

Negation, Polarity, and Deontic Modals

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Universal deontic modals may vary with respect to whether they scope over or under negation. For instance, English modals like *must* and *should* take wide scope with respect to negation; modals like *have to* and *need to* take narrow scope. Similar patterns have been attested in other languages. In this article, we argue that the scopal properties of modals with respect to negation can be understood if (a) modals that outscope negation are positive polarity items (PPIs); (b) all modals originate in a position lower than I^0 ; and (c) modals undergo reconstruction unless reconstruction leads to a PPI-licensing violation.

Keywords: modality, negation, polarity, reconstruction, verb movement

1 Introduction

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 scope relations between negation and deontic modals.

1.1 The Problem

Existential deontic modals (“ \diamond ”) in English—and, as far as we know, in all languages—take scope under (hereafter, just *scope under*) negation.

- (1) a. John cannot leave. ¬ > \diamond
b. John may not leave. ¬ > \diamond ¹

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¹Note, though, that under special intonation these constructions can also have a reading where the negation scopes under the modal. (1b) would then mean that John is allowed not to leave. This reading, however, is not the regular interpretation of this construction and may well be associated with constituent negation.

However, some universal deontic modals (“□”) scope over negation, whereas others scope under negation. This variation can be attested in English ((2), (3)) as well as in other languages such as Greek (4), Dutch (5), Hindi (6), and German (7). (The Hindi data are from Rajesh Bhatt (pers. comm.), cited in von Stechow and Iatridou 2007:451.)

- | | | |
|--------|--|--------------------|
| (2) a. | John doesn't/does not have to leave. | ¬ > □ |
| b. | John doesn't/does not need to leave. | ¬ > □ |
| (3) a. | John mustn't/must not leave. | □ > ¬ |
| b. | John oughtn't/ought not to leave. | □ > ¬ |
| c. | John shouldn't/should not leave. | □ > ¬ |
| d. | John isn't to leave. | □ > ¬ |
| (4) a. | Dhen chriazete na figis. ² | ¬ > □ |
| | NEG need NA leave | |
| | 'You don't need to leave.' | |
| b. | Dhen prepi na to kanume afto. | □ > ¬ |
| | NEG must NA it do this | |
| | 'We must not do this.' | |
| (5) a. | Hans moet niet vertrekken. | □ > ¬ ³ |
| | Hans must NEG leave | |
| | 'Hans must not leave.' | |
| b. | ... dat Hans niet moet vertrekken. | □ > ¬ ⁴ |
| | ... that Hans NEG must leave | |
| | '... that Hans must not leave.' | |
| (6) a. | tumhen Dilli nahiiN jaa-naa hai. | ¬ > □ |
| | you.DAT Delhi NEG go-INF be.PRES | |
| | 'You don't have to go to Delhi.' | |
| b. | tumhen Dilli nahiiN jaa-naa caahiye. | □ > ¬ |
| | you.DAT Delhi NEG go-INF should | |
| | 'You should not go to Delhi.' | |
| (7) a. | Hans muss nicht abfahren. | ¬ > □ |
| | Hans must NEG leave | |
| | 'Hans doesn't have to leave.' | |
| b. | ... dass Hans nicht abfahren muss. | ¬ > □ |
| | ... that Hans NEG leave must | |
| | '... that Hans doesn't have to leave.' | |

² Giannakidou (1998) takes *chriazete* to be a negative polarity item. However, she has since agreed (pers. comm.) that it is not.

³ Dutch *moeten* 'must' does not scope over negation in all dialects; in most southern and eastern varieties, it scopes under negation (as in German).

⁴ Dutch speakers for whom *moeten* 'must' scopes over negation in main clauses generally also allow the inverse reading in subordinate clauses; that is, (5b) can be ambiguous (see section 4.1 for more discussion).

In addition, there are universal deontic modals that must appear in the scope of negation, such as English *need* (8), Dutch *hoeven* (9), and German *brauchen* (10). These modals are commonly taken to be negative polarity items (NPIs) (e.g., Van der Wouden 1994).⁵

- (8) a. You need *(not) leave.⁶
 b. No/*Every/*Some student need leave.
- (9) a. Hans braucht *(nicht) zu gehen. ¬ > □
 Hans need NEG to go
 ‘Hans need not go.’
 b. Kein/*Jeder/*Ein Student braucht zu gehen.
 no/every/a student need to go
- (10) a. Je hoeft *(niet) weg te gaan. ¬ > □
 you need NEG away to go
 ‘You need not leave.’
 b. Geen/*Iedere/*Een student hoeft weg te gaan.
 no/every/a student need away to go

1.2 Polarity-Sensitive Modals

At least two previous types of approaches have aimed to account for the scopal interaction between modals and negation. In one type, the basic idea is that different modals are generated at different heights in 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 idiosyncrasies (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 $\neg > \square$ and $\square > \neg$, a given language may have a different universal modal item for each scope relation. As a

⁵ 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 der 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; rather, *nel'zja* is a word, much the way 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.

⁶ 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.

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 idiosyncrasies: 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 indeed possible.

For these reasons, in Iatridou and Zeijlstra 2010 we took a completely different approach. Adopting the working hypothesis that any domain that has NPIs also has positive polarity items (PPIs) (along the lines of Van der Wouden 1994),⁷ we started from the assumption that since NPIs surface in the domain of deontic modality, we might expect to find PPIs there as well.

In short, we analyzed modals that scope over negation—English *must*, *should*, *ought to*, Greek *prepi*, Dutch *moeten*, Hindi *caahiye*, and the like—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 shown in table 1.

With regard to the universal modals, four questions immediately arise, which we will discuss in the following four sections:

- Q1:** To what extent do deontic PPI modals and better-known PPIs exhibit the same distributional behavior?
- Q2:** How do deontic modals take scope with respect to negation, given their polarity requirements and their surface position?
- Q3:** How can the NPI/PPI properties of deontic modals be captured? What makes a (modal) polarity item a polarity item?
- Q4:** To what extent does the analysis apply to epistemic modals too?

If we can provide good answers to these four questions, we can safely conclude that it is the NPI and PPI properties of modals that underlie their scope relations with respect to negation.

The article is organized as follows. Addressing Q1 in section 2, we demonstrate that the distributional patterns of the alleged modal PPIs and other PPIs are virtually identical. Addressing

Table 1
PPI, neutral, and NPI modals

	PPI modals	Neutral modals	NPI modals
Universal	must, should, ought to, to be to	have to, need to	need
Existential	—	can, may	—

⁷ PPIs are elements that cannot appear in the (immediate) scope of an antimorphic, antiadditive operator or the larger class of downward-entailing operators.

Q2 in section 3, we show that all non-PPI modals must reconstruct to a position below negation. Addressing Q3 in section 4, we investigate to what extent current theories of negative and positive polarity can explain what property makes modals like English *must* PPIs, modals like English *need* NPIs, and modals like English *have to* neutral. Addressing Q4 in section 5, we discuss to what extent the analysis can be extended to epistemic modals as well. Section 6 concludes.

2 Q1: To What Extent Do Deontic PPI Modals and Better-Known PPIs Exhibit the Same Distributional Behavior?

The first question that arises is how it can be established that the modals that outscope negation are PPIs. Just saying that these modals are PPIs because they cannot scope under negation is not sufficient. We provide actual arguments that support this claim, by comparing distributional properties of better-known PPIs, such as English *some*,⁸ with distributional properties of modals that outscope negation. If the distributional properties of the modals that 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 follow from their PPI-hood.

The behavioral characteristics of PPIs distribute along three dimensions. First, as shown in Szabolcsi 2004 and references cited there, although PPIs are generally banned from negative contexts, there are actually three types of negative contexts in which all known PPIs, such as the English PPI *some NP*, may surface under the scope of negation. We take occurrence in these contexts as a diagnostic for PPI-hood, and we will show in sections 2.1–2.3 for three different languages that vary syntactically in the way they express negation and/or modality—namely, English, Dutch, and Greek—that according to these diagnostics modals outscoping negation are also PPIs.

Second, it is attested that, just like NPIs, PPIs may vary with respect to 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 antiadditive or antimorphic 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 among English, Dutch, and Greek PPI modals.⁹

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 show in section 2.5 that this contrast also applies to PPI modals.

⁸ Though see Krifka 1995 for a dissenting view, according to which English *some* is not a PPI.

⁹ Antiadditive functions are a subset of downward-entailing functions. A function f is antiadditive if and only if $f(X \vee Y) \Rightarrow f(X) \wedge f(Y)$. The left-to-right direction is automatic for downward-entailing functions: the set of things that 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 downward-entailing operators, then $f(X \vee Y) \Rightarrow f(X) \wedge f(Y)$. What is crucial for antiadditivity, and is *not* true for all downward-entailing functions, is the other direction, $f(X) \wedge f(Y) \Rightarrow f(X \vee Y)$.

No professor is antiadditive because *No professor drinks and no professor smokes* \Rightarrow *No professor drinks or smokes*. On the other hand, *at most one professor* is not antiadditive, though it is downward-entailing: if *at most one professor drinks and at most one 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*.

Given that these three distributional patterns are the same for better-known PPIs and for modals that scope over negation, we conclude that such modals are indeed PPIs.¹⁰

2.1 Metalinguistic/Contrastive Negation

PPIs may appear under the scope of metalinguistic negation and/or contrastive negation (see Szabolcsi 2004 and references therein), as shown here for English *something*. ((12) is based on an example that Roger Schwarzschild (pers. comm.) provided to Szabolcsi.)

