

Partial Cyclicity and Restrictions on Neg-raising

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1. Introduction

It is well known that certain verbs, like *believe* and *want*, exhibit an unusual property when negated. The following examples, adapted from Gajewski (2007) and Homer (2015), show how negation of a verb of this type in the matrix clause is most naturally (but not necessarily) interpreted in the embedded clause. Thus, (1-a) can be interpreted as (1-b). These are referred to as neg-raising predicates (NRPs) in the literature.

- (1) a. John doesn't believe that Fred left.
b. (Neg-raising (NR) reading): John believes that Fred didn't leave.
(Also available non-NR reading): John doesn't have the belief that Fred left.

In contrast, with the non neg-raising predicate, *certain*, negation can only be interpreted in the matrix clause. Sentence (2-a) cannot be interpreted as (2-b).

- (2) a. John is not certain that Fred left.
b. (Unavailable NR reading) John is certain that Fred didn't leave.

It has also been observed (Fillmore (1963), Horn (1971), Gajewski (2007)), that neg-raising can apply cyclically. When one NRP is embedded under another NRP, a negation in the highest clause can be interpreted as if it were in the most deeply embedded clause. Thus, (3-a) can be interpreted as (3-b) (Horn 1971):

- (3) a. I don't believe Bill wanted Harry to die.
b. (Cyclic NR reading): I believe Bill wanted Harry not to die.

Horn notes that this cyclic quality, however, is only partial. It does not hold for all embeddings of NRPs. In contrast to (3), sentence (4-a) cannot be interpreted as (4-b).

- (4) a. I don't want Bill to believe Harry died
b. (Unavailable cyclic NR reading): I want Bill to believe Harry didn't die.

Although the literature on neg-raising is vast, partial cyclicity is a somewhat less extensively researched phenomenon. The goals of this paper will be to introduce new data and observations regarding partial cyclicity in an attempt to better understand the contrasts between sentences like (3) and (4), and to present evidence that supports a new generalization regarding restrictions on neg-raising. In general, NR is blocked in an embedded clause that can be understood as future-shifted or yet unknown from the perspective of the matrix tense. Section 2 will outline Gajewski (2007)'s account of neg-raising and partial cyclicity. Section 3 will introduce new data and observations. In section 4, I argue that the important factors that govern partial cyclicity are modality and temporal orientation. That is, it is not possible for a verb that enables a future-shifted reading of its complement to embed an NRP, and still give rise to a reading in which negation is interpreted in the most deeply embedded clause. I also show

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how this restriction on NR extends to other future-oriented environments. Section 5 discusses questions and consequences for theories of NR, and section 6 concludes.

2. Neg-Raising

Neg-raising remains a controversial topic in the literature. Lakoff (1969), and more recently Collins et al. (2014) argue that it is a function of syntactic movement. Within this approach, negation originates in the embedded clause where it is interpreted, but undergoes movement to its surface position in the matrix clause. Others, such as Bartsch (1973) and Gajewski (2007), argue for a semantic/pragmatic approach. Because the theory presented in Gajewski (2007) addresses the issue of partial cyclicity most directly, that will serve as the starting point for this article.

2.1. Excluded Middle

Gajewski adopts an account of neg-raising that follows Bartsch (1973) in associating NRPs with an excluded middle (EM) presupposition (that they hold either of their complement or of its negation). This, when combined with the assertive content of the negative sentence, yields the inference that they hold of the negation of their complement. A simplified example of this, adapted from Gajewski (2007) is given in (5), where $\text{Dox}(x,w)$ is the set of worlds compatible with x 's beliefs in world w .

