27 Punctual *Until* as a Scalar NPI

Cleo Condoravdi

27.1 Introduction

It is well known that *until*-phrases behave differently with telic and atelic event descriptions. When construed with telic event descriptions (accomplishments and achievements), they are polarity sensitive and are interpreted, in effect, like temporal frame adverbials, locating eventualities in time. In this use, exemplified by (1), *until* is traditionally referred to as "punctual *until*."

(1) a. He didn't arrive until yesterday.
    b. *He arrived until yesterday.

When construed with atelic event descriptions (states and activities), on the other hand, they are polarity insensitive and are interpreted like durative adverbials, asserting that an eventuality extends over a certain time interval. In this latter use, exemplified by (2), *until* is traditionally referred to as "durative *until*."

(2) a. He was here until yesterday.
    b. He was not here until yesterday.

Punctual and durative *until* highlight the question of the proper division of labor between lexical meaning, compositional semantics, and pragmatic inferences. Alternative choices for how this division is made bear on a number of issues of general semantic interest, such as the interpretation of negation in the context of temporal interpretation, the interplay of truth conditional and presuppositional content in the readings observed, and polarity sensitivity.

One view attributes the punctual and durative readings of *until* to lexical ambiguity, another to scopal ambiguity. Adopting the former view here, I reconsider some of the presumed consequences of the lexical ambiguity approach for the interpretation of negation (sections 27.2, 27.3) and revisit the semantics of punctual *until* (sections 27.3–6). Building on the insights of Karttunen (1974) and Declerck (1995), I propose a new analysis that links together the truth conditional and presuppositional

meaning of punctual *until* with its status as a polarity item by incorporating scalarity into its meaning. The analysis thus makes good on the intuition that punctual *until* is scalar by showing how an ordering in the temporal domain translates into an ordering of informational strength. The analysis, moreover, provides a more principled connection between *until* and related polarity items in other languages, some of which are also negative polarity items (NPIs) and some of which are by contrast positive polarity items (PPIs). Finally, even though my proposal assumes lexical ambiguity between punctual and durative *until*, it reveals the common aspects of their meaning, needed to explain how one could have developed from the other.

27.2   Punctual and Durative *Until*

With atelic event descriptions,[1] *until* is acceptable in both positive and negative contexts and the *until*-phrase is interpreted as a durative adverbial, with the temporal expression indicating the right boundary of an interval. As a durative adverbial, *until* requires that a predication hold throughout a given period and is consistent with the predication continuing to hold past that period. Consider, for instance, *until* with the stative predicates in (3a) or (4a) and the activity predicates in (3b) or (4b).

(3) a. He was angry until the end of the conference.
     b. He drank vodka until the end of the conference.

(4) a. He wasn't available until the end of the conference.
     b. He didn't sleep until the end of the conference.

The semantic contribution of the negation is the expected one. The examples in (4) assert that he was unavailable, or sleepless, throughout some period right-bounded by the end of the conference. They are consistent with his remaining unavailable, or sleepless, past the end of the conference.

   With telic event descriptions, on the other hand, *until* is acceptable only in negative contexts, as exemplified by the accomplishment predicate in (5) and the achievement predicate in (6).[2]

(5) a. *He drank a bottle of vodka until today.
     b.   He didn't drink a bottle of vodka until today.

(6) a. *The bomb exploded until yesterday.
     b.   The bomb didn't explode until yesterday.

Moreover, *until* in these contexts gives rise to the following implications: (i) that the relevant event occurred, an implication that is at first sight surprising, given the presence of negation; (ii) that the event occurred within the time denoted by the temporal expression; and (iii) that the time of occurrence could well have been earlier. (6b), for

instance, implies that the bomb exploded, that the explosion occurred yesterday, and that the explosion might/could have occurred before yesterday (but it didn't).

Similar facts hold for the Greek NPI *para mono* lit. 'but for only', as seen in (7), for the German PPI *erst*, as seen in (8), as well as for the Dutch PPI *pas* and English scalar *only*, also a PPI.[3]

(7) a. *I vomva ekseraghi *para mono* htes.
      the bomb exploded but for only yesterday
      'The bomb exploded only yesterday.'

  b. I vomva *dhen* ekseraghi *para mono* htes.
      the bomb not exploded but for only yesterday
      'The bomb didn't explode until yesterday.'

(8) a. Die Bombe ist *erst* gestern explodiert.
      the bomb is only yesterday exploded
      'The bomb exploded only yesterday.'

  b. *Die Bombe ist *erst* gestern *nicht* explodiert.
      the bomb is only yesterday not exploded
      'The bomb didn't explode until yesterday.'

Implication (i) raises the question of whether negation is to receive its usual interpretation in such cases—a question reinforced by the absence of negation with the otherwise equivalent PPIs. Implication (ii) indicates that the *until*-phrase (e.g., *until yesterday*) functions like a frame adverbial (e.g., *yesterday*) in some way—a way that is also consistent with the unacceptability of (6a), (7a), and (8b). Implication (iii) indicates that the temporal expression of the *until*-phrase brings with it alternative times for consideration that are somehow used by *until* and its crosslinguistic equivalents.

These implications also distinguish between durative and punctual *until*. For instance, (9a) does not necessarily imply that he became angry *at* the very end of the ordeal, an implication that is associated with (9b).

(9) a. He wasn't angry until the very end of the ordeal.
  b. He didn't become angry until the very end of the ordeal.

A further difference is that (9a) is ambiguous while (9b) is not. On one reading—let's call it the "throughout-not" reading—(9a) implies that he remained calm throughout the ordeal. The other reading—let's call it the "not-throughout" reading—negates that he remained angry throughout the ordeal and is consistent with a situation in which he was first angry and then calmed down part way through the ordeal. (9b), by contrast, has only one reading, implying that he was calm through the ordeal and that he became angry only at the very end.

Several approaches to the role of negation and the lexical meaning of *until* have been pursued in the literature. Klima (1964), Heinämäki (1974), and Mittwoch (1977), among others, claim that the ambiguity is scopal, not lexical. *Until*-phrases are uniformly interpreted as durative adverbials. Negation is a predicate modifier, turning any predicate it applies to into one that satisfies the selectional restriction of the *until*-phrase, informally characterized as requiring "durative" predicates.[4] This explains the contrasts in (5) and (6), where the *until*-phrase's selectional restriction is satisfied by the result of applying negation to a telic predicate but not by a telic predicate itself. Negation and *until*-phrases are assumed to be of the same type and to scope freely with respect to each other, as required to account for the ambiguity of (9a). A scoping in which the selectional restriction of the *until*-phrase is not satisfied produces no interpretation; hence, (9b) is unambiguous. Finally, implications (i) and (ii) discussed above are argued to not be unique with *until*-phrases construed with telic predicates. They are attributed to a conversational implicature that the asserted predication ceases to hold at the time denoted by the temporal expression of the *until*-phrase (though the mechanism by which such a conversational implicature arises is not pinned down).

This approach can be concretized as follows. We take sentence radicals to denote properties of eventualities and *until*-phrases and negation to be aspectual operators. Aspectual operators are predicate modifiers that can combine directly with a sentence radical and can scope freely with each other. Tense has outermost scope and maps properties to propositions. We then get the logical forms in (10) and in (11) for (9).