- (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.

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

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

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 NA write 2 article this.year
 'Kostas must write 2 articles this year.'
- B: Dhen PREPI na grapsi 2 ala kala tha itan. → > □
 NEG MUST NA write 2 but good FUT be.PST
 'He doesn't have to write 2, but it would be good.'

¹⁰ Independently and for different reasons, Homer (2010) has also reached the conclusion that English *must* is a PPI. He provides additional arguments, adopting the diagnostics provided by Szabolcsi (2004), which show that *must* is indeed a PPI.

(16) A: Theresa moet op negatie werken.

Theresa must on negation work

‘Theresa must work on negation.’

B: Ze MOET niet op negatie werken, ze wordt hooguit aangemoedigd. $\neg > \square$

she MUST NEG on negation work she is at.best encouraged

‘She doesn’t have to work on negation; she is at best encouraged.’

However, 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.

This is due to an independent property of English contrastive focus: if negation licenses focus, it must c-command the focus at surface structure (see Jackendoff 1972).¹¹ This explains why (17B) is ruled out.

However, it is possible to find cases in English where *must* is c-commanded by negation, and then we can duplicate the Greek and Dutch phenomenon. Iatridou and Sichel (2011) point out that negative subjects scope in exactly the same way with respect to modals as plain negative markers do, while preceding the modal at surface 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 scope under contrastive negation induced by a negative subject. This is indeed the case, as shown in (18), with stress on the modal enabling the metalinguistic reading of the example. Predictably, negation contained in an object cannot focus the modal, for the same reason that sentential negation fails to do so (see (19)).

(18) A: A student must read 5 articles on the topic.

B: No student MUST read 5 articles on the topic but one student is 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, thereby meeting the first criterion of PPI-hood too.¹²

¹¹ Note that the application of this criterion is not universal, as one could have guessed already from the fact that the Dutch (14) is acceptable, and the English (17) is not. In Dutch and German verb-second (V2) constructions, verbs can be focused from a lower negation. In non-V2 cases, precedence conditions similar to those noted above for English apply (see, e.g., Jacobs 1980).

¹² The condition that focus must be c-commanded by its licenser at surface structure has been challenged for licensing by *even* (Rooth 1985) and *only* (Wagner 2006), and for negation as well (Beaver and Clark 2008, pointed out to us by Maziar Toosarvandani (pers. comm.)). Under those approaches, a c-command constraint between negation and a contrastive focus is not expected. However, in the case of *must*, it turns out that such c-command constraints are attested.

2.2 Intervention Effects

A sentence with a PPI in the immediate scope of an antiadditive operator is ungrammatical (see Szabolcsi 2004 and references therein). However, when the PPI is not in the immediate scope of an antiadditive operator, because some other intervening element takes scope between the antiadditive operator and the PPI, the sentence is fine (see Kroch 1979).¹³ This is illustrated in the following examples, taken from Szabolcsi 2004:415:

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

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

This is indeed the case. As (21)–(24) show, the intervention tests straightforwardly apply to Greek *prepi* and Dutch *moeten*—and, as the translations indicate, to English *must* as well. The readings that (21) and (22) give rise to have the scope relations *negation* > *because* > *must*; the readings of (23) and (24) have the relations *negation* > *always* > *must*.¹⁴

- (21) Dhen prepi na ton pandrefti epidhi ine oreos ala epidhi ine eksipnos.
 NEG must NA him marry because is handsome but because is smart
 'She must not marry him because he is handsome but because he is smart.'
- (22) Ze moet niet met hem trouwen omdat hij er goed uit ziet, maar omdat hij
 she must NEG with him marry because he there good out looks but because he
 een goede taalkundige is.
 a good linguist is
 'She must not marry him because he is handsome but because he is a good linguist.'
- (23) A: Panda esi prepi na vgazis ta skupidia?
 always you must NA 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 NA them take.out always many times them take.out the son my
 'I must not always take it out. Many times my son takes it out.'

¹³ Note that this is similar to the Immediate Scope Constraint, which states that an NPI is banned from a context where another element takes scope between the NPI and its licenser (see Linebarger 1981, 1987).

¹⁴ Though to get this reading in example (23B), the NPI *hoeven* is preferred over *moeten*.

- (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 buiten zetten; vaak doet Jan het.
 no I must NEG always the garbage outside put often does Jan it
 ‘No, I must not always put 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 or any other context that is known to ban PPIs if this context is clause-external (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 over Greek *prepi*, English *must*, and Dutch *moeten*—yet another environment where these behave like better-known PPIs.

- (26) Dhen nomizo oti prepi na figi.
 NEG think that must NA leave
 ‘I don’t think that she/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 among PPIs

A fourth well-known observation about PPIs is that they may differ with respect to the logical properties of their licensing contexts. Van der Wouden (1994) calls PPIs that are only banned from antimorphic contexts *weak PPIs*. So-called *PPIs of medium strength* may not appear under the direct scope of an antiadditive operator. Finally, *strong PPIs* are banned from all downward-entailing contexts. This is shown for three Dutch PPIs in table 2 (based on Van der Wouden 1994).

If such variation is attested among ‘plain’ PPIs, one might expect it to be attested as well 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 contexts that are downward-entailing but not antiadditive.

- (36) *tha eprepe*
 FUT must + PST¹⁶
 ‘should’, ‘ought to’
- (37) *zou moeten*
 would must
 ‘should’, ‘ought to’

As (38)–(41) illustrate, the Greek and Dutch modals expressing *should* cannot take scope between downward-entailing but non-antiadditive operators, such as ‘few’ and ‘only’, whereas the regular universal modals *prepi* and *moeten* can.

- (38) a. *Ligi fitites prepi na figun.* must > few; few > must
 few students must_{NA} leave
 ‘Few students must leave.’
- b. *Ligi fitites tha eprepe na figun.* should > few; *few > should
 few students FUT must.PST_{NA} leave
 ‘Few students should leave.’
- (39) a. *Mono o Yanis prepi na figi.* must > only; only > must
 only the Yanis must_{NA} leave
 ‘Only Yanis must leave.’
- b. *Mono o Yanis tha eprepe na figi.* should > only; *only > should
 only the Yanis FUT must.PST_{NA} leave
 ‘Only Yanis should leave.’
- (40) a. *Weinig studenten moeten vertrekken.* must > few; few > must
 few students must leave
 ‘Few students must leave.’
- b. *Weinig studenten zouden moeten vertrekken.* should > few; *few > should
 few students would must leave
 ‘Few students should leave.’
- (41) a. *Alleen Jan moet vertrekken.* must > only; only > must
 only Jan must leave
 ‘Only Jan must leave.’
- b. *Alleen Jan zou moeten vertrekken.* should > only; *only > should
 only Jan would must leave
 ‘Only Jan should leave.’

So far in this section, we have shown that modal PPIs differ with respect to the logical properties of their licensing contexts, just like other PPIs. This is not the only way in which

¹⁶ The verb *prepi* is in a small class of Greek verbs for which there is no perfective/imperfective distinction.

modals vary with respect to their PPI strength. Whereas *to be to* must always outscope negation and negative indefinites, as shown in (42), English speakers vary with respect to the strength of *must* (43). While speakers agree that *must* scopes over the sentential negative marker, speakers differ in their judgments on sentences with *must* that contain a negative indefinite subject (see Iatridou and Sichel 2011): whereas all speakers assign a reading $\square > \neg > \exists$ to sentences like (43), some speakers also permit $\neg > \exists > \square$. We refer to these two varieties of English as *English A* and *English B*.

(42) Nobody is to leave. $\square > \neg > \exists, * \neg > \exists > \square$ (English A and B)

(43) Nobody must leave. $\square > \neg > \exists, * \neg > \exists > \square$ (English A)
 $\square > \neg > \exists, \neg > \exists > \square$ (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 antiadditive contexts (like *nobody*). However, for speakers of English B, *must* is only banned in the direct scope of the negative marker—that is, for those speakers, *must* is a weak PPI, which is therefore fine in the complement of negative indefinites.

As we have shown, then, the pattern of PPIs presented in table 2 for nonmodal PPIs naturally extends to modal PPIs, as depicted in table 3. This further strengthens our conclusion that it is PPI-hood that underlies the scopal properties of modals with respect to negation.

2.5 Baker/Szabolcsi Facts

A striking fact about PPIs is that whereas a PPI cannot be in the immediate scope of a clausemate negation/antiadditive operator, this configuration becomes licit when it is in the scope of an NPI-licensing environment. This set of facts was first observed by Baker (1970); it is also discussed at length by Szabolcsi (2004:35–41), for whose explanation of PPI-hood it is crucial. For this

Table 3
 Different strengths of modal PPIs

Weak PPI	must (English B)	He mustn't leave.	$* \neg > \square$
		Nobody must leave.	$\neg > \exists > \square$
		Few people must leave.	$\text{few} > \square$
PPI of medium strength	must (English A)	He mustn't leave.	$* \neg > \square$
		He isn't to leave.	$* \neg > \exists > \square$
	<i>to be to</i>	Nobody must leave.	$\text{few} > \square$
		Nobody isn't to leave.	
		Few people must leave.	
Strong PPI	should	He shouldn't leave.	$* \neg > \square$
		Nobody should leave.	$* \neg > \exists > \square$
		Few people should leave.	$* \text{few} > \square$

reason, we refer to these facts as the *Baker/Szabolcsi facts*. The relevant configurations of these facts are represented and illustrated in (44) and (45).¹⁷

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

We would like to point out, however, that the Baker/Szabolcsi facts do not apply to all PPIs, but only to those PPIs that are either weak or of medium strength. A strong PPI cannot appear in the scope of a negation embedded in a downward-entailing context. This is shown in (46)–(47) for a number of strong PPIs in Dutch.