- (5) John doesn't believe that Fred left.
 (i) *Assertion:*
 $\text{Dox}(j,w) \not\subseteq \{w' \mid \text{Fred left in } w' = 1\}$
 'It's not the case that John believes that Fred left.'
 (ii) *EM presupposition:*
 $\text{Dox}(j,w) \subseteq \{w' \mid \text{Fred left in } w' = 1\}$ **OR** $\text{Dox}(j,w) \subseteq \{w' \mid \text{Fred left in } w' \neq 1\}$
 'John believes that Fred left or John believes Fred didn't leave.'
Assertion + presupposition:
 $\text{Dox}(j,w) \subseteq \{w' \mid \text{Fred left in } w' \neq 1\}$
 'John believes that Fred didn't leave.'

2.2. Strict NPI licensing

Accounting for the licensing of strict negative polarity items (NPIs), such as punctual *until* and *in years/weeks* is a central component to any theory of neg-raising. While non-strict NPIs like *any* and *ever* can be licensed long distance, Lakoff (1969) observed that strict NPIs could be licensed across a clause boundary only if the embedding verb is a neg-raiser:

- (6) a. Bill claimed/thought that Mary wouldn't arrive until tomorrow.
 b. Bill didn't think that Mary would arrive until tomorrow.
 c. *Bill didn't claim that Mary would arrive until tomorrow.
 (7) a. Bill claims/thinks that Mary hasn't been to Wisconsin in years.
 b. Bill doesn't think that Mary has been to Wisconsin in years.
 c. *Bill didn't claim that Mary had been to Wisconsin in years.

This led to an assumption that, unlike other NPIs such as *any* and *ever*, strict NPIs require clausemate negation for licensing. Syntactic theories of neg-raising held that strict NPIs could be licensed when embedded under a NRP because the negation associated with the matrix NRP originates in the embedded clause, where the clausemate condition is satisfied. Gajewski (2007), however, claims that the licensing of strict NPIs is not dependent on a clausemate condition, but rather on the logical environment in which they appear. In particular, he proposes that strict NPIs must be in anti-additive environments. He then shows that the negation of a NRP creates an anti-additive environment, and, therefore, licenses strict NPIs, while the negation of a non neg-raiser does not. Gajewski has since revised his view on strict NPI licensing (Gajewski (2011)), and the topic is actively debated. With this in mind, although I will not

endorse any particular theory of strict NPI licensing, I will continue to follow the standard approach, and use it as a diagnostic for NR.

3. Partial Cyclicity

As illustrated above, the ability to license strict NPIs can be a useful diagnostic for NR. Gajewski (2007) reinforces the contrast in Horn's original partial cyclicity example by adding strict NPIs. NR readings are available when *believe* embeds *want*. When *want* embeds *believe*, however, the NR reading is not available, in which case the strict NPI is not licensed, leading to ungrammaticality:

- (8) a. I don't believe John wanted Bill to die until tomorrow.
b. *I don't want John to believe that Bill died until yesterday.

Gajewski also notes that this asymmetry extends to other pairs of doxastic and bouletic/deontic predicates like *think* > *should* and *imagine* > *ought*. The following section will expand the empirical domain of partial cyclicity, through additional pairwise comparisons of NRPs, and reveal asymmetries in additional categories of neg-raisers that are not discussed by Horn or Gajewski.

3.1. New cyclicity data

3.1.1. *seem* > *expect*

NR is possible with *seem* embedding *expect*, but not with *expect* embedding *seem*:

- (9) a. Analysts don't seem to expect pricing to get this low until 2015
b. *Analysts don't expect pricing to seem to get this low until 2015

The grammaticality judgments in the following examples apply to the readings with the strict NPIs taking scope in the most deeply embedded clause. Following Gajewski (2005), I will attempt to control for the scope of *until* by using examples in which the tense of the main clause and the *until* NPI phrase clash in tense, filtering out irrelevant readings.

- (10) a. John didn't seem to expect Mary to arrive until tomorrow.
b. *John didn't expect Mary to seem to arrive until tomorrow.

The licensing contrast of strict NPI *in years*, which is less sensitive to the scopal ambiguity associated with *until tomorrow*, also confirms the asymmetry.

- (11) a. Bill didn't seem to expect the record player to have been used in years.
b. *Bill didn't expect the record player to seem to have been used in years.
(Intended: Bill expected the record player to seem not to have been used in years.)

