the composite of *prepi* with counterfactual morphology), is not, as is shown below:<sup>19</sup>

- (53) a      An dhen *prepi* na dhulepsi *apopse*, bori na vgi me tin *filenadha* tu  
               If neg must        work tonight, can        go out with the girlfriend his  
               ‘If he must not work tonight he is allowed to go out with his girlfriend’  
               if [ $\neg$  > must]
- b.      An dhen *tha eprepe* na dhulepsi *apopse*, bori na vgi me tin *filenadha* tu  
                       If neg fut must-PST    work tonight, can        go out with the  
                       girlfriend his  
                       ‘If he should not work tonight he is allowed to go out with his girlfriend’  
                       \*if [ $\neg$  > should]
- (54) a.      Kathe *pedhi* pu dhen *prepi* na dhulepsi *apopse* bori na vgi me tin *filenadha* tu  
               Every boy who neg must work tonight can go out with the girlfriend his  
               ‘Every boy who doesn’t have to work tonight is allowed to go out with his  
               girlfriend’  
               every [ $\neg$  > must]
- b.      Kathe *pedhi* pu dhen *tha eprepe* na dhulepsi *apopse* bori na vgi me tin  
                       *filenadha* tu  
                       Every boy who neg fut must-PST work tonight can go out with the  
                       girlfriend his  
                       ‘Every boy who should not work tonight is allowed to go out with his  
                       girlfriend’  
                       \*every [ $\neg$  > should]
- (55) a.      Monacha o Yanis dhen *prepi* na dhulepsi *apopse*  
               Only the John neg must        work tonight  
               ‘Only John doesn’t have to work tonight’  
               Only [ $\neg$  > must]
- b..      Monacha o Yanis dhen *tha eprepe* na dhulepsi *apopse*  
                       Only the John neg fut neg fut must-PST work tonight  
                       ‘Only John should not work tonight’  
                       \*Only [ $\neg$  > should]
- (56) a.      Ekplissome pu then *prepi* na *apofevgis* to *alati*  
               Surprised that neg must        avoid        salt  
               ‘I am surprised that you must not avoid salt’

<sup>19</sup> This example is a bit harder to judge, since the complex *tha eprepe* (would must) can also be taken to indicate counterfactual *prepi*, and in that case *prepi* may appear under the scope of negation. This ambiguity also appears in Dutch.



Surprise [ $\neg$  > must]

- c. Ekplisome pu then tha eprepe na troi alati  
Surprised that neg should eat salt  
'I am surprised that she should not eat salt'  
\*Surprise [ $\neg$  > should]

The same applies to Dutch *moeten* ('must'), which is fine in Baker/Szabolcsi contexts. However, once it is combined with counterfactual morphology (*zouden moeten* 'would must'), which receives a *should*-like interpretation, it cannot be interpreted below the negation anymore:

- (57) a. Als hij vanavond niet moet werken, kan hij met zijn vriendin uitgaan  
If he tonight neg must work, can he with his girlfriend out.go  
'If he must not work tonight he is allowed to go out with his girlfriend'  
if [ $\neg$  > must]
- b. Als hij vanavond niet zou moeten werken, kan hij uitgaan  
If he tonight NEG must work, can he out.go  
'If he must not work tonight he is allowed to go out'  
\*if [ $\neg$  > must]
- (58) a. Iederereen die vanavond niet moet werken, kan uitgaan  
Everybody who tonight neg must work, can out.go  
'Everybody who doesn't have to work tonight is allowed to go out'  
every [ $\neg$  > must]
- b. Iederereen die vanavond niet zou moeten werken, kan uitgaan  
Everybody who tonight NEG would must work, can out.go  
'Everybody who shouldn't have to work tonight is allowed to go out'  
\*every [ $\neg$  > should]
- (59) a. Alleen Jan moet vanavond niet werken  
Only Jan must tonight neg work  
'Only John doesn't have to work tonight'  
Only [ $\neg$  > must]
- b. Alleen Jan zou vanavond niet moeten werken  
Only Jan would tonight NEG must work  
'Only John shouldn't to work tonight'  
\*Only [ $\neg$  > should]
- (60) a. Ik ben verbaasd dat je niet moet sporten  
I am surprised that you neg must sport  
'I am surprised that you must not do sports'  
Surprise [ $\neg$  > must]

- b. Ik ben verbaasd dat je niet zou moet sporten  
 I am surprised that you NEG should sport  
 'I am surprised that you should not do sports'  
 \*Surprise [ $\neg$  > should]

Thus, in English, Greek and Dutch the *must*-type of modal is weak or of medium strength and may take scope in Baker/Szabolcsi contexts. However, in all these three languages, the *should*-type of modal is a strong PPI and is therefore banned from Baker/Szabolcs contexts.

One might wonder what the difference is between *must* and *should*. It might be a “just so” matter, the way possibly the distinctions are in Table I. However, there are reasons to think that it may not be random. As said earlier, in Greek and Dutch (and many other languages; see von Stechow and Iatridou 2007), the modal that translates as *should/ought to* is a universal modal combined with counterfactual morphology. However, we do not yet know what the principle might be that makes the quantificationally weaker modal (*tha eprepe / zouden moeten*) be a strong PPI, even though the strong modal it contains (*prepi / moeten*) is not a strong PPI. We should point out, though, that this may not be a general pattern. We have reason to believe that in Hungarian and Croatian, the metamorphosis of *must* to *should/ought to* does not change the PPI properties of the resulting modal. So a lot more further investigation is needed on this point.

### 3 Q2. How do modals take scope with respect to negation given their polarity requirements and their surface position?

In this section we address the question of how modals take scope with respect to negation given their polarity requirements and their surface position (Q2 in section 1). First, in section 3.1, we discuss how neutral modals (i.e. those modals that are not NPIs or PPIs) end up taking scope below negation, even if they appear in a higher position than negation at surface structure. In section 3.2 we show how the mechanism proposed in 3.1 also applies to those modals that are NPIs. In section 3.3, we discuss how PPI modals take scope above negation, regardless of their surface position in the sentence. Section 3.4 contains some concluding remarks.

We will make the following three assumptions:

- (61) a. Semantic scope should have a corresponding configuration in the (overt or covert) syntax (May 1985 and many others);
- b. Negation never lowers at LF: it is interpreted in its surface position and may only raise to a higher position at LF if it moves along with another, independently raising element (cf. Horn 1989, Zeijlstra 2004, Penka & von Stechow 2001, Penka 2010);
- c. Deontic modals are base-generated lower than  $I^0$

The first and second assumptions are not controversial; the third, however, goes against received wisdom for English, so let us explicate our third assumption a bit further.

It is assumed since Chomsky 1957 that English modal verbs appearing in  $I^0$  are base-generated in  $I^0$ . But is received wisdom correct in this case? The argument for generation in  $I^0$

stems from the fact that these modals always *appear* in  $I^0$ . Such modals are taken to differ in two ways from regular verbs: they only come in tensed forms *and* they are generated in  $I^0$ .<sup>20</sup> However, only the first of these characterizations is needed, as it by itself derives the second one. We know that these deontic modal auxiliaries are moving verbs since they can make it up to  $C^0$ :

(62) Can/may/must he leave?