- (46) a. *Hij is niet {allerminst/inderdaad/verre van} tevreden.
 he is NEG 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 zijn {allerminst/inderdaad/verre van} tevreden.
 few people are not.in.the.least/indeed/far from happy
- (47) a. *Ik ben verbaasd dat je niet {allerminst/inderdaad/verre van} tevreden bent.
 I am surprised that you NEG not.in.the.least/indeed/far from happy are
 b. *Het spijt me dat Jan niet {allerminst/inderdaad/verre van} tevreden is.
 I regret that Jan NEG not.in.the.least/indeed/far from happy is
 c. *Als we niet {allerminst/inderdaad/verre van} tevreden zijn, gaat het mis.
 if we NEG not.in.the.least/indeed/far from happy are goes it wrong
 d. *Iedereen die niet {allerminst/inderdaad/verre van} tevreden is, . . .
 everybody who NEG not.in.the.least/indeed/far from happy is
 e. *Alleen Jan is niet {allerminst/inderdaad/verre van} tevreden.
 only Jan is NEG not.in.the.least/indeed/far from happy
 f. *Weinig mensen zijn niet {allerminst/inderdaad/verre van} tevreden.
 few people are NEG not.in.the.least/indeed/far from happy
 g. *Weinig jongens dachten dat jij niet {allerminst/inderdaad/verre van}
 few boys thought that you NEG not.in.the.least/indeed/far from
 tevreden was.
 happy were

¹⁷ See also Homer, to appear a, for discussion and an account of these facts.

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 context, but that strong PPIs, such as English *should*, cannot. This is indeed the case, as shown for English in (48)–(53).¹⁸

- | | | |
|---------|---|---------------|
| (48) a. | If he must not work tonight, he is allowed to go out with his girlfriend. | not > must |
| b. | If he is not to work tonight, he is allowed to go out with his girlfriend. | not > is to |
| c. | If he should not work tonight, he is allowed to go out with his girlfriend. | *not > should |
| (49) a. | Every boy who must not work tonight is allowed to go out with his girlfriend. | not > must |
| b. | Every boy who is not to work tonight is allowed to go out with his girlfriend. | not > is to |
| c. | Every boy who should not work tonight is allowed to go out with his girlfriend. | *not > should |
| (50) a. | Only John must not work tonight. | not > must |
| b. | Only John is not to work tonight. | not > is to |
| c. | Only John should not work tonight. | *not > should |
| (51) a. | Very few doctors must not work tonight. Most of them are on duty. | not > must |
| b. | Very few doctors are not to work tonight. | not > are to |
| c. | Very few doctors should not work tonight. | *not > should |
| (52) a. | I regret that John must not write a paper on that topic. | not > must |
| b. | I regret that John is not to write a paper on that topic. | not > is to |
| c. | I regret that John should not write a paper on that topic. | *not > should |

¹⁸ Two remarks are in order here. First, Homer (to appear b) argues that, just as in the examples with *should* and *must* in section 2.4, in (48)–(53) *should* takes scope over the negation and *must* does not, because *should* is a neg-raiser and *must* is not. Again, this predicts that *should* will still be fine under negation (since for Homer its PPI-strength is not different from that of *must*), contrary to fact. Homer (to appear b: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 is quite likely a case of contrastive negation, given that it is an instance of double negation, and double negation generally gives rise to contrastive focus readings (see Liberman and Sag 1974, Corblin et al. 2004).

Second, sometimes it is not really clear whether a modal like *must* scopes under negation because it appears in a Baker/Szabolcsi-type context, or whether the negation is clause-external at LF. One example, due to Eric Potsdam (pers. comm.), concerns biased negative questions such as *Mustn't he leave?* Here, the modal is interpreted below negation, but it remains unclear whether this is due to the fact that polar questions may license NPIs and therefore together with the negation form a Baker/Szabolcsi context, or whether a high negation in a biased negative question must receive a clause-external interpretation and therefore allows *must* in its scope.

- (53) a. I am surprised that he must not write a paper about the Romans. not > must
 b. I am surprised that he is not to write a paper about the Romans. not > is to
 c. I am surprised that he should not write a paper about the Romans. *not > 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.¹⁹

- (54) a. An dhen *prepi* na dhulepsi apopse, bori na vgi me if [not > must]
 if NEG must NA work tonight can NA go.out with
 tin filenadha tu.
 the girlfriend his
 'If he must not work tonight, he is allowed to go out with his girlfriend.'
 b. An dhen tha eprepe na dhulepsi apopse, bori na vgi *if [not > should]
 if NEG FUT must.PST NA work tonight can NA go.out
 me tin filenadha tu.
 with the girlfriend his
 'If he should not work tonight, he is allowed to go out with his girlfriend.'
- (55) a. Kathe pedhi pu dhen *prepi* na dhulepsi apopse bori na every [not > must]
 every boy who NEG must NA work tonight can NA
 vgi me tin filenadha tu.
 go.out with the girlfriend his
 'Every boy who doesn't have to work tonight is allowed to go out with his girlfriend.'
 b. Kathe pedhi pu dhen tha eprepe na dhulepsi *every [not > should]
 every boy who NEG FUT must.PST NA work
 apopse bori na vgi me tin filenadha tu.
 tonight can NA go.out with the girlfriend his
 'Every boy who should not work tonight is allowed to go out with his girlfriend.'
- (56) a. Monacha o Yanis dhen *prepi* na dhulepsi apopse. only [not > must]
 only the Yanis NEG must NA work tonight
 'Only Yanis doesn't have to work tonight.'
 b. Monacha o Yanis dhen tha eprepe na dhulepsi apopse. *only [not > should]
 only the Yanis NEG FUT must.PST NA work tonight
 'Only Yanis should not work tonight.'

¹⁹ The (b)-examples in (54)–(57) are 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. See von Stechow and Iatridou 2008 for this distinction.

- (57) a. Ekplisome pu dhen prepi na apofevgis to alati. surprise [not > must]
 surprised that NEG must NA avoid the salt
 'I am surprised that you must not avoid salt.'
- b. Ekplisome pu dhen tha eprepe na troi alati. *surprise [not > should]
 surprised that NEG FUT must.PST NA eat salt
 'I am surprised that she should not eat salt.'

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 can no longer be interpreted below the negation.

- (58) a. Als hij vanavond niet moet werken, if [not > must]
 if he tonight NEG must work
 kan hij met zijn vriendin uitgaan.
 can he with his girlfriend out.go
 'If he must not work tonight, he is allowed to go out with his girlfriend.'
- b. Als hij vanavond niet zou moeten werken, *if [not > must]
 if he tonight NEG would must work
 kan hij uitgaan.
 can he out.go
 'If he must not work tonight, he is allowed to go out.'
- (59) a. Iedereen die vanavond niet moet werken, every [not > must]
 everybody who tonight NEG must work
 kan uitgaan.
 can out.go
 'Everybody who doesn't have to work tonight is allowed to go out.'
- b. Iedereen die vanavond niet zou moeten werken, *every [not > should]
 everybody who tonight NEG would must work
 kan uitgaan.
 can out.go
 'Everybody who shouldn't have to work tonight is allowed to go out.'
- (60) a. Alleen Jan moet vanavond niet werken. only [not > must]
 only Jan must tonight NEG work
 'Only Jan doesn't have to work tonight.'
- b. Alleen Jan zou vanavond niet moeten werken. *only [not > should]
 only Jan would tonight NEG must work
 'Only Jan shouldn't have to work tonight.'

- (61) a. Ik ben verbaasd dat je niet moet sporten. surprise [not > must]
 I am surprised that you NEG must sport
 'I am surprised that you must not do sports.'
- b. Ik ben verbaasd dat je niet zou moeten sporten. *surprise [not > should]
 I am surprised that you NEG would must sport
 'I am surprised that you should not do sports.'

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 three languages, the *should*-type of modal is a strong PPI and is therefore banned from Baker/Szabolcsi contexts.

One might wonder what the difference is between *must* and *should*. It might be a "just so" matter, as the distinctions in table 2 possibly are. However, there are reasons to think that it may not be random. As noted earlier, in Greek and Dutch (and many other languages; see von Stechow and Iatridou 2008), 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*) 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, much more investigation is needed on this point.

3 Q2: How Do Deontic Modals Take Scope with respect to Negation, Given Their Polarity Requirements and Their Surface Position?

In this section, we explore how deontic modals scope with respect to negation, given their polarity requirements and their surface position. In section 3.1, we discuss how neutral modals (i.e., modals that are neither NPIs nor PPIs) end up scoping under negation, even if they appear in a higher position than negation at surface structure. In section 3.2, we show that the mechanism proposed in section 3.1 also applies to those modals that are NPIs. In section 3.3, we discuss how PPI modals 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:

- (62) 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 (see Horn 1989, Penka and von Stechow 2001, Zeijlstra 2004, Abels and Martí 2010, 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 it a bit.

