Time matters: the role of temporal boundaries in NPI licensing[*]

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Abstract

This paper discusses double Negative Polarity Item (NPI) constructions, such as **I don't think <u>at all</u> John will leave <u>until 10pm</u>*. These constructions have been claimed to provide a strong argument for a syntactic approach to Neg-raising (NR) (Lakoff, 1969; Prince, 1976; Crowley, 2019). We show that the empirical landscape is more intricate than what has been reported in the literature. As a result, far from supporting the syntactic approach to NR (Fillmore, 1963; Collins and Postal, 2014, a.o.), double NPI constructions provide strong evidence against it and in favour of a semantic/pragmatic approach (Bartsch, 1973; Gajewski, 2005; Romoli, 2012, a.o.). We propose an account for a subset of double NPI constructions capitalizing on three ideas: (i) punctual *until* has a non-cancellable (modal) inference that the action occurs after the time specified by *until* (Karttunen, 1974; Condoravdi, 2008; Iatridou and Zeijlstra, to appear), (ii) epistemic accessibility relations include a time index as well as a world one, and (iii) NPI-like predicate modifiers, such as *at all*, can be re-conceptualized from a domain-widener to an inhibitor of a contextual domain restriction.

1 Introduction

Several linguists have pointed out the paradigm in (1), e.g. Lakoff 1969; Prince 1976; Crowley 2019. In (1a), the strict/strong Negative Polarity Item (NPI) punctual *until* is licensed under the negated predicate *think*.[1] In (1b), *ever* and *at all*, two other NPIs, are licensed in the same configuration in the matrix clause. However, when both the low and the high NPI are present, (1c), the sentence becomes ungrammatical. We dub the constructions, such as (1c), *double NPI constructions*. They will be the focus of our investigation here.

(1)   a.   I didn't think [John would arrive <u>until 10pm</u>]
        b.   I didn't <u>ever/at all</u> think John would arrive
        c.   * I didn't <u>ever/at all</u> think [John would arrive <u>until 10pm</u>]

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[1]*Until* was traditionally described as being ambiguous between a durative and a punctual reading. Recently, Iatridou and Zeijlstra (to appear) have provided arguments for a unified analysis of *until*. As only the punctual *until* shows NPI properties, we will keep its specification as punctual, for clarity. As an NPI, punctual *until* has the distribution of the so-called strict/strong NPIs, which is more restricted compared to weak NPIs like *any* or *ever*, see Gajewski 2011; Chierchia 2013; Collins and Postal 2014 for recent accounts.

Double NPI constructions have been claimed to provide a strong argument in favour of a syntactic approach to Neg-raising (NR). NR is a phenomenon in which with certain predicates, like *think, believe, expect,* and others, matrix negation can be interpreted in the embedded clause, (2). According to the syntactic approach to NR (Fillmore, 1963; Collins and Postal, 2014, a.o.), NEGation originates in the embedded clause and then undergoes syntactic movement to the matrix clause, (3). The NR-reading arises when the low copy of NEG is interpreted.

(2)   John didn't think/believe/expect it would snow
       ⤳ John thought/believed/expected it wouldn't snow   (NR-reading)

(3)   [John did NEG think [it would ~~NEG~~ snow]]

Under the syntactic approach, the punctual *until* in (1a) is locally (clause-mate) licensed by NEG in the embedded clause, whereas *ever/at all* in (1b) is licensed by the moved NEG in the matrix clause. However, (1c) is unacceptable because, depending on a particular implementation, one of the NPIs remains unlicensed.[2]

An alternative to the syntactic approach to NR is a semantic/pragmatic approach, which derives the embedded reading of negation from the Excluded Middle (EM) inference (Bartsch, 1973; Gajewski, 2005; Romoli, 2012, a.o.). For instance, the assertion in (4a) together with the EM in (4b) entails the NR-reading in (4c).