If these modals are movers, and if they are always tensed, then it follows that if they are generated below  $I^0$ , they will always move to at least  $I^0$ , since tensed verbs that are able to move always move to  $I^0$  or higher.

So, the view that modals that show up in  $I^0$  originate in a position lower than  $I^0$  is thus as consistent with the facts as the generation-in- $I^0$  view is. It is, in fact, superior to the latter as it requires only one assumption (modals are always tensed) instead of two assumptions (modals are always tensed and are always base-generated in  $I^0$ .) Moreover, as we will see, assuming that modals originate in a position lower than  $I^0$  makes it possible to understand the scopal relations between modals and negation in a more straightforward way.

### 3.1 Neutral modals

Now it is already possible to explain the scopal behavior with respect to negation of those modals that we referred to as ‘neutral deontic modals’. Those modals, like English *have to*, German *müssen* or Greek *chriazete* can occur in positive sentences and so they are not NPIs. In negative sentences, they scope under negation so they are not PPIs either.

Syntactically, however, neutral modals can appear to the right (e.g. *does not have to*) or the left of sentential negation (e.g. *can not*). Assuming that the surface position of negation corresponds to the position where negation is interpreted semantically (or at least not lower than that, as per assumption (61)b above), we do not need to say anything further for those that surface at the right of negation, as they are simply interpreted where they are in the overt syntax, that is, their syntactic and semantic scopes are identical. Here are some examples of this category:

- |      |     |                                      |                  |         |
|------|-----|--------------------------------------|------------------|---------|
| (63) | a.  | John doesn't have to leave           | $\neg > \square$ |         |
|      | b.  | John doesn't need to leave           | $\neg > \square$ |         |
| (64) | o   | Yanis dhen chriazete na figi         | $\neg > \square$ | Greek   |
|      |     | the John Neg needs leave             |                  |         |
|      |     | ‘John doesn't need to leave’         |                  |         |
| (65) | ... | dass Hans nicht abfahren muss        | $\neg > \square$ | German  |
|      | ... | that Hans Neg leave must             |                  |         |
|      |     | ‘... hat Hans doesn't have to leave’ |                  |         |
| (66) |     | Juan no tiene que ir                 | $\neg > \square$ | Spanish |

<sup>20</sup> The commonly adopted assumption that modals that can appear in  $I^0$  only come in tensed form is based on the fact that such modals lack infinitival and participial forms.

Juan Neg must PRT go  
 ‘Juan doesn’t need to leave’

However, the question remains open as to how neutral modals that syntactically appear above negation end up scoping under it. The question, in other words, is about situations where syntactic and semantic scope do not coincide, like the following English examples:

- (67) a. John cannot leave  $\neg > \Diamond$   
 b. John may not leave  $\neg > \Diamond$

Here is where our third assumption kicks in. If the modals in (57) are generated below  $I^0$ , then what needs to be added to account for the fact that they scope under negation is that despite the movement of these modals to a position above negation, they are interpreted in their base position, that is, below negation. There are in principle three options available that would achieve these results:

- (68) a. Head-movement necessarily reconstructs  
 b. Head-movement reconstructs unless reconstruction would result in a grammatical violation  
 c. Head-movement takes place at PF only and so does not feed LF (e.g. Chomsky 1995, Boeckx and Stjepanović 2001, Harley 2004)

For now, we will not commit ourselves to any of the options in (68), though we will come back to these issues in much more detail in the section 3.3. But we do conclude that at least those modals that do not have polarity requirements are interpreted in their base position and therefore always take scope below negation.

### 3.2 *NPI modals*

The same reasoning for the cases in (67) can be extended to NPI modals like English *need*, German *brauchen* and Dutch *hoeven*, etc. If they appear syntactically under negation, as in the following example, there is nothing that needs to be said about them further. They are interpreted where they are in the overt syntax:

- (69) a. ... dass Hans nicht abzufahren braucht                      German  
           ... that Hans not    leave            need  
           '... that Hans doesn't need to leave'  
 b.        dat Suzanne niet hoeft te vertrekken                      Dutch  
           that Suzanne not need to leave  
           '... that Suzanne doesn't need to leave'

However, if the NPI modal precedes negation in the syntax, as in (60), then we need to force reconstruction to get the modal under the scope of negation.

(70) John need not leave  $\neg > \square$

We can again appeal to one of (68)a-c above or allude to (71):

(71) NPIs reconstruct to a position that will satisfy their NPI-requirements.<sup>21</sup>

In short, neutral and NPI modal head-movement necessarily reconstructs in the examples containing neutral or NPI modals and negation or happens at PF (68).

### 3.3 *PPI Modals*

The problem now is to account for the scopal interpretation of PPI modals. If modal auxiliaries reconstruct under any of the options in (68), the question that immediately arises is how PPI modals achieve their scope over negation if they are structurally under it.

Recall the three possibilities that can derive the readings for neutral modals ((68), repeated as (72)):

- (72) a. Head-movement necessarily reconstructs
- b. Head-movement reconstructs unless reconstruction would result in a grammatical violation
- c. Head-movement takes place at PF only and so does not feed LF (e.g. Chomsky 1995, Boeckx and Stjepanović 2001, Harley 2004)

If we want to say that PPI modals that are above negation in the syntax stay there for interpretation, we have to reject option (72)c right off the bat. Under the PF-movement scenario, the modal would have to be interpreted under negation<sup>22</sup>. See also Lechner 2006 and Hartman 2010 for more reasons to reject the suggestion that head-movement only takes place at PF<sup>23</sup>.

Similarly, we also need to reject option (72)a, as it does not permit the modal to stay higher than negation. The only viable option is (72)b then.

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<sup>21</sup> See Ladusaw 1992 and de Swart 1998 where a similar possibility is proposed. Generally speaking, NPIs are required to be roofed by some negative operator at the level of LF. Most NPIs are subject to a surface constraint as well (i.e. the NPI must appear under its licenser at surface position, cf. Ladusaw 1979), but this constraint is known to have exceptions, e.g. sentences with modal NPIs (see de Swart 1998). In all these exceptional cases, though, the NPI still needs to be roofed by negation at LF.

<sup>22</sup> Unless one stipulated that overt head-movement happens only at PF but there is additional covert head-movement, which, being covert, would only feed LF. We cannot exclude this option here but will not pursue it further.

<sup>23</sup> The idea that head-movement takes place only at PF is attributed to Chomsky, but this attribution may be overstated. Certainly, Chomsky claims that movement of inflectional categories is semantically empty but leaves open the movement from T-to-C as being semantically interpretable. Other considerations that pushed the head-movement-at-PF-only hypothesis is the concern that head-movement appears to be counter-cyclic (Chomsky), that it helps solve a particular problem in pseudo-gapping (Boeckx and Stjepanović 2001) and that it helps the understanding of synthetic compounds in English (Harley 2004).

Option (72)b will take care of neutral and NPI modals: NPI modals reconstruct because they have to, neutral modals because they have no reason to stay high (i.e. to not reconstruct)<sup>24</sup>. Option (72)b will also permit PPI modals that have moved over negation to be interpreted where they have moved to – if we add the assumption that satisfying the PPI licensing requirement is a strong enough reason for them not to reconstruct.

