
A non-lexical approach to Neg-Raising

Zahra Mirrazi

Hedde Zeijlstra

University of Massachusetts, Amherst University of Göttingen

1 Problem

There are two main approaches to Neg-raising (NR): a syntactic approach (Fillmore, 1963; Horn, 1978; Collins & Postal, 2014) and a semantic-pragmatic approach (Bartsch, 1973; Gajewski, 2005, 2007; Homer, 2015; Romoli, 2012, 2013; Zeijlstra, 2018). The syntactic account posits that negation is base-generated in the embedded clause, where it is semantically interpreted, and then syntactically moves into the matrix clause, where it is phonologically realized. The pragma-semantic approach takes NR readings to be the result of an excluded middle inference (either in terms of a presupposition (Gajewski, 2005, 2007) or in terms of scalar implicatures (Romoli, 2012, 2013; Križ, 2015), which is restricted to a certain group of predicates known as Neg-Raising Predicates (NRPs). The major difference between the two approaches is that the syntactic approach alludes to syntactic movement of negative material, whereas the semantic-pragmatic approach is surface-oriented. In this paper, we first show that despite recent claims to the contrary, the syntactic approach to NR faces severe problems. We then show that although the existing semantic-pragmatic accounts also run into problems, an alternative version of semantic-pragmatic approach, which we present in this paper, can overcome these problems.

2 The syntactic approach and its problems

The classic syntactic approach has been challenged on several grounds. To mention a few, NR involving negative indefinites cannot be accounted for in terms of simple semantic reconstruction. *Nobody thinks nuclear war is winnable* means that everybody thinks that nuclear war is not winnable, not that somebody thinks it's not. Also, the syntactic approach cannot explain why NRPs are always non-factive. (For more problems for the syntactic approach, see (Romoli, 2012, 2013; Zeijlstra, 2018)). Despite these problems, Collins & Postal (2014) present various arguments why the syntactic approach to NR must be re-installed, of which the existence of so-called Horn-clauses is the strongest, and the only one that has not been countered in the literature, see (Romoli, 2012, 2013; Zeijlstra, 2018; Crowley, 2019). Horn-clauses are instances where subject-auxiliary inversion is licensed not by a negative quantifier in SPEC,CP, but rather by an NPI in SPEC,CP, which in turn is licensed by a negated NRP. Negated non-NRPs, by contrast, cannot license Horn-clauses. Examples are in (1).

- (1) I don't think/*claim that anywhere did he mention my book

Since Negative Inversion (subject-auxiliary inversion under negation) applies in a strictly local fashion, Collins & Postal (2014) take the existence of Horn-clauses as strong evidence for a syntactic approach to NR: Only under such an approach can the negation in the main clause have appeared in SPEC,CP at an earlier stage of the derivation, as in (2), where < ... > denotes a lower copy.

- (2) I do NEG think [<NEG > anywhere] did he mention my book [<NEG anywhere>]

Collins & Postal's analysis suffers from at least three insurmountable problems. First, it cannot exclude universal quantifiers from appearing in Horn-clauses. Whereas (3a) is fully acceptable, (3b) is not. The structure in (3c) that derives (3b) should, in principle, be possible in Collins & Postal's system.

- (3) a. Not everywhere did he mention my book.

- b. *I don't think that everywhere did he mention my book.
- c. I do NEG think that [<NEG> everywhere] did he mention my book [<NEG everywhere>].

The only solution that Collins & Postal (2014) offer to rule out (3c) is postulating a condition that bans negated non-existentials from triggering Horn-clauses.

The second problem for Collins & Postal (2014) is that the set of negative predicates that can license Horn-clauses is not restricted to NRP's. Horn (2014) points out that non-factive *know*, *be aware*, and some other predicates, which he dubs *Cloud of Unknowing predicates*, license Horn-clauses too:

- (4) I *(don't) know that ever before had all three boys napped simultaneously

However, in (4), there is no semantic reflection of negation in the embedded clause, i.e. (4) lacks a NR reading. To resolve this, Collins & Postal (2018) stipulate that when a negation raises in a main clause with a Cloud of Unknowing predicate, there must be a distinct negation scoping over it. For them, the underlying structure of (4) must therefore contain two additional negations, one of which is raised into the matrix clause, followed by phonological deletion of the two lower negations:

- (5) [I do NEG₁ know NEG₂ [<NEG₂> that NEG₃ ever before had all three boys napped simultaneously]]

Apart from such an escape hatch being purely stipulative, this predicts, though, that (6) should still be fine with a NR-reading (as here, the predicate is outscoped by the distinct negation *nobody*), contrary to fact:

- (6) Nobody doesn't know that ever before had all three boys napped simultaneously.