(4)   a.   John didn't think it would snow
       b.   EM: John thought it would snow or John thought it wouldn't snow
       c.   ⤳ John thought it wouldn't snow   (NR-reading)

This approach has had little-to-nothing to say about the deviance of (1c) with the exception of Gajewski 2005. Gajewski (2005, 71-2) suggests that double NPI constructions are unacceptable because with *ever/at all* in the matrix clause, the EM projects existentially rather than universally, which does not guarantee the entailment in (4c) necessary for licensing *until*.

Both the syntactic and the semantic/pragmatic approach to NR explain the ungrammaticality of double NPI constructions by appealing to the way NR is derived. This reasoning predicts that the acceptability of double NPI constructions does not depend on a particular NPI in the embedded and/or matrix clause. For the syntactic approach, what is important is that the low NPI is a strict/strong NPI, which requires a clause-mate negation. The punctual *until* is one such NPI. Other strict/strong NPIs and minimizers, like *in weeks, a single soul*, and *sleep a wink*, are predicted to be equally unacceptable in double NPI constructions. For the semantic/pragmatic approach, in addition to the above prediction, the high NPI should be an existential quantifier. In other words, the semantic/pragmatic approach predicts, for example, that substituting *not..ever* in (1c) by *never* should make (1c) fully acceptable for the EM under *never* projects universally and nothing bars the entailment necessary for licensing a strong NPI in the embedded clause.

In the next section, we see that the distribution of double NPI constructions is more complex that what has been reported in the literature and the predictions of neither the syntactic nor the semantic/pragmatic approach to NR are borne out. More specifically, we present the results of a survey study showing that the acceptability of double NPI constructions does depend on the choice of an NPI in the embedded as well as the matrix clause. No amendments can save the syntactic approach to NR since there is no difference between the syntactic licensing of different strict/strong NPIs, e.g. *until* vs. *in weeks*. Therefore, far from being a strong argument in favour

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[2]Arguably, this reasoning is supported by examples like *John didn't <u>ever</u> arrive <u>until (after) 10pm</u>*, where the two NPIs are licensed when occurring in the same clause.

of the syntactic approach to NR, double NPI constructions, in fact, provide strong grounds for eliminating this approach (for other arguments against the syntactic approach to NR see e.g. Zeijlstra 2017). In section 3, we propose an account for a subset of double NPI constructions, which is compatible with the semantic/pragmatic approach to NR. Section 4 concludes the paper.

2   The intricate empirical landscape

2.1   Double NPI constructions in the literature

To the best of our knowledge, double NPI constructions have not been studied as a phenomenon in itself. They have been mentioned as a side (or footnote) phenomenon in the literature on NR and are mostly restricted to the paradigm in (1). Below, we briefly review known to us studies which deal with double NPI constructions indicating the judgments provided by the authors. The upshot of this review is that the empirical grounds are not settled. First, the data sample is not representative as it usually involves the same low and high NPIs (*until* and *ever/at all*). Second, the grammaticality judgments are often controversial or even contradictory.

Lakoff (1969, 142) mentions the contrast between (5a) and (5b-d) and suggests that it casts doubt on the rule of Negative Transportation (Fillmore, 1963).

(5)   a.   I didn't think John would leave <u>until tomorrow</u>

    b.   * I didn't <u>ever</u> think that John would leave <u>until tomorrow</u>

    c.   * I <u>never</u> thought that John would leave <u>until tomorrow</u>

    d.   * At <u>no time</u> did I think that John would leave <u>until tomorrow</u>

However, Lakoff (1969) also provides the examples in (6), which have a similar structure, but are grammatical, according to her judgements. She does not propose an explanation for the contrast between (5a) and (5b-d), nor between (5b-d) and (6).

