

The world is not enough: the role of time in double NPI constructions

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This paper discusses the manner in which temporal bounds play a role in double Negative Polarity Item (NPI) constructions, such as **I don't at all think John will leave until next week* and the need for an expansion of epistemic accessibility relations that would include a time index as well as a world one. We begin with an introduction of existing data and the two main Neg-raising (NR) approaches, provide new data and then motivate the proposed new approach.

1 The two approaches to NR Lakoff 1969, Prince 1976, Crowley 2019 point out the paradigm in (1) that they claim is a strong argument for a syntactic approach to NR:

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

According to the syntactic approach to NR (Fillmore 1963, Collins and Postal 2014, a.o.), negation originates in the embedded clause, where it can locally (clause-mate) license the strong/strict NPI *until*, (1a), and then moves to the matrix clause, where it can license *ever/at all*, (1b). This movement of negation is responsible for the fact that with predicates like *think* matrix negation can be interpreted in the embedded clause, i.e. *John didn't think it would snow* can be interpreted as *John thought it wouldn't snow*. Under this approach, (1c) is out because, depending on a particular implementation, one of the NPIs remains unlicensed. This reasoning is supported by examples like (2), where the two NPIs are licensed when occurring in the same clause:

- (2) John didn't ever arrive until (after) 10pm

An alternative to the syntactic NR is a semantic/pragmatic approach which derives the embedded reading of negation from an Excluded Middle (EM) inference, i.e. *John didn't think it would snow* together with *John thought it would snow or John thought it wouldn't snow* (EM) entails *John thought it wouldn't snow* (Bartsch 1973, Gajewski 2005, Romoli 2012, a.o.). This approach has had little-to-nothing to say about the deviance of (1c).

2 New data and a problem of over-generalization The pattern in (1) does not carry over to other strong NPIs, (3). Thus, the pattern in (1) is not general enough to constitute an argument for the syntactic NR. The deviance of (1c) is due to *until* rather than the way NR is obtained.

- (3) a. I don't at all think that Mary has been here in weeks
 b. I didn't ever think that John would give a red cent to this charity
 c. I didn't ever think that John would sleep a wink last night

3 A tripartite proposal 3.1 Motivation: *until* and quantificational domain restriction

We begin with the observation that in (2) *ever* does not mean 'never-ever': the domain of *ever* must be restricted to times before 10pm. This is because *until* carries an inference (presupposition or non-cancellable Change Of State implicature - CoS) that John arrived after 10pm, (4), e.g. Condoravdi 2008, Iatridou and Zeijlstra 2018.

- (4) #John didn't arrive until 10pm and maybe he didn't arrive at all

If the domain of *ever* (contextually set by $C_{[n,m]}$ in (5)) has the right temporal boundary which spans beyond 10pm, speaker's knowledge is inconsistent, (5a,a'). This problem is avoided when the right temporal boundaries of *ever* and *until* are aligned, (5b,b').

- (5) τ = event time span, $C_{[n,m]}$ = time interval concept (i.e. $g(C_{[g1,g2]}) = \lambda w. \text{ a time interval in } w \text{ with } g1 \text{ and } g2 \text{ as its left and right boundaries}$) $_{g1} | \dots \dots \dots 10 | \text{pm} \dots \dots \dots |_{g2}$
 a. $\lambda w. \exists \tau [\tau = C_{[g1,g2]}(w) \wedge \neg \exists e [\text{arrive}(e,j) \wedge e \subseteq \tau \wedge e < w]]$ (*ever* not restricted by *until*)
 $\wedge \exists \tau [\tau = C'_{[g1,10pm]}(w) \wedge \neg \exists e [\text{arrive}(e,j) \wedge e \subseteq \tau \wedge e < w]]$ (assertion of *until*)
 a' $\lambda w. \exists \tau [\tau = C''_{[10pm,g2]}(w) \wedge \exists e [\text{arrive}(e,j) \wedge e \subseteq \tau \wedge e < w]]$ (CoS of *until*)
 b. $\lambda w. \exists \tau [\tau = C'_{[g1,10pm]}(w) \wedge \neg \exists e [\text{arrive}(e,j) \wedge e \subseteq \tau \wedge e < w]]$ (*ever* restr. by *until*)
 $\wedge \exists \tau [\tau = C'_{[g1,10pm]}(w) \wedge \neg \exists e [\text{arrive}(e,j) \wedge e \subseteq \tau \wedge e < w]]$ (assertion of *until*)