This pattern also generalizes to *appear/expect*, and *think/expect*

- (12) a. John didn't appear to expect Mary to arrive until tomorrow.
b. *John didn't expect Mary to appear to arrive until tomorrow.
(13) a. John didn't appear to expect Mary to have been there in years.
b. *John didn't expect Mary to appear to have been there in years.
(intended: John expected Mary to appear not to have been there in years)

3.1.2. *think* > *expect*

- (14) a. I didn't think that John expected Mary to arrive until tomorrow.
b. *I didn't expect John to think that Mary would arrive until tomorrow.
(intended: I expected John to think that Mary wouldn't arrive until tomorrow.)
(15) a. I don't think that John expects Mary to have been to France in years.
b. *I don't expect John to think that Mary has been to France in years.
(intended: I expect John to think that Mary hasn't been to France in years.)

Additional contrasts are evident with *seem/likely*, and *think/likely*:

3.1.3. *seem* > *likely*

- (16) That doesn't seem to be likely to happen at all until the end of the decade.
(taken from web)
- (17) a. John doesn't seem to be likely to have missed a class in years.
b. *John isn't likely to seem to have missed a class in years.
(intended: John is likely to seem not to have missed a class in years.)
- (18) a. John didn't seem to be likely to arrive until tomorrow.
b. *John wasn't likely to seem to be arriving until tomorrow.
(intended: John was likely to seem not to be arriving until tomorrow.)

3.1.4. *think* > *likely*

- (19) I don't think it's likely to come into effect until 2015.
(taken from web)
- (20) a. Bill didn't think that John was likely to leave until tomorrow.
b. *John wasn't likely to think that Bill would leave until tomorrow.
(intended: John was likely to think that Bill wouldn't leave until tomorrow.)
- (21) a. John doesn't think that they are likely to have been to France in years.
b. *John isn't likely to think that they have been to France in years.
(intended: John is likely to think that they haven't been to France in years.)

3.2. *Argument against a purely syntactic view of NR*

The sentences with *seem* and *appear* in sections 3.1.1 and 3.1.3 above are particularly important because they show a contrast between pairs of verbs, both of which take infinitival complements. In general, it appears that restrictions on NR licensing cannot be attributed to any particular syntactic configuration. For example, the grammaticality of the (a) examples show that we cannot account for lack of neg-raising by positing a general ban of NR out of non-finite clauses, as NR out of the non-finite complements of *seem* and *appear* is clearly available. It is important to make this point because Collins et al. (2014) suggest a generalization that neg-raising is not possible in a wide variety of cases where a potential host is non-finite. Some of the examples they cite are given below.

- (22) a. *They expect me not to think that the play was half bad.
b. *For Curtis not to think that they have visited her in ages is strange.
c. *They are certain not to think that she can help cheating.
d. *John appears not to have figured that the movie would be all that bad.

The sentences in (9)-(13), with *seem* and *appear*, however, are not counter-examples to this claim, as Collins & Postal's generalization pertains particularly to sentences in which the negative morpheme, *not*, appears in the non-finite clause, and the embedded clause is finite. With *seem* as the matrix predicate, however, sentences in such a configuration do not appear to be that bad. They do, however sound somewhat worse than the sentences in which *not* appears in the matrix finite clause.

- (23) a. ?The coach seemed not to think that Bill would play until next season.
b. ?Bill seems not to think that Mary has been to France in years.
- (24) a. The coach didn't seem to think that Bill would play until next season.
b. Bill doesn't seem to think that Mary has been to France in years.

The judgments here are subtle. Also, a discussion of the contrast between (23) and (24) is not the main focus of this section. I am primarily concerned with showing that a finite vs. non-finite contrast alone cannot account for the contrasts in partial cyclicity that are under investigation in this paper.