(6)   a.   <u>No one</u> thought that John would leave <u>until tomorrow</u>

    b.   It wasn't thought by <u>anyone</u> that John would leave <u>until tomorrow</u>

Seuren (1974, reprinted as Seuren 2001) repeats Lakoff's examples in (5b-d) and adds the examples in (7):

(7)   a.   * I didn't think <u>yet</u> that Fred would get here <u>until midnight</u>

    b.   * <u>Often</u> I don't think he has got it <u>yet</u>

    c.   * He <u>usually</u> doesn't think there is as much as <u>a shred of evidence</u>

Seuren (1974) attributes the ungrammaticality of (5b-d) and (7) to the presence of the adverb in the matrix clause that blocks NR. He also points out that it is plausible that there is a deeper semantic reason for the blocking effect, but leaves this reason unexplored.

Prince (1976, fn. 7) independently points out the examples in (8) attributing them to Richard Smaby. For her, the ungrammaticality of (8c) is predictable in terms of the syntactic (raising) analysis of NR, the requirement on *until* to be clause-mate licensed, and *at all* to be under the scope of negation.

(8)   a.   I don't <u>at all</u> think that John will leave

    b.   I don't think that John will leave <u>until next week</u>

    c.   * I don't <u>at all</u> think that John will leave <u>until next week</u>

The subsequent literature (Gajewski, 2005; Crowley, 2019) uses Prince's paradigm in (8) for their main (although opposite) claims. Moreover, Gajewski (2005, fn.2) challenges Lakoff's judgements (as well as her conclusions) reporting that according to his informants, (5c) is grammatical whereas (6b) is ungrammatical:

(9)   Lakoff 1969

    a.   It wasn't thought by <u>anyone</u> that John would leave <u>until tomorrow</u>

    b.   * I <u>never</u> thought that John would leave <u>until tomorrow</u>

(10)   Gajewski 2005

    a.   * It wasn't thought by <u>anyone</u> that John would leave <u>until tomorrow</u>

    b.   I <u>never</u> thought that John would leave <u>until tomorrow</u>

Overall, the literature does not provide a clear empirical picture. Therefore, we conducted a pilot study to investigate the distribution of double-NPI constructions.

2.2 Pilot study

Participants were recruited via Amazon Mechanical Turk (MTurk). Overall 28 participants took part in the study. We excluded subjects who did not complete the survey, failed an attention task or took less than 2 minutes to complete the survey. Nine participants in total were excluded.

In each trial, a participant was presented with a sentence containing target items and then asked to rank its level of acceptability on a 5 point Likert scale where 1 is the least acceptable and 5 is the most acceptable. There were 3 practice trials, 32 experimental trials, out of which 11 were fillers not containing any target items, and one trial checking the participant's attention. Target items and fillers were pseudo-randomized.

Four items were designed to check baseline judgments. They contained the NPIs *until* and *in weeks/months* embedded under *think*, in either a negative environment with a wide scope negation or a non-negative environment.[3] The baseline items are shown in (11) with the mean judgements in square brackets, see also Figure 1. The standard prediction that strict/strong NPIs are licensed under negated Neg-raising predicates was borne out.

(11)   a. I don't think that Mary will arrive <u>until Thursday</u>   [4.63/5]

        b. I don't think that John has been here <u>in weeks</u>   [4.31/5]

        c. I think that Sue will leave <u>until next week</u>   [1.89/5]

        d. I think that Mary has visited us <u>in months</u>   [1.73/5]

The other trials in the survey dealt with double NPI constructions and tested for the combination of high NPIs *ever, any, never, yet* with low NPIs *until, in days/weeks/years*. The items with corresponding mean judgements are shown in (12) and Figure 2.