(10) *Negation scoping under* until-*phrase*
  a. *Past*((*Until*(EoO)(*Not*(he-be-angry))))
  b. *Past*((*Until*(EoO)(*Not*(he-become-angry))))

(11) *Negation scoping over* until-*phrase*
  a. *Past*(*Not*((*Until*(EoO))(he-be-angry)))
  b. *Past*(*Not*((*Until*(EoO))(he-become-angry)))

The throughout-not reading of (9a) corresponds to the scoping in (10a) and the not-throughout reading to that in (11a). The punctual reading exhibited by (9b) is, in this analysis, a throughout-not reading, corresponding to the scoping in (10b). (11b) has no semantic value because the telic predicate the *until*-phrase directly combines with does not conform to its selectional restriction.

Another kind of approach assumes that *until* is lexically ambiguous between a durative *until* (henceforth, *until*^{D}) and a punctual *until*, (henceforth, *until*^{P}), each with its own selectional restrictions, intuitively characterized as durativity and punctuality. This approach is coupled with varying assumptions regarding the status of negation.

Horn (1970, 1972) and Karttunen (1974) claim that negation is an operator scoping over the $until^P$-phrase and that $until^P$ is an NPI. The logical form for (9b) is (11b) rather than (10b): only in the scopal configuration of (11b) is $until^P$ licensed. Karttunen, moreover, argues that negation always scopes over both $until^D$- and $until^P$-phrases, hence the scoping options in (10) are excluded. He attributes the ambiguity of (9a) to the lexical ambiguity of *until* and an additional ambiguity of predicates like *be angry* between a stative and an inchoative reading. On its stative reading the predicate satisfies the selectional restriction of $until^D$, on its inchoative reading that of $until^P$. The not-throughout reading, then, corresponds to the logical form in (12a) and the throughout-not reading to the logical form in (12b).

(12) a. $Past(Not((Until^D(\mathrm{EoO}))(\text{he-be-angry}^{stat})))$
      b. $Past(Not((Until^P(\mathrm{EoO}))(\text{he-be-angry}^{inch})))$

Declerck (1995), in another variant of the lexical ambiguity approach, claims that *not ... until* is semantically a single lexical item, interpreted as a temporal exclusive focus particle, with *not* indicating the exclusive aspect of the meaning.

The decisive arguments in favor of lexical ambiguity, familiar from Karttunen (1974) and Declerck (1995), are twofold. The first argument is that the actualization implication associated with $until^P$ (implication (i) discussed above) cannot be cancelled the way conversational implicatures are. The second argument is that other languages make a lexical distinction between $until^P$ and $until^D$, using a polarity-sensitive item for $until^P$ and a non-polarity-sensitive item for $until^D$.[5] The purely scopal analysis of *until* trades uniformity in the meaning of English *until* with non-uniformity between NPIs and PPIs among the crosslinguistic equivalents of $until^P$: PPIs, such as German *erst*-phrases, clearly do not combine with a negative predicate and cannot be interpreted as durative adverbials.

(13) shows that the actualization implication is cancellable with $until^D$ but not with $until^P$.

(13) a. He wasn't there until six and he may not have shown up at all.
      b. He didn't come until six (#and he may not have shown up at all).

(14) shows that $until^D$ is lexicalized differently from $until^P$ in Greek.

(14) a.   Itan thimomenos *mehri* htes.
          was angry   until yesterday
          'He was angry until yesterday.'
      b.   (*Mehri* htes)   dhen itan thimomenos (*mehri* htes).
            until   yesterday not   was angry   until   yesterday
          'He was not angry until yesterday.'
      c.   *I   vomva ekseraghi *mehri* htes.
           the bomb exploded until yesterday
          'The bomb exploded until yesterday.'

    d. ?*I   vomva dhen ekseraghi *mehri* htes.
        the bomb not exploded until yesterday
        'The bomb didn't explode until yesterday.'

    e. I   vomva dhen ehi/ihe ekraghi   *mehri* tora/htes.
        the bomb not has/had exploded until now/yesterday
        'The bomb has/had not exploded until now/yesterday.'

    f. I   vomva dhen ekseraghi *para mono* htes.
        the bomb not exploded but for only yesterday
        'The bomb didn't explode until yesterday.'

As would be expected, Greek *mehri*, the equivalent of $until^D$, is acceptable with atelic event descriptions in positive and negative contexts (see (14a,b)) and is unacceptable with telic event descriptions in positive contexts (see (14c)). Moreover, (14b) exhibits the same ambiguity as (9a), with a preference for linear order to mirror semantic scope: if the throughout-not reading is intended, the *mehri*-phrase is preferably preposed; with the *mehri*-phrase preposed, only the throughout-not reading is available. With telic event descriptions in negative contexts, *mehri*-phrases whose temporal expression refers to calendrical times, such as *yesterday*, *last Monday*, *at 5 pm today*, are unacceptable with perfective past tense (traditionally known as the aorist) but acceptable with present and past perfect ((14d) vs. (14e)).[6] The negative context in which *mehri* is unacceptable is precisely the one where *para mono*, the equivalent of $until^P$, is used ((14d) vs. (14f)).

    Interestingly, these two kinds of arguments against a purely scopal analysis are also arguments against Karttunen's (1974) claims regarding scope and negation. (13a) has the throughout-not reading, which on Karttunen's analysis involves $until^P$. But if (13a) involved $until^P$, as (13b) does, then the contrast between them would remain unexplained. It follows that (13a) must involve $until^D$ scoping over negation. Similarly, the two readings of (14b), paralleling those of (9a), indicate a scopal rather than a lexical ambiguity for the two readings of *until* with atelic predicates. Therefore, it is durative *until* that gives rise to the throughout-not reading with atelic predicates, and $until^D$-phrases must be allowed to scope over negation, just as the scope analysis requires.

    Now it is often assumed that the scope analysis and the analysis of $until^P$ as an NPI each necessitate a different analysis of negation. As de Swart (1996, 225) puts it, "Part of the issue whether aspectual adverbials have a separate status as negative polarity items revolves around the question of the aspectual character of negative sentences. The one *until* theory makes crucial use of negation as an aspectual operator, whereas Karttunen and others deny that negative sentences are durative."[7]

    My proposal will reconcile the treatment of $until^P$ as an NPI with the treatment of negation as an aspectual operator allowed to scope narrowly. (11b) will be the logical

form for *until^P*, as in the NPI analysis, and (10a) and (11a) the logical forms for *until^D*, as in the scope analysis.[8]

27.3   Negation and Scope

The proposal is couched in an event-based framework, with a domain $\mathscr{E}$ of eventualities, a domain $\mathscr{T}$ of nonnull temporal intervals (with points as a special case), and a domain W of worlds. The temporal trace τ is a partial function from $\mathscr{E} \times W$ to $\mathscr{T}$, giving the time span of an eventuality that occurs in a given world. $\mathscr{T}$ is partially ordered by the relation of temporal precedence $\prec$ and by the subinterval relation $\subseteq_\mathscr{T}$; $\mathscr{E}$ by the subevent relation $\subseteq_\mathscr{E}$. The operations $\oplus_\mathscr{T}$ on $\mathscr{T}$ and $\oplus_\mathscr{E}$ and $\mathscr{E}$ give the sum of two intervals and of two eventualities, respectively (intuitively, the minimal interval/eventuality with these two as subintervals/subevents). An operation $\cap$ on $\mathscr{T}$ gives the intersection of two intervals (the maximal interval that is a subinterval of both) and is defined only for those intervals that overlap. In what follows, only convex (i.e., continuous) intervals are needed, so all intervals referred to below are taken to be convex. I will make reference to (right/left) closed and open intervals as follows. $[t_1, t_2]$ is an interval with t_1 and t_2 as an initial/final subinterval (intuitively, the interval that stretches from the beginning of t_1 to the end of t_2). (t_1, t_2) is an interval all of whose initial/final subintervals do not overlap t_1/t_2 and whose sum with t_1/t_2 yields a convex interval. Finally, for any world w and time t, $\mathscr{E}_{w,t}$ is that subset of $\mathscr{E}$ that consists of all eventualities e occurring in w and whose temporal trace in w is a subinterval of t.