Finally, the same problem as with Cloud of Unknowing predicates arises with many other predicates, for instance with *accept*. Crucially, these predicates are not NRPs, but when negated, they still can license subject-auxiliary inversion with an NPI in SPEC,CP, (7).

- (7) I *(didn't) accept that any of those problems had she ever really solved

For (7), Collins & Postal (2014) argue that here the NPI *any of those problems* takes matrix scope and that therefore examples like (7) are different from real Horn-clauses. But, the claim that *any of those problems* in (7) takes matrix scope is false. If it were the case, (7) should be felicitous in a scenario where we know that Mary solved some problems, but we don't know which ones (e.g., when solving some problems is a requirement for passing a test, and we only know that Mary passed the test).

In sum, Collins & Postal's claim that Horn-clauses provide evidence in favour of the syntactic approach to NR is highly problematic, as it both overgenerates and undergenerates. Nevertheless, as of date, no existing alternative account for Horn-clauses has been proposed that does not require movement of negation. In this talk, we argue that a novel version of the semantic-pragmatic approach to NR fills this gap and provides a full explanation for the overall distribution and readings of Horn-clauses.

3 The semantic-pragmatic approach and its problems.

While successful in accounting for many aspects of the behavior of NRPs, the semantic-pragmatic approach also faces certain non-trivial problems. Most importantly, the presuppositionality of the excluded middle has been challenged on at least three grounds. (i) The excluded middle doesn't behave like other presuppositions; it doesn't project through operators like conditionals and questions (Romoli, 2012; Križ, 2015) and it doesn't pass the so-called "*Hey, wait a minute*" test (Križ, 2015).

- (8) a. If Mary doesn't think that Bill should be hired, she will say so at the next faculty meeting.
 b. Does Mary think that Bill should be hired?
- (9) a. Mary doesn't think that Bill should be hired.
 b. # Hey, wait a minute! I didn't know that she necessarily has an opinion about that.

(ii) There are contexts under which NRP's receive a non-NR reading without resulting in a presupposition failure (Homer, 2015). In many contexts, the universal projection of an excluded middle presupposition from the scope of negative indefinites is too strong, as shown in the example below; for the NR reading to be true, not only everybody should have an acquaintance relation with you but also have an opinion about whether or not you're stupid:

- (10) *It's the first day of school, before entering the school your mom tells you:*
 Remember, nobody here thinks you're stupid.

Finally, (iii), in certain contexts, some non-NRPS nevertheless get a NR reading, as illustrated below (where the lawyer must know what is constitutionally possible).

- (11) Trump: I can overturn the result of the election.
 Constitutional lawyer: I don't know/ am not sure that's constitutionally possible, sir.

To circumvent these problems concerning the excluded middle presupposition, Romoli (2012) proposes a scalar implicature account of NR instead, under which NRPS, and NRPS only, take the excluded middle as a lexical alternative. Any such scalar implicature account of NR has the advantage of not running into the projection problems of the presuppositional account (as mentioned in (i)). Moreover, as the generation of scalar implicatures depends on the contextual relevance of particular alternatives, the problem addressed in (ii) doesn't arise either. However, Romoli's special implementation of the implicature calculation is based on the assumption that NRPS have *lexical* alternatives, which are hardly pronounceable and are not attested elsewhere (Križ, 2015). Moreover, Romoli's account cannot solve problem (iii).

4 A novel approach to NR

We propose a new implementation of scalar implicature account that does not suffer from the issues discussed above. Our analysis has two components:

- (12) a. *Strict duality*: $\neg\forall \Leftrightarrow_{strict} \exists\neg$ (with \forall and \exists having the same presupposition)
 b. *strengthening of subdomain alternatives* (Chierchia, 2013)

We propose that the Exhaustivity operator can apply to a strictly logical equivalent of a given LF, provided that the dual quantifier in the logical equivalent is not expressible (due to lexical gap). (13) shows the definition of logical equivalence in a trivalent system, where the possible truth-values are $\{1,0,\#\}$ and presupposition failure is marked by the third truth-value.

- (13) a. p is strict equivalent to q ($p \Leftrightarrow_{strict} q$) iff p strictly entails q ($p \Rightarrow_{strict} q$) and q strictly entails p ($q \Rightarrow_{strict} p$).
 b. p strictly entails q ($p \Rightarrow_{strict} q$) iff in every world where p is true, q is true as well.

Given the dual rules, EXH can apply to the dual of a negated universal modal, $\neg\forall w: p(w)$, which is $\exists w: \neg p(w)$, if and only if (1) the two are strictly equivalent; and (2) $\exists w \in W: \neg p(w)$ is not lexicalized. This is indeed the case for non-factive epistemic modals, such as *think*. By strict duality $\neg\forall w \in W: p(w)$

$\Leftrightarrow_{strict} \exists w \in W: \neg p(w)$, the literal meaning of **negated** NRPs is $\exists w \in W: \neg p(w)$. This weak existential reading, which is strictly equivalent to negated NRPs, can be further subject to strengthening.