Finally, we come to the hardest case, namely PPI modals that appear in the syntax under negation, like the following Greek and Spanish examples:

- (73) O Yanis dhen prepi na figi                      syntactic order  $\neg > \Box$ ;                      Greek  
 John    NEG MUST leave                      semantic scope:  $\Box > \neg$   
 ‘John must not leave’

- (74) Juan no debe ir                                      syntactic order  $\neg > \Box$                       Spanish  
 John NEG MUST leave                      semantic scope:  $\Box > \neg$   
 ‘John must not leave’

How does the PPI manage to scope over negation here?<sup>25</sup> DP PPIs that outscope negation are said to do so by QR (cf. Krifka 1992, Szabolcsi 2004).

- (75) John didn't see a man                                       $\neg > \exists; \exists > \neg$   
 John didn't see some man                                       $*\neg > \exists; \exists > \neg$

Extending this line of reasoning, it is predicted that modals, being quantifiers over world variables, may raise across negation as a result of QR as well.<sup>26</sup> However, this immediately brings us to the following questions:

- (76) a.        Where does the PPI modal move to?  
           b.        What is the type of the modal?  
           c.        What is the type of its trace?

We assume that the answer to (76)a is that some functional head should be available as a landing site for the modal, without going further into indentifying it.

With respect to (76)b, we follow Bhatt 1997 and Wurmbrand 1999, who have argued that deontic modals are raising verbs. Thus the subject in a clause with such a modal reconstructs into its base position in the vP. Therefore, the complement of the modal at LF must be a proposition (type  $\langle s, t \rangle$ ) and we take the type of the modal thus to be  $\langle \langle s, t \rangle, t \rangle$ .

<sup>24</sup> This is not to say that there may not be variation across languages with respect to the necessity or optionality of this type of reconstruction, the way there is in other domains (Diesing 1992 and many others).

<sup>25</sup> Another logical possibility is that PPI modals that precede negation might first reconstruct, and subsequently gain scope over negation in whichever way PPIs do that follow negation in the overt syntax. While we cannot exclude this possibility, it seems cumbersome.

<sup>26</sup> See also Homer (2010, 2011) who assumes that PPI *must* scopes out by QR.

As for (76)c, we follow Fox 2006 among others, who have argued that (using different mechanisms) in the absence of specific clues for a type, the trace has the lowest type that will make the composition work. That means that in our case, the type of the trace would be s.

Hence the representations of the surface and LF structures containing the modals are as in (77) and (78) respectively:<sup>27,28</sup>

(77) [not [PPI-modal [vP]]] Surface structure  
 [<t,t> [<<s,t>, t> [<s,t>]]]

(78) [PPI-modal<sub>i</sub> [not [t<sub>i</sub> [vP]]]] LF  
 [<<s,t>, t> [<t,t> [s <s,t>]]]]

If these assumptions are correct, PPI modals that appear syntactically under negation may thus undergo covert movement to a position above negation.

Note that this predicts that only those PPIs that can independently undergo movement (such as quantifier raising) are PPIs that can be rescued if they appear under the scope of negation. To the best of our knowledge, this is correct. PPIs like *some*, and as discussed above *must*, are quantificational and can be interpreted above negation even if they appear under negation at surface structure. Other PPIs, such as *tons*, *utterly*, *insanely*, *way (too)*, *sorta*, *rather*, *somewhat* (all taken from Israel 1996) are not quantificational and cannot undergo raising across negation:

- (79) a. \*I don't have tons of money  
 b. \*I am not way too tall  
 c. \*I am not somewhat ill

In order to show that this is the best way to account for the scopal readings of PPI modals that appear below negation at surface structure, it needs to be shown that alternative accounts face problems.

One alternative would be to assume that the scope of the PPI over negation is not achieved syntactically but is the result of e.g. some interplay of presuppositions and implicatures. An instance of such a mechanism is Gajewski's pragmatic explanation of neg-raising (though see

<sup>27</sup> Here is how the full semantic composition would go:

[[67]] = [[PPI-modal]<sub>i</sub>] ([not]([w<sub>i</sub> [John left]])) =  
 [λq. for all w' in W', q at w']<sub>i</sub> ([λp.NOT(p)] (w<sub>i</sub> [λw. J. left at w])) =  
 [λq. for all w' in W', q at w']<sub>i</sub> ([λp.NOT(p)] ([J. left at w<sub>i</sub>])) =  
 [λq. for all w' in W', q at w']<sub>i</sub> (NOT([J. left at w<sub>i</sub>])) =  
 [λq. for all w' in W', q at w'] λw<sub>i</sub>(NOT([J. left at w<sub>i</sub>])) =  
 for all w' in W', λw<sub>i</sub>(NOT([J. left at w<sub>i</sub>]))(w') =  
 for all w' in W', NOT(J. left at w')

For a sentence like (63), this composition will give "In all worlds compatible with what should happen, John does not leave". Negation indeed is semantically in the scope of the modal.

<sup>28</sup> Maziar Toosarvandani (p.c.) note that this predicts that sentences with a modal are of type t. In that sense they may be different from sentences without a modal, which are <s,t> and that will have their world variable contextually bound.

Homer 2010 for why neg-raising is not behind the interaction of *must* and negation).<sup>29</sup> However, more evidence can be provided that shows that it is a level of *syntactic* representation where the modal is higher than negation, even though in overt syntax it appears under negation.

One indication that the scope of modals and negation is computed at a syntactic level of representation is the sensitivity of other elements to this configuration. One such case in question is English PPI *must* and neutral *may*, on their deontic interpretations:

- (80) a. John must not leave  $\Box > \neg$   
 b. John may not leave  $\neg > \Diamond$

Suppose now that the subject of these modals is a PPI. Both wide scope and narrow scope interpretations of the DP are possible:

- (81) a. Some students must leave *some students > must, must > some students*  
 b. Some students may leave *some students > may, may > some students*

Now consider what happens when negation enters the picture as well. For both modals, their relative scope with negation is fixed: *must* scopes over it, and *may* scopes under it. What about the scope of the DP?

As we indicate below, the two scope construals are still possible in the *must* case because the PPI *some students* can satisfy its PPI property while still scoping over or under the modal *must*<sup>30</sup>:

- (82) Some students must not leave *some students > must > ¬* (wide scope)  
*must > some students > ¬* (narrow scope)

However, with *may*, a narrow scope interpretation for the DP does not seem possible. We take it that this is because the PPI *some students* can now not satisfy its PPI property while scoping under *may* for a de dicto reading:<sup>31</sup>

- (83) Some students may not leave *some > ¬ > may* (wide scope)  
 \* *¬ > may > some* (narrow scope)

In other words, even though both *must* and *may* syntactically appear before negation, a PPI subject cannot be under *may* without being under negation as well, which is a point in favor of the proposed LF configuration: It shows that at the level where the scope of the DP is determined, the modal already outscopes negation.