Let Ep be the collection of properties of eventualities, Tp the collection of temporal properties, and Prop the collection of propositions. Sentence radicals denote in Ep. Untensed sentences modified by frame adverbials or aspectual operators denote in Tp. Tensed sentences denote in Prop.

Tense and aspectual operators operate on properties of eventualities or on temporal properties and instantiate them relative to a world and a time as defined in (15). Instantiation of properties of eventualities involves the familiar existential quantification over the event variable.

(15) $\text{INST}(P, w, t) = \begin{cases} (\exists e \in \mathscr{E}_{w,t})P(w)(e) & \text{if } P \in \mathsf{Ep} \\ P(w)(t) & \text{if } P \in \mathsf{Tp} \end{cases}$

Tense operators are mappings from $\mathsf{Ep} \cup \mathsf{Tp}$ to Prop instantiating properties in a time relative to the time of utterance now. (16) specifies the content of past tense relative to a fixed context.

(16)   *Past*: $\lambda P \lambda w.\text{INST}(P, w, (-\infty, \mathsf{now}))$

I assume that the logical form of frame adverbials involves an operator *At* (sometimes corresponding to an overt preposition, as in *on Monday*) with a temporal

expression as an argument. I take temporal expressions like *Yesterday* to denote the temporal interval yest, encompassing the entire day before the day of utterance. Frame adverbials are mappings from Ep to Tp and, as seen in (17), they instantiate properties of eventualities in the intersection of the time denoted by the temporal expression and the time of evaluation supplied by aspectual operators or tense.[9] Like any expression whose meaning makes reference to interval intersection, they have a semantic value only if intersection is defined on the relevant intervals.

(17) $At(Yesterday)$: $\lambda P\lambda w\lambda t.\textsc{Inst}(P, w, \mathsf{yest} \cap t)$

I treat negation uniformly as an aspectual operator, that is, a mapping from Ep $\cup$ Tp to Tp. Independent evidence that negation is an aspectual operator comes from its scopal interaction with modals and the perfect, argued to be aspectual operators in Condoravdi (2002). In (18), for instance, negation needs to scope under the modal and over the perfect.

(18) a. He may not have arrived yesterday.
     b. *Pres*(*May*(*Not*(*Perf*(*At*(*Yesterday*)(he-arrive)))))

Its interpretation can be specified as in (19). Negation applied to a property of eventualities or of times yields, for any world, the set of intervals in which that property is not instantiated.

(19) *Not*: $\lambda P\lambda w\lambda t.\neg\textsc{Inst}(P, w, t)$

A popular idea often associated with treating negation as an aspectual operator is that negation yields predicates of states and that durative predicates, selected by $until^D$, are to be identified with stative predicates (see de Swart 1996 for a detailed discussion). Although it is an attractive idea at first sight, it turns out that the sortal distinction between events and states does no real work.[10] Rather, what is crucial is the reference to the maximal eventuality relative to an interval (Krifka 1989) and what properties of eventualities are instantiated in that interval.

To see this, let us adapt de Swart's (1996) proposal as in (20), supposing that $\mathscr{E}$ is sorted into a set of states $\mathscr{E}^S$ and a set of events $\mathscr{E}^E$ and that $\bigoplus$ is a generalization of the binary sum operation $\oplus$ to a set of elements in the relevant domain.[11]

(20) *Not*: $\lambda P\lambda w\lambda t\lambda s.s = \bigoplus_{\mathscr{E}^S}(\lambda s'.\tau(s', w) \subseteq_{\mathscr{E}^S} t \wedge \neg\textsc{Inst}(P, w, \tau(s, w)))$

However, for eventive P, (20) above and (21) below are equivalent both truth conditionally and in terms of the (second-order) properties of the denotation of the resulting negative predicate.

(21) *Not*: $\lambda P\lambda w\lambda t\lambda e.e. = \bigoplus_{\mathscr{E}^E}(\lambda e'.\tau(e', w) \subseteq_{\mathscr{E}^E} t \wedge \neg\textsc{Inst}(P, w, \tau(e, w)))$

For any given P, w, t, the resulting predicate of states under (20) holds of the maximal state relative to t if and only if the resulting predicate of events under (21) holds

of the maximal event relative to t if and only if P is not instantiated relative to w, t ($\tau(s, w) = t$ in (20) and $\tau(e, w) = t$ in (21)). Moreover, on both analyses a negative predicate's denotation is null or singular for any given world and time; hence, (20) and (21) cannot differ in the aspectual effect of negation.

We can conclude that the sortal distinction plays no role in the aspectual effect of negation and, consequently, that durativity is not to be reconstructed in terms of the sort of eventuality a predicate ranges over. Thus, one potential motivation for analyzing negation as a mapping to Ep rather than to Tp is removed. The treatment of negation in (19) is simpler for our purposes and more general.[12]

Until^D is a backward-expanding interval operator: when it operates on a temporal expression denoting time t, it yields a predicate modifier making reference to an interval with t as a final proper subinterval (in the absence of any contextual restrictions $(-\infty, t)$). In what follows, I will assume that expanded intervals are contextually restricted via intersection with a contextually supplied bounded interval. An *until*^{D}-phrase is a mapping from Ep $\cup$ Tp to Tp, requiring that P be instantiated throughout the contextually restricted expanded interval.[13] The content of *until*^{D} *yesterday* relative to a fixed context is specified in (22), taking I to be a contextually determined interval with I_B as its starting point.[14]

(22) *Until*^{D}(*Yesterday*): $\lambda P \lambda w \lambda t.(\forall t' \subseteq_{\mathscr{T}} [I_B, \text{yest} \cap t])\text{INST}(P, w, t')$

The selectional restriction of *until*^{D} can now be seen as way to ensure that the falsity of the universal statement is a matter of contingent fact; this would be the case only if P has certain reference properties (I use the term "reference properties," in the sense of Krifka 1992, for second-order properties of predicate denotations). The most straightforward way to connect *until*^{D}'s selectional restriction with its content is by reconstructing durativity as divisiveness; but even if divisiveness turns out to be an inadequate reconstruction, the general point remains that the selectional restriction has to do with the reference properties of P, rather than the sort of individual (e.g., states) that P is a property of. An informal characterization of divisiveness for one-place predicates is given in (23).

