The complex beauty of boundary adverbials: in years and until

Sabine Iatridou & Hedde Zeijlstra

In this paper we discuss two NPI adverbials: *in years* (and its cousins *in days, in months*, etc.) and *until*. We argue that a lot is to be gained by analyzing the two in juxtaposition. We explore *in years* first, following Iatridou & Zeijlstra (2017), and on the basis of our analysis of this item, we proceed to an analysis of *until*. Our approach will also permit a unified account of *until*, the duality in the behavior of which has led the literature to consider it lexically ambiguous. The commonalities between *in years* and our unified *until* will in the end of the paper also lead us to a rationale for why both these boundary adverbials are strong as opposed to weak NPIs.

1 Constant’s Observation

Consider sentences with a negated Perfect, as in (1):

(1) a. The patient hasn’t had a seizure in (the last) 5 years.
   b. The patient hasn’t had a seizure since 2015.

Iatridou (2014) notes that (1) comes with an inference that the patient had a seizure 5 years ago or in 2015 (the “actuality inference”, AI henceforward) but that this inference is cancellable:

(2) A: Has the patient ever had a seizure?
    B: She hasn’t had one in the five years that I have been here. I don’t know about earlier.
    B’: She hasn’t had one since I arrived here. I don’t know about earlier.

(3) She hasn’t had a seizure in the last five years. In fact, she has never had one.

In the negated Perfect, the existence of the event is a conversational implicature and can be cancelled. Iatridou (2014) attributes this implicature to the semantics of the Perfect. Iatridou, Anagnostopoulou & Izvorski (2001), describe a Perfect like (4) as in (5)-(7).\(^1\),\(^2\)

(4) I have visited Cape Cod three times since 1990.

(5) a. There is a time span (the Perfect Time Span/PTS);
    b. The Right Boundary (RB) of the PTS is manipulated by Tense and since (4) is a Present Perfect, RB is the time of utterance (UT);
    c. The Left Boundary (LB) of the PTS is the argument of *since*: (some time in) 1990;
    d. In the PTS there are 3 (non-overlapping) subintervals at which that the speaker visits Cape Cod.\(^3\)

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\(^1\) See von Fintel and Iatridou 2017 for an implementation of Iatridou et al. (2001) in a more formal context.

\(^2\) We leave implicit the condition that t’, t”, t’’’ have to be distinct.
(6) \( \exists t : \text{RB}(\text{UT}, t) \text{ and } \text{LB}(1990, t) \text{ and } \exists' t', t'', t''' \subseteq t : \text{I visit Cape Cod at } t', t'', t''' \)

(7) 1990

<table>
<thead>
<tr>
<th>LB</th>
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|                                                      (the Perfect Time Span/PTS) |

The LB of the PTS can be set by an adverbial (“PTS-adverbs”), as in (4)-(7), or contextually:

(8) I have visited Cape Cod three times (= since the beginning of my life, or since I entered the US).

Now consider a negated Perfect:

(9) I haven’t visited Cape Cod since 1990/in the last 3 years.

Everything in (5)a-c still holds, but negation shows up and the existence of the relevant event(s) inside the PTS is negated. So, for (9), in addition to (5)a-c, we have (10)-(11) instead of (5)d-(6):

(10) It is not the case that in the PTS there is a subinterval at which I visit the Cape.  
    = there is no event of my visiting the Cape in the PTS.

(11) \( \exists t : \text{RB}(u, t) \text{ and } \text{LB}(1990, t) \text{ and } \neg \exists' t \subseteq t : \text{I visit Cape Cod at } t' \)

In short, in the Perfect, the existence of the event in the PTS is part of the assertion. When the Perfect is negated, the assertion is that there is no relevant event in the PTS. If there is a PTS-adverbial like since 1990 or in the last 5 years, a conversational implicature arises that conveys that a visiting event took place prior to 1990 or three years before UT. The reason is that the cooperative hearer will infer that while there is no relevant event in the PTS, there may be one outside the PTS. Otherwise, why would the speaker bother to point out the non-existence of an event in a specific time span? But as we saw in (2)-(3), and as expected, this conversational implicature is cancellable.

