What's an excluded middle inference?:
Neg-raising, projective content, and accommodation

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1 Introduction

Neg-raising (so named by Kiparsky and Kiparsky 1970) is the strengthening of an attitude predicate when embedded beneath negation. For example, in (1-b) below, the negated predicate 'do not think' conveys certainty that the embedded clause content is false. While in (1-c), with the negated predicate 'not sure', this effect does not emerge. This is somewhat surprising given that 'think' and 'be sure' are semantically quite similar: they both are often analyzed as doxastic necessity modals. The interpretation of 'do not think' as conveying certainty that the embedded clause content is false is an example of a neg-raising inference.

(1) Do you think Donald Trump will end up serving his full term as president, or not?
   a. Think Donald Trump will end up serving his full term as president.
   b. Do not think Donald Trump will end up serving his full term as president.
   c. Not sure (Public Policy Polling, May 16, 2017)

Since Bartsch (1973), neg-raising inferences are often handled via an *excluded middle (EM) inference*. The use of a NR-predicate like 'think' gives rise to an EM-inference, or an *opinionatedness* inference. By EM-inference, we mean that the truth of the embedded clause content is settled with respect to the relevant modal base. For example, according to this analysis, $\textit{think}(\phi)$ is understood to give rise to the EM-inference $\textit{think}(\phi) \vee \textit{think}(\neg\phi)$.

If the NR predicate is negated, the EM-inference gives rise to a neg-raised interpretation. For example:

(2) "x doesn't think that p":
   a. $(\textit{x thinks that p})$ *or* $(\textit{x thinks that not p})$ excluded middle inference
   b. $\textit{not}(\textit{x thinks that p})$ literal meaning
   c. $\therefore$ *x thinks that not p* disjunctive syllogism

This analysis of neg-raising only works if the EM-inference in (a) in (2) escapes the scope of negation. The standard explanation for how the EM-inference escapes the scope of negation is that the EM-inference is not part of the asserted content of (2). But how the EM inference emerges and escapes negation is a subject of controversy. Bartsch's original proposal takes the EM-inference to be a contextual entailment, assumed by interlocutors. For Gajewski (2005), the EM-inference is a presupposition, lexically encoded by the NR-predicate.

This paper focuses on building a comprehensive account of neg-raising building on this central insight from Gajewski. However, this paper's account makes several theoretical and empirical improvements on previous presuppositional accounts of neg-raising. I show how such accounts over-predict the projection of the EM-inference, generating unattested readings. I also show how Gajewski's treatment of presupposition projection, couched within Heim's version of Satisfaction Theory, predicts inferences in quantificational sentences which are too strong.

I lay out a set of goals for any EM-based theory of NR-inferences. Included in these goals are the following observations. First, the EM imposes no conditions on the global discourse context, i.e., it need not be *discourse old*. Second, the extent to which the EM disjunction can project is limited by quantifiers.

In order to meet these goals, I propose a new way of understanding the EM-inference. I argue that it should be understood as *automatically accommodated projective content* (AAP). By this, I mean that the EM-inference is introduced as part of the *not at-issue* content encoded by the NR-predicate, following Gajewski. However, I propose that the EM-inference is obligatorily accommodated and thus becomes part of the *at-issue* content within the course of the semantic composition. I show how this approach resolves problems with the presuppositional account of neg-raising. The precise notion of *automatically accommodated projective content* is given a formal definition within a version of Discourse Representation Theory (Kamp 1981). I show how projection and accommodation can be dealt with in DRT. The framework is a modified version of the analysis of presuppositions in Van der Sandt 1992. van der Sandt provides a way of understanding how not at-issue content is introduced into Discourse Representation Structures, and accommodated. The present paper makes several crucial revisions to van der Sandt's framework.

I advocate for moving away from treating the EM-inference as a traditional sort of presupposition, in which it must be a discourse old commitment of interlocutors. In this paper's account, the EM-inference always ends up as part of the at-issue content. Thus, *presupposition* ends up being an inappropriate label for the EM-inference, despite the origin's of the account in Gajewski's presuppositional proposal. Instead, AAP is taken to be an extraordinary type of projective content. Its projective status determines where the meaning component is able to scope: the height to which an AAP projects is capped by any quantifier binding a variable within the content of the AAP. However, as it is obligatorily accommodated, it does not give rise to presupposition failures.

I show how this formal notion is useful in characterizing neg-raising inferences, and I anticipate it has broader applications outside the domain of neg-raising.

2 Accounts of neg-raising inferences

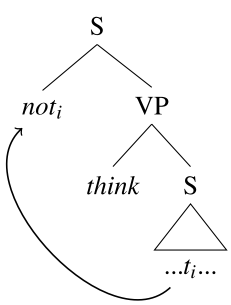
In this section I give a basic overview of previous accounts of neg-raising inferences, including syntactic accounts and semantic-pragmatic accounts. If X is a NR-predicate, and ϕ is its prejacent, a NR-inference holds any time the literal meaning $\neg(X(\phi))$ ends up being interpreted as $X(\neg(\phi))$. The attitude encoded by NR-predicate is interpreted as scoping above negation, even though negation may be syntactically higher than the NR-predicate. Horn (1989) claims that this type of inference applies to the following English predicates under negation:

(3) a. Opinion: *think, believe, suppose, imagine, expect, reckon, feel*
b. Perception: *seem, appear, look like, sound like, feel like*
c. Probability: *be probable, be likely, figure to*
d. Intention: *want, intend, choose, plan*
e. Judgement: *be supposed to, ought, should, be desirable, advise, suggest* Horn 1989

Various authors have made suggestions in order to group these predicates together semantically. Horn (1978, 1989) suggests that the predicates in (3) are *mid-scalar*. For example, on a scale of predicates of likelihood, ‘likely’ is interpreted as stronger than ‘possible’ but as weaker than ‘certain’. Homer (2015) additionally suggests that NR-predicates are all *assessor-dependent*. Thus, they are interpreted relative to the subjective perspective of an agent. Beyond these suggestions, the present paper has little to say about semantic generalizations which group NR-predicates together.

Given an identified class of NR-predicates, the challenge of this paper is to determine how the NR-inference is derived. Previous approaches to this problem fall broadly into two classes: syntactic approaches and semantic-pragmatic approaches. Under the syntactic approach, tracing its origins to Fillmore 1963 and Lakoff 1969, holds that negation originates in the embedded clause, moves to its surface position in the matrix clause, and is interpreted via reconstruction.

(4)



A prominent modern instantiation of this kind of account can be found in Collins and Postal 2014, 2017, 2018a,b. Collins and Postal’s analysis is intricate and full of insights, and a thorough commentary on its features is left for future work, but see Horn 1978, 1989; Gajewski 2007; Romoli 2013; Homer 2015; Hoeksema 2017; Zeijlstra 2018; Anvari et al. 2019; Romoli and Mandelkern 2019; Collins 2019, and many others for theoretical and empirical commentary on this account.

This paper focuses on the semantic-pragmatic account of NR-inferences. These accounts largely owe their origin to Bartsch 1973. Under Bartsch’s approach, NR-predicates, as in (3), are analyzed as necessity modals. When negated, NR-predicates like ‘think’ are interpreted in their surface scope position, under negation (contrast the analysis in (4)), without recourse to movement or reconstruction. Crucially, the use of an NR-predicate gives rise to an *excluded middle inference*, or EM-inference, as in (2) above.

What is the nature of the EM-inference in (2)? Bartsch assumes the EM-inference is a contextual entailment, mutually assumed by interlocutors. But such an analysis leaves certain aspects of NR-structures unexplained. Importantly, we find cross-linguistic and cross-dialectal variation in terms of which lexical items give rise to a NR-inference, i.e., which predicates fit into the class exemplified by (3). For example, Horn (1978) observes English ‘hope’ is not a neg-raiser but its Danish approximate translation ‘håber’ is.

(5) a. I don’t hope you’re feeling bad ($\not\Rightarrow$ I hope you’re not feeling bad)
b. *Jeg håber ikke at De blev bange*
I hope not that you become bad
I don’t hope you’re feeling bad ($\Rightarrow$ I hope you’re not feeling bad)

Horn also notes that ‘guess’ is a NR predicate in some English dialects but not others.

(6) I don’t guess that he’ll leave. $\Rightarrow$ *I guess that he won’t leave* (some dialects only)

Thus Bartsch’s theory is left to explain why Danish ‘håber’ gives rise to an EM-inference, but English ‘hope’ does not. Based on these kinds of observations, Horn and Bayer (1984) argue that NR-inferences must be (at least partly) conventionalized. Interlocutors thus must have meta-linguistic awareness of which lexical items give rise to a NR-inference. Further, Bartsch’s account is unclear about how the EM-inference emerges compositionally. If it is a contextual entailment, how does the EM-inference interact with expressions like quantifiers, conditionals, questions, and multiple, stacked NR-predicates, such as in (7)? Ideally, a theory of NR-inferences should make clear predictions about how NR-predicates behave in complex sentences.

(7) Homer doesn’t think that Marge wants to leave. ($\Rightarrow$ *Homer thinks that Marge wants to not leave*)

Gajewski 2005, 2007 provides a version of Bartsch’s EM-based account which responds to these issues.

3 The excluded-middle inference as a presupposition

This section explores the presuppositional account of the excluded middle inference and its empirical predictions. For Gajewski 2005, 2007, the EM-inference is encoded as a semantic presupposition. This presupposition is lexically encoded by each NR-predicate, and is proposed to be the definitional characteristic of NR-predicates. The presupposition, under Gajewski’s account, is encoded as a definedness condition.

For example, ‘prefer’, a non-NR-predicate, encodes no presupposition in (8-a). ‘want’, a NR-predicate, on the other hand, encodes an EM-inference as a presupposition in (8-b) (marked by square brackets). Below, let $\mathbb{B}_x^w$ be a universal quantifier over bouletic alternatives, i.e., worlds compatible with x’s desires in world w.

(8) a. $\textit{prefer} \rightsquigarrow \lambda p.\lambda x.\lambda w.\mathbb{B}_x^w p$
b. $\textit{want} \rightsquigarrow \lambda p.\lambda x.\lambda w : [\mathbb{B}_x^w p \vee \mathbb{B}_x^w \neg p]\ .\ \mathbb{B}_x^w p$

This account immediately allows us to explain the lexical idiosyncrasy of NR-inferences. The presence of a presupposition in (8-b) explains why near paraphrases of neg-raising predicates with near synonymous predicates do not necessarily give rise to the same inferences—as the EM-presupposition is lexically specified, only the neg-raising predicates encode for it.

(9) a. I don’t want to X $\Rightarrow$ I want to not X
I don’t have a desire/preference to X $\not\Rightarrow$ I have the desire/preference to not X
b. I don’t think that X $\Rightarrow$ I think that not X
I don’t have a belief/expectation that X $\not\Rightarrow$ I have the belief/expectation that not X
c. It doesn’t seem to me that X $\Rightarrow$ I seems to me that not X
I don’t have the impression/evidence that X $\not\Rightarrow$ I have the impression/evidence that not X

The evidence for the inference patterns in (9) can be bolstered with a simple contradiction test. A negated NR-predicate like ‘don’t want to p’ should be interpreted as $\textbf{want}(\neg p)$, while a negated non-NR predicate like ‘don’t have a desire to p’ should be interpreted as $\neg\textbf{want}(p)$. Only the latter interpretation allows for the possibility that the relevant attitude holder is *indifferent* about p. This accounts for the following contrast:

(10) a. Lisa may or may not be indifferent about leaving, #(but she doesn’t want to leave).
     b. Lisa may or may not be indifferent about leaving, but she doesn’t have a desire to leave.

The second conjunct in (a) above appears to exclude the possibility that Lisa is indifferent, thus contradicting the first conjunct. The second conjunct in (b), on the other hand, does not. This is expected under Gajewski’s account, only the NR-predicate *want* encodes the EM-inference as a presupposition, disallowing the possibility that Lisa is indifferent. As the EM-inference is a presupposition, we expect that it ‘projects through’ negation, i.e., it becomes a supposition of the whole second conjunct.

(11) Lisa doesn’t want to leave.

a.	*not*(*Lisa wants to leave*)	at-issue content
b.	(*Lisa wants to leave*) *or* (*Lisa wants to not leave*)	presupposition of *want*
c.	$\therefore$ *Lisa wants to not leave*	from (a) and (b)

But when we replace the negation in (10) with other sorts of holes[1], such as conditionals, questions, and possibility modals, no contradiction appears to emerge with *either* the NR-predicate ‘want’ or the non-NR predicate ‘have a desire’.

(12) a. Lisa may or may not be indifferent about leaving, $\left\{\begin{array}{c}\text{but if she wants to leave, come get me}\\ \text{so does she want to leave?}\\ \text{so perhaps she wants to leave}\end{array}\right\}$.

     b. Lisa may or may not be indifferent about leaving, $\left\{\begin{array}{c}\text{but if she has a desire to leave, come get me}\\ \text{so does she have a desire to leave?}\\ \text{so perhaps she has a desire to leave}\end{array}\right\}$.

The judgement in (12-a) is unexpected under Gajewski’s account. If ‘want’ encodes for the EM-inference as a presupposition, we should expect that it projects through hole operators like conditionals, questions, and modals. We therefore predict that the second conjunct in (12-a) entails *opinionatedness*, and thus contradicts the first conjunct, predicting infelicity. This is a consistent effect where NR-predicates are incompatible with statements of ignorance when negated as in (13), but are compatible with such ignorance statements when scoping under other kinds of holes, as in (14). This is unexpected under Gajewski’s account whose construal of the EM-inference as an ordinary presupposition predicts uniformity across (13) and (14).

(13) I don’t know if Lisa has a preference about leaving, #(but she doesn’t want to leave).

(14) I don’t know if Lisa has a preference about leaving, $\left\{\begin{array}{c}\text{but if she wants to leave, come get me}\\ \text{so does she want to leave?}\\ \text{but maybe she wants to leave}\end{array}\right\}$.

As far as I know, this contrast between negation and other sorts of presuppositional holes like conditionals has not been noted in the literature on neg-raising. We find the contrasts extend to NR-predicates in other semantic domains, such as doxastic attitudes like ‘think/believe’, and evidentials like ‘seem’.

(15) a. Lisa may or may not have any idea about whether the light is on, (#but she doesn’t think/believe it’s on.)
     b. Lisa may or may not have any idea about whether the light is on, but she if she thinks/believes it’s on, come get me.

(16) a. Lisa may or may not have any evidence about whether the light is on, (#but it doesn’t seem to her that it’s on.)

[1] A hole is an operator which ordinarily take semantic scope under presuppositions triggered within their syntactic scope (Karttunen, 1973)

b. Lisa may or may not have any evidence about whether the light is on, but if it seems to her that it's on, come get me.

The view in this paper is that Gajewski's analysis of the EM-inference as a lexicalized presupposition is on the right track. It correctly accounts for the lexical idiosyncrasy of NR-inferences, and reconstructs Bartsch's excluded middle-based analysis of the NR-inference. However, the projective properties of the presupposition need to be refined in order to account for contrasts such as those discussed in this section. In the remainder of this section, I explain why the Satisfaction Theory based account of presupposition projection, originating in Heim (1983), does not generate the right readings for NR-predicates when combined with operators like conditionals and quantificational subjects.

This discussion will establish the background for the theory of presuppositions and projection advocated in this paper which makes the right predictions for the EM-inference of neg-raising predicates. Thus the spirit of Gajewski's analysis of neg-raising can be preserved, with a significantly modified notion of how not at-issue meaning components project.

3.1 Satisfaction Theory and neg-raising

Gajewski's presuppositional account of NR-inferences is couched within the theory of presuppositions outlined in Heim 1982, 1983, which I will refer to as *Satisfaction Theory* (following terminology in Geurts 1996, 1998). According to Satisfaction Theory, the meaning of a sentence S is defined in terms of how an information state, representing a discourse context, is updated with the information encoded by S. This update serves to produce a new information state, representing the post-utterance discourse context. The presuppositions of S in Satisfaction Theory are construed as conditions on the input context for a successful update with S.

This section outlines the formalism behind Satisfaction Theory and discusses the predictions of a Satisfaction Theory-based account of NR-inferences. In sum, I argue that the predictions of Satisfaction Theory, particularly with regards to quantificational sentences lead to overly strong truth conditions.

3.1.1 Conditionals vs. negation in Satisfaction Theory

The immediate goal for our theory of neg-raising is to explore why Satisfaction Theory does not predict the contrast in (17), repeating an example from earlier. We observe in (17) that NR-predicates behave differently when embedded under negation vs. conditional antecedents.

(17) a. Lisa may or may not be indifferent about leaving, #but she doesn't want to leave.
b. Lisa may or may not be indifferent about leaving, but if she wants to leave, come get me.