(12)   a. I didn't <u>ever</u> think that Harry would arrive <u>until Monday</u>   [3.42/5]

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[3]The survey also originally contained sentences with *sleep a wink*. The data on this NPI manifested a pattern which did not fit any of the theory-related predictions on NPIs, including high acceptance values in environments that do not license NPIs and low acceptance values in environments that do license NPIs. Since accounting for this puzzling behavior is beyond the scope of this paper, the *sleep a wink* items were not taken into consideration.
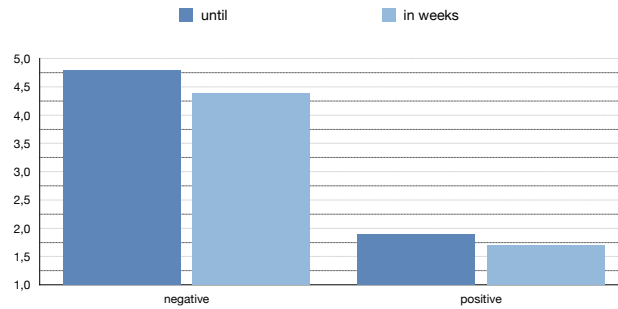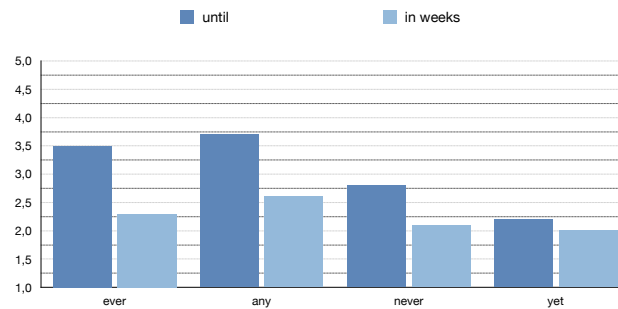
Figure 1: Baseline

Figure 2: Different combinations of low and high NPIs

b.	I didn't <u>ever</u> think that Kate had been here <u>in years</u>	[2.26/5]
c.	I don't believe to <u>any degree</u> that Miriam will leave <u>until tomorrow</u>	[3.57/5]
d.	I don't believe to <u>any degree</u> that Kyle has come <u>in days</u>	[2.52/5]
e.	I <u>never</u> believed that Dan arrived <u>until Friday</u>	[2.73/5]
f.	I <u>never</u> believed that Charlie had visited us <u>in weeks</u>	[2.05/5]
g.	I didn't think <u>yet</u> that Jack would get here <u>until midnight</u>	[2.1/5]
h.	I didn't think <u>yet</u> that Laura had been here <u>in weeks</u>	[2/5]

The relatively high acceptability of *until* with *ever/to any degree*, compared to *in weeks*, goes against the predictions of the syntactic approach to NR. In addition, the low acceptability of sentence with *never* compromises the semantic/pragmatic approach.

An interesting picture emerges when *at all* is used in the matrix clause of double NPI constructions. This picture, as the findings above, cannot be explained by the syntactic approach to NR. The configuration with *at all* shows three distinct patterns depending on whether *until* or *in weeks* is used in the embedded clause. We label these patterns 'Down' (*until* is (significantly) more acceptable than *in weeks*), 'Flat' (both *until* and *in weeks* are acceptable), and 'Up' (*in weeks* is more acceptable than *until*). The items with their means are given in (13) and illustrated in Figure 3. In the next section, we will concern ourselves with this observation.

(13)	a. I don't believe <u>at all</u> that Eric will leave <u>until Wednesday</u>	[4.25]	[4.6]	[2.6]
	b. I don't believe <u>at all</u> that Fred has talked to Mary <u>in weeks</u>	[2.5]	[4.6]	[4]
		'Down'	'Flat'	'Up'
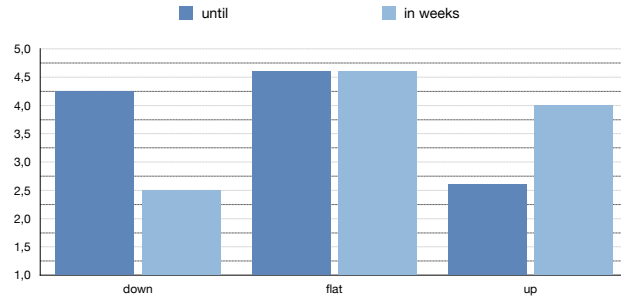
Figure 3: Three groups for *not..at all...until/in weeks*