- (84) a. [[Some students] must<sub>i</sub> [not t<sub>i</sub> [leave]]] LF (wide scope)

<sup>29</sup> Homer presents various reasons as to why a neg-raising analysis cannot apply to account for the scopal interaction between negation and *must*, one of them being that it would then be expected that *must* may outscope extra-clausal negation, contrary to fact.

<sup>30</sup> Modals do not cause Immediate Scope Violations, as pointed out by von Stechow and Iatridou 2007:

i. You don't have to bring anything to the party ( $\neg > \text{modal} > \text{NPI}$ )

They would, therefore, not be expected to rescue the PPI from the harmful effects of negation.

<sup>31</sup> Again ignoring the intonation that goes with constituent negation on the VP.



- b. [ must<sub>i</sub> [ [Some students] not t<sub>i</sub> [leave]]] LF (narrow scope)
- (85) a. [IP [Some students] [not may [<sub>VP</sub> leave]]] LF (wide scope)  
 b. \* [IP [not may [<sub>VP</sub> [Some students] leave]]] LF (narrow scope)

If the narrow and wide interpretations are the result of the DP being in a certain position at LF, then the conclusion is that the modal outscopes negation already at LF, a level of syntactic representation. If pragmatic considerations were involved in determining the relative scope of the modal and the negation, then why do we see this relative scope having an effect on the scope of another element in the sentence? On the other hand, if scope is determined at LF, all falls into place.

These considerations also naturally extend to Spanish. Spanish has PPI *deber* and neutral *tener que*<sup>32</sup>. Both verbs appear after negation in the overt syntax:

- (86) a. Juan no debe ir □ > ¬  
 Juan Neg must go  
 b. Juan no tiene que ir ¬ > □  
 Juan neg has to go
- (87) a. Alguien no debe ir alguien > debe > ¬,  
 somebody neg must go debe > alguien > ¬  
 b. Alguien no tiene que ir alguien > ¬ > tiene,  
 somebody neg has to go \*¬ > tiene > alguien

Again the narrow interpretation of the PPI subject is not possible with the neutral modal, because the PPI property of the subject cannot be satisfied in the position where it would have to be to receive the narrow scope. On the other hand, the PPI subject can be above or under the scope of the PPI modal (to achieve wide or narrow scope with respect to it) even though in the overt syntax, the PPI modal appears under negation. This means that at the level where the relative scope of the modal and the subject DP is established, the *deber* modal is above negation.

If PPI modals take scope above negation by moving across it, we predict that if a modal is unable to move due to some independent mechanism that blocks movement (e.g. the Head Movement Constraint (Travis 1984)), movement can no longer apply. One such case might well be the behaviour of the French universal modal in perfective constructions.

Homer 2010 shows that French universal modal *devoir* may scope both above and under negation, a property that he alludes to as lexical ambiguity: *devoir* comes about in two guises, according to him: one PPI and one what we would call “neutral”.<sup>33</sup>

- (88) Il ne doit pas partir ¬ > □, □ > ¬  
 He modal not leave  
 ‘He must not leave’, ‘He does not have to leave’

<sup>32</sup> Thanks to Paola Menendez-Benito for discussion of the Spanish judgments

<sup>33</sup> We are not committed to a lexical ambiguity analysis of *devoir*. Other reasons could also be responsible for the two scopes of *devoir* with respect to negation (e.g. more liberal constraints on reconstruction).

We found that this scopal ambiguity persists when the modal is infinitival:

- (89) a. Ne pas devoir faire la vaisselle, c'est super preferred:  $\neg > \Box$   
 Neg modal do the dishes, that is great  
 'It is great to not have to do the dishes'
- b. Ne pas devoir fumer pendant 5 heures, c'est terrible preferred:  $\Box > \neg$   
 Neg modal smoke during 5 hours, that is terrible  
 'To not be allowed to smoke during 5 hours, that is terrible'

Since the reading  $\Box > \neg$  is possible, it means that in (89)b the modal can covertly move across negation. Consider now (90), in which the modal is put in the perfective. When the modal is put in the perfective, there is an entailment that the underlying event happened (Bhatt's 2000 "actuality entailment"; see also Hacquard 2006)

- (90) Jean a du prendre l'autobus  
 Jean has modal(participle) take the bus  
 'Jean was forced by circumstances to take the bus'

Putting aside the question of how the actuality entailments come about, the auxiliary provides us with a higher head that might potentially block movement of the modal over negation. Note that indeed this head blocks covert raising of *devoir* across *pas*:

- (91) Jean n'a pas du prendre l'autobus  $\neg > \Box, *\Box > \neg$   
 Jean have NEG modal.PART take the bus

This sentence means that Jean was not forced to take the bus. It does not mean that he was forced by the circumstances to not take it. Although, it is too early to conclude with any certainty that it is the HMC that is at play in (91), it is a clear possibility. The exact interplay of the HMC, modal raising and the possible interference of actuality entailments remains subject to further study.

### 3.4 Concluding remarks

To conclude, the assumptions adopted in this section correctly predict that exactly those modals that are neutral or NPIs take scope under negation: all such modals discussed are base-generated below negation and obligatorily reconstruct.

Reconstruction of head movement can only be overruled if head reconstruction causes ungrammaticality.<sup>34</sup> This is the reason why PPI modals do not reconstruct. Even stronger, since modals are quantifiers (over possible worlds) they may even covertly raise across negation if absence of raising would lead to a PPI violation.

Note that this does not entail that PPI modals must always take scope over negation. In all those cases, described in section 2, where PPIs may scope under negation (e.g. if some intervening element takes scope between the PPI modal and its licenser or if the PPI modals is embedded in a Baker/Szabolcsi type of context) it is predicted that the modal can take scope

<sup>34</sup> We note that in this sense reconstruction is different from A or A-Bar reconstruction, where it is optional unless forced or forbidden.

under negation, since reconstruction of the PPI modal to its base position no longer leads to a grammaticality violation.

#### 4. Q3. How can the NPI/PPI properties of modals be captured?

Our proposal is that the scopal properties of modals with respect to negation follow from their polarity sensitivity properties: English *need* is an NPI; *must*, *should*, *to be to* are PPIs; *have to*, *need to* are polarity-neutral. The question now arises how the NPI and PPI property of these modals can be accounted for. In this section we couch the discussion of polarity-sensitive modals within two existing accounts for polarity sensitivity and compare them. We do not mean to imply that one of these accounts is necessarily correct. It is an assessment of what could be said about polar-sensitive modals within two current approaches to polarity.

Basically, two different types of approaches to polarity can be distinguished, aligned with the answer to the question of whether the licensing of NPIs and PPIs is of a semantic/pragmatic or rather of a syntactic nature.<sup>35</sup>

For the semantic/pragmatic approach, NPIs and PPIs are always endpoints of a scale and must obligatorily introduce alternatives, which need to find their place in the semantic/pragmatic composition of the sentence. A sentence with an NPI or a PPI comes with certain semantic/pragmatic strengthening requirements that need to be fulfilled. If these are not fulfilled, the sentence violates its conditions of use. We will call this approach the “semantic/pragmatic approach.”