Take C to be a discourse context in the sense of Stalnaker 1979. For Heim, a discourse context is a set of world-assignment pairs (indices). A proposition ϕ is also a set of indices. $C[\phi]$ represents the discourse context produced by intersecting C with ϕ (i.e., throwing out indices incompatible with ϕ). Heim gives the following "context change potentials" (or CCPs) as meanings for basic sentences.

(18) a. $C[\phi] = C \cap \phi$
b. $C[\mathbf{not}(\phi)] = C - C[\phi]$
c. $C[\mathbf{if}(\phi)(\psi)] = C - (C[\phi] - C[\phi][\psi])$

A sentence may encode a presupposition, construed as a definedness condition on the input context. Below, $\phi \ll \psi$ means that ϕ presupposes ψ. A presuppositional sentence is assigned the following CCP.

(19) $C[\phi \ll \psi]$ is defined iff $C \subseteq \psi$, and where defined $C[\phi \ll \psi] = C[\phi]$.

Using these definitions, it follows that certain operators are holes, i.e., presuppositions in their scope are inherited as suppositions of the whole sentence.

(20) a. $C[\mathbf{not}(\phi \ll \psi)] = C[(\mathbf{not}\phi) \ll \psi]$ — negation is a hole
b. $C[\mathbf{if}(\phi \ll \psi)(\chi)] = C[(\mathbf{if}(\phi)(\chi)) \ll \psi]$ — a conditional antecedent is a hole

How do we apply this analysis to NR-predicates? A NR-structure should be represented as presupposing an EM-inference, in the notation of Satisfaction Theory: $(\mathbf{not}\Box(\phi)) \ll (\Box\phi \vee \Box\mathbf{not}\phi)$. Applying this theory to negation and conditional antecedents following (20), we predict that the EM-inference should project through *both* negation and conditional antecedents. We therefore do not predict the contrast in (17-a).

From (20-a), we know that (21-a) is equivalent to (21-b). Therefore, we predict an NR statement like 'she doesn't want to leave' presupposes the EM-inference. As the first conjunct in (17-a) overtly denies the EM-inference, we correctly predict that (17-a) is a contradiction.

(21) a. $C[\mathbf{not}(\Box L \ll (\Box L \vee \Box\mathbf{not}(L)))]$
b. $C[\mathbf{not}(\Box L) \ll (\Box L \vee \Box\mathbf{not}(L))]$

On the other hand in (20-b), we know that conditional sentences (a) and (b) in (22) are equivalent. Therefore, we predict that the second conjunct in (17-b) presupposes the EM-inference. Therefore, we predict that the conjunction in (17-b) should be contradictory, mimicking the pattern in (21). But intuitively, (17-b) is judged as perfectly natural.

(22) a. $C[\mathbf{if}(\Box L \ll (\Box L \vee \Box\mathbf{not}(L)))(\chi)]$
b. $C[\mathbf{if}(\Box L)(\chi) \ll (\Box L \vee \Box\mathbf{not}(L))]$

Therefore, Satisfaction Theory doesn't draw a distinction between negation and conditionals, even though a distinction between these two operators appears to be warranted by the judgements. Further, as per (14), we observe that questions and modals behave like conditional antecedents. Therefore, any theory of neg-raising employing the EM-inference has to explain why the EM-inference projects through negation, but not through other holes.

3.1.2 Universally quantified presuppositions in Satisfaction Theory

The presuppositional account of NR-inferences, supplemented with a Satisfaction Theory based account of presupposition projection, gives us a clear understanding of how NR-predicates interact with quantificational expressions. For example, how should we interpret the following sentences involving a NR-predicate embedded beneath a quantifier.

(23) a. Every boy doesn't want to leave.
b. Some girls who don't think it's raining brought an umbrella.
c. Exactly two cats don't believe they can play the saxophone.

But what I show in this subsection is that the Satisfaction Theory based account predicts overly strong truth conditions for quantificational sentences like those in (23). This is due to the well-known property inherited from Heim's theory – that presuppositions in the scope of a quantifier are universally quantified. I show that in various cases, this assumption leads to unattested inferences.

Heim gives the following definition for a universal quantifier. Let g^i_d be an assignment function which is just like g, except that g^i_d maps i to d.

(24) $C[\mathbf{every}_i(\phi)(\psi)] = \{\langle g, w\rangle \in C \mid \forall d[\langle g^i_d, w\rangle \in C[\phi] \to \langle g^i_d, w\rangle \in C[\phi][\psi]]\}$

Based on this definition, and those above, it follows that the following projective behavior is predicted for universal quantifiers.

(25) **Satisfaction Theory predictions**
a. A presupposition in the second argument of **every** holds universally for individuals in the restriction
$$C[\mathbf{every}_i(\phi)(\psi \ll \chi)] = C[(\mathbf{every}_i(\phi)(\psi)) \ll (\mathbf{every}_j(\phi)(\chi))]$$
b. A presupposition in the first argument of **every** holds universally for individuals in the domain
$$C[\mathbf{every}_i(\phi \ll \chi)(\psi)] = C[(\mathbf{every}_i(\phi)(\psi)) \ll (\mathbf{every}_j(\top)(\chi))]$$

The principle in (25-a) makes some good empirical predictions. For example, we correctly predict the NR-inference in (26).

(26) every boy doesn't want to leave $\rightsquigarrow$ *every boy wants to not leave*

a. $\mathbf{every}_x(\mathbf{boy}\ x)(\mathbf{not}(\Box_x L \ll (\Box_x L \vee \Box_x \mathbf{not}(L))))$ literal meaning
b. $\mathbf{every}_x(\mathbf{boy}\ x)(\mathbf{not}(\Box_x L) \ll (\Box_x L \vee \Box_x \mathbf{not}(L)))$ negation is a hole: (20-a)
c. $\mathbf{every}_x(\mathbf{boy}\ x)(\mathbf{not}(\Box_x L)) \ll \mathbf{every}_i(\mathbf{boy}\ x_i)(\Box_x L \vee \Box_x \mathbf{not}(L)))$ from (25-a)
d. $\mathbf{every}_x(\mathbf{boy}\ x)(\mathbf{not}(\Box_x L))$ at-issue meaning of (c)
e. $\mathbf{every}_x(\mathbf{boy}\ x)(\Box_x L \vee \Box_x \mathbf{not}(L)))$ presupposition of (c)
f. $\therefore \mathbf{every}_i(\mathbf{boy}\ x_i)(\Box_x \mathbf{not}(L)))$ from (d) and (e)

Further, if we analyze the determiner *no* as being deconstructed into $\mathbf{every}(\ldots)(\mathbf{not}\ldots)$, we make further good empirical predictions. Under such a deconstruction of *no*, we correctly predict that ‘no boy wants to leave’ generates the same inference as in (26).

(25-b) is a more problematic principle, predicting unattested inferences. For example, (25-b) predicts the overly strong inference in (27). Let S represent the proposition ‘x bought a Sudoku’.

(27) Every boy who didn’t want to leave brought a Sudoku $\rightsquigarrow$ *everyone is opinionated about leaving*
a. $\mathbf{every}_x(\mathbf{boy}\ x; \mathbf{not}(\Box_x L \ll (\Box_x L \vee \Box_x \mathbf{not}(L))))(S)$ literal meaning
b. $= \mathbf{every}_x(\mathbf{boy}\ x; \mathbf{not}(\Box_x L) \ll (\Box_x L \vee \Box_x \mathbf{not}(L)))(S)$ negation is a hole: (20-a)
c. $= \mathbf{every}_x(\mathbf{boy}\ x; \mathbf{not}(\Box_x L))(S) \ll \mathbf{every}_x(\top)(\Box_x L \vee \Box_x \mathbf{not}(L))$ from (25-b)
d. $\models \mathbf{every}_x(\top)(\Box_x L \vee \Box_x \mathbf{not}(L))$ presupposition of (c)

The Satisfaction Theory based account of neg-raising therefore systematically predicts the overly strong inferences in (28). But the utterances in (28) are perfectly compatible with a denial of the universally quantified EM-inference, as in (29). We therefore find that the Satisfaction Theory based account makes overly strong predictions here.

(28) a. *Every boy who wants it to rain will bring an umbrella*
$\rightsquigarrow$ Everybody has a preference about rain.
b. *No girl who believes it will rain will bring an umbrella.*
$\rightsquigarrow$ Everybody has an opinion about whether it will rain.

(29) a. Every boy who wants it to rain will bring an umbrella, the girls couldn’t care less about the weather.
b. Every boy who wants it to rain will bring an umbrella, but those who don’t mind either way didn’t bother.

For Heim, an indefinite determiner has no quantificational force of its own. Rather, an indefinite simply introduces an individual variable with an unused index. Heim’s theory of indefinites predicts the following behavior of presuppositions embedded under an indefinite determiner:

(30) A presupposition in the argument of an indefinite determiner projects universally.

$$C[(P(x_i))(Q(x_i) \ll \chi)] = C[(P(x_i))(Q(x_i)) \ll \mathbf{every}_j(P(x_j))(\chi)]$$

Similar to analogous structures with *every*, the Satisfaction Theory based account of neg-raising makes overly strong predictions here. A NR-predicate embedded beneath an indefinite quantifier is predicted to project universally, but intuitively, the indefinite sentence in (31) gives rise to no such inference.

(31) some boy didn’t want to leave $\rightsquigarrow$ *every boy is opinionated about leaving*
a. $(\mathbf{boy}_x)(\mathbf{not}(\Box_x L \ll \Box_x L \vee \Box_x \mathbf{not}(L)))$ literal meaning
b. $= (\mathbf{boy}_x)(\mathbf{not}(\Box_x L) \ll \Box_x L \vee \Box_x \mathbf{not}(L))$ negation is a hole: (20-a)
c. $= (\mathbf{boy}_x)(\mathbf{not}(\Box_x L)) \ll \mathbf{every}_y(\mathbf{boy}_y)(\Box_y L \vee \Box_y \mathbf{not}(L))$ from (30)
d. $\models \mathbf{every}_y(\mathbf{boy}_y)(\Box_y L \vee \Box_y \mathbf{not}(L))$ presupposition of (c)

Heim 1983 stipulates that presuppositions of indefinites can be accommodated in the indefinite determiner’s nuclear scope. Making this move would get the correct predictions for (31). But this kind of stipulation brings us back to lexically specified projection properties, which Heim’s analysis is trying to avoid.

As a general observation, we find that non-universal quantifiers *do not* give rise to a universally EM-inference, contradicting the Satisfaction Theory-based account. Intuitively, none of (a–c) in (32) give rise to an entailment of (d).

(32)
a. At least two boys don't want it to rain.
b. Not every boy wants it to rain.
c. No fewer than ten boys want it to rain.
d. *Every boy prefers it to rain, or prefers it to not rain.*

Examining the examples above, we find a consistent trend that the universal quantification of presuppositions content leads to empirical problems. In particular, we find that the Satisfaction Theory based account of neg-raising makes some unexpected predictions when it comes to non-monotone quantifiers. For example, a Satisfaction Theory based account predicts the following two sentences are semantically equivalent.

(33)
a. Some but not all boys want to leave.
b. Some but not all boys don't want to leave.

Under Gajewski's theory, both of these sentences give rise to a universally quantified presupposition 'every boy is opinionated about leaving'. Due to this presupposition, whenever (a) is true, (b) must also be true, and vice versa.

This can be better illustrated visually. Let ☺ represents a boy who wants to leave, 😐 is a boy with no opinion about leaving, and ☹ is a boy who wants to not leave. (34) represents (classes of) possible worlds based on the boys' attitudes to leaving.

(34)
a. ☺☺☺
b. 😐😐☺
c. ☹😐☺
d. ☹☹☺
e. 😐😐😐
f. ☹☹😐
g. ☹☹☹

The Satisfaction Theory based account demands that we eliminate any world in which 😐 is present. This is due to the universally quantified EM-inference, amounting to the inference that every boy is opinionated (i.e., ☺ or ☹). Therefore, the meanings of the sentences in (33) are only defined in worlds ☺☺☺, ☹☹☺, and ☹☹☹. Both sentences in (33) are true in world ☹☹☺ (i.e., there is a combination of boys who want to leave and boys who want to stay), while both sentences in (33) are false in ☺☺☺ and ☹☹☹. Therefore, the sentences in (33) have equivalent truth conditions.

But this predicted equivalence does not hold empirically. Intuitively, both sentences are compatible with there being or not being boys with no opinion about leaving. If we neglect to take the step in which any world with 😐 is eliminated, we obtain different results. (33-a) is compatible with worlds 😐😐☺, ☹😐☺, and ☹☹☺. (33-b) is compatible with worlds ☹😐☺, ☹☹☺ and ☹☹😐. Therefore, without the universally quantified presupposition, the two sentences are *not* truth conditionally equivalent.

Both sentences, like other quantificational sentences discussed above in (29), are compatible with individuals with no opinion (i.e., 😐-boys). With a continuation which makes the presence of 😐-boys explicit, the two sentences describe clearly different scenarios.

(35)
a. Some but not all boys want to leave, the rest haven't made their mind up either way.
b. Some but not all boys don't want to leave, the rest haven't made their mind up either way.

Further, the two sentences in (33) can be coordinated without redundancy (although the result is rather convoluted) as in (36-a). The redundancy is unexpected if they are semantically equivalent. Likewise, as in (36-b), one cannot be denied by an assertion of the other (thanks to a reviewer for suggesting this example).

(36)
a. Some but not all boys want to leave, and some but not all don't, (the rest don't care either way).
b. A: Some but not all boys want to leave.
B: #You're absolutely right. Some but not all boys don't want to leave.

Summing up this section, the Satisfaction Theory-based analysis predicts that the EM-inference should project out of negation, conditionals, and other holes. However, we find that consistency judgements lead to a conclusion that negation should be treated separately from other kinds of holes. Our goal is a theory which allows the EM-inference to project through negation, but not through other kinds of holes like conditionals.

Further, Gajewski's analysis makes use of Heim's principle that presuppositions are universally quantified when they are introduced within the scope of quantificational determiners. I have shown that this analysis makes overly strong predictions in a number of cases.

3.2 Cancelling the NR-inference

Gajewski notes (echoed by Romoli 2013 and Homer 2015) that the excluded middle implication of negated NR-predicates *can* be suspended. All of these authors note that this requires some kind of marked intonational contour. In my judgement, the most natural contour obtaining this “cancellation” reading is stressing the NR-predicate itself.[2]

(37) Maggie doesn’t WANT$_{\star}$ to leave, she hasn’t made up her mind.

Gajewski analyzes such cases via a covert operator defined in Beaver and Krahmer 2001. The parse of (37), maybe signalled by the intonation, contains Beaver and Krahmer’s presupposition cancellation operator *A* scoping between negation and the NR-predicate.

(38) Homer(not(*A*(want it to rain)))

But there’s a simple reason to disprefer this approach to presupposition cancellation. If *A* scopes above *want*, then it also scopes above anything embedded beneath *want*. This means that *A* will unselectively cancel presuppositions in the scope of *want*. In (39), the NR-predicate embeds a factive predicate *be angry*, which presupposes the truth of its prejacent. The NR-predicate bears its presupposition cancelling intonation, rendering it compatible with Homer’s lack of preferences. However, this intonation intuitively has no effect on the factive presupposition of *be angry*, which remains unaffected. However, Gajewski’s use of Beaver and Krahmer’s *A* operator predicts the factive presupposition is also cancelled. See also Romoli 2011 which makes a similar point about the *A* operator outside of the domain of neg-raising.

(39) Homer didn’t WANT$_{\star}$ to be angry that Bart skateboarded.
$\rightsquigarrow$ *Bart skateboarded.*

Although I would object to the use of Beaver and Krahmer’s *A* operator, I would argue that Gajewski’s approach to cancelled neg-raised readings via presupposition cancellation is on the right track. These cases can be understood like metalinguistic negation. In (37), the speaker asserts that ‘want’ is an inappropriate term to describe Maggie’s (undecided) attitude, and likewise for (39).

A similar story involving metalinguistic negation is promising for examples raised by Homer (2015). In (40), Homer suggests that the NR-reading of ‘want’ is cancelled, as such a reading implies that my great-grandparents had a preference about spending time on the internet (contrary to assumptions). But this could also be a case of presupposition negation, in which the bracketed constituent is taken to be an inappropriate linguistic description of my great-grandparents. In fact, we also see the existential presupposition of the definite ‘the internet’ negated, given that the relevant attitude is intended to be interpreted relative to a time pre-internet. I would thus object to an analysis of (a) as a case of variable scope of negation and ‘want’, but instead, advocate an analysis in which (40) is a case of presupposition cancellation.

(40) Unlike many people nowadays, my great-grandparents didn’t [want to spend all their spare time on the internet].

A similar analysis is possible for (41), also from Homer (2015). The most natural interpretation of (41) is one in which the interviewee asserts a desire to not make a lot of money.

(41) Context: At a job interview. . .
I don’t [want to make a lot of money], you know.