2.3 Summary and outlook

After inspecting the data on double NPI constructions, the picture which arises is of a land-scape more intricate than what the literature has had. Different NPIs do not behave alike in double NPI constructions. This is contrary to the predictions of the syntactic approach to NR. Moreover, the syntactic approach has no way of accounting for the diverse behaviour of *until* and *in week* that we saw above. Therefore, double NPI constructions pose a serious problem to the syntactic approach to NR. The semantic/pragmatic approach is also undermined as the judgments it is based on do not prove to be robust.

3 Proposal for *not...at all...until/in weeks*

In this section, we propose an account for a subset of double NPI constructions. More precisely, we look at the configuration where *at all* is used in the matrix clause and *until* or *in weeks* is used in the embedded clause. This configuration shows three patterns as illustrated in Figure 3. We begin by explaining the pattern labelled 'Up'. The 'Up' pattern is exemplified in (14).

(14) a. ?? I don't think <u>at all</u> that John arrived <u>until Friday</u>   [2.6/5]

   b.   I don't t hink <u>at all</u> that John has been here <u>in weeks</u>   [4/5]

   Our proposal capitalizes on three ideas: (i) punctual *until* has a non-cancellable (modal) inference that the action occurs after the time specified by *until* (Karttunen, 1974; Condoravdi, 2008; Iatridou and Zeijlstra, to appear), (ii) epistemic accessibility relations include a time index as well as a world one, and (iii) NPI-like predicate modifiers, such as *at all*, can be re-conceptualized from a domain-widener to an inhibitor of a contextual domain restriction. We elaborate on these ideas in the next three sections (sections 3.1-3.3). In section 3.4, we attend to the remaining two patterns 'Down' and 'Flat' in Figure 3 and suggest a tentative explanation for them.

3.1 Change of State Inference of *until* (CoSI)

The observation that punctual *until* has a Change of State Inference (CoSI) goes back at least to Karttunen 1974. He points out that sentences like (15a) have the presupposition in (15b), which explains the infelicity of (15c). The status of the inference in (15b) (presupposition vs. non-cancellable implicature) is controversial (see Iatridou and Zeijlstra to appear for the discussion). simply as an inference.

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(15) a. John didn't arrive until Friday
      b. $\leadsto$ John arrived after Friday   (CoSI)
      c. # John didn't arrive until Friday and maybe he didn't arrive at all

Following Iatridou and Zeijlstra (to appear), we assume that the non-cancellable CoSI of *until* is modal, i.e. it can be satisfied by a non-actual world, when the proposition is embedded under a modal. This assumption resolves the tension between the infelicitous (15c) and the felicitous (16), where John's leaving after Friday can be true in some non-actual future world.

(16)   John won't leave until Friday, if at all

3.2 *Think* and the satisfaction of CoSI

The key point of our proposal is that for the modal CoSI of *until* to be satisfiable, the set of worlds over which an attitude predicate like *think* ranges must be restricted along the time index. To model our account, we take the universal quantifier associated with epistemic attitudes like *think* to range over $\langle w, t \rangle$-pairs as shown in (18), where the time span of the doxastic accessibility relation R_x is contextually restricted by the selection function $S_{[m,n]}$.[4] This selection function can be thought of as analogous to the ordering source in Kratzerian double-base semantics for modals (Kratzer, 1991, 2012). We assume that the flow of time is held fixed in a rigid manner due to the doxastic accessibility relation's reliance on a *stereotypical* ordering source, whose assumptions adhere to a stereotypical flow of time across the relevant worlds. The intuition is that 'x *thinks* ϕ' does not make a statement about all time intervals in x's life, but is rather defined over an implicitly contextual time interval. Furthermore, we propose that when ϕ contains punctual *until*, the domain of quantification of *think* is further contextually restricted on the right temporal boundary to align with the time specified by *until*, (19).