4. Future Shift and Modality

In this section, I will explore the hypothesis that the availability of NR in an embedded clause is dependent upon its temporal orientation relative to the matrix clause. In general, neg-raising is not possible out of an embedded clause that can be interpreted as future-shifted relative to the tense of the matrix clause. In other words, if NRP1 in a matrix clause allows a future-shifted interpretation of the embedded clause, then a neg-raised reading of NRP2 in the embedded clause will not be possible.

With respect to the NRPs that I have discussed in the previous sections, the ones that allow future shifted orientation of the complement clause are exactly the ones that don't allow cyclic NR readings when they embed additional NRPs: *want*, *expect*, *be likely*:

- (25) a. John wants Mary to be happy right now / tomorrow.
 b. John expects Mary be happy right now / tomorrow.
 c. John is likely to be happy right now / tomorrow.

As discussed in section 3, the complements of *seem* and *appear*, which do allow NR, must be interpreted as simultaneous with the matrix tense:

- (26) a. John seems to be happy right now / *tomorrow
 b. John appears to be happy right now / *tomorrow

4.1. Cyclic NR with 2 Future Oriented NRPs

To further illustrate the generalization above, I will also show that NR is not possible in a configuration in which both NRPs allow future shifted readings of their complement clause. This is somewhat more difficult, because controlling for the scope of *until tomorrow* is tricky with multiple future-shifted clauses. This being the case, I will use the strict NPI *in at least two weeks*. In order to create examples in which it makes sense to want something not to have happened, consider the following scenario: Suppose Mary is a researcher, and she is running an experiment that investigates potential allergic reactions to pine nuts. In order to control for external factors, she wants the subject of her study, Bill, not to have eaten pine nuts in at least 2 weeks.

- (27) a. *I don't want Mary to want Bill to have eaten pine nuts in at least two weeks.
 (intended: I want Mary to want Bill not to have eaten pine nuts in at least two weeks.)
 b. *I don't expect Mary to want Bill to have eaten pine nuts in at least two weeks.
 (intended: I expect Mary to want Bill not to have eaten pine nuts in at least two weeks.)
 c. *I don't expect Mary to expect Bill to have eaten pine nuts in at least two weeks.
 (intended: I expect Mary to expect Bill not to have eaten pine nuts in at least two weeks.)
 d. *I don't want Mary to expect Bill to have eaten pine nuts in at least two weeks.
 (intended: I want Mary to expect Bill not to have eaten pine nuts in at least two weeks.)

The data in (27) is consistent with the generalization that cyclic NR is not available when the matrix NRP allows a future-shifted interpretation of the embedded clause.

4.2. Additional Future-Oriented Environments

In addition to the infinitival complements of NRPs *want*, *expect*, and *be likely*, neg-raising appears not to be possible in clauses embedded under *will* or *going to*:¹

¹ It has come to my attention that the contrast in availability of NR under the scope of *will* was first noticed in Prince (1976). Footnote 13, p. 420 cites the unavailability of NR for *seem* embedded under *will* as an example of NR not being possible in a context that is inconsistent with a 'metastatement hedge.' Prince does not, however, discuss cyclicity or account for the full generality of lack of NR in future-oriented environments. Also, although the link between some NRPs and hedging is well justified, especially in the first person, it is not clear that NR is always unavailable in environments that are pragmatically incompatible with hedging. Instead, it does appear possible to construct examples showing NR that do not contain any obvious hedge. For example, the use of *think* in

- (28) Bill won't think it's raining.
 ≠ Bill will think it's not raining.
- (29) John won't appear to enjoy the presentation.
 ≠ John will appear not to enjoy the presentation.