However Homer cites a possible reading in which the interviewee is expressing something more like ‘no particular desire to make money’, i.e., a non-NR-reading. I think this reading comes out more clearly if the utterance is assigned

[2] Several authors Gajewski (2005, 2007); Romoli (2013); Homer (2015) also argue that stressing the negated auxiliary in (37) obtains the same result. This is a crucial component of Romoli’s analysis of such “cancellation” examples, but I do not share the judgement that stressing the auxiliary leads to the same interpretation as stressing the NR-predicate as in (37). It remains to be examined whether this is dialect or individual variation.

contrastive intonation, as in (a) below. Another construal which makes a non-NR-reading more clear is in (b) below, in which the interviewee uses a NR-predicate to conform to a linguistic parallelism with the interviewer's lead-in question. In both cases, the negation is targeting the appropriateness of the bracketed constituent as an adequate linguistic description of the interviewee's attitude, and thus would fall under a general account of metalinguistic negation, implying presupposition cancellation.

(42) a. Context: At a job interview. . .
I dont [want to make a lot of MONEY], you know, I simply want the PRESTIGE of being a superintendent.
b. Interviewer: Are you one of those candidates who just wants to make a lot of money?
Interviewee: I dont [want to make a lot of money], you know, I care more about the humanitarian aspects of the job.

Allowing for the possibility of metalinguistic negation does imply a system in which the use of negation is ambiguous between a presupposition cancelling version and a regular, classical negation. There is ample evidence from other semantic-pragmatic studies of negation that such a split is necessary for a variety of phenomena. See Horn 1985, 1989, McCawley 1991, Carston 1996, and many others on the phenomenon of metalinguistic negation, and see, e.g., Potts 2007, Maier 2014 for definitions of operations which bridge the use/mention divide of linguistic expressions, such that the appropriateness of an expression may be negated.

3.3 Some alternative accounts

This section provides a rundown of some prominent accounts of presupposition projection, among the plethora of such accounts out there in the literature. It is impossible to do justice to every account but we can extract some key properties from various accounts of projective behaviour and how they link up with the neg-raising facts, before moving on to this paper's account.

3.3.1 The excluded middle as a soft presupposition

Presuppositions are often characterized as a prior discourse commitment of the interlocutors, for example see Stalnaker 1973, 1979. But intuitively, the EM-inference is not required to be a discourse commitment of interlocutors prior to the utterance of a NR-predicate.

We can adapt a diagnostic from Tonhauser et al. 2013 to demonstrate this property of NR-predicates, showing that it does not require the EM-inference to be assumed prior to utterance. Tonhauser et al. propose that this property of presupposition triggers can be specifically targeted by the following test. Let's assume that ϕ is a meaning component presupposed by an expression S. To diagnose the status of ϕ as a prior discourse commitment, compare an utterance of S within two contexts which minimally differ as to whether ϕ is entailed. S should be analyzed as imposing ϕ as a prior discourse commitment only if S is unacceptable in a context which does not entail ϕ, but acceptable in a minimally different context which entails ϕ.

(43) Context: *Homer is deciding on whether to sign an employment contract, he is given 2 minutes to decide. When he has decided, he is asked to press a red button to inform Marge that he has made a decision.*
a. *Marge comes in after 1 minute, before Homer has had a chance to press the button. Homer says:*
I (don't) want to sign the contract.
b. *Homer presses the button to signal he's made a decision, so Marge enters the room. Homer says:*
I (don't) want to sign the contract.

Contexts (a) and (b) in (43) minimally differ as to whether the EM-inference is entailed. Here the EM-inference is that Homer has made a decision, signalled by pressing the red button. The NR-predicate is acceptable in both contexts, and so this diagnostic tells us that the EM-inference is not required to be a prior discourse commitment. Compare this result with an analogous test applied to a presupposition trigger like *too*.

(44) Context: *The family are ordering at a restaurant.*

a. *Bart speaks first*:
I want to order the fried shrimp too.
b. *Lisa orders the fried shrimp. Then Bart speaks:*
I want to order the fried shrimp too.

If the EM-inference is analyzed as a presupposition, we need to explain why it behaves differently when compared to a presupposition trigger like *too*. To address this discrepancy, Gajewski suggests that the EM-inference should be analyzed as a *soft* presupposition in the sense of Abusch (2005, 2010), to be discussed in a following subsection.

Abusch's theory of presuppositions is, like Heim's, couched within Satisfaction Theory. Abusch proposes that soft presuppositions are imposed on discourse contexts at a weaker strength than non-soft presuppositions. For example, Abusch proposes that *stop*(ϕ) gives rise to a soft presupposition that ϕ held in the past. As the presupposition is soft, it doesn't give rise to an infelicity judgement in contexts in which the presupposition is not entailed.

(45) Context: *Marge's friend looks unhappy. Homer, who doesn't know the friend, asks why. Marge says:*
She has stopped smoking.

Gajewski proposes that the EM-inference is a soft presupposition, triggered by NR-predicates. As soft presuppositions don't trigger an infelicity judgement in contexts not entailing the presupposition, this proposal would correctly predict the following sentences, repeated from above, are judged as non-contradictory.

(46) Lisa may or may not be indifferent about leaving, $\left\{\begin{array}{c}\text{but if she wants to leave, come get me}\\ \text{so does she want to leave?}\\ \text{but maybe she wants to leave}\end{array}\right\}$.

What is essential to Abusch's account is that soft presupposition triggers are associated with an alternative set. This alternative set gives rise to a set of alternative propositions. Abusch proposes that soft presuppositions trigger an inference that *at least one* proposition in the alternative set is entailed by the local context of the presupposition trigger.

(47) *Generalization L:* If a sentence ψ is uttered in a context with a common ground C and ψ embeds a clause ϕ which contributes an alternative set Q, then typically C is such that the corresponding local context D for ϕ entails that *some element of Q is true.*

We can use an example to illustrate. Abusch proposes that the proposition *x stops* ϕ is associated with the alternative set $\{\mathbf{continue}(x)(\phi), \mathbf{stop}(x)(\phi)\}$. By the principle in (47), an expression of *x stops* ϕ will force its local context to entail that one of the propositions in the alternative set is true, i.e., that $\bigvee\{\mathbf{continue}(x)(\phi), \mathbf{stop}(x)(\phi)\}$ is true. As both $\mathbf{continue}(\phi)$ and $\mathbf{stop}(\phi)$ imply that ϕ held in the past, $\bigvee\{\mathbf{continue}(x)(\phi), \mathbf{stop}(x)(\phi)\}$ amounts to a conclusion that ϕ held in the past. Thus by the principle in (47), an expression of *x stops* ϕ will force its local context to entail that ϕ held in the past.

For Gajewski's account, a NR-predicate is associated with the alternative set in (48). Following Abusch's framework, if this alternative set is disjoined, we simply reconstruct the EM-inference. So by (47), a NR-predicate triggers the inference that its local context entails $\Box_a(\phi) \vee \Box_a(\neg\phi)$.

(48) $\text{ALT}(\Box_a(\phi)) = \{\Box_a(\phi), \Box_a(\neg\phi)\}$

But Abusch's theory does not end up drawing a distinction between negation and other sorts of presuppositional holes. The local context for conditional antecedents is simply the global context. This is a direct entailment of the definition in (18-c), following from Heim's theory of context update. Thus, according to Gajewski's theory, the sentences in (49) are predicted to trigger the inference that the global context entails EM.

(49) a. If John wants to swim, tell me.
b. Does John want to swim?

Adopting Abusch's theory does not help us explain the key contrast at hand. Why is (50) perceived as contradictory, while the sentences in (14) are not? In (50), according to Gajewski, the NRP in the second conjunct triggers the expectation that EM is entailed by the global context, contradicted by the first conjunct. But Gajewski makes the same prediction about the sentences in (14), leaving the contrast unexplained.

(50) Lisa may or may not be indifferent about leaving, #(but she doesn't want to leave).

Further, Romoli (2013), following Sauerland (2008), points out some empirical issues with Abusch's framework, particularly when soft triggers are stacked, as in (51). Like 'stop', Abusch analyzes the verb 'win' as a soft presupposition trigger. 'win' is analyzed as triggering a soft presupposition that the subject participated (in the event/race/competition). Abusch's theory makes unexpected predictions when we combine soft presupposition triggers. Intuitively, (51) gives rise to an inference that 'John used to win.' But Abusch's predicted inference comes from disjoining the alternative set, as in (b), which merely leads to an inference that 'John used to participate', weaker than what is observed.

(51) a. John stopped winning.
b. $\bigvee \left\{ \begin{array}{c} \mathbf{continue}(\mathbf{win})(\mathbf{j}), \mathbf{continue}(\mathbf{lose})(\mathbf{j}) \\ \mathbf{stop}(\mathbf{win})(\mathbf{j}), \mathbf{stop}(\mathbf{lose})(\mathbf{j}) \end{array} \right\} =$ "John used to participate"

Abusch's notion of soft presupposition resolves some issues arising from the presuppositional account of neg-raising. Specifically, it provides an explanation of why infelicity judgements do not arise when the NR-predicate is uttered in a context which doesn't entail EM. However, Abusch's framework introduces new theoretical issues into the analysis, leading to some unexpected predictions.

3.3.2 Implicature-based accounts

Before moving on, I will briefly comment on some alternative semantic-pragmatic accounts, in which presupposition projection is derived by rational inference about alternatives raised by the presupposition trigger.

The first account to be examined is proposed in Romoli 2013, see also Xiang 2013 and Bervoets 2020. Romoli's account is comprehensive and insightful, and a full discussion of its implications are a topic for a separate paper. One point worth commenting on: the implicature-based account makes unusual predictions when it comes to upward entailing quantifiers like *some*.

Under Romoli's account, a NR-predicate, like *want*(ϕ), pragmatically competes with an abstract predicate of opinionatedness, something like *want*(ϕ) *or want*($\neg\phi$). Simultaneously, quantifiers pragmatically compete with their scalemates as usual, for example, *some* competes with *every*. Based on these two assumptions, we predict the following reasoning leading to the implicature in (c).

(52) a. *some boys want to swim* competes with the non-weaker *every boy is opinionated about swimming*.
b. via scalar reasoning, *some boys want to swim* implicates *not(every boy is opinionated about swimming)*
c. thus, *some boys want to swim* implicates *some boys have no preference wrt swimming*

I take (c) to be an undesired prediction of the scalar implicature-based account. Intuitively, *some boys want to swim* is compatible with a situation in which every boy is opinionated. Interestingly, the scalar implicature-based account makes the opposite prediction to Gajewski's presuppositional account here.

(53) Some boys want to swim:
a. Every boy is opinionated about swimming — *prediction of presuppositional account*
b. Not every boy is opinionated about swimming — *prediction of implicature account*

I take both of these predictions to be too strong. Intuitively, 'some boys want to swim' says nothing about the boys not quantified over by the determiner *some*. The utterance is compatible with either (a) or (b).

A reviewer asks whether Chemlas account of variable projective behaviour under quantifiers falls into the same issues. Chemla (2010) argues for the following types of presupposition projection under different quantifiers. His analysis is backed up by experimental evidence in Chemla 2009 demonstrating that different quantifiers yield different projective behaviours.

(54) a. '$\mathbf{every}(boy)(\phi \gg \psi)$' implies that '$\mathbf{believe}(\mathbf{every}(boy)(\psi))$'
b. '$\mathbf{some}(boy)(\phi \gg \psi)$' implies that '$\mathbf{believe}(\mathbf{some}(boy)(\psi))$ **and possible**$(\mathbf{every}(boy)(\psi))$'

There is much to be said about Chemlas analysis of projection. However, with particular respect to its analysis of presupposition projection, the results for existential quantifiers are too weak. They demonstrate the same property outlined in van der Sandts 1992 overview of presuppositional theories. van der Sandt points out that such analyses in which the presupposition is re-quantified within the projective content, are too weak.

Let's make the standard assumption that '*Some boy climbed the wall again*' asserts '*Some boy climbed the wall now*' and, employing Chemla's analysis, presupposes that '*(At least) some boys climbed the wall before*'. Given these two meanings, we have no guarantee that the same boys are quantified within the two sentences. For example, the proposed meanings are compatible with a reading where Alphonse climbed the wall in the past and Bertrand climbed it in the present, which is intuitively not a reading of '*Some boy climbed the wall again*'.

The same issue arises with NR-predicates. Under Chemla's account, 'some boy wants to leave' is expected to give rise to the inference '(at least) some boys are opinionated about leaving'. But this holds no guarantee that the same boys are quantified over in both sentences, contra to intuition.

This particular re-quantificaton property of certain presuppositional theories was the motivating factor behind the development of van der Sandt's dynamic account of projection, which informs the formal account in Section 4 and beyond.

3.4 Outlook

Before moving onto the particulars of this paper's account, we can sum up the story so far: this paper maintains that an optimal theory of NR-inferences should have the following properties:

(55)
a. The EM-inference does not project through certain operators, intensional in nature, like conditional antecedents.
b. The EM-inference is not systematically universally quantified when the associated NR-predicate is embedded in a quantificational context.
c. The EM-inference is not imposed as a condition on the discourse context: it doesn't need to be *discourse old*).

Moreover, both Romoli's and Chemla's accounts, discussed above, end up making claims about the opinionatedness of individuals not quantified over by the quantifier. To match our intuitions about quantificational neg-raising sentences, we can make the following preliminary generalization about NR-predicates under quantifiers, discussed further in the remainder of the paper.

(56) Sentences of the form $Qx[\text{NRP}(x)[...]]$ make no entailments about individuals not quantified over by Q.

The challenge for the rest of the paper is to propose a formal account of the EM-inference which predicts these properties.

4 Automatically accommodated projective content

Having laid out a series of goals for a semantic-pragmatic theory of neg-raising, the remainder of this paper presents a formal system which meets those challenges. The following sections of this paper characterize the EM-inference as a variety of projective content encoded at the level of the lexical item, just as in Gajewski's account. However, the EM-inference is *not* encoded as a garden variety presupposition.

I define a notion of *automatically accommodated projective content* (or AAP). An AAP is a variety of projective content which does not need to be entailed by the prior discourse context. Further, the projection of an AAP is limited in scope by quantifiers. AAPs are a type of projective content, by virtue of being introduced as compositionally separate from the at-issue content. However, they are also at-issue, in that the compositional semantics is geared towards resolving AAPs by conjoining them with the at-issue content. And as such, after they have been resolved via this conjunction operation, they are able to scopally interact with at-issue expressions such as quantifiers.

AAPs therefore have properties of both not at-issue content and at-issue content. The introduction and resolution of projective content in this way bears a strong resemblance to the scope-taking behavior of ordinary at-issue meanings.

This formal notion of AAPs suggests it is possible to conceive of content which is intermediary between at-issue scope-taking content and not at-issue projective content. This cline between scope-taking and projection is implicit in several accounts of projective meanings, including Russell's (1905) original account of definite descriptions.

The notion of AAPs is spelled out in a modified version of compositional DRT (Muskens 1996), adding a notion of *accommodation* as defined in Van der Sandt (1992).

4.1 Preliminaries

AAPs are propositional meanings, analyzed as part of the compositional semantics. They are embedded beneath a metalanguage operator $\ll$ (symbol from Karttunen 1973), and using this operator, they are separated from the at-issue content. AAPs are *resolved* within the broader compositional structure. The resolution of an AAP means simply conjoining it with the at-issue content at an appropriate height. Although AAPs are separated from at-issue content when introduced into the composition, they are resolved by being incorporated into the at-issue content. The resolution mechanism could be considered a type of scope-taking apparatus.

According to our definitions of quantifiers, if a quantifier binds a variable within an AAP, the AAP must be resolved within the quantifier's scope. Again, AAPs bear a strong resemblance to scope-taking phenomena, which are also subject to *roofing* constraints of this type (e.g., see Chierchia 2001). Here we define a version of DRT which incorporates this notion.

Under the theory presented here, natural language expressions are translated into a metalanguage based on Muskens' compositional DRT. If a DRT expression contains no *unresolved presuppositions*, it can be interpreted relative to a model. The metalanguage uses the following types:

(57) The set of types is the smallest set such that:

a. e, t, s, and g are basic types.

b. If σ and τ are types, then $\sigma \to \tau$ is a type.

Well formed expressions in the metalanguage include pre-defined constants and variables for each type, as well as any expressions constructed via function application $\alpha(\beta)$ and λ-abstraction $(\lambda\alpha.\beta)$.