(23) A unary predicate P is divisive iff its denotation in any model is closed under the subpart relation (i.e., any subpart of a P-entity is also a P-entity).

Stative and activity predicates are divisive;[15] accomplishments and achievements are not.[16] Negation as in (19) applied to any property of eventualities yields a divisive predicate, given the downward persistence of noninstantiation.

Until^D can, therefore, appear in the logical forms (10a) and (11a) and is excluded in (11b). But what about (10b)? The fact that the actualization implication is uncancellable in cases like (13b) indicates that *until*^{D} cannot appear in the configuration of (10b). The unacceptability of cases like (14d) in Greek leads to the same conclusion.[17]

I leave as an open question in this chapter a proper account of these facts. Given the predominance of evidence in favor of both lexical ambiguity for *until* and of scopal ambiguity between *until*[D] and negation, I take it that they do not argue against an analysis of negation as an aspectual operator and that an explanation ought to be sought elsewhere. An indication in support of the view that they may be due to independent factors comes from the effect of the perfect, seen in (14e), as well as the contrast in Greek between two kinds of *mehri*-phrases—'until the end' versus 'until yesterday'—seen in (24a,b). The verbal predicates in (24) are telic predicates and are also acceptable with *para mono*, as seen in (24c,d). (24c,d) give rise to the actualization implication, while (24a) does not.

(24) a. Dhen thimose/mas paratise *mehri* to telos.
         not   get-angry/us abandon until the end
         'He didn't (once) become angry/abandon us until the end.'
         (throughout-not reading)
     b. ?*Dhen thimose/mas paratise *mehri* htes.
         not   get-angry/us abandon until yesterday
         'He didn't (once) become angry/abandon us until yesterday.'
     c. Dhen thimose/mas paratise *para mono* sto   telos.
         not   get-angry/us abandon but for only in-the end
         'He didn't become angry/abandon us until the end/yesterday.'
     d. Dhen thimose/mas paratise *para mono* htes.
         not   get-angry/us abandon but for only yesterday
         'He didn't become angry/abandon us until yesterday.'

Like frame adverbials, *until*[P]-phrases are mappings from Ep to Tp and can, consequently, have only narrow scope relative to any aspectual operator, including negation. On the analysis I propose below there is no need to assume any selectional restriction for *until*[P]-phrases; they can combine with event descriptions of any kind and can, therefore, appear in the configuration of (11a).[18] Hence, (9a) is three-way ambiguous: in addition to the two scopal readings involving *until*[D], it has a reading involving *until*[P] and, on that reading, it implies that he got angry at the very end of the ordeal. The inchoative reading of atelic event descriptions with *until*[P] follows from the meaning of *until*[P].

But what is the meaning of *until*[P]? In the following section I pull together some of the necessary ingredients by looking at the meaning assigned to it by the two main analyses that recognize it as distinct from *until*[D], Karttunen's and Declerck's. I provide a compositional reformulation of these analyses in the setup introduced in the present section to facilitate comparison between them and between each one of them and my own proposal to be presented in section 27.5.

27.4   Assertion, Presupposition, and Alternatives

Any analysis of *until^P* has to answer the following two questions. How is the instantiation inference (actualization implication) compatible with the presence of negation? How does the inference arise that the eventuality is located within the time denoted by the temporal expression? For instance, what is the meaning of the phrase *until yesterday* that results in (25)'s implying that he left and that the departure took place yesterday?

(25) He didn't leave until yesterday.

Karttunen and Declerck answer these questions differently. For Karttunen the actualization implication is presuppositional, while the implication that the departure took place yesterday is a contextual entailment, due both to the presuppositional and the truth conditional content of *until^P*. For Declerck both implications are presuppositional, associated with the composite lexical item *not … until*.

Karttunen (1974) argues that truth conditionally *until^P* is equivalent to *before* but that it carries presuppositional content that *before* does not. His schematic characterization of the presuppositional and assertive content of sentences of the form 'A Until^P T' is given in (26). (The intuitions behind Karttunen's proposed meaning are best captured if we take the disjunction in (26a) to be exclusive.) A sentence of the form 'Not A Until^P T' then has (26a) as its presuppositional content and (27) as its assertive content.

(26) a. *Presupposition*
      (A AT T) $\vee$ (A BEFORE T)
   b. *Assertion*
      A BEFORE T

(27) *Assertion*
   NOT (A BEFORE T)

We can formulate the presuppositional and assertive content of *Until^P* (*Yesterday*) in our terms as in (28), taking I to be a contextually given interval with I_B as its starting point. Recall that $[I_B, \text{yest})$ is an interval such that $[I_B, \text{yest}) \prec \text{yest}$ and $[I_B, \text{yest}) \oplus_{\mathcal{T}} \text{yest}$ is a convex interval. *Until^P* is a backward-expanding interval operator, requiring that P be instantiated within the expanded interval.

(28) a. *Presupposition*
      $\lambda P \lambda w \lambda t.\text{INST}(P, w, \text{yest} \cap t) \vee \text{INST}(P, w, [I_B, \text{yest} \cap t))$
   b. *Assertion*
      $\lambda P \lambda w \lambda t.\text{INST}(P, w, [I_B, \text{yest} \cap t))$

With the logical form of (25) as in (29), as discussed in section 27.2, the proposition expressed by (25) is the one in (30) and the proposition presupposed the one in

(31).[19] In order for (25) to be felicitously uttered in a context, the context has to satisfy (25)'s presupposition, that is, it must entail the proposition in (31).

(29) $Past(Not((Until^P(Yesterday))(\text{he-leave})))$

(30) $\lambda w.\neg(\exists e \in \mathscr{E}_{w,[I_B,\text{yest})})\text{he-leave}(w)(e)$

(31) $\lambda w.(\exists e \in \mathscr{E}_{w,\text{yest}})\text{he-leave}(w)(e) \vee (\exists e \in \mathscr{E}_{w,[I_B,\text{yest})})\text{he-leave}(w)(e)$

An argument Karttunen offers that the truth conditional content of $until^P$ is equivalent to that of *before* comes from counterfactual contexts, on the assumption that a counterfactual context implies the truth of the negation of the proposition expressed by the sentence in its scope. If the truth conditional content of (25) is as in (30), then the implication associated with (32a,b) is predicted to be that he in fact left before yesterday. This is exactly what (32a,b) imply.

(32) a. I wish he hadn't left until yesterday.
      b. If he hadn't left until yesterday, we could have gone with him.

An important point about Karttunen's analysis is the distinction it draws between truth conditional entailments, presuppositional implications, and what we can call "contextual entailments of assertions." The instantiation implication is an entailment of the presuppositional content of $until^P$. The inference that the eventuality occurs within the interval denoted by the temporal expression is a contextual entailment that arises as follows. Suppose a sentence that presupposes a proposition $p \cup q$ and expresses the proposition $\neg p$ is uttered in a context c satisfying its presupposition, thus $c \subseteq p \cup q$. Then the resulting context, $c \cap \neg p$, would entail q. Therefore, (25), with truth conditional content as in (30), asserted in a context satisfying its presupposition, thus entailing (31), results in a context entailing that he left yesterday.