The researchers who on the other hand believe that NPI/PPI licensing is a matter of syntax basically postulate a certain set of features on NPI and PPIs. These features come with particular requirements to be fulfilled, e.g. checking by negation, and if these requirements are not met, the resulting sentence is ungrammatical. We refer to this approach as the “syntactic approach.”

In this section. We will take a representative of each approach and we will examine how it can be extended to capture the NPI/PPI properties of modals. In section 4.1, we discuss an example of a scalarity approach. In section 4.2, we discuss a syntactic approach. In section 4.3, we will compare and evaluate the two.

##### 4.1 *Semantic/pragmatic approaches*

The idea that sentences containing NPIs in non-downward entailing contexts are bad because such sentences violate their conditions of use goes back to Kadmon & Landman (1993). This insight has been adopted in various ways by Krifka (1995), Lahiri (1998), Israel (1996) and Chierchia (2006, 2011). All of these analyses share the idea that they take the fact that most NPIs denote low scalar endpoints at heart. In this section we will take a closer look at Chierchia (2006, 2011) who builds primarily on Krifka (1995) but modifies for some shortcoming in Krifka’s proposal.<sup>36</sup>

Chierchia takes NPIs to always introduce both scalar alternatives and domain alternatives that need to be obligatorily exhaustified. We will discuss each of these notions in turn.

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<sup>35</sup> For a detailed overview of the different views on the nature of negative and positive polarity, cf. Giannakidou (2010).

<sup>36</sup> Since Chierchia, as we will see, does not only allude semantic and pragmatic principles, but also uses syntactic feature checking, strictly speaking he does not fall under the semantic/pragmatic approach only.

We take it that the notion of scalar alternatives is familiar since Horn (1972) and much subsequent work. Scalar items are elements that are elements of the same scale (e.g. *a* and *every*) and that when substituted in the same sentence yield two propositions that stand in an entailment relationship. For example, (92)a entails (92)b. To see what is meant by domain alternatives, consider (92) again. Uttering (92)b in different contexts leads to different interpretations of the domain of quantification of "a book". For instance, in a linguistic context, it may be understood as referring to the set of linguistic books, whereas in other contexts it may refer to any book there is in the world. Since the former is a subset of the latter, the first domain of quantification can be thought of as a subdomain of the latter. Chierchia takes subdomains to be possible alternatives associated with quantificational expressions too.

- (92) a. Mary read every book  
b. Mary read a book

As we said above, in addition to the concepts of scalar and domain alternatives, the notion of exhaustification is the third crucial ingredient of Chierchia's account<sup>37</sup>. The result of exhaustifying a proposition is to make all its stronger alternatives false. For example (93)a is compatible with Kathy having more than three children. Once the exhaustifier *only* is introduced, as in (93)b, this is not possible anymore.

- (93) a. Kathy has three children. In fact she has four  
b. Kathy only has three children. \*In fact she has four

Chierchia's account basically states that a. elements denoting low scalar endpoints can introduce both scalar and domain alternatives; b. NPIs are low scalar endpoints that *must* introduce scalar and domain alternatives; c. propositions containing NPIs are obligatorily exhaustified; d. such propositions give rise to contradictions if the NPI is not embedded in a downward entailing context. Chierchia acknowledges that though some contradictions lead to ungrammaticality, not all do. It remains to be determined why contradictions of this type lead to ungrammaticality. Take for example (94).

- (94) \*I read any book

In (94) *any*, as an NPI, obligatorily introduces scalar and domain alternatives. Because it contains an NPI, (94) needs to be exhaustified. This has as result that all stronger propositions containing scalar alternatives and all propositions containing domain alternatives are false. And this, in turn, leads to the contradiction that makes (94) bad. This is how. Suppose there are three books in the world: a blue book, a green book and a red book. Then (94) asserts that I read a blue, a green or a red book. But since {blue book, green book} is a subdomain of the domain of quantification of *any book* it must be introduced as an alternative to *any book*. Now "*I read a blue or a green book*" is a stronger sentence than "*I read a blue, a green or a red book*" (as it is true in fewer situations). Therefore the obligatory exhaustification makes it so that (94) also asserts that I did not read a blue or a green book. And since {blue book}, {green book} and {red book} are subdomains of "*any book*" as well, (94) also entails "*I didn't read a blue book*" and "*I didn't read a green book*" and "*I didn't read a red book*". But if all these three statements are

<sup>37</sup> Chierchia takes the idea that exhaustification is behind NPI licensing from Krifka.

true, they contradict (94), which, given that *any* is an existential quantifier, entails that I must have read (at least) a blue, a green or a red book. It is this contradiction that is the source of the unacceptability of (94) according to Chierchia, following Krifka (1995).

On the other hand, when the NPI is embedded in a downward entailing context, no contradiction arises. Example (95) is stronger than all of its alternatives already (since there is an existential in the scope of negation), which means that all alternative propositions are entailed to be true. Therefore, exhaustification does not have any semantic effect and no contradiction arises. Thus, (95) is fine.

(95) I didn't read any book

In order to ensure that propositions containing NPIs are obligatorily exhaustified, Chierchia proposes that NPIs are equipped with a feature  $[+\sigma]$ , which must be checked by a higher  $\sigma$  operator.  $\sigma$  operators are abstract exhaustifying operators.<sup>38</sup> In other words, Chierchia builds the desired result of exhaustification in the (morpho-)syntax of a sentence containing an NPI.

The representations underlying the examples in (96) containing a licensed and an unlicensed NPI respectively are in (97):

- (96) a. \*Mary saw anything  
b. Mary didn't see anything
- (97) ai. \* Mary saw anything $[+\sigma]$   
a.ii. \* EXHAUST $[+\sigma]$  Mary saw anything $[+\sigma]$   
b. EXHAUST $[+\sigma]$  Mary didn't see anything $[+\sigma]$

So, for Chierchia, a sentence containing an unlicensed NPI can be bad for two reasons: either it is not checked by an exhaustifying operator, as (97)ai, or, if it is, it yields a contradiction, as in (97)a.ii. But if the NPI is embedded in a downward entailing context it is fine again: (96)b is stronger than all of its alternatives and exhaustification does not have any effect.

Next, we come to the question of how PPI-hood can be derived under Chierchia's approach. Although Chierchia does not discuss the construction of PPIs himself, his extension of Krifka's approach to NPIs can be duplicated in the domain of PPIs also. Take for instance the PPI *tons of*:

- (98) a. They have tons of money  
b. \*They don't have tons of money

Assume that *tons of X* is a maximum value on some scale (in other words, there are no higher values; we can think of *tons of money* as being the maximal amount of money a person can have). Under Chierchia's approach, a PPI, like *tons of*, would carry a  $[+\sigma]$  feature, thus requiring the presence of an exhaustification operator. In a non-negative sentence *tons of money* would be fine, as it is the strongest proposition among its scalar counterparts.

<sup>38</sup> Just like focus-sensitive operators, such as *only* or *even*.