A discourse representation structure (DRS) is a proposed update to a discourse context. A DRS is an expression of type $g \to (g \to t)$ which henceforth is abbreviated as T. A DRS can be decomposed into a pair $\langle\{x_1,...,x_n\},\{\gamma_1,...,\gamma_m\}\rangle$. $\{x_1,...,x_n\}$ is a set of discourse referents of any type. $\{\gamma_1,...,\gamma_m\}$ is a set of conditions, each of type T. We can refer to a DRS K's set of discourse referents as $\mathsf{dref}(K)$ and K's set of conditions as $\mathsf{cond}(K)$. A DRS $\langle\{x_1,...,x_n\},\{\gamma_1,...,\gamma_m\}\rangle$ can be alternatively represented as:

$$\begin{array}{|c|}\hline x_1,...,x_n \\ \hline \gamma_1, \\ ..., \\ \gamma_m \\ \hline \end{array}$$

For example, an update like "*a skateboarder loves a saxophonist*" might be represented as in (58), with two introduced discourse referents and three conditions.

(58)
$$\begin{array}{|c|}\hline x,y \\ \hline \textbf{skateboarder}(w)(x) \\ \textbf{saxophonist}(w)(y) \\ \textbf{loves}(w)(y)(x) \\ \hline \end{array}$$

We can construct more complex DRSs by conjoining them via the definition in (a) in (59). By virtue of the model theoretic interpretation of conjunction, (a) amounts to unionizing the conjuncts' sets of discourse referents and sets of conditions, making more complex DRSs, yielding (b) in (59).

(59) a. *Conjunction:* If K_1 and K_2 are DRSs, then so is $K_1;K_2$.

b. $K_1;K_2 = \langle \mathsf{dref}(K_1) \cup \mathsf{dref}(K_2), \mathsf{cond}(K_1) \cup \mathsf{cond}(K_2) \rangle$

By this procedure, new utterances can be merged into the prior discourse, creating larger and larger DRSs representing the conversational context. For example, an update "*a sous-chef is jealous*" is represented as in (60-a). It's conjunction with (58) is represented in (60-b).

(60) a. $\begin{array}{|c|}\hline z \\ \hline \textbf{sous-chef}(w)(z) \\ \textbf{jealous}(w)(z) \\ \hline \end{array}$

b. $\begin{array}{|c|}\hline x,y \\ \hline \textbf{skateboarder}(w)(x) \\ \textbf{saxophonist}(w)(y) \\ \textbf{loves}(w)(y)(x) \\ \hline \end{array} ; \begin{array}{|c|}\hline z \\ \hline \textbf{sous-chef}(w)(z) \\ \textbf{jealous}(w)(z) \\ \hline \end{array} = \begin{array}{|c|}\hline x,y,z \\ \hline \textbf{skateboarder}(w)(x) \\ \textbf{saxophonist}(w)(y) \\ \textbf{loves}(w)(y)(x) \\ \textbf{sous-chef}(w)(z) \\ \textbf{jealous}(w)(z) \\ \hline \end{array}$

The metalanguage comes with operators designed for creating more complex conditions, as in (61). Most important in this discussion is (61-d) which introduces a presupposition operator $\ll$.

(61) *Conditions*:

a. If R is an n-place predicate, then $R(x_1)\dots(x_n)$ is a condition.
b. If x_1 and x_2 are expressions of the same type, then $x_1 = x_2$ is a condition.
c. If K is a DRS then $\neg K$ is a condition.
d. **If K is a DRS, and n is a natural number, then $\ll_n K$ is a condition.**
e. If K_1 and K_2 are DRSs then $K_1 \vee K_2$ and $K_1 \Rightarrow K_2$ are conditions.

The operator $\ll_n$ is an operator which marks a DRS as *unresolved*. This means it contains not at-issue content which has not been properly incorporated into the utterance meaning. The marked is given a unique numerical index in order to keep track of its resolution (a similar principle is employed in Bos 2003). The central proposal of this paper is that the excluded middle inference of neg-raising predicates is as an AAP, and thus embedded beneath a $\ll_n$ operator.

In order to discuss the sorts of modal meanings essential to NR-structures, we first defined some abbreviations for convenience. Below, $\mathbf{W}(x)(w)(v)$ means that v is compatible with x's desires at w. Attitude predicates are analyzed as necessity modals. $\mathbf{want}^w_x$ is a universal quantifier over x's bouletic alternatives at w, i.e., the worlds compatible with x's desires at w.

(62) "$\mathbf{want}^x_w v : p(v)$" abbreviates "$\begin{array}{|c|}\hline \\ \hline \begin{array}{|c|}\hline v \\ \hline \mathbf{W}(x)(w)(v) \\ \hline \end{array} \Rightarrow p(v) \\ \hline \end{array}$"

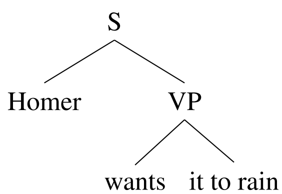
Thus we can compare the lexical entries for *want* an NR-predicate and *prefer* a non NR-predicate. The analysis implements Gajewski's proposal that NR-predicates lexically encode the EM-inference as part of their not-at-issue content. Though here we propose that the EM-inference is an automatically accommodated presupposition.

(63) a. *want* $\rightsquigarrow \lambda p.\lambda x.\lambda w. \begin{array}{|c|}\hline \\ \hline \mathbf{want}^x_w v : p(v) \ll_n (\mathbf{want}^x_w w' : p(w') \vee \mathbf{want}^w_x w'' : \neg p(w'')) \\ \hline \end{array}$

b. *prefer* $\rightsquigarrow \lambda p.\lambda x.\lambda w. \begin{array}{|c|}\hline \\ \hline \mathbf{want}^x_w v : p(v) \\ \hline \end{array}$

Combining the NR-predicate with a complement and subject, we get the representation in (64) for a basic NR-structure. The structure is interpreted as the proposition that Homer wants it to rain, and the structure introduces the not at-issue meaning component that Homer either wants it to rain, or wants it to not rain (the EM-inference).

(64)



$$\rightsquigarrow \lambda w. \begin{array}{|c|}\hline \\ \hline \mathbf{want}^{\mathbf{homer}}_{w} v : \mathbf{rain}(v) \\ \ll_0 \left(\mathbf{want}^{\mathbf{homer}}_{w} w' : \mathbf{rain}(w') \vee \mathbf{want}^{\mathbf{homer}}_{w} w'' : \neg\mathbf{rain}(w'')\right) \\ \hline \end{array}$$

4.2 Resolved and unresolved content

By the principles outlined above, certain DRSs introduce *unresolved content* embedded underneath a $\ll_n$ operator. Following a general insight from Van der Sandt 1992, any DRS which contains *unresolved content* is unable to be assigned an interpretation relative to a model. As such the resolution of any unresolved content is a necessary prerequisite for interpretation.

Under van der Sandt's system, the metalanguage translation of an utterance is an unresolved DRS. The unresolved DRS is then subject to a distinct set of principles in order to resolve any unresolved content. Thus, the compositional semantics and resolution mechanism are two distinct modules of interpretation. In this paper (unlike in van der Sandt's account), the resolution mechanism is a component of the compositional semantics. Thus, well-formed parse trees are able to be assigned a model theoretic interpretation, without an intermediary step. First a definition of *resolved* and *unresolved*.

(65) a. *Sub-condition*:
   (i) If $K_1 \in \mathsf{cond}(K_2)$, then K_1 is a sub-condition of K_2.
   (ii) If K_i is a sub-condition of K_j, and K_j is a sub-condition of K_k, then K_i is a sub-condition of K_k.
  b. *Unresolved*:
   If $\ll_n K_i$ is a sub-condition of K_j, then K_j is *unresolved* (for any n).
  c. *Resolved*:
   If K_j has no sub-conditions of the form $\ll_n K$, then K_j is *resolved* (for any n).

In short, in order to resolve a DRS, all $\ll$ operators must be eliminated. In order to resolve a DRS, we can introduce a resolution operator $\bullet_{\{i,\ldots,k\}}$. The resolution operator applies to a DRS and returns a new DRS. $\{i,\ldots,k\}$ is a set of one or more numerical indices. These indices correspond to the AAPs that the resolution operator is to resolve. For example the operator $\bullet_{\{0,3,8\}}$ will resolve the AAPs indexed with 0, 3, and 8. Thus, unlike van der Sandt's system (but like Bos's (2003) system) the presupposition resolution mechanism narrowly targets specific presuppositions.

Here is a relatively informal description of the function of the resolution operator:

(66) $\bullet_N(K)$ is just like K except that for any $n \in N$:
  a. in K, delete the box embedded beneath a $\ll_n$ operator (call this π_n).
  b. call this new DRS, with π_n deleted, K'
  c. conjoin π_n to the at-issue content, i.e., $\bullet_{\{n\}}(K) = K'; \pi_n$
  d. if there is no subordinate $\ll_n$ operator in K, then $\bullet_{\{n\}}(K) = K$

In order to define this operator more precisely, we need some auxiliary definitions. Let $|\cdot|$ be the function which translates natural language expressions (in the form of parse-trees) into the DRS-based metalanguage. Let $|\cdot|^{\pi}$ be a function applying to a metalanguage expression, and returns the set of that expression's unresolved sub-conditions.

(67) a. If K is a DRS, $|K|^{\pi} = \{\langle K', n\rangle : K'$ is a presuppositional sub-condition of K bearing index $n\}$
  b. If $\lambda\sigma. \ldots .\tau$ is an expression of type $a \to \ldots \to T$, then $|\lambda\sigma. \ldots .\tau|^{\pi} = |\tau|^{\pi}$.
  c. $|\alpha|^{\pi}$ is undefined for any other type.

Below is a simple, illustrative example. Here, the content of the proper name 'Burns' is analyzed as an AAP, consisting of the discourse referent associated with the proper name. The content of the possessive phrase ‘his car’ is also analyzed as an AAP, consisting of a discourse referent associated with the possessed individual, i.e., the car. In both cases, this paper does not make the analytical claim that proper names and possessive phrases are best analyzed as automatically accommodated projective content. The analysis is merely used to illustrate how the system works. Both AAPs bear a numerical index. When the DRS is fed through the $|\cdot|^{\pi}$, we obtain the set containing the presuppositional sub-conditions.

(68) a. $\Big|[\textit{Burns}\ [\textit{doesn't}\ [\textit{drive his car}]]]\Big| = \begin{array}{|l|}\hline \\ \hline \neg \begin{array}{|c|}\hline \\ \hline \textbf{drive}(x)(y) \ll_0 \begin{array}{|c|}\hline x \\ \hline \textbf{car-of}(y)(x) \\ \hline \end{array} \ll_1 \begin{array}{|c|}\hline y \\ \hline \textbf{burns}(y) \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array}$

b. $\Big|(\text{a})\Big|^{\pi} = \{\ \langle \begin{array}{|c|}\hline x \\ \hline \textbf{car-of}(y)(x) \\ \hline \end{array}, 0\rangle\ ,\ \langle \begin{array}{|c|}\hline y \\ \hline \textbf{burns}(y) \\ \hline \end{array}, 1\rangle\}$

The resolution operator $\bullet_{\{i,\dots,k\}}$ applies to a DRS K and serves to (a) delete the unresolved content indexed with any numeral $i,\dots,k$ in K, and (b) conjoin any such content to K. Deconstructing this operator into two tasks, we need a function which deletes presuppositions, defined here:

(69) *Deletion*: the function del_N, where N is a set of indices, is defined such that it searches a DRS K for any subordinate conditions of the format $\ll_n K'$ where $n \in N$, and deletes them. By deletion, we mean that the sub-condition $\ll_n K'$ is replaced with a tautology:

a. Where $K = \langle\{x_i,\dots,x_m\},\{\gamma_i,\dots,\gamma_k\}\rangle$, then $\mathsf{del}_N(K) = \langle\{x_i,\dots,x_m\},\{\mathsf{del}_N(\gamma_i),\dots,\mathsf{del}_N(\gamma_k)\}\rangle$.
b. Where K is condition $R(x_1)\dots(x_n)$ or $x_1 = x_2$, $\mathsf{del}_N(K) = K$
c. Where $\otimes$ is any binary operator $(;,\vee,\Rightarrow)$, then $\mathsf{del}_N(K_0 \otimes K_1) = \mathsf{del}_N(K_0) \otimes \mathsf{del}_N(K_0)$.
d. $\mathsf{del}_N(\neg K) = \neg(\mathsf{del}_N(K))$
e. Where $m \notin N$, $\mathsf{del}_N(\ll_m K) = \ll_m \mathsf{del}_N(K)$
f. Where $n \in N$, $\mathsf{del}_N(\ll_n K) = \top$

Resolution of a DRS K simply amounts to the deletion of a unresolved sub-condition of K and conjunction of that sub-condition to K.

(70) *Resolution*: $\bullet_{\{i,\dots,k\}}(K) = \mathsf{del}_{\{i,\dots,k\}}(K);\pi_i;\dots;\pi_k$, where $\{\langle\pi_i,i\rangle,\dots,\langle\pi_k,k\rangle\} \subseteq |K|^{\pi}$

For example, the $\bullet$ operator is applied to the DRS in (68-a). The result is a *resolved* DRS, that is, a DRS which does not contain any unresolved AAPs. Observe also how the mechanism illustrated here serves to place the content of the AAPs in a position which outscopes negation. Thus we can see how the mechanism here encodes a notion of “projection” which is very similar to scope-taking.

(71) $\bullet_{\{0,1\}}(|(68\text{-a})|) = \begin{array}{|l|}\hline \\ \hline \neg \begin{array}{|c|}\hline \\ \hline \textbf{drive}(x)(y) \\ \hline \end{array} \\ \hline \end{array} ; \begin{array}{|c|}\hline x \\ \hline \textbf{car-of}(y)(x) \\ \hline \end{array} ; \begin{array}{|c|}\hline y \\ \hline \textbf{burns}(y) \\ \hline \end{array} = \begin{array}{|c|}\hline x,y \\ \hline \textbf{burns}(y) \\ \textbf{car-of}(y)(x) \\ \neg \begin{array}{|c|}\hline \\ \hline \textbf{drive}(x)(y) \\ \hline \end{array} \\ \hline \end{array}$

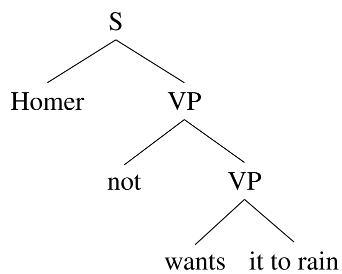
We can also define an operator $\bullet_{\forall}$, which unselectively applies the bullet operator to all remaining, unresolved presuppositions. The proposal here is that this unselective operator $\bullet_{\forall}$ applies at the root node of a parse-tree, ensuring that an expression is able to be interpreted relative to a model, as all its AAP sub-conditions are resolved.

(72) *Root principle*:
Let R be the root node of a parse-tree, and $|R|$ is its basic metalanguage translation.

The default metalanguage translation of R is $\bullet_{\forall}(|R|)$.

We can now apply this theory to see how NR-inferences are derived in basic cases. In (73), we have a NR-predicate embedded beneath negation. The NR-predicate encodes for an EM-inference as part of its not-at-issue content. Formally, this means that the EM-inference is embedded beneath a $\ll$ operator. The compositional semantics determines that the EM-inference is embedded beneath negation.

(73)



$$\rightsquigarrow \lambda w. \begin{array}{|c|}\hline \\ \hline \neg \begin{array}{|c|}\hline \\ \hline \textbf{want}^{\textbf{homer}}_{w} v : \textbf{rain}(v) \\ \ll_0 \left(\textbf{want}^{\textbf{homer}}_{w} w' : \textbf{rain}(w') \vee \textbf{want}^{\textbf{homer}}_{w} w'' : \neg\textbf{rain}(w'')\right) \\ \hline \end{array} \\ \hline \end{array}$$

To interpret the root node in (73), we must apply an unselective $\bullet$ operator to resolve any unresolved AAPs. (74) shows how the resolution mechanism allows the excluded middle inference to project above negation. The EM-inference is introduced in the scope of negation, then deleted and re-conjoined at a level above negation.

Not that the model theoretic definitions of negation and disjunction are analogous to their definition in propositional logic to the extent that the disjunctive syllogism ($\neg p, p \vee q \models q$), crucial to Bartsch's analysis, still holds. With these premises in place, we generate the NR-inference in (c).

(74) a. $\bullet_{\{0\}}(73) = \begin{array}{|c|}\hline \\ \hline \textbf{want}^{\textbf{homer}}_{@} w' : \textbf{rain}(w') \vee \textbf{want}^{\textbf{homer}}_{@} w'' : \neg\textbf{rain}(w'') \\ \neg \begin{array}{|c|}\hline \\ \hline \textbf{want}^{\textbf{homer}}_{@} v : \textbf{rain}(v) \\ \hline \end{array} \\ \hline \end{array}$ via definition of ;

b. $= \begin{array}{|c|}\hline \\ \hline \textbf{want}^{\textbf{homer}}_{@} w : \neg\textbf{rain}(w) \\ \hline \end{array}$ via disjunctive syllogism

The analysis here shares much with Gajewski's analysis. The reading in (74) is derived by introducing the EM-inference as not-at-issue content encoded as part of the verb's lexical meaning. The EM-inference projects above negation. The at-issue content of (74) and the EM-inference jointly entail the neg-raised reading via a disjunctive syllogism.