It has been 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 that these modals are

generated in I^0 stems from the fact that they 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 .²⁰ 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 .

(63) 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 at least to I^0 , since tensed verbs that are able to move always move to I^0 or higher.

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. Moreover, it is 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). In addition, as we will show, assuming that modals originate in a position lower than I^0 makes it possible to understand the scope 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 (e.g., English *have to*, German *müssen*, and Greek *chriazete*) can occur in positive sentences, 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 (e.g., *can not*) of sentential negation. 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 (62b)), we need say nothing further for neutral modals that surface to the right of negation. They are simply interpreted where they appear in the overt syntax; that is, their syntactic and semantic scopes are identical. Here are some examples of this category, from English (64), Greek (65), German (66), and Spanish (67).

- (64) a. John doesn't have to leave. ¬ > □
 b. John doesn't need to leave. ¬ > □
- (65) O Yanis dhen chriazete na figi. ¬ > □
 the Yanis NEG needs NA leave
 ‘Yanis doesn't need to leave.’
- (66) . . . dass Hans nicht abfahren muss. ¬ > □
 . . . that Hans NEG leave must
 ‘. . . that Hans doesn't have to leave.’

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

- (67) Juan no tiene que ir. ¬ > □
 Juan NEG has PRT go
 ‘Juan doesn’t have to go.’

However, how neutral modals that syntactically appear above negation end up scoping under it remains an open question. In other words, what happens when syntactic and semantic scope do not coincide, as in the following English examples?

- (68) a. John cannot leave. ¬ > ◇
 b. John may not leave. ¬ > ◇

Here is where our third assumption, (62c), becomes relevant. If the modals in (68) are generated below I^0 , then what needs to be added to account for the fact that they scope under negation is that despite moving to a position above negation, they are interpreted in their base position—that is, below negation. There are in principle three options that would achieve these results:

- (69) a. Head movement necessarily reconstructs.
 b. Head movement reconstructs unless reconstruction would result in ungrammaticality.
 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 (69), though we will come back to these issues in much more detail in 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 scope under negation. This conclusion is based on an empirical observation gleaned from a small number of languages. If this observation turns out to be wrong—that is, if further crosslinguistic investigation shows that there are languages where neutral modals scope over negation, we will want to amend our apparatus so that this becomes possible. Linguistics studies part of the natural world, after all, and if the natural world proves different from what we originally thought, we amend our theory.

3.2 NPI Modals

The same reasoning we used for the cases in (68) can be extended to NPI modals like English *need*, German *brauchen*, and Dutch *hoeven*. If they appear syntactically under negation, as in German (70a) and Dutch (70b), nothing further needs to be said about them. They are interpreted where they appear in the overt syntax.

- (70) a. . . . dass Hans nicht abzufahren braucht.
 . . . that Hans NEG leave need
 ‘. . . that Hans doesn’t need to leave.’
 b. . . . dat Suzanne niet hoeft te vertrekken.
 . . . that Suzanne NEG need to leave
 ‘. . . that Suzanne doesn’t need to leave.’

However, if the NPI modal precedes negation in the syntax, as in (71), then we need to force reconstruction in order to interpret the modal under the scope of negation.

(71) John need not leave. ¬ > □

We can again appeal to one of (69a–c), or we can appeal to (72).

(72) NPIs reconstruct to a position that will satisfy their NPI requirements.²¹

In short, neutral and NPI modal head movement either reconstructs or takes place at PF.

3.3 PPI Modals

The problem now is to account for the scopal interpretation of PPI modals. Again, we need to discuss two cases: PPI modals that appear higher than negation in the overt syntax, and PPI modals that appear under negation in the overt syntax. Let us start with the former.

Recall the three possibilities that can derive the readings for neutral modals ((69), repeated as (73)).

- (73) a. Head movement necessarily reconstructs.
- b. Head movement reconstructs unless reconstruction would result in ungrammaticality.
- 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 appear above negation in the syntax stay there for interpretation, we must immediately reject option (73c). Under the PF movement scenario, the modal would have to be interpreted under negation.²² (See also Lechner 2004 and Hartman 2011 for more reasons to reject the suggestion that head movement only takes place at PF.)²³

Similarly, we need to reject option (73a), as it does not permit the modal to stay higher than negation. The only viable option, then, is (73b).

Option (73b) will take care of both 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).²⁴

²¹ 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 LF. Most NPIs are subject to a surface constraint as well (i.e., the NPI must appear under its licenser at surface position; see Ladusaw 1979), but this constraint is known to have exceptions, such as sentences with modal NPIs (see de Swart 1998). In all exceptional cases, though, the NPI still needs to be roofed by negation at LF.

²² 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.

²³ The idea that head movement takes place only at PF is attributed to Chomsky (2000), but this attribution may be overstated. Certainly, Chomsky claims that movement of inflectional categories is semantically empty, but he leaves open the movement from T to C as being semantically interpretable. Other considerations that have pushed the head-movement-at-PF-only hypothesis are the concerns that head movement appears to be countercyclic (Chomsky 2000), that it helps solve a particular problem in pseudogapping (Boeckx and Stjepanović 2001), and that it aids in the understanding of synthetic compounds in English (Harley 2004).

²⁴ 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).

Option (73b) will also permit PPI modals that have moved over negation to be interpreted in their new position—if we add the assumption that satisfying the PPI-licensing requirement is a strong enough reason for them not to reconstruct.

Now we come to the second (and harder) case: PPI modals that appear under negation in the overt syntax, as in the following Greek and Spanish examples:

- (74) O Yanis dhen prepi na figi. syntactic order: $\neg > \square$
 the Yanis NEG must NA leave semantic scope: $\square > \neg$
 ‘Yanis must not leave.’
- (75) Juan no debe ir. syntactic order: $\neg > \square$
 Juan NEG must go semantic scope: $\square > \neg$
 ‘Juan must not go.’

How does the PPI modal manage to scope over negation here? DP PPIs that outscope negation are said to do so by quantifier raising (QR; see Krifka 1992, Szabolcsi 2004).

- (76) a. John didn’t see a man. $\neg > \exists; \exists > \neg$
 b. 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.²⁵ However, this immediately raises the following questions:

- (77) 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 (77a) is that some functional head should be available as a landing site for the modal, though we will not attempt to identify it.

With respect to (77b), 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 therefore take the type of the modal to be $\langle \langle s, t \rangle, t \rangle$.

As for (77c), we follow Fox (2006) and others, who have argued (using different mechanisms) that in the absence of specific clues for a type, the trace has the lowest type that will make the composition work. This 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 (78) and (79), respectively.²⁶

²⁵ See also Homer 2010, to appear b, where it is assumed that PPI *must* scopes over negation by QR.

²⁶ Here is how the full semantic composition would go with a PPI modal:

(i) $[[\text{PPI-modal}]_i \langle [[\text{not}] ((w_i \text{ [John left]}))] \rangle] =$
 $[\lambda q. \text{for all } w' \text{ in } W', q \text{ at } w']_i \langle ([\lambda p. \text{NOT}(p)] (w_i \text{ [}\lambda w. \text{John left at } w])) \rangle =$
 $[\lambda q. \text{for all } w' \text{ in } W', q \text{ at } w']_i \langle ([\lambda p. \text{NOT}(p)] ([\text{John left at } w_i])) \rangle =$

- (78) [not [PPI-modal [vP]]] Surface structure
 [⟨t,t⟩ [⟨⟨s,t⟩, t⟩ [⟨s,t⟩]]]
- (79) [PPI-modal_i [not [t_i [vP]]]] LF
 [⟨⟨s,t⟩, t⟩ [⟨t,t⟩ [s ⟨s,t⟩]]]

If our 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 QR) 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*, and *somewhat* (all taken from Israel 1996) are not quantificational and cannot undergo raising across negation.

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

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 must be shown that alternative accounts face problems.

One alternative would be to assume that the scope of the PPI over negation does not come about syntactically but is the result of (e.g.) some interplay of presuppositions and implicatures. An instance of such a mechanism is Gajewski's (2007) pragmatic explanation of neg-raising (though see Homer 2010 for why neg-raising is not behind the interaction of *must* and negation).²⁷ However, there is evidence 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 is provided by the English PPI *must* and neutral *may*, on their deontic interpretations.

- (81) a. John must not leave. □ > ¬
 b. John may not leave. ¬ > ◇

[λq. for all w' in W', q at w']_i (NOT([John left at w_i])) =
 [λq. for all w' in W', q at w']_i λw_i(NOT([John left at w_i])) =
 for all w' in W', λw_i(NOT([John left at w_i])) (w') =
 for all w' in W', NOT([John left at w'])

For a sentence with *should*, 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.

²⁷ Homer (2010) presents various reasons why a neg-raising analysis cannot apply to account for the scopal interaction between negation and *must*; for one, it would then be expected that *must* can outscope extracausal negation, contrary to fact.

These considerations also naturally extend to Spanish. Spanish has PPI *deber* and neutral *tener que*.³⁰ Both verbs appear after negation in the overt syntax.