Noah Constant (p.c.) made the striking observation that unlike in (1)-(3), in (12) the AI is not cancellable, as shown in (13).

(12) He hasn’t had a seizure in years.

(13) a. He hasn’t had a seizure in years …  
    … #I don’t know about earlier  

b. He hasn’t had a seizure in years. …  
    … #In fact, he has never had one.

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3 The (im)perfective in the Perfect, which plays a crucial role in Iatridou et al. (2001), is here ignored (see also from Fintel and Iatridou 2017).
We refer to this observation as ‘Constant’s observation’. Constant’s observation holds for all $in+$Bare-Plural-Temporal-Noun combinations: $in$ days, $in$ months, $in$ ages, $in$ weeks, $in$ hours. When using $in$ years, we will be referring to this entire class of adverbs. The question thus arises as to why the AI with $in$ years is not a cancellable conversational implicature. It is this question that we address in the first part of this paper. On the basis of the conclusions reached about Constant’s observation, we will examine adverbials headed by until in the second part, and explore the larger significance of our findings.

2 Two more non-cancellable inferences

We saw that the AI is not cancellable when the negated Perfect contains $in$ years. Now we will see that there are two further inferences that are again non-cancellable when the negated Perfects contains $in$ years, but can be cancellable with other negated Perfects.

2.1 The Time-of-Event Inference

Consider (1)a, repeated below:

(14) The patient hasn’t had a seizure in (the last) 5 years.

In (14), there is an inference that the (last occurrence of a) seizure was five years ago. In other words, there is an inference that the event happened at the LB of the PTS. We call this the Time-of-Event Inference, TI henceforward. The source of this TI is intuitively clear: the hearer interprets the fact that the speaker chose a particular point in time to assert that there was no relevant event after it and the hearer attributes this choice to the possibility that that point in time was not “event-free”. In other words, that is a point in time where the (most recent) event occurred. But the LB-time-of-event inference is also cancellable. Interestingly, it is cancellable independently from the AI. Consider (15).

(15) There is a law according to which one cannot apply for a pilot license if one has had a seizure in the last 5 years. That is, in order to apply, one must be 5 years seizure-free. It is now 2016. Sue had a seizure for the last time in 2007. Sue has not had a seizure in (the last) 5 years, so she is eligible to apply

In the context in which (15) is uttered, there clearly is an event of the relevant sort, since Sue had a seizure in 2007. So this is not a case where the AI is cancelled. But the event happened well before the last 5 years. In other words, with $in$ the last 5 years, we have a way to compute the LB of the PTS (in the case of (15) this is done by a contextually given point in time) and it is clear that the event itself does not have to be at LB. In short, (14) has a cancellable AI, as well as a cancellable TI. Moreover, we saw that TI can be cancelled even when the AI is not cancelled.

With $in$ years, though, it is not just the AI that is non-cancellable (“Constant’s Observation”), the TI is non-cancellable too. That is, with $in$ years, the event must be at the LB. It is not possible for the LB of the PTS with $in$ years to be something other than the event, as was possible in (15). For instance, for some older person that visited Amsterdam for the last time when he was a kid, it is impossible to say (16)a. The person can only say (16)b.
(16)  a.  #I haven’t visited Amsterdam in months; the last time I was there was when I was a kid
    b.  I haven’t visited Amsterdam in years; the last time I was there was when I was a kid

The example in (16)a does not violate the AI. The oddness of (16)a shows then that the relevant event cannot take place before the LB: its LB is months ago, but the event happened years ago. In other words, the TI of in years is not cancellable.

That the relevant event must take place at the LB of the PTS of in years and not before is not a trivial fact. After all, there could have been another candidate for the LB: in years might have been able to stretch backwards from RB until it found and “hooked onto” either another kind of contextually salient event or time point, as example (20) shows is possible with other LB-adverbials. But we will see next that this is not possible with in years.