(17) **Notations used in this paper:**
      $S_{[m,n]}$ = selection function restricting a set of $\langle w, t \rangle$s to $t \in [m, n]$
      R_x = doxastic accessibility relation
      $\langle w_c, t_c \rangle$ = actual $\langle w, t \rangle$
      g1, g2 = contextual time points such that $_{g1}|.........................^{\mathbf{10}}|^{\mathbf{pm}}...........|_{g2}$
      $C_{[m,n]}$ = time interval concept (i.e. $g(C_{[g1,g2]}) = \lambda w.$ a time interval in w with g1 and g2 as its left and right boundaries)
      τ = event time span

(18) $\text{think}_x\ \phi = 1$ iff $\forall \langle w, t \rangle \in S_{[g1,g2]}(R_x(\langle w_c, t_c \rangle)) : \langle w, t \rangle \in \phi$

(19) $\neg\ \text{think}_x\ \phi[\text{until 10pm}] = 1$ iff $\neg \forall \langle w, t \rangle \in S_{[\mathbf{g1},\mathbf{10pm}]}(R_x(\langle w_c, t_c \rangle)) : \langle w, t \rangle \in \phi$

The intuition (19) captures is that *until* makes statements like 'x doesn't think ϕ' irrelevant after the time specified by *until* when the epistemic state is updated and the matter (ϕ or $\neg\phi$) is settled. More importantly, the additional domain restriction in (19) is necessary to ensure that CoSI is satisfied. (20) shows the assertion for (1a). (20a) states that it is not the case that in all speaker's belief $\langle w, t \rangle$ pairs such that t spans [g1,10pm], John arrives before 10pm. (20b) spells out the CoSI of *until*, which says that from any speaker's belief $\langle w, t \rangle$ with $t \in$ [g1,10pm], there is an epistemically accessible $\langle w', t' \rangle$ in which John arrives after 10pm. Crucially, if *think* ranges over $\langle w, t \rangle$ with $t \in$ [g1,g2] (unrestricted by *until*), CoSI cannot be satisfied since from

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[4]We retain the standard term *accessibility relation* although strictly speaking we represent this relation as a function.

$\langle w, t \rangle$ with t $\in$ [10pm,g2] where John arrived *before* 10pm, $\langle w', t' \rangle$ where John arrives *after* 10pm is not accessible, (20c).

(20)   a. Assertion of (1a): $\neg\forall\langle w,t\rangle \in S_{[g1,10pm]}(R_{sp}(\langle w_c, t_c\rangle))$:
            $\langle w,t\rangle \in \exists\tau[\tau{=}C_{[t,10pm]}(w) \wedge \exists e[\text{arrive(e,j)} \wedge e \subseteq \tau \wedge e < w\ ]]$

       b. CoSI of *until*: $\forall\langle w,t\rangle \in S_{[g1,10pm]}(R_{sp}(\langle w_c, t_c\rangle)) \ \exists\langle w', t'\rangle \in R_{sp}(\langle w,t\rangle))$:
            $\langle w', t'\rangle \in \exists\tau[\tau{=}C_{[10pm,g2]}(w') \wedge \exists e[\text{arrive(e,j)} \wedge e \subseteq \tau \wedge e < w'\ ]]$

       c. #CoSI of *until*: $\forall\langle w,t\rangle \in S_{[g1,g2]}(R_{sp}(\langle w_c, t_c\rangle)) \ \exists\langle w', t'\rangle \in R_{sp}(\langle w,t\rangle))$:
            $\langle w', t'\rangle \in \exists\tau[\tau{=}C_{[10pm,g2]}(w') \wedge \exists e[\text{arrive(e,j)} \wedge e \subseteq \tau \wedge e < w'\ ]]$

Informally, when an addressee contemplates the assertion of (1a), they contemplate the possibility of John arriving after 10pm. In order to do that, it must be the case that the contemplation is done *while there is something to contemplate* i.e. while the matter is not yet established. This is the work done by *until* - marking the point in time after which new information affects the ordering source in a way that makes further contemplating a matter which has already been settled, infelicitous.