- (87) a. Juan no debe ir. □ > ¬
 Juan NEG must go
 ‘Juan must not go.’
 b. Juan no tiene que ir. ¬ > □
 Juan NEG has PRT go
 ‘Juan does not have to go.’
- (88) a. Alguien no debe ir. somebody > □ > ¬, □ > somebody > ¬
 somebody NEG must go
 ‘Somebody must not go.’
 b. Alguien no tiene que ir. somebody > ¬ > □, *¬ > □ > somebody
 somebody NEG has PRT go
 ‘Somebody does not have to go.’

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 in order to take narrow scope.³¹ 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 *deber* and the subject DP is established, *deber* is above negation.

If PPI modals take scope above negation by moving across it, we predict that if a modal is unable to move because of 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 behavior of the French universal modal in perfective constructions.

Homer (2010) shows that the French universal modal *devoir* may scope both over and under negation, a property that he alludes to as lexical ambiguity. According to him, *devoir* comes in two guises, one PPI and one that we would call ‘neutral.’³²

- (89) Il (ne) doit pas partir.³³ ¬ > □, □ > ¬
 he NEG must NEG leave
 ‘He must not leave.’/‘He does not have to leave.’

We find that this scopal ambiguity persists when the modal is infinitival.

³⁰ Thanks to Paola Menendez-Benito for discussion of the Spanish judgments.

³¹ As one reviewer points out, in (84) and (88) the modal *may* does not count as an intervener, just as it does not count as an intervener for NPI-licensing (see footnote 28). That is, it does not protect the PPI from negation.

³² We are not committed to a lexical ambiguity analysis of *devoir*. There could also be other reasons for the two scopes of *devoir* with respect to negation (e.g., more liberal constraints on reconstruction).

³³ French has two discontinuous negative markers, *ne* and *pas*, that jointly express negation. *Pas* is the main negator; *ne* can be left out.

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

The fact that the reading $\square > \neg$ is possible in (90b) means that in this case the modal can covertly move across negation. Now consider (91). When the modal is in the perfective, as in (91), there is an entailment that the underlying event happened (Bhatt's (2000) 'actuality entailment'; see also Hacquard 2006).

- (91) Jean a du prendre l'autobus.
 Jean has must.PART 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 a higher head that might potentially block movement of the modal over negation. And indeed, this head blocks covert raising of *devoir* across *pas*.

- (92) Jean (n)'a pas du prendre l'autobus. $\neg > \square, * \square > \neg$
 Jean NEG has NEG must.PART take the bus
 'Jean didn't have to take the bus.'

This sentence means that Jean was not forced to take the bus. It does not mean that he was forced by circumstances to not take it. Although it is too early to conclude with any certainty that it is the Head Movement Constraint that is at play in (92), this is a clear possibility. The exact interplay among the Head Movement Constraint, 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 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.³⁴ 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 scope over negation. In all those cases, described in section 2, where PPIs may scope under negation (e.g., if some intervening

³⁴ We note that in this sense reconstruction is different from A- or \bar{A} -reconstruction, where it is optional unless forced or forbidden.

element scopes between the PPI modal and its licenser or if the PPI modal is embedded in a Baker/Szabolcsi-type context), it is predicted that the modal can scope under negation, since reconstruction of the PPI modal to its base position no longer leads to ungrammaticality.

A final note: The proposal in this article is based on facts observed in a few languages. This raises the question of how it fares crosslinguistically. Certain things are not expected to vary across languages (e.g., the fact that negation never raises by itself), but we do not exclude that other things might be subject to crosslinguistic variation (e.g., the position where negation or the modal is base-generated, or whether verb reconstruction always, in every language, ‘‘must take place if it can’’). The latter parameters might yield more cases where neutral modals scope ambiguously with respect to negation.

4 Q3: How Can the NPI/PPI Properties of Deontic Modals Be Captured? What Makes a (Modal) Polarity Item a Polarity Item?

Our proposal is that the scopal properties of deontic modals with respect to negation follow from their polarity sensitivity properties: English *need* is an NPI; *must*, *should*, and *to be to* are PPIs; *have to* and *need to* are polarity-neutral. Now, how can the NPI and PPI properties of these modals be accounted for? That is, what sorts of properties are associated with lexical items that exhibit polarity behavior?³⁵ We cannot provide a conclusive answer to this question here; in fact, there is very little agreement about what is responsible for the properties of more familiar PPIs. Even so, in this section we will sketch what might be said about modal PPIs within existing frameworks.

Basically, two different approaches to the properties of polarity items can be distinguished, aligned with whether the licensing of NPIs and PPIs is viewed as semantic/pragmatic or syntactic in nature.³⁶

For the *semantic/pragmatic approach*, NPIs and PPIs are always endpoints of a scale and must obligatorily introduce alternatives. 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.

Under the *syntactic approach*, NPIs and PPIs bear certain features. These features come with particular requirements that need to be fulfilled (e.g., checking by negation); if they are not, the resulting sentence is ungrammatical.

4.1 Semantic/Pragmatic Approaches

The idea that sentences containing NPIs in non-downward-entailing contexts are infelicitous because they violate their conditions of use goes back to Kadmon and Landman 1993. This insight has been adopted in various ways by Krifka (1995), Israel (1996), Lahiri (1998), and Chierchia (2006, 2011). All of their analyses share the following claim: (most) NPIs denote low scalar

³⁵ Note that this is a somewhat different (though of course related) question from the one about the proper characterization of the licensing environment, which we will not address here.

³⁶ For a detailed overview of the different approaches to the nature of negative and positive polarity, see Giannakidou 2011.

endpoints and PPIs high endpoints, and they introduce alternatives that affect the domain of quantification.³⁷ As a result of the domain-widening property of NPIs and PPIs, the contribution of sentences containing an NPI or a PPI is either extremely low or extremely high, depending on the polarity of the clause the NPI or PPI appears in. NPIs in nonnegative (or non-downward-entailing) contexts are highly uninformative; PPIs in such contexts are highly informative. Naturally, once such elements appear in a scale-reversing environment, their informativity reverses too: an NPI embedded in a negative (or other downward-entailing) context becomes highly informative; a PPI in such a context, by contrast, becomes very uninformative. Furthermore, all these analyses share the view that, if by some semantic or pragmatic mechanism, sentences containing an NPI or a PPI become exhaustified (i.e., all stronger sentences than the one containing the NPI or PPI are taken to be false), then sentences that are extremely uninformative will even yield a semantic contradiction.³⁸

Under the analyses outlined above, high-scale elements, such as English *must*, can become PPIs if they are domain wideners (thus introducing domain alternatives) that are in need of strengthening by exhaustification. Thus, if it is assumed that *must* (as well as Dutch *moeten* and Greek *prepi*) has these properties, its PPI-hood can be formulated under the semantic/pragmatic approaches.³⁹

³⁷ English *some* is a notable exception to the observation that PPIs generally denote high endpoints of scales; it instead denotes a low endpoint. This is the reason why Krifka (1995) does not take *some* to be a PPI, though he acknowledges that its distribution is similar to that of what he takes to be real PPIs.

³⁸ To see this, consider the English NPI *any*.

(i) *I read any book.

In (i) *any*, as an NPI, obligatorily introduces scalar and domain alternatives. Because it contains an NPI, (i) needs to be exhaustified. This has the 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 (i) unacceptable. This is how. Suppose there are three books in the world: a blue book, a green book, and a red book. Then (i) asserts that the speaker 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, as a result of the obligatory exhaustification, (i) also asserts that the speaker 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, (i) 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 of these three statements are true, they contradict (i), which, given that *any* is an existential quantifier, entails that the speaker 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 (i) according to Chierchia (2006), following Krifka (1995). For a discussion of why certain contradictory statements are ungrammatical, see Gajewski 2002 and Fox and Hackl 2006.

³⁹ Again, to see this, consider (i).

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

Now, think of a 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 (ii).

(ii) John must not leave.

Now the question arises, which takes wider scope, the modal or negation? Let us start with the case in which the modal scopes under negation, and moreover, both scope under the required exhaustifier.

(iii) EXH > NEG > MUST

How can we prove that *must* (and the other PPI modals) obligatorily introduce domain alternatives? In truth, we cannot. The reality is that, in general, the diagnostics for detecting whether some element introduces domain alternatives are very weak. For instance, it is very hard to prove independently that *any* obligatorily introduces domain alternatives and causes domain widening, while *a* does not. The only thing that can be said is that if elements like *must* are assigned the ability to introduce alternatives, then it may be possible to express their PPI-hood in certain preexisting frameworks.

Moreover, if such an analysis is correct, the question arises as to why *must* is banned only from antiadditive contexts and not from all downward-entailing contexts.

Another problem that arises is this: since nothing specific in the discussion of polarity hinges on the choice of world variables instead of variables over individuals, we would expect there to be universal PPIs and existential NPIs in both domains of quantification. This is not the case, however. In the domain of individuals, PPIs and NPIs only seem to come with existential force; no polarity items with universal force over individuals seem to exist.⁴⁰ However, when we look at deontic modals, PPIs and NPIs are found only among items with universal force. That is,

Interpreting (ii) with the scopal order of (iii) gives the 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 scopes above negation again, as in (iv), since expressions of the form ‘must (not (p))’ are stronger than their alternatives and will therefore not be contradicted by negated stronger alternatives.

(iv) EXH > MUST > NEG

In this way, the PPI-hood of modals like *must* can be captured in terms of Chierchia’s (2006, 2011) analysis (and *mutatis mutandis* in Krifka’s (1995) terms too).