Imagine a scenario in which Fred is 55 years old. He had a paralyzing accident when he was 40. Moreover, he used to drive a car, but he stopped when he was 30. That is, the reason he stopped driving is not the accident. Now consider (17):

(17)  a.  #Fred hasn’t driven in years, already 15 years now.
    b.  Fred hasn’t driven in years, already 25 years now.

If the LB could have been set by the contextually salient event (the accident), the boundaries of the PTS and therefore the PTS itself would be defined, and (17)a would be predicted to be fine. However, (17)a, is odd in this context, which shows that in years cannot pick as LB a time point or an event other than that of the VP, however high its salience. That is, in (17)b, in years can only (try to) pick out as LB a previous (in fact, the most recent) driving occasion, and cannot pick as LB the paralyzing accident. This confirms that neither the AI, nor the TI can be cancelled with in years. So in years stretches backwards from RB until it finds and “hooks onto” the relevant event.

We can say that there is a deeper truth to Constant’s observation then. The role of the event described in the VP in sentences with in years is different from the role it plays in sentences with adverbials like in (the last) 5 years, or since-adverbials. The difference between these two classes of adverbials does not just lie in the cancellability of the AI. With in years, the “actuality-at-LB” (TI) is also not cancellable. Next we discuss yet another inference that sets in years apart from other PS adverbials.

2.2  The Beyond Expectation Inference

In examples like (18) nothing is said about whether the speaker is surprised about the length of the PTS, that is, the length of the interval throughout which John did not have a seizure. This sentence can be uttered in a context where John used to have a seizure very often, so that the speaker is surprised that it has not happened in the last 5 years. It can also be uttered in a situation where due to a medication that John had been taking for the last 10 years, the speaker had expected there to be no seizure at all in the last 10 years. Finally, (18) can be also uttered if the speaker has no expectation at all. If the doctor would ask whether John has had a seizure in
the last 5 years, the speaker could simply answer with (18) as well, without indicating any surprise or other expectations.

(18) John hasn’t had a seizure in (the last) 5 years

This is not the case with *in years*. This adverbial conveys that the event took place earlier than the speaker had expected or hoped for. For instance, (19) shows that when uttering a sentence containing *in years / in months / in days*, the speaker conveys that the visiting event was expected to have taken place more recently than it did. That is, the expectation is that the event-free PTS would have been shorter:

(19) I know May does not like to visit our common aunt Trudy. So when I visited aunt Trudy myself, I expected to hear that May had not been there in the last few weeks. But, it was …

a. … worse than I thought. She had not been there in months.

b. … better than I thought. She had not been there in days.

(compare to … better than I thought. She had been there just the day before/very recently)

What an utterance containing *in years* conveys is that there is some contextually relevant PTS that forms a weaker alternative to the *in years* utterance. We refer to this third inference as the “Beyond Expectation Inference”, henceforward BEI. BEI states that the event took place beyond a contextually set expectation.

In total, then, *in years* comes with three inferences that *in (the last) 5 years* lacks: a non-cancellable AI and TI and the BEI. We will try to see now how these properties can follow from the formal semantic properties of this type of adverbial.

3 Formal properties of the *in years* class

The *in years* class has two formal properties that distinguish them from other adverbials and that therefore may form the source of the unexpected behavior of *in years*. First, they are so-called PTS adverbials. Second, they are (strong) NPIs. Let’s look at each property in some detail.

3.1 In years as a PTS-adverbial

In the Perfect, the RB of the PTS is manipulated by Tense: in the Present Perfect, RB is at UT, in the Past Perfect, RB is before UT, and in the Future Perfect, RB is after UT (See Iatridou et al. 2001, Iatridou 2014, von Fintel and Iatridou 2017). The LB of the PTS, on the other hand, can be set by adverbials, or as we saw above, contextually. PTS-adverbials set the LB either by specifically naming it, like the *since*-adverbial in (20), or by counting backwards from the RB, like the *for*-adverbial in (21) (see Iatridou et al. 2001 and references therein):