However, the account is crucially different to Gajewski's analysis in other respects. Primarily, the proposed meaning for the English expression in (73), represented in (74-b), contains no presuppositional content. Resolution amounts to deleting the not-at-issue component and incorporating it into the at-issue component. We therefore have no expectation that the representation in (74-b) imposes any requirement on the prior discourse context.

We also correctly predict that (75) should be interpreted as a contradiction. The first conjunct is a denial of the EM-inference. The second conjunct is interpreted analogously to (74-b), and as such entails the EM-inference as part of its at-issue content. Naturally, the entire conjunction is contradictory.

(75) Lisa may or may not be indifferent about leaving, #(but she doesn't want to leave).

4.3 AAPs vs. other types of projective content

Where do AAPs sit in relation to other proposed types of projective content? In the past couple of decades, the notion that projective content is a heterogeneous class has become essentially ubiquitous. For example, Potts (2005) draws a clear distinction between what he labels 'presuppositions' and 'conventional implicatures', distinguished primarily by a need for a discourse antecedent: presuppositions are understood to encode discourse-old information, while conventional implicatures encode discourse-new information. Tonhauser et al. (2013) provide a rigorous typology of projective content, arguing that such content can be divided by (at least) two parameters, the familiar discourse-old/new distinction as well as projective behavior in attitudinal contexts.

The present proposal takes a similar worldview: AAPs are a *class* of projective content, to be distinguished from other classes such as garden variety presuppositions. The characteristic properties of AAPs are (i) the projection of the AAP's content, so long as the projection does not cause a variable to become unbound, and (ii) the incorporation of the projected content into the truth conditional content (thus, automatic accommodation).

Due to property (ii), AAPs are understood in opposition to other types of projective content which impose what Tonhauser et al. (2013) label as a 'strong contextual felicity' (SCF) condition. According to Tonhauser et al. (2013), if a lingusitic expression X introduces a SCF condition, then it imposes a requirement on the discourse context that some meaning p must be a part of the pre-utterance common ground in order for the utterance of X to be felicitous.

For example, Tonhauser et al. (2013:(18)) cite additive *too* in English, and its Guaraní corollary *avei*, as a candidate for an expression which imposes an SCF condition. In (76-a), English *too* is only felicitous in an utterance context in which the property 'is eating empanadas' is understood to be true of an alternative to the F-marked constituent. In a minimally different context, in which the utterance context does meet this condition, the expression is felicitous.

(76) a. *Context*: Malena is eating her lunch, a **hamburger**, on the bus going into town. A woman who she doesn't know sits down next to her and says::
#'[Our bus driver]$_F$ is eating empanadas, too.'
b. *Context*: Malena is eating her lunch, some **empanadas**, on the bus going into town. A woman who she doesn't know sits down next to her and says::
'[Our bus driver]$_F$ is eating empanadas, too.'

Tonhauser et al. (2013) contrasts expressions like *too* with other expressions which give rise to projective content. For example, prenominal *only* in English, and its Guaraní corollary *-nte*, is understood to encode the truth of its prejacent as projective content. However, unlike *too*, prenominal *only* does not impose an SCF condition. The utterance is felicitous even though the context does not entail the truth of the prejacent (i.e., 'I have been cleaning our house.'). Likewise, *almost*, and its Guaraní corollary *aimete*, encodes projective content with the reverse polarity of its prejacent. This content likewise does not impose an SCF constraint, see Tonhauser et al. (2013:(16)).

(77) a. *Context*: Carla, a mother of three teenage daughters, falls on the way to the supermarket and breaks her leg. After being in the hospital for a week, the girls come to visit her. When she asks them how they are doing, her youngest daughter blurts out:
'Only I have been cleaning our house!'
b. *Context*: A mother calls for her daughter to come down for dinner. Her daughter doesnt appear so she goes upstairs to check on her. When she comes back down, she says to her husband:
'It seems that Malena is sick. She almost threw up.'

This paper's notion of AAP exhibits a clear parallel with Tonhauser et al.'s notion of projective content which lack SCF constraints.

Previous work has accounted for semantic phenomena with the use of automatically accommodated projective content. For example, Jäger (2007); Sæbø (2013) class specific indefinites like *a certain boy* as introducing their descriptive content $[\mathbf{boy}(x)]$ as projective content which scopes to the highest possible level (such that the variable does not become unbound) and is then existentially closed. See also Tonhauser (2015) for further arguments for such a class of projective content.

As AAPs are distinguished in this analysis from garden variety presuppositions, we should expect differing behaviour. A reviewer points out that the treatment of presuppositions in Sudo (2012) makes different predictions about the licensing of presuppositions. For example, Sudo claims that gendered pronouns introduce gendered presuppositions. If the presupposition is introduced below an operator which permits cross-sentential anaphora, the presupposition is given an singular anaphoric reading as in (78-a). Otherwise, the preuspposition can be given a plural anaphoric reading, yielding a universal interpretation, as in (78-b). Below, the bracketed constituent is Sudo's predicted preuspositional inference.

(78) a. Some student criticised herself. $\rightsquigarrow$ [The student uses 'she' pronouns].
b. Every student criticised herself. $\rightsquigarrow$ [Every student uses 'she' pronouns].

This treatment of presuppositions makes different predictions when it comes to conditionals. As conditionals limit the anaphoric potential of an indefinite, Sudo predicts a universal inference, correctly in my judgement.

(79) If (a student criticises herself), we need to bring in a guidance counsellor.
$\rightsquigarrow$ [Every student uses 'she' pronouns].

But the EM-inference of NR-verbs does not behave in this way. Using Sudo's guidelines on quantifiers and conditionals, we get a different pattern. While the predictions under 'some' and 'every' are the same, we don't want to predict a universal inference under conditionals, as discussed in Section 3.

(80) a. Some boy wants to leave. $\rightsquigarrow$ [The boy is opinionated].
b. Every boy wants to leave. $\rightsquigarrow$ [Every boy is opinionated].
c. If a boy wants to leave, we need to bring in a guidance counsellor. $^{??}\!\rightsquigarrow$ [Every boy is opinionated].

Thus it appears that AAPs (like the EM inference in this paper) and presuppositions such as gendered inferences from pronouns have different projective properties.

Is the AAP a singleton class, only containing the EM-inference of NR-verbs? If so, it would weaken the paper's theory as being overly specific to the data concerning us here. However, I believe the AAP theory extends to other phenomena. Firstly, it extends to related phenomena such as the homogeneity inference of plural definites. Work such as Löbner (2000); Gajewski (2005); Križ (2016) and others claim that plural definites give rise to a homogeneity inference which matches the pattern of the EM-inference of NR-predicates.

(81) a. The students went jogging $\rightsquigarrow$ every student jogged or every student didn't jog.
b. The students didn't go jogging $\rightsquigarrow$ every student jogged or every student didn't jog.

In unembedded environments like (81-a) and under negation like (81-b), nothing prevents the homogeneity inference (on the right side of the $\rightsquigarrow$ arrow) from projecting. However, under operators which are predicted to trap AAPs (i.e., ones that bind variables), we should not expect the homogeneity inference to project past this operator. For (82-a) imagine a context at the Olympics where the competitors are several nationalities. The conditional binds a world variable. If homogeneity is a garden variety presupposition, we should get global accommodation as in (c). If it is an AAP, homogeneity should be trapped in the conditional antecedent, getting local accommodation in (d). In my judgement, (d) seems like the right reading.

(82) a. If the medalists are French, then we should play *La Marseillaise*.
b. Presuppositional content: $\lambda w.\mathbf{every}(\mathbf{medallist}(w))(\mathbf{French}) \vee \mathbf{every}(\mathbf{medallist}(w))(\neg\mathbf{French})$
c. Global accommodation:
$\Box(\mathbf{every}(\mathbf{medallist}(w))(\mathbf{French}) \vee \mathbf{every}(\mathbf{medallist}(w))(\neg\mathbf{French})) \wedge \mathbf{if}(\mathbf{French}(M))(\mathbf{Marseillaise})$
$\rightsquigarrow$ *Every medallist will be French or every Medallist will not be French*
d. Local accommodation:
$\mathbf{if}(\mathbf{every}(\mathbf{medallist}(w))(\mathbf{French}(M)) \vee \mathbf{every}(\mathbf{medallist}(w))(\neg\mathbf{French}) \wedge \mathbf{French}(M))(\mathbf{Marseillaise})$
$= \mathbf{if}(\mathbf{every}(\mathbf{medallist}(w))(\mathbf{French}))(\mathbf{Marseillaise})$
$\not\rightsquigarrow$ *Every medallist will be French or every Medallist will not be french*

We see the same pattern with questions. With global accommodation, a definite plural in a question should imply homogeneity holds independently of the question. With local accommodation, homogeneity is part of the question. Thus, it's possible that the medallists include some French people and some non-French people.

(83) a. Are the medallists French?
b. Presuppositional content: $\lambda w.\mathbf{every}(\mathbf{medallist}(w))(\mathbf{French}) \vee \mathbf{every}(\mathbf{medallist}(w))(\neg\mathbf{French})$
c. Global accommodation:
$[Q]w(\mathbf{French}(M)) \wedge \Box(\mathbf{every}(\mathbf{medallist}(v))(\mathbf{French}) \vee \mathbf{every}(\mathbf{medallist}(v))(\neg\mathbf{French}))$
$\rightsquigarrow$ *Every medallist is French or every Medallist is not French*
d. Local accommodation:
$[Q]w(\mathbf{French}(M) \wedge (\mathbf{every}(\mathbf{medallist}(w))(\mathbf{French}) \vee \mathbf{every}(\mathbf{medallist}(w))(\neg\mathbf{French})))$
$\not\rightsquigarrow$ *Every medallist is French or every Medallist is not French*

These kinds of judgements suggest homogeneity of definites is an AAP like the EM-inference of NR-predicates. This would be expected, as parallels between homogeneity and the EM-inference are clear, see Gajewski (2005) especially.

Thus, to spot an AAP, we need to see the projective content being trapped by any operator which binds a variable within the projective content. What about Tonhauser et al.'s triggers which lack an SCF condition? These seem to be strong candidates for AAPs: if a trigger lacks an SCF, it is reasonable to assume that it is automatically accommodated. Tonhauser et al. place *almost* and *only* in this category. If these trigger AAPs, then we should expect they *locally accommodate* beneath variable binding quantifiers.

(84) a. Most children almost threw up.
Local accommodation: Most children nearly threw up but didn't.
Global accommodation: Most children nearly threw up, and every child didn't throw up.
b. Most children are studying only Chinese.
Local accommodation: Most children study no non-Chinese languages and study Chinese.
Global accommodation: Most children study no non-Chinese languages and every child studies Chinese.

In (85), the local accommodation readings appear to be more natural, supporting the hypothesis that *only* and *almost* should be classified as AAP triggers. However, much more empirical work is to be done to carve out a cross-linguistic category of AAPs, and this paper concentrates only on the semantic characterisation of the EM-inference and NR-predicates. Therefore, the classification of different projective content triggers as AAPs or non-AAPs is a topic for future work.

Before moving on, it's worth noting that Sudo's account of presuppositions as intrinsically related to cross-sentential anaphora is closely aligned with the perspective taken in Van der Sandt (1992), which informs the framework of this paper. In fact, van der Sandt draws a distinction between two mechanisms for resolving projective content: *binding* and *accommodation*. Sudo's treatment of presuppositions is similar in many ways to van der Sandt's notion of presupposition binding, while the treatment of EM-inferences in this paper draws from van der Sandt's notion of presupposition accommodation. Thus, the notion that projective content splits into distinct categories based on how the open variables are resolved is a foundational notion for the perspective taken in this paper. Therefore, we should expect that different triggers allow only global accommodation, some allow only local accommodation, and some allow either. See Bos (2003;§4.2) who provides a thorough formal account as to how the resolution mechanism can be specified per lexical item, as requiring binding, accommodation, or allowing either.

5 Neg-raising and quantifiers

This paper's analysis of neg-raising and Gajewski's analysis really start to separate when we look at quantificational sentences. As a general principle, under this paper's analysis, the EM-inference, introduced by NR-predicates, ends up being quantified by the same determiner which quantifies the at-issue content. Compare this to Gajewski's analysis, as well as others such as Homer (2015), in which an EM-inference embedded beneath a quantifier is always universally quantified, even if the relevant quantificational determiner is not universal.

The basic premise of this paper's analysis is that quantifiers themselves have the power to resolve any AAPs within their scope, so long as the AAP contains a variable bound by the quantifier. In this section I outline a theory of how AAPs interact with quantifiers, show how this theory obtains good empirical results for NR-structures, and extend the analysis to modal sentences.

5.1 Resolving AAPs under quantifiers

I propose that *quantifiers come with in-built •-operators as part of their lexical content*. These •-operators serve to resolve any unresolved box which contains an instance of a variable bound by the quantifier. Here we spell out this notion formally.

The term $[x]$ is a function applied to a DRS, and returns the set of indices of any presuppositions that contain a free instance of x. This is defined as in (85-a). Take the toy DRS in (85-b), which contains two AAPs, both of which contain a free instance of x. The function $[x]$ returns the indices of those AAPs.

(85) a. $[x](K) = \{n : \text{there is a } K' \text{ s.t. } \langle K', n\rangle \in |K|^{\pi} \text{ and } K' \text{ contains a free instance of } x\}$

b. $$[x]\left(\begin{array}{|c|}\hline \\ \hline \begin{array}{|c|}\hline y \\ \hline \mathbf{P}(y) \ll_0 \begin{array}{|c|}\hline \\ \hline \mathbf{Q}(x)(y) \\ \hline \end{array} \\ \hline \end{array} \Rightarrow \begin{array}{|c|}\hline \\ \hline \mathbf{R}(x)(y) \ll_1 \begin{array}{|c|}\hline \\ \hline \mathbf{S}(x) \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array}\right) = \{0,1\}$$

We can use this function in the metalanguage translations of quantificational determiners in this system. A determiner encodes a •-operator scoping over both of its arguments. The •-operator serves to resolve any presupposition containing a free instance of the variable bound by the quantifier. (86) gives a generalized definition for a quantificational determiner. Below and throughout, let $\bullet_{[x]}(\phi)$ abbreviate $\bullet_{[x](\phi)}(\phi)$.

(86) $Det(P)(Q) \rightsquigarrow \mathbf{det}\, x : \bullet_{[x]}(P(x))\, \bullet_{[x]}\,(Q(x))$

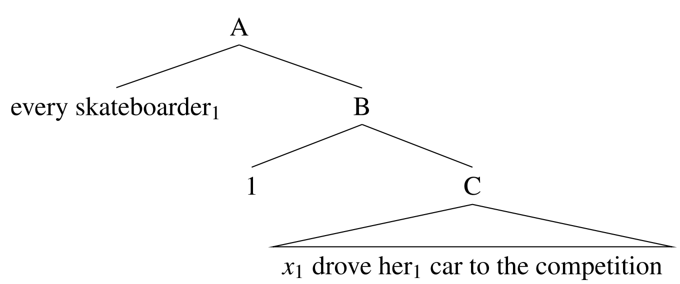
For example, below is a lexical entry for 'every'. The general structure of the lexical entry follows the semantics of universal quantification in Kamp 1981. However, in this paper, I propose that both of its arguments are subject to a •-operator which resolves any AAPs containing a free instance of the variable bound by 'every'. NB: we can abbreviate the box notation for space, where $\langle\{x_1,...,x_n\},\{\gamma_1,...,\gamma_m\}\rangle$ is written as $[x_1,...,x_n|\gamma_1,...,\gamma_m]$.

(87) $every \rightsquigarrow \lambda P.\lambda Q.\lambda w.\left[\ \middle|\ [x|\ ]\ ;\ \bullet_{[x]}P(w)(x) \Rightarrow \bullet_{[x]}Q(w)(x)\right]$

We can illustrate this process with an example. As with a previous example, the illustration represents the presuppositional content of a possessive description as an AAP. However, this is just for illustrative purposes; this paper makes no claim about which variety of projective content an English possessive phrase is best categorized as.

Following Heim and Kratzer 1998, quantifier scope is analyzed using quantifier raising: a quantificational phrase occupies a scope position, binding a trace in its surface position. The quantifier comes with a covert operator (represented as 1 below), which λ-abstracts over the co-indexed variables. Using this general principle, we obtain the representation in (88-b) as a semantics for the nuclear scope of the quantifier. Note that the representation in (88-b) is unresolved as it contains unresolved content (marked by $\ll$).