⁴⁰ There may, in fact, be a way to rule out the existence of universal quantifier PPIs in general. Under Chierchia’s (2006, 2011) analysis, a high-scale element can only act as a PPI if a covert exhaustifier applies both to the negation and to the high-scale element. However, nothing a priori forces the exhaustifier to take scope from a position higher than negation. So whereas 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

According to Gennaro Chierchia (pers. comm.), the fact that an exhaustifier can always scope between the negation and a universal might be the reason that plain universal PPIs (i.e., universal PPIs quantifying over individuals) are not attested. But the question then arises why a modal PPI 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, then in languages where the modal precedes the negation, EXH must always outscope the modal and the negation. Furthermore, if we assume that in languages where the negation and the modal form a morphological unit at surface structure, the exhaustifier cannot intervene between the negation and the modal, then in those languages as well EXH always outscopes the modal and the negation too. Note that reconstructing the modal puts it under EXH > NEG, which renders the sentence contradictory again.

(ii) EXH John must not leave

This account predicts 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 Dutch examples in (5), repeated here.

among the deontic modals, no PPIs or NPIs with existential force have been reported.⁴¹ If these are not gaps in our knowledge but actual gaps, the question of why these gaps exist where they exist would need to be addressed before we could be sure of adequately understanding the issues involved.⁴²

4.2 Syntactic Approaches

The tradition that takes NPIs to come 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 a special instance of syntactic binding, and by Laka (1990), who relates NPIs to the obligatory presence of an affective phrase (ΣP). Postal (2000) revives Klima's theory and claims that NPIs, such as English *any*, underlyingly carry a negative feature.⁴³

(93) any: [_D NEG [SOME]]

On the other hand, a PPI like *somebody* has two negative features.

(94) somebody: [_D NEG [NEG [SOME]]]

-
- (iii) a. Hans moet niet vertrekken. □ > ¬
 Hans must NEG leave
 'Hans must not leave.'
 b. ... dat Hans niet moet vertrekken. □ > ¬, ¬ > □
 ... that Hans NEG must leave
 '... that Hans must not leave/does not have to leave.'

As addressed in footnote 4, only in subordinate clauses may Dutch *moeten* also scope under negation. This follows once we adopt the assumption that the exhaustifier may freely be included before or after negation.

- (iv) a. ... dat Hans EXH niet moet vertrekken. □ > ¬
 b. ... dat Hans niet EXH moet 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 can be drawn, we need to know under exactly what conditions the exhaustifier may be included.

⁴¹ The only existential NPI modal that we know of is epistemic *can*. Note that in the domain of epistemics, *may* also has a peculiar epistemic-specific behavior. Epistemic *may* behaves like a PPI, deontic *may* like a neutral modal.

⁴² Note that while the existence of universal NPI modals is a question for Chierchia's (2006, 2011) approach, it is perhaps less of a question for Krifka's (1995), since Krifka can 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. In Krifka's approach, elements like *some* are not PPIs in the regular, scalar sense; rather, they are plain indefinites that are "fossilized" for wide scope with respect to negation. Exactly how such a fossilization mechanism works and whether it actually exists in the first place are not clear, but if such a mechanism does exist, it may naturally extend to universal NPI modals.

⁴³ Den Dikken (2006) adopts the essence of Postal's (2000) analysis, but recasts it in terms proposed by Chomsky (see, e.g., Chomsky 1995): some 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) reach 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 (2004), following up on Postal's ideas, 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 Szabolcsi's terms, "absorbs") one of the negative features of the PPI. Since the first negative feature has now been absorbed, it no longer cancels out the second negative feature, and that feature is no longer dormant.

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 occurring in the scope of such operators (as also evidenced by the fact that they can appear in such a scope when the operator is extr Clausal). Instead, the reason is that the [downward-entailing operator > PPI] complex contains what is essentially an unlicensed NPI.

Within this approach, the representations of NPI and PPI modals are as in (95) and (96), respectively.

(95) need/hoeven/brauchen: [_v NEG [□]]

(96) must/prepi/moeten: [_v NEG [NEG [□]]]

The complex $\neg \neg \square$ then spells out as *must/prepi/moeten*. But the two negative features can also be spelled out in different positions in the sentence (as long as both are spelled out).

In principle, then, this approach accounts for the fact that among deontic modals both NPIs and PPIs are attested. However, there are again several problems.

A first problem that such purely syntactic approaches face is to explain why most types of NPIs (e.g., *lift a finger*, *have a red cent*) denote the endpoint of a scale, a fact that lies at the heart of the semantic/pragmatic approach. If being an NPI is merely a matter of having certain syntactic features, then we would expect a more random distribution of NPIs, and not the observed higher concentration within the class of scalar items.⁴⁴

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

- (97) a. I didn't say that Mary bought any cookies.
b. I don't work in order to make any money.

A third problem concerns the licensing of NPIs by downward-entailing determiners. For Postal (2000), this means that an NPI-licensing expression, such as *few*, must contain an underlying (incorporated) negation. However, whereas *few* is easily seen to be decomposable into a negation

⁴⁴ But see Herburger and Mauck 2007 for a version of the syntactic approach that aims at accounting for this fact.

and a quantifier like ‘many’, for other downward-entailing environments (e.g., an *if*-clause or the first argument of a universal quantifier), this is less clear.

The first two problems naturally extend to the application of the syntactic approach to modals. PPI and NPI modals clearly denote endpoints of scales, as they are universal; and as (98) shows, modal NPIs can also be checked by a negation in another syntactic domain.

- (98) a. Ik zeg niet dat hij hoeft te werken.
 I say NEG that he need to work
 ‘I don’t say that he has to work.’
 b. Ik werk niet om honger te hoeven lijden.
 I work NEG PRT hunger to need suffer
 ‘I don’t work in order to have to suffer from hunger.’

But it is unclear whether the third problem applies to modals. As Hoeksema (2008) notes, Dutch *hoeven* is much more restricted in terms of its licensing conditions than other NPIs. It can be licensed by some non-antiadditive downward-entailing operators (e.g., negative universals or *alleen* ‘only’), showing that it is a weak NPI, but not in other downward-entailing contexts, such as the first argument of a universal quantifier or an *if*-clause.

- (99) a. Niet iedereen hoeft te werken.
 NEG everybody need to work
 ‘Not everybody needs to work.’
 b. Alleen Jan hoeft te werken.
 only Jan need to work
 ‘Only Jan needs to work.’
 (100) a. *Iedereen die hoeft te werken wordt om 7:00 verwacht.
 everybody who need 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, you are expected at 7:00.’

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

- (101) a. Not everybody need know.
 b. Only God need know.
 (102) a. *Everybody who need know, should be informed.
 b. *If you need know, you’ll be informed.
 (103) a. Nicht jeder braucht zu arbeiten.
 NEG everybody need to work
 ‘Not everybody need to work.’
 b. Nur Hans braucht zu arbeiten.
 only Hans need to work
 ‘Only Hans needs to work.’

- (104) a. *Jeder der zu arbeiten braucht, wird um 7:00 erwartet.
 everybody who to work need is at 7:00 expected
 ‘Everybody who needs to work is expected at 7:00.’
- b. *Wenn du 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, you are expected at 7:00.’

These data suggest that perhaps the NPI modals are actually better NPI candidates for Postal’s (2000) proposal than English *any*-terms, as these modals are restricted to contexts that seem to spell out a separate negation.⁴⁵

Several additional questions arise when applying the syntactic approach to NPI and PPI modals. For instance, Szabolcsi’s (2004) approach makes no predictions about what types of elements can be NPIs and PPIs. It claims only 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 NPI). Hence, it remains an open question why only universal deontic modals may be NPIs or PPIs, and existential deontic modals may not, something that is also a question for the semantic/pragmatic approach.

4.3 Comparison

So far, it looks as though both approaches have some success in accounting for the PPI/NPI-hood of modals; but at the same time, each faces problems as well.

Under the semantic/pragmatic approach, it can be explained why *must* is a PPI (as well as the other deontic modals that scope above negation), but only if some general assumptions about obligatory introduction of (domain) alternatives and obligatory exhaustification are adopted, as well as assumptions about why PPIs like *must* are banned from antiadditive contexts only. Still more assumptions are needed to explain why PPIs are widely attested among universal modals, but do not appear to show up in the domain of universal quantifiers over individuals. Also, this approach cannot straightforwardly explain why no existential deontic PPI modals are attested and why certain universal modals are NPIs.

Under the syntactic approach, the question of why certain modals are NPIs or PPIs appears less acute, but mostly because this approach involves no restriction on what elements are prone to become NPIs or PPIs in the first place. Also, this approach argues that it is just negation (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 fit the nature of NPI modals, which appear to be restricted to those licensing contexts that consist of a decomposable negation.

⁴⁵ The idea that certain downward-entailing operators contain a decomposable negation is not new. For negative indefinites, it has been suggested by Jacobs (1980), Rullmann (1995), Penka (2010), and Zeijlstra (2011), among others. For *only*, it has been suggested by von Stechow and Iatridou (2007). Whether decomposability into a separate negation is a common property of those contexts that license modal NPIs is a subject for further study.