(20) I have visited Cape Cod three times since 1990

(21) For 5 days he has been sick with the yellow fever
The PTS-adverbial *in years* behaves like the *for*-adverbial in that it stretches backwards from RB. In (22)a, it stretches backwards from the utterance time UT, which is the RB because we are dealing with a Present Perfect. In (22)b, it stretches backwards from an RB that is before UT because of the Past Perfect:

(22)  
   a. He hasn’t shaved in days  
   b. I saw him last week. He had not shaved in days

However, unlike *for*-adverbials, which can be both PTS- or VP-level adverbials (Dowty 1979), *in years* is only a PTS-adverbial, that is, it cannot appear outside the perfect:

(23)  *He didn’t go to the movies in years*  
   (vs. He hasn’t been to the movies in years)  
(24)  *I didn’t exercise in years*  
   (vs. He hasn’t exercised in years)  
(25)  *I didn’t eat bananas in years*  
   (vs. I haven’t eaten bananas in years)

In short, *in years* is only a PTS-adverb, not a VP-level adverb, and it sets the LB by stretching backwards from RB until it finds the first (i.e. the most recent) event of the VP-sort. We also saw that *in (the last) 5 years* and *since*-adverbs do not behave this way. However, these are also PTS-adverbs. So it can’t be the case that the need of *in years* to place the time of the VP-event at LB (TI) is due to it being a PTS adverbial, nor does the BEI inference follows from it. Hence, another property of *in years* must be relevant.

### 3.2 In years as a (strong) NPI

Another important characteristic of *in years* (and its cousins *in minutes, in days* etc.) is that it is an NPI (Horn 1971, Zwarts 1989, Hoeksema 2006):

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4 *For*-adverbials are both PTS-adverbials and VP-level adverbials (Dowty 1979, Iatridou et al. 2001)). Similarly, *in 5 years* can appear both in perfect, as already seen, as well as in simple past sentences:

i. He wrote 5 books in 5 years

In simple past sentences *in 5 years* measures out the time of the culmination of a telic event:

ii. He walked to the park in 5 hours (=It took him 5 hours to walk to the park)

iii. #He walked in the park in 5 hours

But with the Negated Perfect, the requirement for telicity goes away (and obviously this is not due to a “stativizing” effect of negation, as VP-level *for*-adverbials are not compatible with the subinterval property):

iv. He has not walked in the park in 5 hours

So *in 5 hours* is both a PTS- and a VP-level adverbial. It measures out the time of culmination when it is a VP-level adverbial (i-ii). When it functions as a PTS- adverbial (iv), it measures the PTS. The PTS usage of *in 5 years* is not restricted to negative sentences, as is shown in (v), where it is clear that it does not have to measure the time of culmination of the book- or paper-writing. The fronted position is compatible only with PTS-level readings of adverbials that can in principle be either PTS-level or VP-level (cf. Dowty 1979, Iatridou et al. 2001):

v. In 5 years, he has written a book and 5 papers
(26)  a. He hasn’t had a seizure in years
    b. *He has had a seizure in years
    c. Nobody has had a seizure in years
    d. *Somebody has had a seizure in years

Moreover, *in years* is a so-called strong NPI, that is, it is only licensed by anti-additive contexts (such as *not* or *nobody*) and not by other downward entailing contexts, such as *few* or *at most* (Zwarts 1989).  

(27)  a. *Few patients have had a seizure in years
    b. *At most 10 patients have had a seizure in years

By contrast, *since*-adverbials and *in (the last) five years* are not NPIs:

(28)  He has had two seizures in (the last) 5 years/ since 1990

We will see next how the NPI-ness of *in years* is the key to Constant’s observation.