Sentence (28) seems only to have the reading where Bill will not have an opinion regarding whether or not it is raining, not that he has formed an opinion that it is not raining. Likewise, (29) indicates that John will not have the appearance of enjoying the presentation. It's not that he will have the appearance of not enjoying the presentation, he is just hard to read, and won't be giving off any clues either way. Non-NR readings can be further illustrated by the lack of licensing of strict NPIs in the following examples:²

- (30) a. Bill doesn't think it started raining until last night.
 b. *Bill won't think it started raining until last night.
 c. *Bill isn't going to think it started raining until last night.
 (intended: Bill will/is going to think it didn't start raining until last night.)
- (31) a. *Mary won't appear to have been to the dentist in years.
 (intended: Mary will appear not to have been to the dentist in years)
 b. *Mary isn't going to appear to have been to the dentist in years.
 (intended: Mary is going to appear not to have been to the dentist in years)

4.3. Beyond cyclicity: epistemic vs. root must

NR is available in the complement of *must* when it expresses epistemic modality, as in (32-a). Here (like the complement of *seem*), the prejacent can only be interpreted as temporally simultaneous with the matrix tense. This contrasts with the root (teleological) sense of *must* in (32-b), which favors a future-shifted interpretation of its complement, and where NR is unavailable.

- (32) a. (From what I know about John and how humble he is)
 John must not think that his work will be recognized until after he dies.
- b. (In order to avoid high expectations, and remain humble)
 # John must not think that his work will be recognized until after he dies.
 (intended: John must think that his work will not be recognized until after he dies.)

This shows that NR can be blocked in embedded environments are not limited to examples where the NR is cyclic. Although the mechanism by which root *must* takes wide scope over sentential negation is controversial, it is standardly considered not to involve NR (as discussed in Horn (1989) and shown in detail in Homer (2011)). Thus, NR blocking in (32) constitutes a new puzzle, distinct from the partial cyclicity phenomena discussed by Horn and Gajewski. The contrast between a cyclic configuration (33) and non-cyclic NR blocking (34) is illustrated below:

- (33) [NOT [I Want [John to believe p]]]
- (34) [Must [NOT [John think p]]]

A reviewer points out that there may be a structural difference between (32-a) and (32-b), as epistemics are in a higher position than root modals. While this is true, a question still remains as to how this height

the following sentence seems to be not a hedge on behalf of a third person subject or a reported hedge derived from direct discourse, but a straightforward report of Bill's belief state. Here, NR is still available:

- (i) Although we never spoke about it explicitly, judging from the fact that he left his umbrella sitting on his desk, Bill clearly doesn't think that it's going to start raining until tomorrow.

² A reviewer suggests that sentences like (30-b) may be acceptable with *until tomorrow* in place of *until yesterday*. In this case, there is no tense clash to control for the scope of the NPI. However, a pre-clausal temporal modifier that filters out readings where the NPI takes scope over *think* illustrates that NR is indeed blocked:

- (i) #When I speak to John this afternoon, he won't think it's going to start raining until tonight.

difference can account for the contrast in availability of NR, as both epistemic and root *must* share the property of always scoping above sentential negation in unembedded declarative sentences like (32-a) and (32-b).

5. Consequences and questions for theories of neg-raising

5.1. Extending Gajewski's account of partial cyclicity to the new data

Within a context that attributes NR interpretations to entailments derived from an excluded middle presupposition, Gajewski's (2007) account of partial cyclicity explains the contrast in (8-a) and (8-b) as resulting from the different ways that presuppositions project in the complements of desire vs. belief predicates (Karttunen (1974), Heim (1992)). In this view, NR cannot apply cyclically in the complements of desire predicates, like *want*, because the excluded middle presupposition of the embedded clause projects as a belief as opposed to a desire (see Gajewski (2007) for a detailed compositional account of how this contrast leads to a failure of cyclic NR in these cases).

Although the new data in this article does not constitute evidence against Gajewski's approach, without additional assumptions about the presupposition projection properties of *will* and *going to*, it is unclear how this approach can extend to the data in section 4.2. This is because *will* and *going to* are not standardly considered to project the presuppositions of their complements in the same way as propositional attitudes such as *believe* and *want*. Instead, Karttunen (1974) suggests that modals and aspectual verbs are "'transparent' with respect to presuppositions of their complements." Thus, the presuppositions should project directly, and a presupposition projection account of the kind offered by Gajewski may not be sufficient to account for lack of NR in (30)-(31). Also, it is unclear if this approach can extend to the non-cyclic NR blocking configurations in (32).