5 Q4: To What Extent Does the Analysis Apply to Epistemic Modals Too?

Finally, the question arises, to what extent the account for the scope relations between deontic modals and negation extends to epistemic modals as well. For many modals, it is true that the way the modal scopes with respect to negation on its deontic interpretation is the same as the way it scopes with respect to negation on its epistemic interpretation. We illustrate this below with *have to*, *can*, and *must* (the (a) examples are nonepistemic; the (b) examples are epistemic).

- | | | |
|----------|---|-------------|
| (105) a. | He doesn't have to leave. | neg > modal |
| | b. He doesn't have to have fallen. (Maybe somebody pushed him.) | neg > modal |
| (106) a. | He can't leave. | neg > modal |
| | b. He can't be home yet. | neg > modal |
| (107) a. | He must not leave. | modal > neg |
| | b. (His car is not in the driveway.) He must not be home. ⁴⁶ | modal > neg |

The same holds for other languages, such as Greek and Dutch.

- | | | |
|----------|--|-------------|
| (108) a. | Dhen bori na pai sinema.
NEG can NA go movies
'He cannot go to the movies.' | neg > modal |
| | b. Dhen bori na echi ftasi idhi.
NEG can NA has arrived already
'He cannot have arrived already.' | neg > modal |
| (109) a. | Hij hoeft het niet te doen.
he need it NEG to do
'He doesn't have to do it.' | neg > modal |
| | b. Hij hoeft het niet gedaan te hebben.
he need it NEG done to have
'He doesn't have to have done it.' | neg > modal |
| (110) a. | Hij kan niet vertrekken. ⁴⁷
he can NEG leave
'He cannot leave.' | neg > modal |
| | b. Hij kan niet in zijn kamer zijn.
he can NEG in his room be
'He cannot be in his room.' | neg > modal |

The data so far suggest that if a modal is a PPI or an NPI on its deontic use, it exhibits the same kind of polarity-sensitive behavior in its epistemic use.

⁴⁶ It should be noted, though, that contracted *mustn't* only receives a deontic interpretation.

⁴⁷ For some speakers of Dutch, though, *kunnen* 'can' is slightly dispreferred with a deontic reading.

Rather surprisingly, though, we find that certain modals are more restricted in their scopal properties with respect to negation in their epistemic uses than in their deontic uses. Below we provide two such puzzling cases, where modals that are polarity-neutral in their deontic uses appear to be polarity-sensitive once they are interpreted epistemically. To the best of our knowledge, the reverse pattern has not been attested, but at this stage the number of investigated languages is too small to allow any substantive claims along these lines.

5.1 Puzzle 1: Epistemic May

Deontic *may* scopes under negation. Epistemic *may*, however, scopes over negation.

- (111) a. He may not go to the movies. neg > may
 b. He may not have left earlier in the day. may > neg

At least three possible explanations open up at this point:

- (112) a. There are two independent modals: one neutral modal (the deontic one) and one PPI modal (the epistemic one). There is (accidental) homophony.
 b. There is one modal, and depending on what modal base it combines with, it behaves like a neutral or a PPI modal.
 c. The epistemic modal is generated in a position higher than negation. As a result, it can never reconstruct to a position under negation, which would be necessary for it to behave like a neutral modal.

Option (112a) is a ‘‘just so’’ story. It may very well be correct; but if it is, there isn’t much more to say about it.

In option (112b), which modal base is at play will have to be known at LF so that the option of reconstruction (to yield the neutral modal) or no reconstruction (to yield the PPI modal) can be chosen. But if this is the way to go, we will still be dealing with a property of *may* itself and not of epistemic modals in general, because (as shown in (109)–(110)) there are modals that scope under negation in both their deontic and epistemic functions.

The same point should be made for option (112c): if *may* scopes over negation because it is generated higher than negation, this is also a property of epistemic *may* and not of epistemic modals in general, as there are certainly such modals that scope under negation and so cannot have been generated higher than it.

A final point that should be made here is that contrary to what we saw in the domain of deontic modals, *may* would be an existential modal PPI.

5.2 Puzzle 2: Epistemic Can’t

For many English speakers, *can* does not appear to be able to function as an epistemic modal. However, *can’t* does function epistemically.

- (113) a. He arrived very early. This means that he may/*can have left early.
 b. He usually sleeps until noon. This means that he can’t have left early.

One way to describe this situation is to say that epistemic *can* is an NPI modal. If this is the case, we have another difference with the deontic paradigm, where no NPI modals were found with existential force.

However, we should also point out that we have found considerable variation with respect to which downward-entailing environments license epistemic *can* (recall in this regard the discussion of Hoeksema 2008, where we noted that NPI modals are licensed in a surprisingly small number of environments).

- (114) He may / %/*/?can never have left.
 (115) Few people may / %/*/?can have left.
 (116) Only John may / %/*/?can have left.
 (117) Everybody who may / */?can have been there at the time of the murder should be interviewed.
 (118) If he may / */? can have been there at the time of the murder, he should be interviewed.

The aforementioned properties of epistemic *may* and *can't* may be related in that deviations from the deontic paradigm are found in two directions: in the existence of both PPIs and NPIs. In fact, this case patterns nicely with Van der Wouden's (1994) observation that if NPIs occur in one domain, PPIs may occur there as well, and vice versa.

6 Conclusions

In this article, we addressed these questions:

- Q1:** To what extent do deontic PPI modals and better-known PPIs exhibit the same distributional behavior?
Q2: How do deontic modals take scope with respect to negation, given their polarity requirements and their surface position?
Q3: How can the NPI/PPI properties of deontic modals be captured? What makes a (modal) polarity item a polarity item?
Q4: To what extent does the analysis apply to epistemic modals too?

With respect to Q1, we have shown that the distribution of PPI modals and other known PPIs is virtually identical, providing evidence that an analysis that aims to account 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 have argued that once it is adopted that modals obligatorily undergo reconstruction to a position below negation, unless this reconstruction violates a PPI-licensing requirement, it can be understood why all neutral and NPI modals scope under negation, whereas PPI modals do not. In addition, we provided evidence that scope construal of NPI and PPI modals takes place no later than the construal of the wide and narrow reading of subjects with respect to modals, suggesting that the answer to the question of how modals scope with respect to negation indeed

lies in the syntactic/semantic component of the grammar and not in postgrammatical computation of inferences.

With respect to Q3, we have argued that although several problems still exist, current approaches that aim at explaining why certain elements are sensitive to the polarity of their environment may capture at least why some modals are PPIs or NPIs. In particular, the semantic/pragmatic approach seems to fare quite well at explaining why certain modals may not appear in negative clauses, and the syntactic approach seems to give a good account of the exact licensing conditions of those modals that may not appear in positive clauses.

Finally, as for Q4, we find that generally speaking, the analysis proposed here could be extended to epistemic modals as well (e.g., Dutch *hoeven*, Greek *prepi*, English *must*). But we also find, rather surprisingly, that certain modals are more restricted in terms of polarity sensitivity in their epistemic uses than in their deontic uses. The cause of these further restrictions is subject to future study.

References

- Abels, Klaus, and Luisa Martí. 2010. A unified approach to split scope. *Natural Language Semantics* 18: 435–470.
- Baker, C. L. 1970. Double negatives. *Linguistic Inquiry* 1:169–186.
- Beaver, David, and Brady Clark. 2008. *Sense and sensitivity: How focus determines meaning*. Oxford: Wiley-Blackwell.
- Bhatt, Rajesh. 1997. Obligation and possession. In *Papers from the UPenn/MIT Roundtable on Argument Structure and Aspect*, ed. by Heidi Harley, 21–40. MIT Working Papers in Linguistics 37. Cambridge, MA: MIT, MIT Working Papers in Linguistics.
- Bhatt, Rajesh. 2000. Covert modality in non-finite contexts. Doctoral dissertation, University of Pennsylvania, Philadelphia.
- Boeckx, Cedric, and Sandra Stjepanović. 2001. Head-ing toward PF. *Linguistic Inquiry* 32:345–355.
- Butler, Jonny. 2003. A Minimalist treatment of modality. *Lingua* 113:967–996.
- Chierchia, Gennaro. 2006. Broaden your views: Implicatures of domain widening and the “logicality” of language. *Linguistic Inquiry* 37:535–590.
- Chierchia, Gennaro. 2011. Meaning as an inferential system: Polarity and free-choice phenomena. Ms., Harvard University, Cambridge, MA.
- Chomsky, Noam. 1957. *Syntactic structures*. The Hague: Mouton.
- Chomsky, Noam. 1995. *The Minimalist Program*. Cambridge, MA: MIT Press.
- Chomsky, Noam. 2000. Minimalist inquiries: The framework. In *Step by step: Essays on Minimalism in honor of Howard Lasnik*, ed. by Roger Martin, David Michaels, and Juan Uriagereka, 89–155. Cambridge, MA: MIT Press.
- Corblin, Francis, Viviane Déprez, Henriëtte de Swart, and Lucia Tovena. 2004. Negative concord. In *Handbook of French semantics*, ed. by Francis Corblin and Henriëtte de Swart, 417–452. Stanford, CA: CSLI Publications.
- Cormack, Annabel, and Neil Smith. 2002. Modals and negation in English. In *Modality and its interaction with the verbal system*, ed. by Sjef Barbiers, Frits Beukema, and Wim van der Wurff, 133–163. Amsterdam: John Benjamins.
- De Haan, Ferdinand. 1997. *The interaction of modality and negation: A typological study*. New York: Garland.
- Diesing, Molly. 1992. *Indefinites*. Cambridge, MA: MIT Press.