4 Deriving Constant’s observation

For Kadmon & Landman (1993) and others, NPIs extend the contextually restricted domain of quantification. That is, they make the domain of quantification bigger than what would otherwise be contextually expected. This domain-widening property is for them (partly) responsible for NPIs being NPIs. Kadmon & Landman (1993: 360) present the following example to show this:

(29)  YOU: Will there be French fries tonight?
    ME: No, I don't have potatoes.
    YOU: Maybe you have just a couple of potatoes that I could take and fry in my room?
    ME: Sorry, I don't have ANY potatoes

For Kadmon & Landman (1993) domain wideners like *any* are subject to a strengthening requirement that forces the utterance containing the domain widener to be stronger than its non-domain widening alternatives: the utterance in (29), which contains *any potatoes* must be stronger than the utterance in (29), which contains just *potatoes*. Since extending the domain of quantification of an existential quantifier in a positive context makes the utterance less informative (*I saw a car* is less informative than *I saw a BMW*), this strengthening requirement can only be met if the existential is embedded in environment that reverses inferences, i.e. in downward entailing contexts. This, for Kadmon & Landman, makes domain wideners like *any* NPIs.

The description of NPI *in years* from this perspective is quite fruitful: The choice of NPI adverbials *in years* (and *in days, in minutes*) can be seen to have a similar effect. It conveys that the domain of quantification (the PTS) is larger than a contextually salient interval. Also, *in minutes* conveys that the domain of quantification is larger than a contextually salient amount of minutes, etc. This is the BEI, which we saw earlier. Here are some more examples:

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5 Though see Gajewski 2011 for a discussion of the mixed properties of *few* in this regard.
(30) a. He hasn’t drunk anything in 5 minutes
   b. #He hasn’t drunk anything in minutes
   c. He hasn’t drunk anything in days

(31) a. He hasn’t taken a breath in minutes
    b. #He hasn’t taken a breath in seconds

As we saw above, these facts confirm the BEI of *in years*: the event took place earlier than expected. And remember that ‘earlier than expected’ means that the PTS is longer than expected. It is in this sense that *in years* can be seen as widening the domain of quantification. Hence, the question arises as to how *in years*’s status of domain widener can be derived, and whether and how the other inferences of *in years* follow from its status as domain widener as well.

More recent approaches to NPI-hood, such as Krifka (1995) and Chierchia (2006, 2013), adopt Kadmon & Landman’s insight that domain widening elements are generally prone to be NPIs, but argue that the property of domain widening itself does not underlie NPI-hood. Following Krifka (1995), the reasons why Chierchia, whose recent account of NPI-hood we adopt here, rejects domain widening as such as the primitive source of NPI-hood are twofold.

First, it is argued that the original account by Kadmon & Landman is non-compositional: their strengthening requirement, i.e. the requirement that an utterance containing an NPI can only be used if the utterance with the NPI is stronger than the one with its non-NPI counterpart, does not follow from the lexical meaning of any NPI. Second, not every NPI is always used as a domain widener. Chierchia points out that out of the blue, a sentence like (32)b can be uttered without any domain widening effect. Only in contrast with an alternative like (32)a does the domain widening effect arise.

(32) a. I don’t have eggs
    b. I don’t have any eggs

Under Chierchia’s approach, the flagship characteristic of NPIs is not domain widening as such, but the fact that NPIs introduce subdomain alternatives and that the sentences they occur in are obligatorily exhaustified.6 NPI-hood is then a necessary, but not sufficient condition for domain widening. Domain widening comes about when an item introduces subdomain alternatives is contrastively stressed, an issue we will return to later.

In general, exhaustification has the result that all alternatives that are stronger than the assertion, are made false. This is what happens in this case as well. With indefinites/existentials and other lower scalar endpoints, the result of these requirements is a logical contradiction that is responsible for the ungrammaticality when the NPI is outside a downward-entailing context.

To see this, suppose there is a domain of quantification involving three books (\{b_1, b_2, b_3\}). Then the denotation of *I have any book* (without the exhaustifier applying) would be that I have at least one of these three books (given that *any* is an indefinite / existential). Then, for Chierchia, a sentence like *I have any book* introduces subdomain alternatives, such as ‘I have a book that is a member of the set \{b_1, b_2\}’, or ‘I have a book that is a member of the singleton-set \{b_3\}’. These alternatives with smaller domains of quantification are logically stronger than the

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6 For Chierchia 2013 those are two separate properties of NPIs. See Zeijlstra 2017 for an attempt to derive the requirement for exhaustification from the fact that NPIs introduce domain alternatives.
original sentence: for instance, ‘I have a book that is a member of the set \{b_1, b_2\}’ entails ‘I have a book that is a member of the set \{b_1, b_2, b_3\}’, not the other way round. Now, when the sentence I have any book is exhaustified, all stronger alternatives are negated. In other words, ‘I have a book that is a member of the set \{b_1, b_2\}’ will be false, and ‘I have a book that is a member of the singleton-set \{b_3\} will be false, as these are the stronger alternatives.