On this kind of analysis, a sentence with a positive polarity item, such as 'A Erst T', would have the same presuppositions as one with $until^P$ (in this case it is crucial that the disjunction be exclusive), but its truth conditional content would be A AT T.[20] Corresponding NPIs and PPIs, on this view, have the same presuppositional content, in our terms as in (28a), but the former have the truth conditional content of *before*, as in (28b), whereas the latter have the truth conditional content of frame adverbials, as in (17).

I adopt Karttunen's proposal for the truth conditional content of $until^P$ as reconstructed here, aiming for a more uniform meaning for NPIs and PPIs, seeking a better motivation for the disjunctive specification of the presuppositional content and relating the reference to times other than that denoted by the temporal expression to the appearance of focus on the temporal expression.

Declerck (1995), observing that the temporal expression is in focus, proposes that $not \ldots until^P$ is an exclusive focus particle. Following König (1991), he assumes that exclusive focus particles "trigger a presupposition that corresponds to the relevant

sentence in the scope of the particle'' (p. 55). Unlike the scope analysis or the NPI analysis, *not … until^P* is not the composition of two independent elements but one element semantically, *Not-Until*. As an exclusive focus particle, its truth conditional content makes reference to the alternatives generated by the expression in focus; its presupposition makes reference to the ordinary semantic value of the expression in its scope, giving rise to the inference that the eventuality description is instantiated within the time denoted by the temporal expression. On this analysis, (25) presupposes that he left yesterday and asserts that he didn't leave at any of the alternative times, restricted to times preceding yesterday.

In order to formalize Declerck's proposal, let us assume that *Not-Until*, combining with a temporal expression in focus, both restricts and uses up the focus-generated alternatives. Supposing that the alternatives are contextually restricted to a disjoint cover of a contextually determined interval I,[21] we can take *Not-Until* to further restrict them to those preceding the time denoted by the temporal expression and to assert that the relevant property is not instantiated at any of the restricted alternatives. We can then specify the meaning of *Not-Until*(*Yesterday*) as in (33).[22] Phrases with the corresponding PPIs, like *erst*, are assigned the same meaning.

(33) a. *Presupposition*
$\lambda P \lambda w \lambda t. \text{INST}(P, w, \text{yest} \cap t)$

  b. *Assertion*
$\lambda P \lambda w \lambda t. t = t \wedge \neg(\exists t^{alt} \in Alt^R(Yesterday)) \text{INST}(P, w, t^{alt})$, where
$Alt^R(Yesterday) = \{t \in Alt(Yesterday) \mid t \prec \text{yest}\}$

Given the assumptions we have made about the alternatives, Declerck's analysis of *Not-Until* as an exclusive focus particle and Karttunen's analysis of *until^P* as an NPI are truth conditionally equivalent. The two analyses differ, however, on the truth conditional content of *erst*: Declerck's truth conditional content is Karttunen's contextual entailment, and Karttunen's truth conditional content is Declerck's presuppositional content (compare (17) and (33a)).

The presupposition of punctual *until* is stronger on Declerck's analysis and, as it turns out, too strong. On the assumption that counterfactual contexts preserve the presupposition of the sentence in their scope, (32a,b) are predicted to imply that he left at some time before yesterday *in addition to* leaving yesterday, contrary to fact. Another argument that the presupposition on Declerck's analysis is too strong, offered by Mittwoch (2001) in a somewhat different connection, comes from presupposition projection data.[23] If the consequent of the conditional in (34a) presupposed that he left yesterday, then the conditional as a whole would have the (conditional) presupposition in (34b), a presupposition that intuitively appears too strong.

(34) a. If he left at all, then he didn't leave until yesterday.
  b. If he left at all, he left yesterday.

Declerck describes *not ... until* as a scalar particle, but the proposed meaning as an exclusive temporal operator, functioning temporally like the operator *At* in frame adverbials, does not cash out this intuition. Even though the domain of focus-generated alternatives is ordered (by the relation of temporal precedence), there is no corresponding ordering of semantic specificity or informational strength. In the following section I show how this intuition can be cashed out.

27.5   Scalar Assertions

The analysis posits that $until^P$ is a focus-sensitive, polarity-sensitive, backward-expanding interval operator. Though focus sensitive, it does not use up the focus-generated alternatives; rather it operates on them and projects them upward. Though polarity sensitive, it does not introduce alternatives of its own but operates on the alternatives introduced by the expression in focus it combines with. As a backward-expanding interval operator, it operates both on the ordinary semantic value of the expression it combines with and on the alternatives, resulting in propositions ordered by the entailment relation. This makes it a scalar operator.

I take as a starting point Krifka's (1995) theory of polarity items and scalar asser-tions. In that theory, polarity items introduce ordered alternatives whose ordering ultimately induces an ordering of semantic specificity. Illocutionary operators, asso-ciated with different kinds of speech acts, exploit the resulting alternative proposi-tions in the contextual update they determine. An assertion is a scalar assertion if for every alternative proposition, the result of updating the context with it is either as strong as or as weak as the result of updating the context with the actually asserted proposition. Contexts are construed as sets of possible worlds, and the rela-tion of strength (informativity) between contexts is the subset relation.

Until^P is like the aspectual particles *already* and *still* in presupposing a phase tran-sition within a contextually given interval I (Löbner 1989). The transition is from a maximal initial subinterval of I in which a given property of eventualities is not instantiated, let's call it I_{NEG}, to a minimal final subinterval in which it is, let's call it I_{POS}. The alternatives associated with the temporal expression in focus, contextually restricted to disjoint subintervals of I, are epistemic alternatives for when that phase transition might have occurred. In a felicitous utterance of $until^P$, the context con-tains the information that the relevant eventuality occurred in exactly one of the alternatives times, but it does not determine in which one.[24]

Intuitively, then, (25) presupposes (i) that the contextually relevant interval I can be divided into an initial phase that contains no occurrence of his leaving and a final phase that does (hence, the instantiation implication); (ii) that any one of the times in the set of alternatives, which contains the actually asserted time, might be a time when the departure occurred;[25] and (iii) that no other time might be a time when

the departure occurred. For (25) to be felicitously uttered in a given context, the proposition $\lambda w.(\exists e \in \mathscr{E}_{w,t})$he-leave$(w)(e)$ must be consistent with the context, for every $t \in Alt(Yesterday)$ (and yest $\in Alt(Yesterday)$), and inconsistent with the context for any $t \notin Alt(Yesterday)$. In other words, the context would have to contain insufficient information to discriminate among the times in the set of alternatives but would have to be informative enough to exclude any other times as potential times for his departure.

I do not formalize the presupposition here, as this would require a more essentially dynamic system of interpretation than I am assuming for the purposes of this chapter. It should be noted, in any case, that with the notion of epistemic alternatives at our disposal, we do not need to resort to disjunction in the specification of the presuppositional content: the disjunction can be reformulated as a conjunction of epistemic possibilities.

The presupposition proposed here is weaker than the one proposed by Karttunen in that it does not require that the time denoted by the temporal expression of the *until*^{P}-phrase be the latest time at which the eventuality is taken to have possibly occurred. Cases such as (35), involving a sequence of epistemic conditionals, provide evidence in favor of the weaker presupposition.[26]

(35) If he didn't leave until Sunday$_F$, then he must have seen Mary.
     If he didn't leave until Monday$_F$, then he must have seen Bill too.