3.3   *At all* as predicate modifiers that inhibit domain restriction

At all, in *John is *(not) tired at all.*, is standardly analyzed as a property modifier that triggers domain widening (in the sense of Kadmon and Landman (1993)) by obligatorily introducing non-exhaustive alternatives, which explains its NPI status (Krifka, 1995; Chierchia, 2013, a.o.). In other words, *at all* requires to consider even minimal degrees of precision for tiredness, which are normally disregarded as pragmatically irrelevant. We propose that classical domain widening by *at all* can be re-conceptualized as a ban on (contextual) domain restriction. That is to say, instead of requiring to consider even the minimal degrees of tiredness, *at all* inhibits domain restriction to pragmatically relevant degrees of tiredness.

(21)   a. John is *(not) tired at all.
       b. Alternatives for *at all*: { P | P$\subset$ **tired** $\wedge$ $\neg$min(P) }   (simplified)
       c. Non-exhaustivity: $\cup$\{ P | P$\subset$**tired** $\wedge$ $\neg$min(P) \} $\subset$ **tired**

With this re-conceptualization, it is easy to see how the paradigm in (1) is explained: (1a) has no *at all* and is shown in (20a,b). In (1b), *at all* requires that *think* ranges over all world-time pairs with an unrestricted time interval. This is unproblematic as there is no *until*. However, when both *until* and *at all* are present, (1c), the domain of quantification of *think* cannot be restricted by *until* for *at all* requires the widest possible domain and CoSI cannot be satisfied, (20c), which explains the infelicity of (1c). As *in weeks* does not have CoSI, we also explain the contrast in (14).

3.4   A note on three groups

Above, we proposed an explanation why in double NPI constructions, *until* is less acceptable than *in weeks*. We argued that the culprit is the non-cancellable Change of State inference of *until*. However, in Figure 3, we saw that there are actually three patterns, which we labelled 'Down', 'Flat', and 'Up'.

We tentatively suggest that these three patterns represent distinct groups of population that differ with respect to their pragmatic strategies. Recently, Crnič et al. (2018) argue that the high error rate (>80%) in experiments concerning logical reasoning may be due to not

taking into account different reasoning strategies. They provide experimental evidence that at least three groups of people can be distinguished with respect to whether they compute scalar implicatures in premises, conclusions, or both in syllogistic arguments, see Table 1.

	Logicians don't compute SIs	**Validators** SIs for premises, but not conclusions	**Strengtheners** SIs for premises and conclusions
premise	weak	strong	strong
conclusion	weak	weak	strong

Table 1: Different reasoning strategies (Crnič et al., 2018)

Given these findings, the difference between 'Up'-group, on the one hand, and 'Flat' and 'Down' groups, on the other hand, may be due to the fact that the former but not the latter compute CoSI for *until* when judging the naturalness of a sentence. More research needs to be done (including more experimental work) to confirm this suggestion as well as to get to the bottom of the difference between the 'Flat' and the 'Down' patterns.

4   Conclusion

This paper's contribution to the literature on negation, via an examination of double NPI constructions, is both theoretical and empirical. Our glimpse into the empirical landscape yielded a much intricate picture than previously reported, favoring the semantic/pragmatic approach to Neg-raising over the syntactic one. Our theoretical account provided for a subset of double NPI constructions, in which both time and world indices play a role in epistemic accessibility relations, offers both a semantic-pragmatic way to account for these constructions as well as a re-conceptualization of NPI-like predicate modifiers as contextual domain restriction inhibitors rather than domain-wideners.

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