Crucially, Strict duality is not valid for all modals. Modals might carry presuppositions that block duality: e.g. factive *know*. Assume $\Diamond K_p$ is the existential dual knowledge operator of $\Box K_p$. When the existential knowledge operator also carries the factivity presupposition that the embedded p is true, the strict duality is not valid.

$$(14) \quad \underline{p(w) = 1. \neg \Box K p(w)} \Leftrightarrow_{strict} \underline{\neg p(w) = 1. \Diamond K \neg p(w)}$$

Even when $\Diamond K_p$ doesn't carry any presupposition, the strict duality is still not valid. In a world where the factivity presupposition is not satisfied, $\neg \Box K p(w)$ is #, but $\Diamond K \neg p(w)$ is true.

$$(15) \quad \underline{p(w) = 1. \neg \Box K p(w)} \Leftrightarrow_{STRICT} \Diamond K \neg p(w)$$

As $\Diamond K \neg p(w)$ is not strictly equivalent to $\neg \Box K p(w)$, EXH cannot apply to $\Diamond K \neg p(w)$. Therefore, a strengthened Neg-raising reading cannot be derived for the factive *know*. This means that is not NRPs that are special in allowing NR inferences; it is rather strictly *non*-NRPs that are special in not allowing them. Since strictly non-NRPs, i.e. predicates that never yield NR readings, carry a presupposition or a modal commitment that is incompatible with their dual form, no weak *existential* reading can be derived that can be further strengthened.

This brings us to the second component, *strengthening of subdomain alternatives*. An existential reading, like the one that is entailed by negated NRPs, can be further subject to strengthening. Parallel to the implicature account of Free Choice (Fox, 2007; Bar-Lev & Fox, 2017), and Homogeneity (Bassi & Bar-Lev, 2018; Magri, 2014; Bar-Lev, 2020), we take strengthened readings to be the result of the application of an exhaustivity operator at LF. We adopt the definition of the exhaustivity operator (EXH) by Bar-Lev & Fox (2017), according to which EXH takes a proposition (p), and a set of alternatives (C) as arguments, and returns the conjunction of all of the negated innocently excludable (IE) alternatives, and all of the asserted innocently includable (II) alternatives.

The NR reading is then derived via application of EXH, starting with the LF corresponding to the basic weak reading ($\exists w \in W: \neg p(w)$). To see how this works exactly, let's assume the speaker's belief worlds consists of three worlds w_1, w_2 and w_3 . The alternatives generated from replacing the domain variable with its subsets in the weak, existential reading are given in (16).

$$(16) \quad \exists w \in \{w_1, w_2, w_3\}: \neg p(w), \exists w \in \{w_1, w_2\}: \neg p(w), \exists w \in \{w_1, w_3\}: \neg p(w), \exists w \in \{w_2, w_3\}: \neg p(w), \\ \exists w \in \{w_1\}: \neg p(w), \exists w \in \{w_2\}: \neg p(w), \exists w \in \{w_3\}: \neg p(w)$$

Upon exhaustification, we will have (17), which is equivalent to the NR reading.

$$(17) \quad EXH^{IE+II}(\text{Alt}(\exists w \in \{w_1, w_2, w_3\}: \neg p(w))) = \exists w \in \{w_1, w_2, w_3\}: \neg p(w) \wedge \exists w \in \{w_1, w_2\}: \neg p(w) \wedge \\ \exists w \in \{w_1, w_3\}: \neg p(w) \wedge \exists w \in \{w_2, w_3\}: \neg p(w) \wedge \exists w \in \{w_1\}: \neg p(w) \wedge \exists w \in \{w_2\}: \neg p(w) \wedge \exists w \in \{w_3\}: \neg p(w) = \forall w \in \{w_1, w_2, w_3\}: \neg p(w)$$

We argue that strict duality is a necessary step in strengthening $\neg \Box$ to $\Box \neg$, as directly applying EXH to $\neg \Box$ (?) requires assigning truth value T or F to alternatives containing universal quantification over singleton sets (e.g. $\neg \forall w \in \{w_2\}: p(w)$).