Each conditional presupposes that he left at some point, and the use of a conditional implies that the time of his departure is unknown to the speaker. If the first conditional, moreover, presupposed that the latest possible time of his departure was Sunday and the second conditional that the latest possible time of his departure was Monday, then any context that satisfied the presuppositions of one would not satisfy the presuppositions of the other, as their presuppositions would be contradictory. However, these two conditionals can coherently appear in this order in a discourse, indicating that their presuppositions are not contradictory.

The basic idea about the interpretation of *until yesterday* in the scope of negation is that of all the backward-expanded alternative intervals, $[I_B, \text{yest})$ is the longest interval in which there is no eventuality of type P occurring, hence the longest interval contained in I_{NEG}. That it is an interval in which no eventuality of type P occurs is due to *until*^{P}'s truth conditional content and the interpretation of negation. That it is the longest such interval among the alternatives is a quantity implicature, due to the fact that *until*^{P} gives rise to scalar assertions, as explained below.

We can specify the content of $Until^P(Yesterday)$ as in (36). The first member of the pair is the ordinary semantic value of the phrase, the same as in (28b). The second member is the set of contextually restricted alternatives that constitute a subset of its focus semantic value.

(36) $\langle\lambda P\lambda w\lambda t.\text{INST}(P, w, [I_B, \text{yest} \cap t)),$

  $\{\lambda P\lambda w\lambda t.t = t \wedge \text{INST}(P, w, [I_B, t^{alt})) \mid t^{alt} \in Alt(Yesterday)\}\rangle$

The alternatives in (36) are not discharged at the level of the *until*-phrase. They project upward, ultimately giving rise to alternative propositions.

 The proposition expressed by (25), then, is as in (37), and the set of alternative propositions, including the proposition expressed, is as in (38).

(37) $\lambda w.\neg(\exists e \in \mathscr{E}_{w,[I_B,\text{yest})})\text{he-leave}(w)(e)$

(38) $\{\lambda w.\neg(\exists e \in \mathscr{E}_{w,[I_B, t^{alt})})\text{he-leave}(w)(e) \mid t^{alt} \in Alt(Yesterday)\}$

(25), thus, entails that he didn't leave at any time preceding yest and contextually entails that he left within yest or later. Since the presupposition of (25) is weaker on this analysis than on Karttunen's and the truth conditional content the same, the contextual entailment is correspondingly weaker. The stronger implication that he left within yest is, I claim, the result of defeasible pragmatic reasoning associated with scalar assertions.

 The ordering of temporal precedence in the set of alternative times induces an ordering in the set of alternative propositions in (38) via the expanded intervals introduced by $until^P$. For any $t_1, t_2 \in Alt(Yesterday)$ such that $t_1 \prec t_2$, $[I_B, t_1) \subset_{\mathscr{T}} [I_B, t_2)$, and, consequently, the proposition $\lambda w.\neg(\exists e \in \mathscr{E}_{w,[I_B,t_2)})\text{he-leave}(w)(e)$ asymmetrically entails the proposition $\lambda w.\neg(\exists e \in \mathscr{E}_{w,[I_B,t_1)})\text{he-leave}(w)(e)$ given the downward persistence of noninstantiation. The crucial role of expanded intervals in the scalarity of $until^P$ is now apparent: there is no relation of entailment between the propositions $\lambda w.\neg(\exists e \in \mathscr{E}_{w,t_1})\text{he-leave}(w)(e)$ and $\lambda w.\neg(\exists e \in \mathscr{E}_{w,t_2})\text{he-leave}(w)(e)$, for any $t_1, t_2 \in Alt(Yesterday)$.

 An assertion of (25), therefore, constitutes a scalar assertion: the proposition actually asserted is informationally (at least) as strong as the alternative propositions corresponding to alternative times earlier than yest and (at least) as weak as the alternative propositions corresponding to alternative times later than yest. Relative to contexts c satisfying $until^P$'s presuppositions, the proposition actually asserted is, in fact, stronger than the alternative propositions corresponding to times earlier than yest and weaker than the alternative propositions corresponding to times later than yest. For any $t_1, t_2 \in Alt(Yesterday)$ such that $t_1 \prec t_2$, the context resulting from the update with the proposition corresponding to t_2 is more informative than the one resulting from the update with the proposition corresponding to t_1: $c^2 \subset c^1$, where $c^i = c \cap \lambda w.\neg(\exists e \in \mathscr{E}_{w,[I_B,t_i)})\text{he-leave}(w)(e)$, for $i = 1, 2$. To see this, consider the subset c_{t_1} of c, corresponding to those worlds in which he left within t_1: c_{t_1} remains a subset of c^1 but not of c^2.

 Suppose now that the pragmatics of scalar assertions requires that for any of the nonasserted alternative propositions that are informationally stronger than the actu-

ally asserted proposition the speaker has grounds for not asserting it. The best possible grounds for not asserting it would be if the speaker knows (or presumes) that the proposition is false. Then by using an element that gives rise to a scalar assertion, without any further qualification, a speaker indicates that any stronger proposition is in fact (or can be presumed to be) false. In the case of (25), the propositions corresponding to alternative times later than yest must not be viable alternatives, for otherwise they would entail the asserted proposition. Therefore, his leaving is implied to have occurred within yest.

However, this is a defeasible inference. The speaker can suspend the presumption of falsity of informationally stronger alternative propositions by some explicit means. One such case, noted by Mittwoch (1977), is (39), which implies that he may have woken up later than nine.

(39) He didn't wake up until at least nine.

Moreover, given that the informationally stronger alternative propositions correspond to times later than yest, any qualification suspending this presumption of falsity would have to implicitly or explicitly make reference to times later than yest, hence the often noted contrast in (40), originally discussed by Horn (1972).[27]

(40) He didn't leave until Sunday, if not later/#if not earlier.

The corresponding positive polarity items, such as German *erst*, are similarly scalar and presuppose a phase transition within a contextually supplied interval I but must make reference to expanded intervals that contain the presupposed positive phase I_{POS}. This must be so in order for the ordering in the set of alternative propositions, induced by the ordering of temporal precedence via the expanded intervals, to be the same for sentences like (25) and those like (41).

(41) Er fuhr erst gestern   ab.
    he went only yesterday away
    'He only left yesterday.'

PPIs like *erst* differ from NPIs like $until^P$, therefore, in being forward-expanding interval operators, with the expanded interval being (left and right) closed. As seen in (42), *Erst* expands the time denoted by its argument to the ending point I_E of the contextually supplied bounded interval,[28] requiring that P be instantiated within the expanded interval.

(42) *Erst*(*Yesterday*): $\langle \lambda P \lambda w \lambda t. \text{INST}(P, w, [\text{yest} \cap t, I_E]),$
    $\{ \lambda P \lambda w \lambda t. t = t \wedge \text{INST}(P, w, [t^{alt}, I_E]) \mid t^{alt} \in Alt(\text{Yesterday}) \} \rangle$

The basic idea about the meaning of *erst gestern* in a positive context is that of all the forward-expanded alternative intervals, [yest, I_E] is the shortest interval in which an eventuality of type P occurs, hence the shortest interval containing I_{POS}. As with

until^P, that it is an interval in which an eventuality of type P occurs is its plain truth conditional content; that it is the shortest such interval among the alternatives is a scalar implicature.