5.2. Simultaneous complements

It is important to note that although a future-shifted environment is a sufficient condition to block NR, it is not a necessary one. With some NRPs discussed in section 3, simultaneous interpretations are possible in the complement clause, while NR is still blocked. For example, while the complement clause of *expect* in (35) can be interpreted as simultaneous with the matrix tense, the cyclic NR reading is still unavailable.

- (35) Right now, as Kim is reviewing Mary's job performance...
- a. *I don't expect Kim to think that Mary has been late to work in years.
(intended: I expect Kim to think that Mary hasn't been late to work in years.)

This suggests that it is not necessarily the future shift that is responsible for blocking NR readings in these cases, but the type of modality that is associated with the availability of a temporal shift.³ The future orientation (optional for statives, and necessary for eventives) of certain complements has been described as a result of the type of modality present in the matrix predicate, and can apply to bare VP complements of modals (Stowell (2004)) and infinitival complements (Abusch (2004), Wurmbrand (2014)). It is this modality that is likely the core factor that leads to blocking NR interpretations.

5.3. Excluded middle presupposition in embedded modal environments

The concept of future tense and/or future oriented modality is complicated, and a detailed, theoretical discussion of how it interacts with neg-raising predicates is beyond the scope of this paper. I will, however, offer a preliminary speculation as to why NR is not possible in the relevant examples. It appears that in these environments, the excluded middle presupposition is either not triggered or canceled. Thus, the inferences outlined in section 2.1 are not available to give rise to NR interpretations. Perhaps the reason that the EM inference is impeded in these environments relates to the conditions some matrix predicates enforce on their complements. Looking at the difference between complements of *expect* and *believe* may provide a clue as to what that condition is. As noted in sentence (35), NR

³ Thank you to Tim Stowell (p.c.) for drawing my attention to this distinction.

is blocked in the complement of *expect*. A minimally different sentence with *believe* instead of *expect*, however, supports cyclic NR, as in (36):

(36) I don't believe Kim thinks that Mary has been late to work in years.

As shown in section 3.2, we cannot attribute this contrast to the fact that *expect* selects a non-finite complement. There is, however an independent reason to suggest that *expect* places restrictions on its complement that *believe* doesn't. For example, Wurmbrand (2014) describes the believe-type use of *expect* as expressing "a belief by the matrix subject, with the additional restriction that to expect something to be the case conveys that the speaker does not yet know whether the content of the belief is true or not." This is similar to the presupposition that Heim (1992) suggests for *want*, as a condition that states that the modal base must contain both worlds in which the prejacent is believed to be true, and worlds in which the prejacent is believed to be false by the attitude holder.

This suggests that NR is blocked when the NRP is directly embedded in a modal environment in which the truth or falsity of the prejacent is not yet known from the perspective of the matrix time. As future-oriented complements are inherently unknowable, they provide a sufficient condition to block neg-raised readings. I propose that the excluded middle inference that leads to NR either fails to be triggered, or is canceled due to the uncertainty associated with future-shifted or yet-unknown environments. I hope to pursue a detailed semantic analysis of this process in future work.

6. Conclusion

The goal of this article has been to expand the empirical domain of partial cyclicity associated with neg-raising predicates. In doing so, I have argued for a generalization that neg-raising is not available in a wide range of modal environments that are future-shifted or not yet known from the perspective of the matrix tense. These include complements of future-shifting auxiliaries (*will*, *going to*), root interpretations of *must*, and infinitival complements of *want*, *expect*, *likely*. While the environments that block NR vary considerably in syntactic configuration and semantic class, their future-shifting temporal orientation represents a consistent, independently-motivated way to predict restrictions on NR. I propose that accounting for the incompatibility of the excluded middle inference in these environments will be desirable for any theory of the licensing of neg-raising.

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