(88) a.



b. $|\mathrm{B}| = \lambda x.\lambda w.\left[\ \middle|\ \mathbf{drove}(w)(y)(x) \ll_0 [y|\mathbf{car\text{-}of}(w)(x)(y)]\right]$

Composing the nuclear scope constituent B with the quantifier gives us a fully resolved meaning. This is because the •-operator, encoded as part of the lexical meaning of the quantifier, resolves the representation in (88-b). The

$\bullet$-operator scoping over the nuclear scope serves to resolve any presupposition containing a free instance of x. The presupposition with index 0 contains a free instance of x, and as such it will be resolved by the $\bullet$-operator. As the derivation below demonstrates, the system determines that the unresolved content ends up being accommodated *within the nuclear scope of the quantifier.*

(89) $\textit{every}(\textit{skateboarder})(\mathrm{B}) \rightsquigarrow \lambda Q.\lambda w. \Big[\Big| [x|\textbf{skateboarder}(w)(x)] \Rightarrow \bullet_{[x]} Q(w)(x) \Big]$
$= \lambda w. \Big[\Big| [x|\textbf{skateboarder}(w)(x)] \Rightarrow \bullet_{[x]} \Big[|\textbf{drove}(w)(y)(x) \ll_0 [y|\textbf{car-of}(w)(x)(y)] \Big] \Big]$
$= \lambda w. \Big[\Big| [x|\textbf{skateboarder}(w)(x)] \Rightarrow \textbf{drove}(w)(y)(x); [y|\textbf{car-of}(w)(x)(y)] \Big]$
$= \lambda w. \Big[\Big| [x|\textbf{skateboarder}(w)(x)] \Rightarrow [y|\textbf{car-of}(w)(x)(y); \textbf{drove}(w)(y)(x)] \Big]$
if there's a skateboarder x at w, then there is a y such that y is a car owned by x at w, and x drove y at w

The resolution mechanism defined here is quite different from van der Sandt's notion of accommodation. As stated earlier, van der Sandt's accommodation mechanism is defined as a distinct module from the compositional semantics. The output of the compositional semantics is an unresolved DRS, which is fed into an independent resolution mechanism.

Furthermore, van der Sandt's notion of accommodation allows for the possibility of *intermediary accommodation*, meaning that a presupposition triggered in the nuclear scope of a quantifier can be accommodated within the quantifier's restriction. Thus van der Sandt would allow the presuppositional meaning component, $[y][\textbf{car-of}(w)(x)(y)]$, to be accommodated as in the DRS in (90), which doesn't represent an intuitive reading of (88-a). This representation is not generated by the present analysis.

(90) $\lambda w. \Big[\Big| [x, y|\textbf{car-of}(w)(x)(y); \textbf{skateboarder}(w)(x)] \Rightarrow \textbf{drove}(w)(y)(x) \Big]$
if there's an x,y such that x is a skateboarder and y is x's car, then, x drove y.

Therefore, this paper follows Beaver's (2001) intuition that allowing intermediary accommodation leads to an empirically less sound theory, and that putative cases of intermediary accommodation can be explained away as mis-analyses of the data. See Beaver 2001:§5.2 for more details on the debate on whether to allow intermediary accommodation and for Beaver's arguments against doing so.

Next, both van der Sandt's theory and the present theory rule out an AAP being resolved in such a way that a bound variable becomes *un-bound*. If we resolve the AAP $[y|\textbf{car-of}(x)(y)]$ to be resolved within the biggest DRS, the variable x (bolded in (91)) is outside the scope of the quantifier, and thus not bound.

(91) $*\Big[y \Big| \textbf{car-of}(\mathbf{x})(y); \Big([x|\textbf{skateboarder}(x)] \Rightarrow \textbf{drive}(y)(x) \Big) \Big]$

In this paper's system, the DRS in (91) is not able to be generated. By the definition in (86), AAPs containing bound variables are only resolved within the scope of the quantifier. In van der Sandt's system, on the other hand, a representation like (91) is ruled out by a well-formedness constraint like (92) on DRS structures.

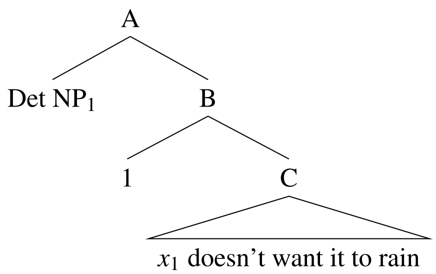
(92) No condition in K contains a variable which occurs free (Van der Sandt 1992:p.365)

Under this paper's analysis, no separate well-formedness constraint like (92) is needed.

5.2 Accommodating the excluded middle under quantifiers

We are now in a position to calculate the truth conditions of NR-predicates embedded under quantificational expressions. A basic quantificational sentences with a NR-predicate is represented in (93):

(93)



As per the proposed lexical entries for NR-predicates, following (73), we obtain (94) as a semantics for constituent B. The attitude predicate, as well as the excluded middle inference are both embedded under negation. Throughout, let $\mathbf{want}(p)(x)(w)$ stand for $\mathbf{want}^x_w v : p(v)$, and $\mathbf{opinionated}(p)(x)(w)$ stand for $\mathbf{want}^x_w w' : p(w') \vee \mathbf{want}^x_w w'' : \neg p(w'')$.

(94) $B \rightsquigarrow \lambda x.\Big[\ \Big|\neg[\ |\mathbf{want}(\mathbf{rain})(x)(w) \ll_0 \mathbf{opinionated}(\mathbf{rain})(x)(w)]\Big]$

The AAP in (94) will be resolved by the •-operator baked in to the determiner's semantics. In order to calculate the readings, we'll need some semantics for some English determiners, following the principle in (86), which states that determiners encode a •-operator resolving any presupposition containing a bound variable. Starting with non-universal quantifiers, I propose the following lexical entries. Let $\#X$ be the number of atomic components of X.

(95) a. $a \rightsquigarrow \lambda P.\lambda Q.\lambda w. \begin{array}{|c|}\hline x \\ \hline \\ \hline \end{array}\ ;\ \bullet_{[x]}P(x)\ ;\ \bullet_{[x]}Q(x)$

b. $some \rightsquigarrow \lambda P.\lambda Q.\lambda w. \begin{array}{|c|}\hline X \\ \hline \#X \geq 1 \\ \hline \end{array}\ ;\ \bullet_{[x]}P(x)\ ;\ \bullet_{[x]}Q(x)$

c. $at\ least\ three \rightsquigarrow \lambda P.\lambda Q.\lambda w. \begin{array}{|c|}\hline X \\ \hline \#X \geq 3 \\ \hline \end{array}\ ;\ \bullet_{[x]}P(x)\ ;\ \bullet_{[x]}Q(x)$

Calculating the truth conditions for a quantificational sentence is relatively simple, using the semantics in (94) for the nuclear scope. The following derivation shows how the EM-inference is resolved by virtue of being composed with a quantificational determiner. It also shows how the EM-inference is quantified over by the determiner, inheriting its quantificational force.

(96) *a(boy)(doesn't want it to rain)(w)*

$\rightsquigarrow [x|\mathbf{boy}(w)(x)]\ ;\ \bullet_{[x]}\Big[\ \Big|\neg[\ |\mathbf{want}(\mathbf{rain})(x)(w) \ll_0 \mathbf{opinionated}(\mathbf{rain})(x)(w)]\Big]$ def. of *a*

$= [x|\mathbf{boy}(w)(x)]\ ;\ \neg[\ |\mathbf{want}(\mathbf{rain})(x)(w)]\ ;\ \mathbf{opinionated}(\mathbf{rain})(x)(w)$ def. of $\bullet_{[x]}$

$= \Big[x\Big|\mathbf{boy}(w)(x)\ ;\ \neg[\ |\mathbf{want}(\mathbf{rain})(x)(w)]\ ;\ \mathbf{opinionated}(\mathbf{rain})(x)(w)\Big]$ def. of ;

$= \Big[x\Big|\mathbf{boy}(w)(x)\ ;\ \mathbf{want}(\neg\mathbf{rain})(x)(w)]$ disjunctive syllogism

there is an x such that x is a boy at w, and x wants at w for it to not rain

The AAP containing the EM-inference is resolved entirely within the nuclear scope of the determiner, due to the determiner's in-built •-operator. Therefore, the EM-inference ends up being quantified over by the determiner, inheriting its quantificational force. This is unlike Gajewski's analysis, in which the EM-inference is universally quantified. Under the latter account, we predict this reading for existential quantifiers.

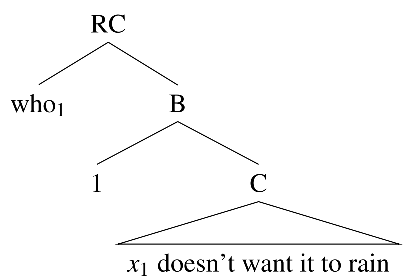
(97) a boy(doesn't want it to rain) $\rightsquigarrow \exists x[\mathbf{boy}(x) \wedge \neg\Box_x(\mathbf{rain})] \wedge \forall y[\mathbf{boy}(y) \rightarrow (\Box_y(\mathbf{rain}) \vee \Box_y(\neg\mathbf{rain}))]$

there is a boy x such that x doesn't have a preference for rain,
and every boy y is such that y has a preference for rain or for no rain.

This reading entails asymmetrically entails the reading in (96). I judge the reading in (97) as too strong. It predicts the following discourse is contradictory, contrary to intuitive judgements. The representation in (96) does not predict (98) is contradictory.

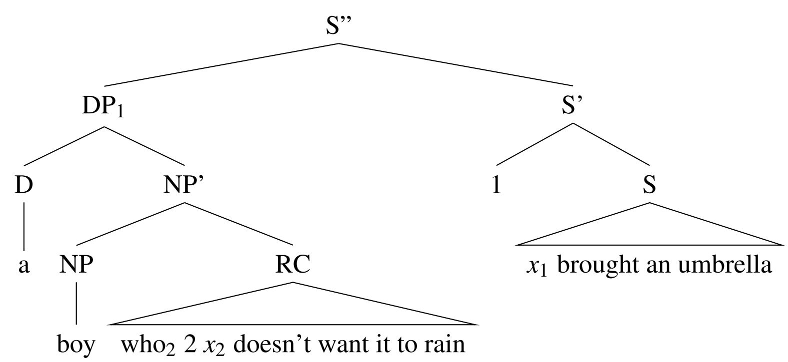
(98) A boy doesn't want it to rain, and his buddies don't care either way.

In order to look at NR-predicates embedded in the restriction of a quantifier, we need a semantics for relative clauses. We take relative clauses to involve a relative pronoun, which binds its trace via the same numerical operator used in quantifier raising, as in (99-a). *who* and other relative pronouns are analysed as in (99-b), as a simple property conjoiner. *who* serves to conjoin the content of the relative clause with the nominal description.

(99) a.


b. $who \rightsquigarrow \lambda P.\lambda Q.\lambda x.\lambda w.P(w)(x);Q(w)(x)$

Using the semantics in (99), we can calculate the semantics for quantifiers with NR-predicates in their restriction. First, we take (100-a) to be an LF for a quantificational sentence with a NR-predicate in the determiner's restriction. The two property-denoting arguments for the determiner 'a' follow in (b) and (d).

(100) a.


b. S' $\rightsquigarrow \lambda x.\lambda w.$ $\mathbf{brought\text{-}umbr}(w)(x)$

c. RC $\rightsquigarrow \lambda Q.\lambda x.\lambda w.\neg[\ |\mathbf{want}(\mathbf{rain})(x)(w) \ll_0 \mathbf{opinionated}(\mathbf{rain})(x)(w)]$

d. NP $\rightsquigarrow \lambda Q.\lambda x.\lambda w.\Big[\ \Big|\mathbf{boy}(w)(x)\ ;\ \neg[\ |\mathbf{want}(\mathbf{rain})(x)(w) \ll_0 \mathbf{opinionated}(\mathbf{rain})(x)(w)]\Big]$

The NP content and the nuclear scope are fed into the quantifier. Only the •-operator over the restriction has any effect, as only the restriction contains not at-issue material.

(101) $a(\text{NP'})(\text{S'}) \rightsquigarrow \lambda w.[x|\ ]\ ;\ |\text{NP'}|(w)(x)\ ;\ \bullet_{[x]}|\text{S'}|(w)(x)$
$= \lambda w.[x|\mathbf{boy}(w)(x)\ ;\ \mathbf{want}(\neg\mathbf{rain})(x)(w)\ ;\ \mathbf{brought\text{-}umbr}(w)(x)]$
there is an x such that x is a boy, x prefers no rain, and x brought an umbrella.

Under the satisfaction theory-based analysis, presuppositions in the restriction of a quantifier are universally quantified. Thus we predict the following reading for the same sentence.

(102) a (boy (who doesn't want it to rain))(brought an umbrella)

$\rightsquigarrow \exists x[\mathbf{boy}(x) \wedge \neg\Box_x(\mathbf{rain}) \wedge \mathbf{bring\text{-}umbr}(x)] \wedge \forall y[\Box_y(\mathbf{rain}) \vee \Box_y(\neg\mathbf{rain})]$
there is a boy x such that x doesn't prefer rain and x brought an umbrella and for all individuals y, y has a preference about whether it rains or not.

Again, we judge this reading as too strong. It asymmetrically entails the reading in (101). The utterance in (102) seems compatible with continuations suggesting that other individuals are unopinionated.

(103) A boy who doesn't want it to rain brought an umbrella, while the girls couldn't care less about the weather so they went without any wet weather gear.

5.3 Universal quantifiers and pre-subject negation

Derivations for NR-predicates embedded under universal quantifiers largely follow the same sort of pattern as non-universal quantifiers illustrated in the previous sub-section. The semantics for *every* follows Muskens 1996, but with added •-operators for resolving content containing bound variables.

(104) $\mathit{every} \rightsquigarrow \lambda P.\lambda Q.\lambda w. \begin{array}{|l|}\hline \\ \hline \begin{array}{|c|}\hline x \\ \hline \\ \hline\end{array} ; \bullet_{[x]}P(w)(x) \Rightarrow \bullet_{[x]}Q(w)(x) \\ \hline\end{array}$

With no further stipulation, this determiner can combine with the meanings proposed above for the relevant constituents. (105) states that each boy prefers it not to rain. The full derivation is left for the reader.

(105) [[every boy$_1$] [1 [t_1 didn't want it to rain]]] $\rightsquigarrow \begin{array}{|l|}\hline \\ \hline \begin{array}{|c|}\hline x \\ \hline \mathbf{boy}(w)(x) \\ \hline\end{array} \Rightarrow \begin{array}{|c|}\hline \\ \hline \mathbf{want}^x_w v : \neg\mathbf{rain}(v) \\ \hline\end{array} \\ \hline\end{array}$

The DRS-based analysis in (105) generates a reading which is essentially equivalent to the reading generated under Gajewski's Satisfaction Theory-based account. According to Gajewski's account, a presupposition in the scope of a universal quantifier is re-quantified by a *distinct* universal quantifier. This ends up deriving a reading equivalent to (105).

(106) [[every boy$_1$] [1 [t_1 didn't want it to rain]]] $\rightsquigarrow \forall x[\mathbf{boy}(x) \rightarrow \neg\Box_x\mathbf{rain}] \wedge \forall x[\mathbf{boy}(x) \rightarrow (\Box_x\mathbf{rain} \vee \Box_x\neg\mathbf{rain})]$
(equivalent to) $\forall x[\mathbf{boy}(x) \rightarrow \Box_x\neg\mathbf{rain}]$

When the NR-predicate is in the restriction of the universal, rather than in the nuclear scope, the predictions of DRT vs. Satisfaction Theory come apart. (107) is the DRT interpretation of a NR-predicate in the restriction of a universal. Again, we simply draw from definitions in the previous subsection to calculate this DRS in (b). The EM-inference is simply quantified by the determiner under which it is embedded. On the other hand, the Satisfaction Theory-based account predicts the reading in (c).

(107) a. [[every [boy [who$_2$ 2 [t_2 didn't want it to rain]]] [1 t_1 brought an umbrella]]

b. $(a) \rightsquigarrow \Big[\ \Big|[x|\mathbf{boy}(w)(x)\ ;\ \mathbf{want}(\neg\mathbf{rain})(w)(x)] \Rightarrow \mathbf{bring\text{-}umbr}(w)(x)\Big]$

if there is an x, such that x is a boy and x prefers no rain, then x brought an umbrella

c. (a) $\rightsquigarrow \forall x[(\mathbf{boy}(x) \wedge \neg\Box_x\mathbf{rain}) \rightarrow \mathbf{bring\text{-}umbr}(x)] \wedge \forall y[\Box_y\mathbf{rain} \vee \Box_y\neg\mathbf{rain}]$

for every boy x, that doesn't prefer it to rain, x brought an umbrella, and for every individual y, y has a preference for rain or not-rain

Again, we judge the reading in (107-c) as too strong. Intuitively, when NR-predicates appear in the restrictor of a universal, they do not trigger an inference that *everyone* is opinionated. The discourse in (108) is coherent, as predicted by the DRT-based theory, but not the ST-based theory.