(41), thus, entails that he left within yest or later and contextually entails that he didn't leave at any time preceding yest. The implication that he left within yest is a scalar implicature. With PPIs, both the presuppositional and the truth conditional content are weaker on this analysis than on Karttunen's. Evidence in favor of the weaker truth conditional content comes from cases like (43), where, as in (39) or (40), the added qualification suspends the presumption giving rise to the scalar implicature.

(43) Er fuhr erst am Sonntag ab,   oder noch später.
      he went only on Sunday away or   still   later
      'Ho only left on Sunday, or even later.'

Expanded intervals are crucial in the scalarity of *erst*. For any $t_1, t_2 \in$ *Alt*(*Yesterday*) such that $t_1 \prec t_2$, $[t_2, I_E] \subset_{\mathcal{T}} [t_1, I_E]$, and, consequently, the proposition $\lambda w.(\exists e \in \mathcal{E}_{w,[t_2, I_E]})$he-leave$(w)(e)$ asymmetrically entails the proposition $\lambda w.(\exists e \in \mathcal{E}_{w,[t_1, I_E]})$he-leave$(w)(e)$ given the upward persistence of instantiation. It follows that an assertion of (41) is scalar and that relative to contexts satisfying *erst*'s presuppositions the proposition actually asserted is, in fact, stronger than the alternative propositions corresponding to times earlier than yest and weaker than the alternative propositions corresponding to times later than yest. The pragmatics of scalar assertions gives rise to the inference that the propositions corresponding to alternative times following yest are not viable alternatives, for otherwise they would entail the asserted proposition. Therefore, his leaving is implied to have occurred within yest.

27.6 Polarity Sensitivity

Can we now use the scalarity of *until*^{P} and *erst* to explain their polarity sensitivity? Though scalar, these items do not correspond to minimal or maximal elements of a scale and, as a result, the alternative propositions are not uniform in terms of their relation of informational strength with the actually asserted proposition. Moreover, they are not exhaustive with respect to the alternatives on either side or taken together; for instance, $[I_B, \text{yest}) \neq \oplus_{\mathcal{T}} \{[I_B, t) \mid t \prec \text{yest}\}$. Consequently, Krifka's (1995) explanation for the polarity sensitivity of weak PIs, such as *any*, cannot be applied to them.

Krifka folds scalar implicatures into the contextual update with scalar assertions, as seen in (44). The idea is that scalar assertions result in a more informative context than plain assertions: in addition to asserting the proposition expressed, they negate any informationally stronger alternative propositions.

(44) $ScalAssert(\langle p, Alt(p)\rangle, c) =$
$\{w \in c \mid w \in p \land \neg(\exists p' \in Alt(p))w \in p' \land c \cap p' \subset c \cap p\}$

Weak PIs in a nonlicensing environment give rise to a proposition that is informationally weaker than all the alternatives. Since they are exhaustive with respect to the alternatives, the assertive effect of such items is to lead to a contradictory context (the empty set).

In the scope of negation, *until yesterday*, in effect, expresses that the presupposed negative phase I_{NEG} extends at least up to yest ($[I_B, \mathsf{yest}) \subseteq_{\mathcal{T}} I_{\mathrm{NEG}}$). In a positive environment the relation of inclusion between I_{NEG} and $[I_B, \mathsf{yest})$ would be reversed so that $[I_B, \mathsf{yest})$ properly contains I_{NEG} ($I_{\mathrm{NEG}} \subset_{\mathcal{T}} [I_B, \mathsf{yest})$). Similarly, in a positive environment *erst gestern* expresses that the presupposed positive phase I_{POS} does not start before yest ($I_{\mathrm{POS}} \subseteq_{\mathcal{T}} [\mathsf{yest}, I_E]$). In a negative environment the relation of inclusion between $[\mathsf{yest}, I_E]$ and I_{POS} would be reversed so that I_{POS} properly contains $[\mathsf{yest}, I_E]$ ($[\mathsf{yest}, I_E] \subset_{\mathcal{T}} I_{\mathrm{POS}}$). Reversing the polarity on these elements reverses the relation of informational strength: the proposition actually asserted is weaker than the alternative propositions corresponding to times earlier than yest and stronger than the alternative propositions corresponding to times later than yest. However, reversing the polarity does not produce scalar implicatures that contradict what is actually said. Updating a context c with the corresponding proposition and set of alternatives as dictated by (44) would yield a nonempty subset of c, consisting of those worlds in which the phase transition occurs in the alternative time immediately preceding yest.[29]

To relate the polarity sensitivity of these items to their scalarity, we first have to distinguish between the full set of alternatives, implicated in scalar implicatures, and a restricted subset of uniform alternatives. Then we need an account that does not capitalize on a systematic conflict between truth conditional content and scalar implicatures. Below I make a brief proposal for such an account. The account accords with Krifka's general program of attributing the polarity sensitivity of PIs to conditions for their use.

In addition to operating on the full set of alternatives associated with a temporal expression in focus, *until*^{P} and *erst* select a designated subset. That subset consists of those alternatives preceding the time denoted by the temporal expression. In general, the presence of designated alternatives among the full set of alternatives signals a special kind of scalar assertion, corresponding to the illocutionary operator *CapAssert*, whose effect is to settle a given issue with respect to the designated alternatives. In other words, the context resulting from such an assertion should either entail, or be incompatible with, any proposition based on a designated alternative. *CapAssert* is associated with the felicity condition in (45), where $Alt(p)$ is the full set of alternatives and $Alt^D(p)$ the designated subset.

(45) *CapAssert* is defined for $\langle p, Alt^D(p), Alt(p) \rangle$, c only if for every $p' \in Alt^D(p)$:
$c \cap p \cap p' = c \cap p$ or $c \cap p \cap p' = \emptyset$

In order for the felicity condition in (45) to be satisfied, the actually asserted proposition must be strong enough that the result of updating a context with it is sufficiently informative to determine the truth or falsity of the designated alternative propositions. For assertions involving *until*^{P} and *erst*, the designated alternative propositions are those corresponding to times earlier than the time denoted by the temporal expression.

As discussed in section 27.5, with *until*^{P} in the scope of negation and with *erst* in a positive environment, the proposition expressed entails the designated alternative propositions. With the polarity reversed, on the other hand, the proposition expressed is not strong enough to settle the truth or falsity of the designated alternatives. For instance, the positive counterpart of (25) would express the proposition in (46) and the negative counterpart of (41) the one in (47).

(46) $\lambda w.(\exists e \in \mathscr{E}_{w,[I_B,\text{yest})})\text{he-leave}(w)(e)$

(47) $\lambda w. \neg(\exists e \in \mathscr{E}_{w,[\text{yest},I_E]})\text{he-leave}(w)(e)$

A context compatible with the departure occurring at any one of the alternative times, once updated with (46) or with (47), will remain compatible with the departure occurring at any one of the alternative times preceding yest. But then it will neither entail, nor be incompatible with, any of the designated alternative propositions.