But then we have arrived at a contradiction: the assertion of I have any book is that I have at least one of the books of the set \{b_1, b_2, b_3\}, but the exhaustification of alternatives conveys that I don’t have a book of the set \{b_1, b_2\} and that I don’t have a book of the set \{b_3\}. This is a contradiction. And as Chierchia follows Gajewski (2002) in assuming that logical contradictions trigger ungrammaticality judgements, this renders unacceptable sentences which contain an unlicensed NPI.

Once an NPI is embedded under scale-reversing (i.e. downward entailing) operators, before it is exhaustified, the domain alternatives do not yield stronger propositions, as the entailment relations are reverse: ‘I don’t have a book that is a member of the set \{b_1, b_2, b_3\}’ entails ‘I don’t have a book that is a member of the set \{b_1, b_2\}’ or ‘I don’t have a book that is a member of the singleton set \{b_3\}’, not the other way round. Under the scope of a downward entailing operator there are no domain alternatives that yield stronger propositions. Therefore, the domain alternatives of a sentence like I don’t have any book do not yield a contradiction under exhaustification. Exhaustification takes place vacuously. A sentence with an NPI under the (direct) scope of a downward entailing operator is no longer contradictory and therefore fine.

Under this approach, NPIs are not domain wideners as such, but elements that introduce domain alternatives. Nothing forbids setting the domain of quantification freely, but as Chierchia points out, whenever NPIs are used contrastively against some contextually set domain of quantification, as for instance in the orginal example from Kadmon & Landman (29), the NPI’s domain of quantification must be stretched beyond these contextual restrictions. Once contrastively stressed, NPIs are again domain-wideners in the sense of Kadmon & Landman. Or as Chierchia (2013: 36) puts it in discussing any: when contrastively stressed, any acts as a “domain widener”, but when it is not contrastively stressed it is interchangeable with a plain indefinite.

Chierchia (2013: 217) argues explicitly that the same mechanism does not only apply to NPIs like any, but is also the case for temporal in-adverbial NPIs, such as in weeks. That is, in years is an element that introduces subdomain alternatives, it is subject to an exhaustification requirement, and it is contrastively stressed. This is exactly the focus of our investigation, so we need to lay out where we agree and where we disagree with Chierchia (2013). More specifically, Chierchia takes utterances containing expressions like in years or in weeks to have a denotation as follows (after Chierchia: 2013: 218):

\begin{align*}
\text{(33)  \\ a.  \\ & *\text{Joe has met Mary in weeks} \\
& \exists e [\text{met}_m(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{WEEKS}] \\
& \text{cul = culminated and } \tau(e) = \text{the temporal span of } e \text{ and } \subset \text{ stands here for temporal inclusion} \\
& \text{b.  \\ & There is a culminated event of Joe meeting Mary whose temporal span is included in a period of one or more weeks long} \\
\end{align*}

Once it is assumed that (33)a introduces domain alternatives of the kind as in (34)a, the NPI-
If a culminated event takes place in a subinterval of \(\tau\), it also takes place in \(\tau\), whereas the reverse does not hold. That means that all alternatives in (34)b entail (33)b. Exhaustification then has the result that all alternatives that are stronger than the assertion are made false, which means that all the alternatives of the kind in (34)b must be false. Then we reach a logical contradiction. If in no subdomain of \(D\) a meeting event took place, it cannot have taken place in \(D\) either. This contradiction does no longer hold when the sentence is embedded under negation. Since (35) entails all alternatives in (36), exhaustification takes place vacuously.