(108) Every boy who doesn't want it to rain brought an umbrella, while the girls couldn't care less about the weather so they went without any wet weather gear.

Next, we can move to negative quantifiers like *not every* and *no*. Gajewski 2005, 2007; Romoli 2013; Collins and Postal 2014, and others investigate NR-structures in which the sole negation is introduced by negative determiners as in (109), i.e., without sentential negation.

(109) a. Not every boy wants it to rain.
b. No boy wants it to rain.

A very simple analysis is that *not every* and *no* are simply the negations of *every* and *a*, respectively.

(110) a. *not every* $\rightsquigarrow \lambda P.\lambda Q.\lambda w. \begin{array}{|c|}\hline \\ \hline \neg\Big(\begin{array}{|c|}\hline x \\ \hline \\ \hline \end{array} ; \bullet_{[x]} P(w)(x) \Rightarrow \bullet_{[x]} Q(w)(x)\Big) \\ \hline \end{array}$ **not**(**every**(...))

b. *no* $\rightsquigarrow \lambda P.\lambda Q.\lambda w. \neg\Big(\begin{array}{|c|}\hline x \\ \hline \\ \hline \end{array} ; \bullet_{[x]} P(w)(x) \;; \bullet_{[x]} Q(w)(x)\Big)$ **not**(**some**(...))

We can investigate how these lexical entries for determiners combine with *positive polarity* NR-predicates. We find that using these lexical entries above, we do *not* generate NR-inferences. In neither case is an individual claimed to have a dispreference for the prejacent.

(111) a. [[not every boy] [1 [x_1 wants it to rain]]]

$\rightsquigarrow \lambda w.\Big[\ \Big|\neg\Big([x|\mathbf{boy}(w)(x)] \Rightarrow \mathbf{opinionated}(\mathbf{rain})(w)(x) \;;\; \mathbf{want}(\mathbf{rain})(w)(x)\Big)\Big]$

$= \lambda w.\neg\Big([x|\mathbf{boy}(w)(x)] \Rightarrow \mathbf{want}(\mathbf{rain})(w)(x)\Big)$

it is not the case that if there is a boy x at w, then x prefers it to rain at w ($\neq$ a NR-inference)

b. [[no boy] [1 [x_1 wants it to rain]]]

$\rightsquigarrow \lambda w.\Big[\ \Big|\neg\Big([x|\mathbf{boy}(w)(x)] \;;\; \mathbf{opinionated}(\mathbf{rain})(w)(x) \;;\; \mathbf{want}(\mathbf{rain})(w)(x)\Big)\Big]$

$= \lambda w.\neg[x|\mathbf{boy}(w)(x) \;;\; \mathbf{want}(\mathbf{rain})(w)(x)]$

there is an x such that x is a boy at w and x prefers it to rain at w ($\neq$ a NR-inference)

As the derivations above should make clear, this effect is due to the relative scope of negation and the •-operator in the definitions in (110). Observe that in (110), the •-operator limits the height to which the EM-inference can project. But to draw an neg-raised reading, the excluded middle inference must project *above* negation. In the definitions in (110), negation scopes *above* the •-operator, and thus, the EM-inference is not able to scope above negation, blocking any NR-inference from emerging.

It is an empirical question as to whether or not *no* and *not every* generate neg-raising inferences. As for the case of *not every*, I believe it is an unsettled question as to whether *not every* indeed gives rise to a NR-inference. In my judgement, *no* is more strongly associated with a neg-raising inference than *not every*. For example, I judge the conjunction of clauses ϕ and ψ in (a) as more contradictory than in (b). The judgements in (112) are rather subtle and need more detailed empirical investigation.

(112) a. (No boy wants it to rain)$_\phi$, (most want it to not rain and the others don't care either way)$_\psi$.
b. (Not every boy wants it to rain)$_\phi$, (most want it to rain but the others don't care either way)$_\psi$.

For *no* on the other hand, the lexical entry in (110-b), decomposing *no* into **not**(**some**...) more clearly generates the wrong predictions. By our definition of the projection mechanism driven by the •-operator, our constraint is that the quantificational element of *no* limits the height to which the EM meaning component can scope. On top of that, the NR-inference is derived when the EM meaning component scopes over negation. Therefore, a NR-reading with *no*, according to this system, requires the negation component to scope below the quantificational component.

The solution I propose is that *no* has alternate translations into our DRT-based description language: as **not**(**some**...) and as **every**(...**not**...). The definition in (a), repeated from above, is simply the negation of *some*. The second is a universal construal with low scoping negation. In the ordinary case, these two translations end up yielding equivalent interpretations for sentences quantified by *no*.

(113) a. $no_1 \rightsquigarrow \lambda P.\lambda Q.\lambda w.\neg\left(\begin{array}{|c|}\hline x \\ \hline \\ \hline\end{array}\,;\bullet_{[x]}P(w)(x)\,;\bullet_{[x]}Q(w)(x)\right)$ **not**(**some**(...))

b. $no_2 \rightsquigarrow \lambda P.\lambda Q.\lambda w.\begin{array}{|l|}\hline \\ \hline \begin{array}{|c|}\hline x \\ \hline \\ \hline\end{array}\,;\bullet_{[x]}P(w)(x) \Rightarrow \bullet_{[x]}\neg Q(w)(x) \\ \hline\end{array}$ **every**(...)(**not**...)

However, when we have meaning components scoping between the quantificational elements, the two available translation start to differ semantically. If we use the **not**(**some**(...)) lexical entry, as in (114-a) we get the non-NR reading of *no*. If we use the **every**(...)(**not**...) entry, in which the EM-inference scopes over negation but below the • operator, as in , we get the NR-reading, generating the variability in judgements.

(114) a. [[no$_1$ boy] [1 [x_1 wants it to rain]]] **not**(**some**...)
$\rightsquigarrow \lambda w.\neg[x|\ ];\bullet_{[x]}\mathbf{boy}(w)(x)\,;\bullet_{[x]}[\ |\mathbf{want}(p)(w)(x) \ll_0 \mathbf{opinionated}(p)(w)(x)]$
$= \lambda w.\neg[x|\mathbf{boy}(w)(x)\ ;\ \mathbf{opinionated}(p)(w)(x)\ ;\ \mathbf{want}(p)(w)(x)]$
there is no x such that x is a boy, x is opinionated and x wants it to rain($\neq$ a NR-reading)

b. [[no$_2$ boy] [1 [x_1 wants it to rain]]] **every**(...)(**not**...)
$\rightsquigarrow \lambda w.[x|\mathbf{boy}(w)(x)] \Rightarrow \bullet_{[x]}\neg[\ |\mathbf{want}(p)(w)(x) \ll_0 \mathbf{opinionated}(p)(w)(x)]$
$= \lambda w.[x|\mathbf{boy}(w)(x)] \Rightarrow [\ |\mathbf{opinionated}(p)(w)(x)];\neg[\ |\mathbf{want}(p)(w)(x)]]$
$= \lambda w.[x|\mathbf{boy}(w)(x)] \Rightarrow [\ |\mathbf{want}(\neg p)(w)(x)]]$
for every x such that x is a boy, x wants it to not rain (a NR-reading)

When parsing *no* as **every**(...)(**not**...), we exclude the possibility of *split scope* readings of negative quantifiers, as discussed in detail by de Swart 1996 amongst others. In such split scope readings, a scope-taking element, such as the modals *can* or *have to* in (115), intervene between the negation and quantifier introduced by the negative determiner. To generate such readings, we must use the parse of the determiner in which negation scopes over the quantifier, as in (113-a).

(115) a. No doctor has to be present.
Available: It is not necessary that a doctor be present. **not** $\gg$ **has.to** $\gg$ **some**

b. No witness needs to have seen the crime.
Available: 'It is not an obligation that a witness has seen the crime.' **not** $\gg$ **need** $\gg$ **some**

The theory built in this paper predicts that split-scope readings should *block* NR-inferences. This is because split-scope readings are derived by scoping negation above the **some** component of the quantifier (with the necessity modal **need/have to** scoping between them). As the **some** component traps the scope of the EM, it follows that the EM will be trapped below the scope of negation. This implies that the NR-reading is not available.

The judgements here are subtle and need experimental verification, but by hypothesis the generalisation that split-scope readings block NR-readings has promise. In the cases below, the NR-reading, with lowest scoping negation is marked.

(116) No defense lawyer has to believe their client is innocent.
$\rightsquigarrow$ *It's not necessary for a defense lawyer to be committed to their client's innocence.*
$\rightsquigarrow$ $^{??}$*It's possible that every defense lawyer is committed to their client's guilt.*

(117) No witness needs to think that the signature is valid.
$\rightsquigarrow$ *It's not necessary for a witness to be committed to the signature being valid.*
$\rightsquigarrow$ $^{??}$*It's possible that every witness is committed to the signature being invalid.*

We can try to force the NR-reading by sticking a strong NPI in the subordinate clause, as per Collins and Postal (2014). Again the results are subtle, but in the following examples, the NPI interpretation of *until* (as marking a point in time) is degraded, as compared with the non-NPI interpretation (as marking an expanse of time). In both the cases below, 'until' is easily interpreted as modifying the NR-verb, but hard to interpret as modifying the embedded verb.

(118) a. No parent has to believe that [their child finishes until Monday].
$^{??}$with interpretation "finish on Monday".
b. No sailor has to think that [this boat is departing until 8pm].
$^{??}$with interpretation "depart at 8pm".

The reasoning behind this generalisation is simple. To obtain the NR-reading, negation must press through the individual quantifier. But in a split-scope sentence, this would require the negation to pass through the necessity modal as well, yielding a possibility interpretation.

Rather, the generalisation we are building towards is that the scope of the *the excluded middle inference is trapped by variable binding operators*. As the individual quantifiers *some* and *every* bind variables in the EM-inference, it limits its scope. This determines whether the EM-inference can scope over negation, yielding a NR-inference, or not. In fact, in these split scope readings, we predict that *both* the individual quantifier and the necessity modal trap the scope of the EM-inference, the latter as it binds a world variable in the EM-inference. In the next section, we explore how modal expressions, like individual quantifiers, trap the EM-inference and limit the occurrence of NR-readings.

6 Modal expressions and neg-raising

According to the analysis defended in this paper, quantificational determiners automatically resolve unresolved content in their scope. This means that the theory should extend to other kinds of quantifiers, including modal, temporal, and spatial quantifiers. In this section I explain how neg-raising inferences appear to interact with non-individual quantifiers, especially modals, and how the DRT-based theory explains these interactions.

6.1 Modals as variable binders

Returning to an observation from earlier, we judge the following sentences as *not* giving rise to a global excluded middle inference, despite the presence of NR-predicates, which is expected trigger such an inference. As stated earlier in the paper, this observation is somewhat surprising if the EM-inference is analyzed as a presupposition, as the following contexts (modals, conditional antecedents, questions), are generally analyzed as 'holes' for presuppositions. Why then do the sentences in (119) fail to give rise to an EM-inference (here, an inference that Homer is opinionated)?

(119) a. Perhaps Homer wants to leave now.
b. If Homer wants to leave now, come and grab me.
c. Does Homer want to leave now?

I propose that this effect falls out of the understanding of quantifiers outlined in this paper – quantifiers resolve any AAPs in their scope containing instances of bound variables. This principle holds regardless of whether the bound variable in question ranges over individuals, worlds, times, and so on.

(120) provides a semantics for a possibility modal encoding this principle. As 'perhaps' is analyzed as a quantifier over possible worlds, it binds a world variable (v below), and as such, 'perhaps' supplies a co-indexed $\bullet$-operator. This operator demands that AAPs in its scope must be resolved if they contain free instances of v. NB: $\textbf{epis}(w)(v)$ means v is epistemically accessible from w.

(120) $$\textit{perhaps} \rightsquigarrow \lambda p.\lambda w.\begin{array}{|c|}\hline v \\ \hline \textbf{epis}(w)(v) \\ \hline \end{array}\,;\ \bullet_{[v]}\,p(v)$$

The following derivation shows how the EM-inference gets trapped by the modal. The derivation shows how the EM-inference is only required to hold in the epistemically accessible world, and not necessarily in the actual world. The principle behind the derivation follows directly from the discussion of individual quantifiers in the previous section.

(121) [perhaps [Homer wants it to rain]]

$\rightsquigarrow \lambda w.[v|\mathbf{epis}(w)(v)]\ ;\ \bullet_{[v]}[\ |\mathbf{want}(\mathbf{rain})(\mathbf{h})(v) \ll_0 \mathbf{opinionated}(\mathbf{rain})(\mathbf{h})(v)]$

$= \lambda w.[v|\mathbf{epis}(w)(v)]\ ;\ [\ |\mathbf{want}(\mathbf{rain})(\mathbf{h})(v)\ ;\ \mathbf{opinionated}(\mathbf{rain})(\mathbf{h})(v)]$

$= \lambda w.[v|\mathbf{epis}(w)(v);\ \mathbf{want}(\mathbf{rain})(\mathbf{h})(v)]$

there is epistemically accessible world v s.t. Homer desires at v are such that it rains
(no global entailment that Homer is opinionated)

We can derive analogous sorts of analyses for other kinds of modal operators such as conditionals. (122) is a lexical entry for conditionals. The analysis follows a tradition in which a conditional is understood as a universal quantifier over worlds, see for example Kratzer 1986. Let $\mathfrak{R}(w)(v)$ mean that v is accessible from w via some contextually supplied relation $\mathfrak{R}$. The key insight here is that as a conditional is analyzed as a type of modal, it binds a world variable. Thus, it comes along with a baked in $\bullet$-operator which automatically resolves any AAP containing a free instance of that variable.

(122) $$\mathit{if}(p)(q) \rightsquigarrow \lambda w. \begin{array}{|c|}\hline \\ \hline \begin{array}{|c|}\hline v \\ \hline \mathfrak{R}(w)(v) \\ \hline \end{array}\ ;\ \bullet_{[v]}p(v) \Rightarrow \bullet_{[v]}q(v) \\ \hline \end{array}$$

This analysis makes clear predictions about the behavior of the EM-inference in conditional structures. Crucially, the analysis takes the EM-inference to be trapped in the antecedent if introduced in the antecedent, and trapped in the consequent if introduced in the consequent. Immediately, this explains why the following is interpreted as non-contradictory. The EM-inference introduced by the NR-predicate is trapped in the conditional antecedent. Therefore, we don't predict a contradiction with the denial of the EM-inference in the first conjunct.

(123) Lisa may or may not have a preference about leaving, but if she wants to leave, come get me.

If the EM-inference is introduced within the conditional consequent, we expect that it does not project. Thus, it should be interpreted as contingent on the truth of the conditional consequent. The following provide evidence that this analysis is on the right track. Both suggest that Marge's preference for the vegetarian meal is contingent on the availability of the lasagne. If the EM-inference were expected to project out of the conditional consequent, we would not expect Marge's preference for the vegetarian meal to be contingent in this way.

(124) a. If the lasagne is available, Marge doesn't want to order the vegetarian meal.
b. If the lasagne isn't available, Marge wants to order the vegetarian meal.

Furthermore, the analysis in (122) excludes the possibility of intermediary accommodation; not-at-issue content introduced in the conditional consequent will never be resolved within the conditional antecedent. Recall that intermediary accommodation is a key feature of van der Sandt's analysis of presuppositions introduced in conditional structures. It is is easy to motivate excluding intermediary readings for neg-raising structures.

For example, (a) and (b) in (124) do not have possible readings paraphrased as in (a) and (b) in (125), respectively. In (125), Marge's desire for the vegetarian meal is interpreted on being contingent as to whether she is opinionated about the vegetarian meal or not. The following sentences are compatible with Marge having no opinion about the vegetarian meal. Intuitively, these are not possible readings of the sentences in (124), and are correctly excluded by the analysis of conditionals in (122).

(125) a. If the lasagne is available and Marge is opinionated about the vegetarian meal, then Marge doesn't want to order the vegetarian meal.
b. If the lasagne is available and Marge is opinionated about the vegetarian meal, then Marge wants to

order the vegetarian meal.

We therefore predict from this lexical entry for *if* that the EM-inference should not project out of *either* the antecedent or the consequent. As a general principle, any operator O which binds a variable within the excluded middle inference will stop the excluded middle inference from projecting to a height scoping over O.[3]

This principle applies to other kinds of quantifiers, such as temporal and spatial quantifiers. In both cases in (126), Lisa's opinionatedness about eating friend shrimp is only required to be true in situations quantified over by the fronted quantificational expression. in (a), she is only entailed to be opinionated on Tuesday, and in (b) only in seafood restaurants. She may be unopinionated about eating fried shrimp on other days and in other places.

(126) a. On every Tuesday, Lisa wants to eat fried shrimp.
b. In every seafood restaurant, Lisa wants to eat fried shrimp.