27.7 Conclusion

Until^P and *erst* are felicitously uttered in contexts that determine that a phase transition within a contextually given interval I occurs at one time among a set of alternatives but are agnostic as to which one. *Until*^{P} is sued to (partially) settle the issue of what that time is by determining how far to the right the presupposed maximal negative phase I_{NEG} extends, *erst* by determining how far to the left the presupposed minimal positive phase I_{POS} extends. *Until*^{P} asserts that I_{NEG} extends up to at least the time asserted and scalarly implicates that it does not extend up to any later time. *Erst* asserts that I_{POS} extends up to at most the time asserted and scalarly implicates that it does in fact extend that far.

Notes

1. As is well known from work on aspect, (a)telicity is not a property of the verbal predicate alone: arguments and modifiers affect the (a)telicity of the resulting complex predicate (e.g., Krifka 1989, 1992).

2. In apparent counterexamples such as *He lent me his laptop until the end of exam period*, the *until*-phrase modifies an implicit result state predication associated with the eventive predicate *lend* (e.g., Piñón 1999). Similarly, apparent counterexamples such as *The light flashed until dawn* are due to implicit iterativity.

3. Unlike *until*, these also have nontemporal scalar uses. They are focus and polarity sensitive in all their uses, for example, in Greek *Dhen ehi para mono DHIO vivlia* 'She only has TWO books'. Like *only*, *para mono* also has a nonscalar reading (see note 18).

4. Hitzeman (1991) and Tovena (1995) also pursue an approach that gives a uniform lexical meaning to *until* but take negation to combine directly with *until* and to be interpreted as a complementation operator on intervals.

5. Giannakidou (2002) is a recent reminder of this argument based on Greek.

6. This is similar for *bis*, the German equivalent of *until*^{D}, except that there is no contrast like that between (14d) and (14e). *Die Bombe ist bis gestern nicht explodiert* 'The bomb didn't explode until yesterday' and *Die Bombe ist/war bis jetzt/gestern nicht explodiert* 'The bomb has/had not exploded until now/yesterday' are both acceptable. Arguably, this may be due to the use of the perfect in both cases, though in the first case the perfect is interpreted in the same way as past tense.

7. This position is also reflected in de Swart's formalization of the scope analysis and of Karttunen's proposal for *until*^{P} in an event-based framework. She treats negation as a modifier on predicates of eventualities in her reconstruction of the scope analysis and as a propositional operator in her reconstruction of Karttunen's proposal.

8. This is consonant with Mittwoch's (2001) recent conclusion that English allows for a dual analysis of *until* as a durative adverbial, involving universal quantification and scoping over or under negation, and as an NPI, involving existential quantification and scoping under negation.

9. The interval denoted by the temporal expression is usually a subinterval of the time of evaluation, in which case intersection just yields the interval denoted by the temporal expression. Examples like *He may arrive today*, where his arrival has to occur in the part of today that is in the future of the time of utterance, versus *He may have arrived today*, where the arrival has to occur in the part of today that is in the past of the time of utterance, show that the semantics of these adverbials needs to make reference to the intersection of the two intervals.

10. The proposals in this chapter are all compatible with sorting in the domain of eventualities. The point of this argument is that the aspectual effect of negation is not reducible to the sortal distinction between states and events.

11. The interpretation actually given by de Swart, namely,

(i) *Not*: $\lambda P \lambda s. MAX(s) \wedge \neg \exists e[P(e) \wedge e \subseteq s]$

runs into a more immediate problem: negation simply yields the set of all maximal states (relative to some time). The negative condition is satisfied trivially, given that the domain of events is assumed to be disjoint from the domain of states.

12. It is also worth noting in this connection that the analysis of negation in (20) or (21) does not give us an individuation of "negative eventualities" that is as fine grained as the intuitive characterization of the approach suggests. For any given world w and time t, there is exactly one state (eventuality) for all the properties of eventualities not instantiated relative to w, t. For example, if I didn't eat during a given stretch of time and you didn't sleep during that time, then the state of my not eating is exactly the same as the state of your not sleeping.

13. Although a universal semantics is common for durative adverbials, it is problematic for eventive P if the domain of quantification is not relativized in some way. The reason is that the structure of events may well be taken to be coarser than the structure of times. For the purposes of this chapter, I simply assume that universal quantification is over times at the same level of granularity as that of atomic eventualities.

14. $I \cap (-\infty, \text{yest} \cap t] = [I_B, \text{yest} \cap t]$ if intersection is defined and $I_B \prec \text{yest}$.

15. For activity predicates, we have to relativize the closure condition to a certain level of granularity.

16. I assume that achievements are properties of nonpoint eventualities, for otherwise they would be divisive trivially. If it turns out that they ought to be analyzed as properties of point eventualities, we would need to appeal to a notion of strict divisiveness such as the following: a unary predicate P is strictly divisive if and only if P is divisive and in any model, either there are no P-entities or some P-entity has a proper subpart.

17. Assuming that *mehri*-phrases select for predicates over states, Giannakidou (2002) takes this fact to show that negation is to yield predicates of events (as in (21)) and not predicates of states (as in (18)) on the grounds that if it were to yield predicates of states, sentences like (14d) would be grammatical. But we have seen that no empirical evidence of this sort can discriminate between these two analyses.

18. At least for English. Greek *para mono* selects against stative predicates. For instance, *Dhen itan thimomenos para mono htes* 'He was not angry except for yesterday' has no scalar reading: it can mean only that he was angry yesterday and at no other time, earlier or later. *Para mono* with activity predicates, on the other hand, can have a scalar reading, equivalent to that of $until^P$. For instance, *Dhen kimithike para mono stis pende* 'He only slept at five' has a reading implying that he fell asleep no earlier than five.

19. Negation, as a hole for presuppositions, is the identity mapping when operating on presuppositional content. Also, $\text{yest} \cap (-\infty, \text{now}) = \text{yest}$.

20. The disjunction has to be exclusive in order for 'A Erst T' to contextually entail NOT (A BEFORE T).

21. This is in accord with Rooth's (1992) theory of focus interpretation, whereby the focus semantic value of an expression in the scope of a focus-sensitive operator constrains the set of alternatives the operator operates on rather than fixing it uniquely.

22. Tense or other aspectual operators do not restrict t^{alt} in any way; the condition $t = t$ is meant to avoid vacuous λ-abstraction while keeping the type of the ordinary semantic value and of the elements of the focus semantic value the same.

23. Mittwoch (2001) uses cases like (34) to argue that on Declerck's analysis the actualization implication is more appropriately seen as an entailment than a presuppositional implication.

24. The identity of I_{NEG} and I_{POS}, therefore, varies across the worlds of a given context.

25. We may add that the earlier alternatives are presumed to be more likely than the later alternatives in order to capture a "later than expected" implication associated with $until^P$. This aspect of the presupposition will not be crucial in what follows.

26. Thanks to David Beaver for suggesting this sort of evidence.

27. On Karttunen's and Declerck's analyses, such qualifications would have to be due to presupposition weakening, rather than cancellation of a scalar implicature.

28. $I \cap [\text{yest} \cap t, +\infty) = [\text{yest} \cap t, I_E]$ if intersection is defined and $\text{yest} \prec I_E$.

29. It would be interesting to investigate if there are languages with scalar but non-polarity-sensitive equivalents of $until^P$ or *erst*. The $until^P$ equivalent would appear to mean 'at' in negative contexts and 'just before' in positive contexts; the *erst* equivalent would appear to mean 'at' in positive contexts and 'just before' in negative contexts.

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