However, when putting the PPI under negation, exhaustification of (98)b yields a contradiction again. Take (99):

(99) EXHAUST[+σ] They don't have {tons of}[+σ] money

When EXHAUST[+σ] is applied to (98)b, it has the result that any stronger alternative proposition is false. Since there is some threshold that needs to be satisfied for *tons of* to be applicable, any negated sentence containing an expression below that threshold will be stronger than (98)b (e.g. “*They don't have \$400*”, “*They don't have \$300*”, etc.). This means that exhaustification will yield a contradiction: since exhaustification results in no such proposition being true, it turns out that for all possible amounts *x* of money, even the highest amounts, it is not true that they don't have that amount. So they must have a very high amount of money, but that is in sheer contradiction with (98)b.

For this extension of Chierchia to PPIs to work, however, the EXHAUST operator should apply higher than negation, as in (100):

(100) EXHAUST[+σ] > NEGATION > PPI

If, instead, we had the scopal order in (101), the PPI would be expected to be fine in the scope of negation, because the PPI is not being negated when the proposition it contains gets exhaustified. Negation applies only the proposition after it is exhaustified.:

(101) NEGATION > EXHAUST[+σ] > PPI

While (101) may be the representation of a PPI under extra-clausal negation, the question is how to prevent the order NEGATION > EXHAUST from appearing within one and the same clause. One possible answer is that the EXHAUST operator is an IP-level operator, which would automatically preclude (101) from arising within one clause, since we do not permit negation to raise. But Chierchia does not give any structural restrictions on the placement of the operator, apart from the one requiring that the exhaustifying operator be higher than the element carrying [+σ]. So a question that arises in this context is what determines exactly the locus of the abstract strengthening operator in the syntactic structure.

So far, we have seen how Chierchia's (and, Krifka's) approach captures why certain elements denoting low-scale endpoints are bad in positive and certain elements carrying high-scale endpoints in negative contexts. Now, let's try to see how this approach applies to modal NPIs and PPIs.

For universal modals, the difference between a PPI and a neutral modal should be that the PPI modal has both the [σ] feature and obligatorily introduces domain and scalar alternatives. Is it possible to bring this desired result about?

What we would need is for *must* to introduce scalar and domain alternatives and to be covertly exhaustified. Then in positive contexts all should be fine. So let us assume that these elements are in place with *must*. Indeed, (102) is stronger than its scalar alternatives (e.g. *John may leave*).

(102) a. (according to the law,) John must leave  
b.  $\forall w$ [the law is satisfied in *w*] [John leaves in *w*]

What about domain alternatives? To see this, think of a toy model where the only relevant worlds are  $w_1$ ,  $w_2$  and  $w_3$ . Saying that each of  $w_1$ ,  $w_2$  and  $w_3$  is a world where John leaves provides a stronger statement than saying that John only leaves in a subdomain of these worlds, for instance in  $w_1$  and  $w_2$  only. Therefore, no problem arises when the PPI *must* is uttered in a positive context.

However, once *must* is put under negation, things change dramatically. Take (103):

(103) John must not leave.

Now the question arises as to which takes widest scope, the modal or negation. Let us start with the case in which the modal scopes under negation, and moreover, both scope under the exhaustifier:

(104) EXH > NEG > MUST

Interpreting (103) with the scopal order of (104) has as result that the set  $\{w_1, w_2, w_3\}$  is not a subset of the set of worlds where John leaves, since the universal quantifier of world variables is under the scope of negation. At the same time, all alternative expressions of this assertion are stronger: for instance, saying that  $\{w_1, w_2\}$  is not a subset of the set of worlds where John leaves makes a stronger statement than the original assertion. Therefore, the proposition that  $\{w_1, w_2\}$  is not a subset of the set of worlds where John leaves must be negated, which in turn entails that  $w_1$  and  $w_2$  are worlds where John leaves. Since the same mechanism applies to all subdomains of  $\{w_1, w_2, w_3\}$ , including  $\{w_1\}$ ,  $\{w_2\}$  and  $\{w_3\}$ , interpreting the modal under the scope of negation with the strengthening operator applying above it yields a contradiction.

This contradiction disappears once the modal takes scope above negation again, as in (105), since expressions of the form “must (not (p))” are stronger than their alternatives and will therefore not be contradicted by negated stronger alternatives.

(105) EXH > MUST > NEG

In this way the PPI-hood of modals like *must* can be captured in terms of Chierchia’s analysis (and *mutatis mutandis* in Krifka’s terms too). However, this approach meets with a number of problems.

First, how can we prove that *must* (and the other PPI-modals) carry a  $[+\sigma]$  feature and obligatorily introduce domain alternatives? In truth, we cannot. The reality is that the diagnostics to detect whether some element introduces domain alternatives in general are very weak. For instance, it is very hard to prove independently that *any* obligatorily introduces domain alternatives and *a* does not. The only thing that can be said is that if elements like *must* are assigned a  $[+\sigma]$  feature then it may be possible to express their PPI-hood in certain pre-existing terms.

Another problematic question that arises is the following: since nothing specific in the discussion hinges on the choice of world variables instead of variables over individuals, we would expect there to be PPIs that are universal quantifiers over individuals. However, no such PPIs have been encountered yet. If this is not a gap in our knowledge but an actual gap, the

question arises as to why there are no such universal PPIs quantifying over individuals.<sup>39</sup>

There are two remaining problems. Chierchia's mechanism predicts that it be possible that there are NPI existential modals. Such have not been attested, though.<sup>40</sup> Moreover, he has no way of capturing the existence of NPI universal modals, which are attested (Dutch *hoeven*, English *need*, German *brauchen*). With respect to NPI existentials, nothing would in principle forbid that there are existential modals equipped with [+σ], and which obligatorily

<sup>39</sup> There may, in fact, be a way to rule out the existence of universal quantifier PPIs in general. Under Chierchia's analysis a high scale element can only act as a PPI if the exhaustifier applies both to the negation and the high-scale element. However, nothing a priori forces the exhaustifier to take scope from a position higher than negation. So where the universal in (ia) is expected to exhibit PPI-like behavior, the one in (ib) is not:

- (i) a. EXH > NEG >  $\forall$   
b. NEG > EXH >  $\forall$

For Chierchia (p.c.) the fact that an exhaustifier can always scope in between the negation and a universal might be the reason that one may not attest plain universal PPIs (that is universal PPIs quantifying over individuals). But the question that arises then is as to why modal PPIs cannot appear in a negative clause with the exhaustifier intervening between the negation and the modal.

One solution that comes to mind is that this difference is due to the syntax of (PPI) modals. Recall that in all our examples of PPI modals, the modal precedes the negation or forms a unit with the verb. If the exhaustifier must, in turn, be above the modal (as the modal carries [+σ]), in languages where the modal precedes the negation, EXH must always outscope the modal and the negation. If, furthermore, we assume that in languages where the negation and the modal form a morphological unit at surface structure it is impossible that the exhaustifier intervenes between the negation and the modal, also in those languages EXH always outscopes the modal and the negation too. Note that reconstructing the modal puts it under EXH > NEG, which renders the contradiction again.