$$b' \lambda w. \exists \tau [\tau = C''_{[10pm, g2]}(w) \wedge \exists e [\text{arrive}(e, j) \wedge e \subseteq \tau \wedge e < w]] \quad (\text{CoS of } \textit{until})$$

In other words, since every event is associated with a time interval and both *ever* and *until* modify the same event, the time interval is set by the same (most specific) contextual time interval $[g1, 10pm]$.

3.2 Think and the modal nature of CoS Following Iatridou and Zeijlstra 2018, we assume that the non-cancellable CoS 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 is independently needed to resolve the tension between the infelicitous (4) and *John won't leave until Friday, if at all*, where John's leaving after Friday can be true in some non-actual future world. 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 (6), where the time span of the accessibility relation R is contextually restricted by the selection function S (that can be thought of as analogous to the ordering source in Kratzerian double-base semantics for modals). We assume that epistemic time is rigid. 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. We propose that when ϕ contains *until*, the domain of quantification of *think* is further restricted on the right temporal boundary, (7).

$$(6) \quad R_x = \text{doxastic accessibility relation}; S_{[m, n]} = \text{selection function that restricts a set of } \langle w, t \rangle \text{ to those pairs in which } t \in [m, n]; \langle w_c, t_c \rangle = \text{actual } \langle w, t \rangle \\ \text{think } \phi = 1 \text{ iff } \forall \langle w, t \rangle \in S_{[g1, g2]}(R_x(\langle w_c, t_c \rangle)) : \langle w, t \rangle \in \phi$$

$$(7) \quad \neg \text{think } \phi [\text{until } 10pm] = 1 \text{ iff } \neg \forall \langle w, t \rangle \in S'_{[g1, 10pm]}(R_x(\langle w_c, t_c \rangle)) : \langle w, t \rangle \in \phi$$

The intuition (7) 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 (7) is necessary to ensure that CoS is satisfied. (8) represents (1a). (8a) states that it is not the case that in all speaker's belief $\langle w, t \rangle$ s.t. t spans $[g1, 10pm]$, John arrives before 10pm. (8b) spells out CoS 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*), CoS cannot be satisfied since from $\langle w, t \rangle$ with $t \in [10pm, g2]$ where John arrived *before* 10pm, $\langle w', t' \rangle$ where John arrives *after* 10pm is not accessible, (8c).

$$(8) \quad a. \text{ assertion: } \neg \forall \langle w, t \rangle \in S'_{[g1, 10pm]}(R_{sp}(\langle w_c, t_c \rangle)) : \langle w, t \rangle \in \exists \tau [\tau = C'_{[t, 10pm]}(w) \wedge \exists e [\text{arrive}(e, j) \\ \wedge e \subseteq \tau \wedge e < w]]$$

$$b. \text{ CoS: } \forall \langle w, t \rangle \in S'_{[g1, 10pm]}(R_{sp}(\langle w_c, t_c \rangle)) \exists \langle w', t' \rangle \in R_{sp}(\langle w, t \rangle) : \\ \langle w', t' \rangle \in \exists \tau [\tau = C''_{[10pm, g2]}(w') \wedge \exists e [\text{arrive}(e, j) \wedge e \subseteq \tau \wedge e < w']]$$

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

3.3 At all/ever 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. 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 (8a,b). In (1b), *at all* requires that *think* ranges over all world-time pairs with $t \in [g1, g2]$. 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 to $t \in [g1, 10pm]$ for *at all* requires the widest possible domain and CoS cannot be satisfied, (8c), which explains the infelicity of (1c). We further extend this proposal to *ever*, which, we argue, is a property modifier in cases like (1) and thus is different from the adverbial in (2).

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