As expected, we find that attitude predicates also limit the height to which the EM-inference projects. In (127), Homer's opinionatedness does not project globally – Homer need not be actually opinionated about leaving, we only require that Marge is certain of his opinionatedness. This follows from (i) the EM-inference's classification as an AAP, designed in such a way that it cannot project globally if it contains a bound variable, as well as (ii) the categorization of 'certain' as a modal, trapping the projection of the AAP.

(127) Marge is certain that Homer doesn't want to leave. ($\not\rightsquigarrow$ *Homer is opinionated about leaving*)

Compare the behavior of the EM-inference in (127) with the behavior of a non-accommodating presupposition, such as the factive presupposition of *be angry*. In (128), the factive presupposition (that Lisa left), *does* project globally.

(128) Marge is certain that Homer is angry that Lisa left. ($\rightsquigarrow$ *Lisa left*)

Comparing (127) and (128) we observe that not all projective content behaves in the same way, as discussed in §4.3. This is a key component of the theory. AAPs like the EM-inference generated by neg-raising predicates should be trapped by higher attitude predicates like 'be certain' in (128). However, the factive inference of 'be angry' in (128) does not get trapped in the same way. Rather, (128) appears to give rise to a global factive inference that Lisa left. Thus, factive presuppositions of predicates like 'be angry' behave differently.

Although this paper focuses on the behavior of AAPs like the excluded middle inference, we can roughly sketch how projecting presuppositions like factive presuppositions are handled before moving on.

To distinguish the two types of projective content, we allow the factive presupposition to project as high as possible, over the wider scoping *be certain*, in order for (128) to globally presuppose that Lisa left. Below in (129) is a sketch of a DRS for 'Homer is angry that Lisa left.' Note that the content of the embedded clause, 'Lisa left' is represented twice, as the prejacent of 'Homer is angry that—' and as the factive presupposition of 'be angry'. The factive presupposition is anchored to a independent world variable, which enters the composition through a mechanism like a covert world pronoun at LF (see Percus 2000, von Fintel and Heim 2007, etc.).

(129)
$$\lambda w.\ \begin{array}{|l|}\hline \\ \hline \mathbf{angry}_w(\mathbf{h})\ (\begin{array}{|l|}\hline \\ \hline \mathbf{left}_w(\mathbf{l}) \\ \hline \end{array}) \ll \begin{array}{|l|}\hline \\ \hline \mathbf{left}_{@}(\mathbf{l}) \\ \hline \end{array} \\ \hline \end{array}$$

The presuppositional content in (129) is anchored to a world variable (labelled @) which is independent from the λ-binder. Embedding (129) under an attitude predicate like *be certain* has no effect on the factive presupposition. The world pronoun @ at which the predicate **left** is evaluated. It is therefore unbound by any operator introduced by the wider scoping predicates, including any indexed •-operators. It is therefore able to project above the wider scoping attitude predicates.

[3]Bervoets (2020:§5) suggests that NR-inferences are blocked in progressive aspect. The judgements here are subtle and worthy of a lengthier treatment, though there is an intriguing link between this observation and the account here, given that progressive aspect is often analyzed as involving quantification (see, e.g., Dowty 1979), thus binding a variable in the EM-presupposition.

(130) $\lambda w'.\Big[\ \Big|\ \mathbf{certain}_{w'}(\mathbf{m})\Big(\lambda w.\mathbf{angry}(\mathbf{left}(w)(\mathbf{l}))(w)(\mathbf{h}) \ll \mathbf{left}(@)(\mathbf{l})\Big)\Big]$
$= \lambda w'.\Big[\ \Big|\ \mathbf{left}(@)(\mathbf{l})\ ;\ \mathbf{certain}_{w'}(\mathbf{m})\Big(\lambda w.\mathbf{angry}(\mathbf{left}(w)(\mathbf{l}))(w)(\mathbf{h})\Big)\Big]$

The world pronoun @ can be bound to a discourse level variable. Say the utterance context supplies a world variable as a contextual parameter (as in Lewis 1979). The variable @ can be bound to this world parameter under van der Sandt's system (see Van der Sandt 1992:§3 and Bos 2003:§4 for technical details). This gives rise to the factive interpretation of *be angry*'s complement clause.

6.2 The cyclicity of neg-raising

The AAP-trapping property of quantifiers, including modals, crucially bears on how different NR-predicates interact with each other. Recall that NR-predicates are themselves attitude predicates. Therefore, we expect them to automatically resolve any AAPs in their scope. If a NR-predicate P selects for a clause headed by *another* NR-predicate P', we expect that P will trap the EM-inference introduced by P'. Below, $\mathbf{want}^x_w v : p(v)$ mean that x's desire worlds at w entail p, and analogously for **think**.

(131) a. $want(x)(p)(w) \rightsquigarrow \boxed{\begin{array}{c} \\ \hline \mathbf{want}^x_w v : \bullet_{[v]} p(v) \\ \ll (\mathbf{want}^x_w w' : \bullet_{[w']} p(w') \vee \mathbf{want}^x_w w'' : \bullet_{[w'']} \neg p(w'')) \end{array}}$

b. $think(x)(p)(w) \rightsquigarrow \boxed{\begin{array}{c} \\ \hline \mathbf{think}^x_w v : \bullet_{[v]} p(v) \\ \ll (\mathbf{think}^x_w w' : \bullet_{[w']} p(w') \vee \mathbf{think}^x_w w'' : \bullet_{[w'']} \neg p(w'')) \end{array}}$

NR-predicates resolve AAPs in their complements. This property derives a classic observation from Fillmore (1963:fn2), see also Prince 1976, Horn 1978, Gajewski 2007, and Homer (2015). NR-inferences can apply to multiple stacked NR-predicates. In the neg-raising literature this property is referred to as *cyclicity*

(132) Homer doesn't think that Marge wants to leave $\rightsquigarrow$ *Homer thinks that Marge wants to not leave.*

The cyclicity property follows automatically from the analysis laid out so far. We can derive this step by step, leaving the full derivation for the reader.

(133) a. [Marge wants to leave] $\rightsquigarrow \lambda w.\boxed{\mathbf{want}^{\mathbf{m}}_w v : \mathbf{l}(v) \ll \boxed{\mathbf{want}^{\mathbf{m}}_w v : \mathbf{l}(v) \vee \mathbf{want}^{\mathbf{m}}_w v : \neg\mathbf{l}(v)}}$ (abbrv. W)

b. [think [Marge wants to leave]$_{\text{S}}$]$_{\text{VP}}$ $\rightsquigarrow \lambda x.\lambda w.\boxed{\begin{array}{c} \mathbf{think}^x_w v : \bullet_{[v]} W(v) \\ \ll (\mathbf{think}^x_w w' : \bullet_{[w']} W(w') \vee \mathbf{think}^x_w w'' : \bullet_{[w'']} \neg W(w'')) \end{array}}$

From (131-b), we have *three* •-operators, which will resolve the presuppositions differently, depending on whether the •-operator scopes over negation as in (a), or not, as in (b).

(134) a. $\bullet_{[w]} \neg W(w) = \boxed{\mathbf{want}^{\mathbf{m}}_w v(\neg\mathbf{leave}(v))}$ for any w

b. $\bullet_{[w]} W(w') = \boxed{\mathbf{want}^{\mathbf{m}}_w v(\mathbf{leave}(v))}$ for any w

Based on these equivalences, we can substitute these DRSs into (133-b), generating the representation in (135).

(135) [think that [Marge wants to leave]$_{\text{S}}$]$_{\text{VP}}$

$\rightsquigarrow \lambda x.\lambda w.\boxed{\begin{array}{c} \mathbf{think}^x_w v : \mathbf{want}^{\mathbf{m}}_v v'(\mathbf{leave}(v')) \\ \ll \boxed{\mathbf{think}^x_w v : \mathbf{want}^{\mathbf{m}}_v v'(\mathbf{leave}(v')) \vee \mathbf{think}^x_w v : \mathbf{want}^{\mathbf{m}}_v v'(\neg\mathbf{leave}(v'))} \end{array}}$

In (135), we have a more complex EM-inference encoded as part of the not-at-issue content. Here, the more complex EM-inference is paraphraseable as something like "*x thinks that Marge wants to leave, or, x thinks that Marge wants to not leave*". Note that this process of creating more and more complex excluded middle inferences can be applied recursively, generating Fillmore's observation that cyclicity of NR-predicates could ostensibly be unbounded.

The rest of the derivation follows with the remaining AAP in (135) being resolved at the global level, via our assumed principle that any unresolved AAPs get resolved at the root node, as in (b). The end result is a meaning paraphraseable as something like "*Homer thinks that Marge wants to not leave*."

(136) a. [Homer doesn't [think that [Marge wants to leave]$_S$]$_{VP}$]$_S$

$$\rightsquigarrow \lambda w.\neg(\boxed{\begin{array}{c}\mathbf{think}^{\mathbf{h}}_{w}v : \mathbf{want}^{\mathbf{m}}_{v}v'(\mathbf{leave}(v')) \\ \ll \boxed{\mathbf{think}^{\mathbf{h}}_{w}v : \mathbf{want}^{\mathbf{m}}_{v}v'(\mathbf{leave}(v')) \vee \mathbf{think}^{\mathbf{h}}_{w}v : \mathbf{want}^{\mathbf{m}}_{v}v'(\neg\mathbf{leave}(v'))}\end{array}})$$

$$\rightsquigarrow \lambda w.\boxed{\mathbf{think}^{\mathbf{h}}_{w}v : \mathbf{want}^{\mathbf{m}}_{v}v'(\neg\mathbf{leave}(v'))}$$

Several authors, notably Horn 1978 and Gajewski 2005, 2007, claim that certain orderings of stacked NR-predicates *do not* give rise to this cyclicity effect. For example, when a bouletic NR-predicate like *want* selects for an epistemic NR-predicate like *think*, we don't get a cyclicity effect. See Horn's judgement in Horn (1971:p120).

(137) I don't want him to think that she's innocent ($\not\models$ *I want him to think that she's guilty*)

The analysis outlined above generates a cyclic effect for any neg-raiser, so doesn't predict the judgement in (137). Cases in which cyclicity is allegedly blocked need to be investigated empirically. In my judgement, a reading of (137) with negation in the lowest position seems perfectly possible.

However, the judgement in (137) constitutes an important piece of the debate about how NR-inferences interact with their syntactic environment. Gajewski (2007) points out that strong NPIs are judged as degraded when embedded underneath *want ... believe*, but not underneath *believe ... want*, comprising an argument that the former is *not* a neg-raising environment

(138) a. I don't believe John wanted Harry to die until tomorrow.
b. *I don't want John to believe Harry died until yesterday. Gajewski 2007:(97)

In order to generate the judgements observed by Horn, Gajewski, and others, we need to block the cyclic effect in certain cases, blocking the NR-inference in (137). Gajewski proposes a potential solution by providing a more complex semantics of desire verbs, following several previous observations about the behavior of presuppositions embedded under particular attitudes. Gajewski's analysis of cases like (138) follows a key insight from Heim 1992: that presuppositional content within the prejacent of a bouletic attitude verb is interpreted as holding within the belief state of the bouletic attitude holder (rather than the global discourse context). NB: this effect holds only for the *de dicto* interpretations of content in the prejacent, and not for the (often preferred) *de re* readings (see Geurts 1998, 1999).

Below is a derivation using our standard lexical entry for *want*, showing how a possessive presupposition is accommodated within the prejacent. Again, the possessive is analyzed as an AAP here for illustrative purposes, and this paper makes no theoretical claims about the best way to analyze possessive presuppositions. Also, we omit the EM-inference triggered by *want* for simplicity.

(139) [Homer wants [Marge to drive her car]] $\rightsquigarrow \left[\ \middle|\mathbf{want}^{\mathbf{h}}_{w}v : \bullet_{[v]}(\mathbf{drive}(v)(y)(\mathbf{m}) \ll_0 [y|\mathbf{car\text{-}of}(v)(\mathbf{m})(y)])\right]$

$= \left[\ \middle|\mathbf{want}^{\mathbf{h}}_{w}v : [y|\mathbf{car\text{-}of}(v)(\mathbf{m})(y)\ ;\ \mathbf{drive}(v)(y)(\mathbf{m})]\right]$

In (139), the $\bullet$-operator simply demands that the AAP-content is conjoined to the at-issue content. Alternatively, we could propose a more complicated version of $\bullet$, which does not resolve the AAP. Instead it embeds the AAP's content within the bouletic agent's *belief state*. (140) is a definition of such an operator, symbolized as $\star$.

(140) $\star^{x}_{\{n\}}(K)$ is just like K except:
a. in K, delete the presupposition embedded beneath a $\ll_n$ operator (call this π_n)

b. call this new DRS, with π_n deleted, K'

c. embed π_n to a belief-state, i.e., $\star^{x}_{\{n\}}(K) = K'; (\mathbf{think}_x w : \pi_n(w))$

d. if there is no subordinate $\ll_n$ operator in K, then $\star^{x}_{\{n\}}(K) = K$

Now we can replace the representation in (139) with (141), in which the •-operator is replaced with its more complicated relative defined in (140). Now we can see that the effect of the ⋆-operator in (141) is to embed the not at-issue content introduced by the possessive phrase within a doxastic modal. It then encodes this modalized proposition, paraphraseable as ‘Homer believes Marge has a car’, as part of the not-at-issue content.

(141) [Homer wants [Marge to drive her car]] $\rightsquigarrow$

$$\begin{array}{|l|}\hline \\ \hline \mathbf{want}^{\mathbf{h}}_{w} v : \star^{\mathbf{h}}_{[v]} \begin{array}{|l|}\hline \mathbf{drive}(v)(y)(\mathbf{m}) \ll_0 \begin{array}{|c|}\hline y \\ \hline \mathbf{car\text{-}of}(v)(\mathbf{m})(y) \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array}$$

$$= \begin{array}{|l|}\hline \\ \hline \mathbf{want}^{\mathbf{h}}_{w} v : \begin{array}{|l|}\hline \\ \hline \mathbf{drive}(v)(y)(\mathbf{m}) \\ \hline \end{array} \ll_0 \begin{array}{|l|}\hline \\ \hline \mathbf{think}^{\mathbf{h}}_{w} v : \begin{array}{|c|}\hline y \\ \hline \mathbf{car\text{-}of}(v)(\mathbf{m})(y) \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array}$$

The end result is that the expression in (141) is interpreted as encoding, as part of its not-at-issue content, the proposition that Homer believes Marge has a car. As such, there is no global entailment that Marge has a car.

I will leave a fuller exploration of how this more complicated operator works for future research, but for now it suffices to say that this operator is a DRT-style implementation of Gajewski’s proposal for bouletic verbs like *want*. It encodes the intuition that not-at-issue content embedded beneath *want* is interpreted as holding within a belief state. As presuppositional content behaves differently under *want* as compared with *think*, we generate the observed contrast in (142).

(142) a. I don’t think that he wants her to be innocent ($\models$ *I think that he wants her to be guilty*)

b. I don’t want him to think that she’s innocent ($\not\models$ *I want him to think that she’s guilty*)

These ideas concerning desire vs. belief predicates are left in a rough form here, given that more empirical work is needed to determine whether the contrast in (142) is robust enough to be encoded into a default theory of neg-raising.

7 Conclusion

This paper has been a defense of a particular account of neg-raising inferences, according to which NR-predicates encode an excluded middle inference as part of their not-at-issue content. This sort of analysis was originally proposed by Gajewski 2005, 2007. Though where Gajewski analyzes NR-predicates as triggering a *soft* presupposition of opinionatedness, I argue that the EM-inference is better understood as being *automatically accommodated projective content*.

Furnished with a formal notion of automatically accommodated projective content (AAP), I have shown how this analysis correctly predicts that the EM-inference fails to outscope quantificational subjects, as well as modal operators. This was argued to be a prediction of any account of presupposition accommodation which bans any accommodation leading to un-binding of bound variables. I showed how this account has several empirical advantages over competing presuppositional accounts, especially with regards to quantificational sentences.

The framework for AAPs outlined here is an adaptation of van der Sandt’s theory of accommodation. According to van der Sandt, not at-issue meanings are introduced into the semantics by triggers, and must be resolved via a series of well-formedness principles. The analysis outlined here takes a different approach. Here I embed the AAP resolution mechanism (encoded as a •-operator) as part of the compositional semantics. The resolution operator serves to negotiate how high a not-at-issue meaning component is permitted to project.

Automatically accommodated projective content, as defined in this paper, are part of the not at-issue class of content. But when AAPs are integrated within their broader syntactic context, they end up being part of the at-issue content. As such, they do not impose requirements on the prior discourse context, and they may scopally interact with at-issue operators such as negation. Such scopal interaction is negotiated by the placement of the •-operator. AAPs therefore occupy a space between at-issue content and not-at-issue content. The introduction and resolution of AAPs can be seen to be a way that the AAP's content can take scope. The analysis therefore suggests that there are ways to blur the line between the projection of not-at-issue content, and the scope taking properties of at-issue content.

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