- Dikken, Marcel den. 2006. Parasitism, secondary triggering, and depth of embedding. In *Crosslinguistic research in syntax and semantics: Negation, tense, and clausal architecture*, ed. by Raffaella Zanuttini, Héctor Campos, Elena Herburger, and Paul Portner, 151–174. Washington, DC: Georgetown University Press.
- von Fintel, Kai, and Sabine Iatridou. 2007. Anatomy of a modal construction. *Linguistic Inquiry* 38:445–483.
- von Fintel, Kai, and Sabine Iatridou. 2008. How to say *ought* in foreign: The composition of weak necessity modals. In *Time and modality*, ed. by Jacqueline Guéron and Jacqueline Lecarme, 115–141. Springer.
- Fox, Danny. 2006. *Economy and semantic interpretation*. Cambridge, MA: MIT Press.
- Fox, Danny, and Martin Hackl. 2006. The universal density of measurement. *Linguistics and Philosophy* 29:537–586.
- Gajewski, Jon. 2002. On analyticity in natural language. Ms., University of Connecticut, Storrs.
- Gajewski, Jon. 2007. Neg-raising and polarity. *Linguistics and Philosophy* 30:289–328.
- Giannakidou, Anastasia. 1998. *Polarity sensitivity as (non)veridical dependency*. Amsterdam: John Benjamins.
- Giannakidou, Anastasia. 2011. Negative and positive polarity items: Licensing, compositionality and variation. In *Semantics: An international handbook of natural language meaning*, ed. by Claudia Maienborn, Klaus von Stechow, and Paul Portner, 1660–1712. Berlin: Mouton de Gruyter.
- Hacquard, Valentine. 2006. Aspects of modality. Doctoral dissertation, MIT, Cambridge, MA.
- Harley, Heidi. 2004. Merge, conflation, and head movement: The First Sister Principle revisited. In *NELS 34*, ed. by Keir Moulton and Matthew Wolf, 239–254. Amherst: University of Massachusetts, Graduate Linguistic Student Association.
- Hartman, Jeremy. 2011. The semantic uniformity of traces. *Linguistic Inquiry* 42:364–388.
- Herburger, Elena, and Simon Mauck. 2007. A new look at Ladusaw's puzzle. In *Proceedings of the Workshop on Negation and Polarity*, ed. by Hedde Zeijlstra and Jan-Philipp Soehn, 64–70. Tübingen: Collaborative Research Centre 441.
- Hoeksema, Jack. 2008. Distributieprofielen van negatief-polaire uitdrukkingen: Een vergelijking van het Nederlands, Engels en Duits. *Tabu* 37:111–195.
- Homer, Vincent. 2010. Epistemic modals: High ma non troppo. Paper presented at NELS 40. To appear in the proceedings.
- Homer, Vincent. To appear a. Domains for polarity items. *Journal of Semantics*.
- Homer, Vincent. To appear b. Neg-raising and positive polarity: The view from modals. *Semantics and Pragmatics*.
- Horn, Laurence. 1989. *A natural history of negation*. Chicago: University of Chicago Press.
- Horn, Laurence. 2007. Histoire d'*O: Lexical pragmatics and the geometry of opposition. In *New perspectives on the square of opposition*, ed. by Jean-Yves Béziau and Gillman Payette, 393–426. New York: Peter Lang.
- Iatridou, Sabine. 2000. The grammatical ingredients of counterfactuality. *Linguistic Inquiry* 31:231–270.
- Iatridou, Sabine, and Ivy Sichel. 2011. Negative DPs, A-movement, and scope diminishment. *Linguistic Inquiry* 42:595–629.
- Iatridou, Sabine, and Hedde Zeijlstra. 2010. On the scopal interaction of negation and deontic modals. In *Logic, language and meaning*, ed. by Maria Aloni, Harold Bastiaanse, Tikitou de Jager, and Katrin Schulz, 315–324. Berlin: Springer.
- Israel, Michael. 1996. Polarity sensitivity as lexical semantics. *Linguistics and Philosophy* 19:619–666.
- Jackendoff, Ray. 1972. *Semantic interpretation in generative grammar*. Cambridge, MA: MIT Press.
- Jacobs, Joachim. 1980. Lexical decomposition in Montague Grammar. *Theoretical Linguistics* 7:121–136.
- Kadmon, Nirit, and Fred Landman. 1993. *Any*. *Linguistics and Philosophy* 16:353–422.
- Klima, Edward. 1964. Negation in English. In *The structure of language: Readings in the philosophy of language*, ed. by Jerry A. Fodor and Jerrold J. Katz, 246–323. Englewood Cliffs, NJ: Prentice-Hall.

- Krifka, Manfred. 1992. Some remarks on polarity items. In *Semantic universals and universal semantics*, ed. by Dietmar Zaefferer, 150–189. Dordrecht: Foris.
- Krifka, Manfred. 1995. The semantics and pragmatics of polarity items in assertion. *Linguistic Analysis* 15: 209–257.
- Kroch, Anthony. 1979. *The semantics of scope in English*. New York: Garland.
- Ladusaw, William. 1979. *Polarity sensitivity as inherent scope relations*. New York: Garland.
- Ladusaw, William. 1992. Expressing negation. In *Proceedings of SALT 2*, ed. by Chris Barker and David Dowty, 237–259. Ohio State University Working Papers in Linguistics 40. Columbus: Ohio State University, Department of Linguistics.
- Lahiri, Utpal. 1998. Focus and negative polarity in Hindi. *Natural Language Semantics* 6:57–123.
- Laka, Itziar. 1990. Negation in syntax: On the nature of functional categories and projections. Doctoral dissertation, MIT, Cambridge, MA.
- Lechner, Winfried. 2004. An interpretive effect of head movement. In *Phases of interpretation*, ed. by Mara Frascarelli, 45–69. Berlin: Mouton de Gruyter.
- Liberman, Mark, and Ivan Sag. 1974. Prosodic form and discourse function. In *Papers from the 10th Regional Meeting, Chicago Linguistic Society*, ed. by Michael La Galy, Robert Fox, and Anthony Bruck, 416–427. Chicago: University of Chicago, Chicago Linguistic Society.
- Linebarger, Marcia. 1981. The grammar of negative polarity. Doctoral dissertation, MIT, Cambridge, MA.
- Linebarger, Marcia. 1987. Negative polarity and grammatical representation. *Linguistics and Philosophy* 10:325–387.
- May, Robert. 1985. *Logical Form: Its structure and derivation*. Cambridge, MA: MIT Press.
- Neeleman, Ad, and Hans van de Koot. 2002. The configurational matrix. *Linguistic Inquiry* 33:529–574.
- Penka, Doris. 2010. *Negative indefinites*. Oxford: Oxford University Press.
- Penka, Doris, and Arnim von Stechow. 2001. Negative Indefinita unter Modalverben. In *Modalität und Modalverben im Deutschen*, ed. by Reimar Müller and Marga Reis, 263–286. Hamburg: Helmut Buske Verlag.
- Postal, Paul M. 2000. An introduction to the grammar of *squat*. Ms., New York University.
- Progovac, Ljiljana. 1992. Negative polarity: A semantico-syntactic approach. *Lingua* 86:271–299.
- Progovac, Ljiljana. 1993. Negative polarity: Downward entailment and binding. *Linguistics and Philosophy* 16:149–180.
- Progovac, Ljiljana. 1994. *Negative and positive polarity: A binding approach*. Cambridge: Cambridge University Press.
- Rooth, Mats. 1985. Association with focus. Doctoral dissertation, University of Massachusetts, Amherst.
- Rullmann, Hotze. 1995. Geen eenheid. *Tabu* 25:194–197.
- Swart, Henriëtte de. 1998. Licensing of negative polarity items under inverse scope. *Lingua* 105:175–200.
- Szabolcsi, Anna. 2004. Positive polarity – Negative polarity. *Natural Language and Linguistic Theory* 22: 409–452.
- Travis, Lisa deMena. 1984. Parameters and effects of word order variation. Doctoral dissertation, MIT, Cambridge, MA.
- van der Auwera, Johan. 2001. On the typology of negative modals. In *Perspectives on negation and polarity items*, ed. by Jack Hoeksema, Hotze Rullmann, Victor Sánchez-Valencia, and Ton van der Wouden, 23–48. Amsterdam: John Benjamins.
- van der Wouden, Ton. 1994. Negative contexts. Doctoral dissertation, University of Groningen.
- Wagner, Michael. 2006. Association by movement: Evidence from NPI-licensing. *Natural Language Semantics* 14:297–324.
- Wurbrand, Susi. 1999. Modal verbs must be raising verbs. In *WCCFL 18: Proceedings of the 18th West Coast Conference on Formal Linguistics*, ed. by Sonya Bird, Andrew Carnie, Jason Haugen, and Peter Norquest, 599–612. Somerville, MA: Cascadilla Press.

- Zeijlstra, Hedde. 2004. Sentential negation and negative concord. Doctoral dissertation, University of Amsterdam.
- Zeijlstra, Hedde. 2011. On the syntactically complex status of negative indefinites. *Journal of Comparative Germanic Linguistics* 14:111–138.

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