There are certain contexts where the NR reading does not arise, as in (10). Following Bar-Lev's (2018; 2020) account of non-maximal readings of definite plurals, we take the non-NR reading to be the result of pruning all the subdomain alternatives which are singleton sets (i.e. $\{w_1\}, \{w_2\}, \{w_3\}$).

$$(18) \quad \exists w \in \{w_1, w_2, w_3\}: \neg p(w), \exists w \in \{w_1, w_2\}: \neg p(w), \exists w \in \{w_1, w_3\}: \neg p(w), \exists w \in \{w_2, w_3\}: \neg p(w)$$

By applying EXH to this set of alternatives, we get the weak non-NR reading.

$$(19) \text{ EXH}^{IE+II}(\text{Alt}(\exists w \in \{w_1, w_2, w_3\}: \neg p(w))) = \exists w \in \{w_1, w_2, w_3\}: \neg p(w) \wedge \exists w \in \{w_1, w_2\}: \neg p(w) \wedge \exists w \in \{w_1, w_3\}: \neg p(w) \wedge \exists w \in \{w_2, w_3\}: \neg p(w)$$

Under this view, the (un)availability of strengthened (NR) readings for duality-allowing epistemic modals is reduced to whether EXH applies over the whole set of subdomain alternatives (yielding the strengthened reading) or over the subset remained after pruning singleton sets (yielding the weak reading). Pruning is a mechanism to reduce the set of alternatives to only those that are plausible and relevant in a given context. We argue that the singleton set alternatives are normally pruned when the modal expresses objectivity or evidentiality. To have access to facts and evidence in a single possible world, the person would have to be omniscient. Following Kratzer (1989), we take this to be implausible.

An argument for the implicature account of NR comes from cases where negated NRPs are embedded in a downward-entailing (DE) environment. As is well known, implicatures cannot be embedded under a DE operator, unless the relevant scalar term bears pitch accent (?Horn, 1989). This prediction seems to be borne out. As shown in 20-??, the strengthened NR reading can only be generated with a pitch accent on “don’t”. In the absence of such marked pronunciation, the strong NPI *in years* is not licensed as NR reading is required for licensing strict NPIS in an embedded clause.

As predicted, no strengthened NR reading can then be generated, as shown in (20), where the absence of the anti-additive NR context over the embedded clause results in the strong NPI *in years* being unlicensed.

- (20) * Few people don’t think Sue has visited in years.
 ↗ Few people think Sue has not visited in years.

5 Advantages

The (novel) observation that (11) has a NR reading, even though non-factive *know* doesn’t always give rise to them, shows that the ability to trigger a NR reading is *not* a lexical property of predicates. Even stronger, this NR reading even becomes obligatory once the NRP has a strict NPI in its complement (an observation overlooked in Horn (2014)):

- (21) a. I can’t say I’ve cooked myself a full meal in weeks, if not months.
 ↗ I can say I’ve not cooked myself a full meal in weeks, if not months.
 b. I don’t know that Santa comes around these parts until Christmas Eve.
 ↗ I know that Santa doesn’t come around these parts until Christmas Eve.

Our approach to NR is the only approach that can account for this observation, as all other theories of NR, including Križ’s suggestion to take NRP as involving not universal quantification over worlds but homogeneous distributive predication over a plurality of worlds, take NRPs to be a special class of verbs with some unique *lexically*-encoded property enabling them to yield NR readings. In fact, we predict that universal modals whose presuppositions and/or lexical alternatives don’t block duality *can* get a NR reading, provided that the context rules out the plausibility of the ignorance inference generated from the first layer of exhaustification, a prediction that seems born out (cf. (Horn, 2015) for *should*).

Under a duality-based approach, any universal predicate that allows duality, gives rise to an equivalent LF where negation scopes below this predicate. This includes both NRPs and Cloud of Unknowing predicates, like non-factive *know*, but also predicates such as *accept*. This opens up the way to understanding Horn-clauses. This is in line with Horn’s 2014 conclusion that the possibility or likelihood of $\neg p$ is an important factor in licensing Horn-clauses – due to duality, $\neg p$ is evaluated.

As a starter, we follow Buring (2004), who shows that Negative Inversion, i.e., T-C movement followed up by fronting a negative phrase, is fine as long as the clause will receive a sentential negation reading. This is equivalent to saying that subject-auxiliary inversion is allowed as long as C' ends up in an anti-additive context. This, essentially means that any LF where negation takes scope below an existential dual of an NRP can license subject-auxiliary inversion, as long as nothing disrupts the Anti-Additive context introduced by this negation. Given the fact that subject-auxiliary inversion is to be followed up by fronting material into SPEC,CP, this material may not disrupt anti-additivity either. For that, (i) embedded SPEC,CP can only contain an existential/indefinite (as non-existentials disrupts anti-additivity) and (ii) this existential may not give rise to any non-anti-additive inferences either. As shown in (22), this is only the case for negated NPIs. Other negated existentials/indefinites give rise to specificity effects or existential import.

(22) {Not anywhere / *Not somewhere / *Not to a place in France} did she go.

Consequently, to ensure that the embedded SPEC,CP ends up being anti-additive, every Horn clause must contain an NPI in this embedded SPEC,CP. This explains the full pattern of Horn-clauses without alluding to syntactic movement.

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