- (ii) EXH<sub>[+σ]</sub> John must<sub>[+σ]</sub> not leave

A prediction that this makes is that in languages where modal PPIs may occur below negation at surface structure, PPI modals should be allowed to occur under negation. This may indeed be the case. Take the following Dutch examples (repeated from section 1):

- |      |    |   |                            |       |
|------|----|---|----------------------------|-------|
| (ii) | a. | Hans moet niet vertrekken<br>Hans must NEG leave<br>'Hans musn't leave'                           | $\Box > \neg$              | Dutch |
|      | b. | ... dat Hans niet moet vertrekken<br>... that Hans NEG must leave<br>'... that Hans musn't leave' | $\Box > \neg; \neg > \Box$ |       |

As addressed in fn 3, only in subordinate clauses Dutch *moeten* may also scope below negation. This follows once it is adopted that the exhaustifier may freely be included before or after negation:

- (iii) a. ... dat Hans EXH<sub>[+σ]</sub> niet moet<sub>[+σ]</sub> vertrekken      □ > ¬  
b. ... dat Hans niet EXH<sub>[+σ]</sub> moet<sub>[+σ]</sub> vertrekken      ¬ > □

In main clauses, however, the exhaustifier can never be included below negation, since the modal is higher than negation and the exhaustifier must appear above the modal.

However, before any more substantial conclusions are drawn, it should be known first what the exact conditions are where the exhaustifier may be included.

<sup>40</sup> The only existential NPI modal that we know of is epistemic *can't*. Note that in the domain of epistemics also *may* has its own behavior. Epistemic *may* behaves like a PPI, deontic *may* like a neutral modal.



introduce scalar and domain alternatives (i.e. the modal counterpart of *any*). With respect to NPI universal modals, in Chierchia's system, high-scale elements can only be PPIs.<sup>41</sup>

## 4.2 Syntactic approaches

The tradition that takes NPIs to come along with a syntactic requirement that they be licensed by a (semi-)negative operator goes back to Klima (1964), and has been presented in more recent frameworks by Progovac (1992, 1993, 1994), who takes NPI licensing to be some special instance of syntactic binding, and by Laka (1990), who relates NPIs to the obligatory presence of an affective phrase ( $\Sigma P$ ). Postal (2000), followed by Szabolcsi (2004) introduces a revival of Klima's theory and claims that NPIs, such as English *any*, underlyingly carry a negation:<sup>42</sup>

(106) *any*: [<sub>D</sub> NEG [SOME]]

In this section we focus on Postal's proposal and Szabolcsi's implementation of it, since it is the most specific about the nature of PPI-hood.

In a negative sentence containing *any*, the negation moves out of *any* to a higher position where it is realized as an overt negator. For example,  $\neg\exists$  will surface as:

- (107) a. *noone* if the negation stays in place: *I saw noone*  
 b. *anyone*  
 i. if the negation raises out: *I didn't see anyone*  
 ii. if the negation is deleted by another negative operator:  
 in *No one saw anyone*, the negation on the object is incorporated the negation of the subject.

Szabolcsi (2004) extends Postal's view on NPI-hood to PPI-hood. Recall that according to Postal, NPIs are lexical items associated with negations. Szabolcsi's conjecture is that if lexical items can be associated with negations, nothing prevents a certain lexical item from being associated with two negations. It is exactly such items (with two negations) that we end up identifying as PPIs, according to Szabolcsi. For her then, NPIs have one, and PPIs two negative features. A PPI like *somebody* has then the following representation:

(108)  $\lambda P \neg \neg \exists x [\text{person}(x) \ \& \ P(x)]$

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<sup>41</sup> Note that while this is a question for Chierchia it is perhaps less of a question for Krifka, since he may take these elements to be the modal counterparts of elements like *some*, which are low-scale elements that are generally speaking banned from negative contexts too. For Krifka elements like *some* are not PPIs in the regular, scalar sense, but rather plain indefinites that are "fossilized" for wide scope with respect to negation. How such a fossilization mechanism exactly works and whether such mechanism may actually exist in the first place is not clear, but if such a mechanism does exist, it may actually naturally extend to universal NPI modals.

<sup>42</sup> Den Dikken (2006) adopts the essence of Postal's analysis, but recasts it within terms proposed by Chomsky (1995 etc): some<sup>42</sup> NPIs carry an uninterpretable negative feature that must be checked against a negative head in the clause. Independently, and for different reasons, Neeleman and Van de Koot (2002) and Herburger and Mauck (2007) reached this conclusion as well.

In regular positive contexts  $\neg\neg\exists$  can be realized as *some*. But, why can't *some* appear in negative contexts as well? In other words, what explains the positive polarity of PPIs?

For Szabolcsi, this is because the two negative features are “dormant”. Dormancy is the state in which the two negative features cancel each other out. However, when the PPI finds itself under a downward entailing operator, something goes wrong. The downward entailing operator activates and licenses (in her terms “absorbs”) one of the negative features of the PPI. Since now the first negative feature has been absorbed, the second negative feature is no longer in a dormant stage, as the first feature no longer cancels it out.

So under a downward entailing operator, the PPI is left with an unlicensed negative feature, which is why it is ruled out. In fact, the [DE-Op > PPI] complex is ruled out for exactly the same reason for which an unlicensed NPI is ruled out; both have a negative feature on the PI item that needs to be licensed. This means that Szabolcsi makes the prediction that the [DE-Op > PPI] complex can be placed under the scope of another downward entailing operator. These are exactly the Baker/Szabolcsi facts discussed in section 2.5.

In short, the reason that a PPI is ungrammatical under a single downward entailing operator is not that there is an abstract prohibition against PPIs being in the scope of such operators (as also evidenced by the fact that they can appear in such scope when the operator is extraclausal). The reason that a PPI under a clausemate DE operator is bad is because the [DE-Op > PPI] complex contains what essentially is an unlicensed NPI.

Now, first, let's apply the syntactic approach to NPI modals, such as English *need*, Dutch *hoeven* or German *brauchen*. For these modals this would mean that their lexical entry contains a universal quantifier over possible worlds and a negation that must be spelled out in a different position in the sentence:

(109) need/hoeven/brauchen: [<sub>V</sub> NEG [ ] ]

PPI modals, such as English *must*, Greep *prepi* and Dutch *moeten*, must have roughly the representation as in (110) within Szabolcsi's terms, as PPIs, for her, carry two underlying negations:

(110) must/prepi/moeten: [<sub>V</sub> NEG [ NEG [ ] ] ]

The complex  $\neg\neg\forall$  then spells out as *must/prepi/moeten*. But, the two negations can also be spelled out in different positions in the sentence (as long as both are spelled out). This can explain for the fact that these PPI modals are fine in Baker/Szabolcsi contexts:

(111) If he mustn't work tonight he is allowed to go out with his girlfriend  $\forall \neg > \text{must}$

So, in principle, the fact that among deontic modals both NPIs and PPIs can be attested for is accounted for under this approach. However, there are also several problems. First, the syntactic approach in general has been criticized for a number of reasons that may extend to its application to modals. Apart from that, the exact implementation to modals also faces some problems of its own.

The main difficulty that such purely syntactic approaches face is to understand why most types of NPIs denote the endpoint of a scale, e.g. *lift a finger*, *have a red cent*, a fact that lies at

A second problem, especially for feature-checking approaches, is that the locality restrictions on NPI licensing appear to be weaker than those for regular feature checking. For instance, NPIs can be licensed across the boundaries of a clause, even across an island, something, which is not possible in more established varieties of feature checking.

- Apart from this, a general problem for the syntactic approach concerns the licensing of NPIs by downward entailing determiners. For Postal, this means that an NPI-licensing expression, such as *few*, must contain an underlying (incorporated) negation. However, whereas for an element like *few* it can be easily seen that it is decomposable into a negation and a quantifier like 'many'. For other downward entailing environments, such as an *if*-clause or the first argument of a universal quantifier, this is less clear.

(113) a. Ik zeg niet dat hij hoeft te werken Dutch  
I say NEG that he needs to work  
'I don't say that he has to work'

b. Ik werk niet om honger te hoeven lijden  
I work not PRT hunger to need I suffer  
'I don't work in order to have to suffer from starvation'

(114) a. Niet iedereen hoeft te werken  
Not everybody needs to work  
'Not everybody needs to work'

b. Alleen Jan hoeft te werken  
Only John needs to work  
'Only John needs to work'

Dutch

- <sup>43</sup> But see Herburger and Mauck (2007) for a version of the syntactic approach that aims at accounting for this fact.

Everybody who needs to work is at 7:00 expected  
 'Everybody who needs to work is expected at 7:00'

- b. \*Als je hoeft te werken, word je om 7:00 verwacht  
 If you need to work, are you at 7:00 expected  
 'If you need to work, are you expected at 7:00'

These facts also apply to English *need* and German *brauchen*.

- (116) a. Not everybody need know
- b. Only God need know

- (117) a. \*Everybody who needs know, should be informed
- b. \*If you need know, you'll be informed

- (118) a. Nicht jeder braucht zu arbeiten  
 Not everybody needs to work  
 'Not everybody needs to work'
- German

- b. Nur Hans braucht zu arbeiten  
 Only John needs to work  
 'Only John needs to work'

- (119) a. \*Jeder der zu arbeiten braucht, wird um 7:00 erwartet  
 Everybody who to work needs is at 7:00 expected  
 'Everybody who needs to work is expected at 7:00'
- b. \*Wenn zu arbeiten brauchst, wirst du um 7:00 erwartet  
 If you to work need, are you at 7:00 expected  
 'If you need to work, are you expected at 7:00'

These data suggest that perhaps the NPI modals are even better NPI candidates for the Postal proposal than English *any*-terms, as these modals are restricted to those contexts that seem to spell out a separate negation.<sup>4445</sup>

At the same time, several questions arise when applying the syntactic approach to NPI and PPI modals. For instance, Szabolcsi's approach makes no predictions about what type of elements can be NPIs and PPIs. The only claim that is made in this respect is that PPIs in some sense form a subclass of NPIs (i.e. if NPIs are defined as elements carrying a negative feature, then all PPIs count as some specific type of NPIs). Hence, the question remains open as to why only universal deontic modals may come about as NPIs or PPIs and never existential deontic

<sup>44</sup> Note that this applies less straightforwardly to PPI modals. English *must* is only anti-licensed in anti-additive contexts, but can be rescued if the anti-additive context that anti-licenses *must* is in the scope of any embedded downward entailing context.

<sup>45</sup> The idea that certain downward entailing operators contain a decomposable negation is not new. For negative indefinites it has been suggested by Jacobs (1980), Rullman (1995), Penka (2010), Zeijlstra (2011) among others. For *only* it has been argued by Von Stechow & Iatridou (2007). Whether decomposability into a separate negation is a common property of those contexts that licensed modal NPIs is subject of further study.

modals, some thing that is also a question for the scalarity approach.

Another question that may arise is whether the Postal/Szabolcsi approach permits a language in which items have 0 or 2 negative features, but not one. Such a language would have deontic modals that are neutral (0 negations) and modals that are PPIs (2 negations) but no modal that is an NPI (1 negation). Greek is such a language. The presence of such a pattern in one language may not mean much, but a worry might arise when many languages systematically lack NPIs of some type while exhibiting corresponding PPIs.

### **4.3 Comparison**

So far, it looks like both type of approaches have some amount of success in accounting for the PPI / NPI-hood of modals, but at the same time face problems as well.

Under the scalarity approach, it can be explained why *must*, as well as the other deontic modals that scope above negation, are PPIs, but only if some general assumptions about obligatory introduction of (domain) alternatives and obligatory exhaustification are adopted. Also, additional assumptions need to be adopted as to understand why PPIs are widely attested among modals, but do not appear to show up in the domain of quantifiers over individuals. Also, under this approach, it cannot straightforwardly be accounted for why no existential deontic PPI modals are attested and why certain universal modals are NPIs.

Under the syntactic approach, it can be understood why certain modals are NPIs or PPIs, but mostly because under this approach there is no restriction as to what elements are prone to become NPIs or PPIs in the first place. Therefore the absence of existential deontic NPIs or PPIs is a problem for this approach too. Apart from this, the syntactic approach argues that it is just negation (or more precisely, some negative feature) that can license NPIs and not downward entailment. Whereas this is generally thought to be problematic when it comes to accounting for the fact that most NPIs are licensed in all downward entailing contexts, interestingly, it may shed some light on the nature of NPI modals, which appear to be restricted to those licensing contexts that exist of a decomposable negation.

## **5. Conclusions**

In this article we addressed the questions Q1-3, which are repeated below.

- Q1:** To what extent do PPI modals and better-known PPIs exhibit the same distributional behavior?
- Q2:** How do modals take scope with respect to negation given their polarity requirements and their surface position?
- Q3:** How can the NPI/PPI properties of modals be understood?

We have shown that, with respect to Q1, the distribution of PPI modals and other known PPIs is virtually identical, providing evidence that an analysis that aims at accounting for the scopal behavior of deontic modals with respect to negation in terms of polarity properties of modals is on the right track.

As for Q2, we argue that once it is adopted that modals obligatorily undergo reconstruction to a position below negation, unless this reconstruction leads to a violation of a PPI licensing requirement, it can be understood why all neutral and NPI modals take scope under negation, whereas PPI modals do not. In addition, we provide evidence that shows that scope construal of NPI and PPI modals takes place at a moment prior to the construal of wide and narrow reading of subjects with respect to modals, suggesting that the solution to the question as how modals take scope with respect to negation indeed lies in the syntax/semantic component of the grammar and is not an instance post-grammatical computation of inferences.

Finally, with respect to Q3, we have argued that although several problems still arise, current approaches that aim at explaining why certain elements are sensitive to the polarity of the environment they appear in, may explain at least why some modals are PPIs or NPIs. In particular, the scalarity approach seems to fare quite well with explaining why certain modals may not appear in negative clauses and the syntactic approach seems to give a good handling of the exact licensing conditions of those modals that may not appear in positive clauses.

Therefore we conclude that the proposed analysis in this paper provides a proper explanation as to why certain deontic modals scope over and others scope under negation. At the same time, several questions remain open, for instance, why is it that no existential modals may scope over negation, or how the analysis extends to negative sentences with epistemic modals? These questions remain subject for future research.

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