(35)  
\begin{align*}
\text{a.} & \quad \neg \exists e [\text{met}_w(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{WEEKS}] \\
\text{b.} & \quad \exists e [\text{met}_w(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{WEEKS}]
\end{align*}

\text{cul = culminated and } \tau(e) = \text{the temporal span of } e \text{ and } \subset \text{ stands here for temporal inclusion.}

(36)  
\begin{align*}
\text{a.} & \quad \neg \exists e [\text{met}_w(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{D}] \\
\text{b.} & \quad \exists e [\text{met}_w(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{D}]
\end{align*}

Hence, assuming that \textit{in years} introduces subdomain alternatives captures that it is an NPI. When such NPIs are used contrastively, it is further derived that they are domain wideners.

However, while we adopt Chierchia’s general approach towards NIPs, we do not adopt his specific proposal for \textit{in years}. The reason is that in it, there is no reason why \textit{in years} should behave differently from other PTS adverbials. Chierchia takes utterances containing expressions like \textit{in years} or \textit{in weeks} to have a denotation as in (33). But this denotation leaves it as a coincidence that \textit{in years} requires the perfect, and how it interacts with Tense. But more crucially, with Chierchia’s semantics, it is left as a mystery why with other PTS adverbials, the AI is cancellable, but with \textit{in years} it is not (‘Constant’s observation). Therefore, while we will keep to Krifka’s and Chierchia’s general approach to NPIs, we will go our own way for the \textit{in years} class.

We start by resetting some of (33) in the Iatridou et al. (2001) frame in (37). Most notably, the culmination referred to in (37)e is the result of the Perfective that is part of the Perfect participle, which contributes the meaning that the time of event/situation (ST) is included in the evaluation time/topic time (TT): ST \(\subseteq\) TT (Klein 1994 and many others).\(^7\) As TT here is the PTS, the meaning of this sentence includes (38)d.

(37)  
\begin{align*}
\text{a.} & \quad \neg \exists e [\text{met}_w(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{WEEKS}] \\
\text{b.} & \quad \exists e [\text{met}_w(e, j, m) \land \text{cul}(e) \land \tau(e) \subset \text{WEEKS}]
\end{align*}

\text{Hence, assuming that \textit{in years} introduces subdomain alternatives captures that it is an NPI. When such NPIs are used contrastively, it is further derived that they are domain wideners.}

\text{However, while we adopt Chierchia’s general approach towards NIPs, we do not adopt his specific proposal for \textit{in years}. The reason is that in it, there is no reason why \textit{in years} should behave differently from other PTS adverbials. Chierchia takes utterances containing expressions like \textit{in years} or \textit{in weeks} to have a denotation as in (33). But this denotation leaves it as a coincidence that \textit{in years} requires the perfect, and how it interacts with Tense. But more crucially, with Chierchia’s semantics, it is left as a mystery why with other PTS adverbials, the AI is cancellable, but with \textit{in years} it is not (‘Constant’s observation). Therefore, while we will keep to Krifka’s and Chierchia’s general approach to NPIs, we will go our own way for the \textit{in years} class.}

\text{We start by resetting some of (33) in the Iatridou et al. (2001) frame in (37). Most notably, the culmination referred to in (37)e is the result of the Perfective that is part of the Perfect participle, which contributes the meaning that the time of event/situation (ST) is included in the evaluation time/topic time (TT): ST \(\subseteq\) TT (Klein 1994 and many others).\(^7\) As TT here is the PTS, the meaning of this sentence includes (38)d.}

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\text{\(^7\) In a different notation: ‘\([\text{PRF } \phi]') = 1 \text{ iff } \exists t' \subseteq t': ‘\([\phi]') = 1. \text{ See von Fintel and Iatridou (2017) for references.}'}
e. In the PTS there is a (culminated) event of Joe meeting Mary

or equivalently:

(38) a. *Joe has met Mary in weeks
b. There is a time span (the Perfect Time Span/PTS)
c. The Right Boundary (RB) of the PTS is manipulated by Tense and since (37) is a Present Perfect, RB is the time of utterance (UT)
d. The PTS is weeks long
e. In the PTS there is a (culminated) event of Joe meeting Mary

(39) \( \exists t : \text{RB(UT, t) and LB (t - weeks, t) and } \exists t' \subseteq t : \text{Joe meets Mary at } t' \)

Once it is assumed that the PTS in (37)-(39) introduces domain alternatives, the NPI-hood follows:

(40) a. Joe has met Mary in \( t' \), where \( t' \) is a subdomain of the PTS \( t \)
b. \( \exists t' : \text{RB(UT, t) and LB (t - weeks, t) and } \exists t' \subseteq t : \text{Joe meets Mary at } t' \)

If an event takes place in a subdomain of the PTS \( t' \) smaller than \( t \), it also takes place in \( t \), whereas the reverse does not hold. That means that all alternatives in (40)b entail (39). Exhaustification results in all alternatives that are stronger than the assertion being made false, which means that apart from (39) all alternatives of the kind in (40)b must be false. Then we reach a logical contradiction. If in no subdomain \( t' \) of the PTS a meeting event took place, it cannot have taken place in the PTS either. Again, this contradiction no longer holds when the sentence is embedded in a downward entailing context. Since (41) entails all alternatives in (42)b, exhaustification takes place vacuously, as there is no stronger alternative that is to be negated anymore.

(41) \( \exists t : \text{RB(UT, t) and LB (t - weeks, t) and Joe does not meet Mary in } t \)

(42) a. Joe has met Mary in \( t' \), where \( t' \) is a subdomain of the PTS \( t \)
b. \( \exists t' : \text{RB(UT, t) and LB (t - weeks, t) and } \exists t' \subseteq t : \text{Joe does not meets Mary in } t' \)

Hence, under our revised representation of *in years*, couched within Iatridou et al. (2001), von Fintel & Iatridou (2017), it still follows under the general approach to NPI-hood as formulated by Chierchia, that once *in years* introduces smaller subdomains of the PTS as domain-alternatives and once it is contrastively stressed, it acts as domain widener. Now, if we want to derive the special inferences of *in years* from its status as a domain widener, within Chierchia’s system we need to assume that *in years* is always contrastively stressed, an assumption that Chierchia certainly makes and on which we are happy to follow him. Since there is always some stress involved with temporal *in*-adverbs such as the *in years*, which is not surprising given that
they are used as emphatic elements (Krifka 1995), they should indeed behave as domain wideners in the aforementioned sense.\(^8\)

Thus we take *in years* to be a domain widener that stretches its domain of quantification beyond any contextual restrictions. Since, the domain of quantification in the case of *in years* is the PTS, contextual restrictions that may normally apply to the PTS no longer do so. Thus, *in years*, has to do two jobs: being a PTS-adverb, it has to set the LB of the PTS, and being a domain widener, it has to widen, i.e., extend the PTS as much as possible. As we already saw, *in years* is like PTS for-adverbials in that it sets the PTS not by naming it (like *since*-adverbials do) but by stretching backwards from the RB (which is set by Tense). Putting the last two properties together, the result is that *in years* must stretch backwards as far as possible from the RB.

Then, there are two seemingly conflicting requirements on *in years*. On the one hand, it needs to set the LB; on the other hand, it needs to stretch backwards as far as possible from RB, beyond any contextually salient alternatives. How can it satisfy both requirements at the same time? We suggest that this conflict is resolved in such a way as to give rise to the facts that we have called Constant’s observation and the other unexpected properties of *in years*.

The *in years*-adverbial stretches backwards as much as is logically possible, beyond any contextual restrictions. That is, it stretches backwards from RB until the point where the sentence would become false. Where is that point? The point in time which *in years* cannot skip over on its stretch-backwards-from-RB path is the point in time where an event of the relevant sort took place. Stretching the PTS any further back would make the sentence false, as the assertion is that no event of the relevant sort occurred in the PTS. In the example at hand, *in years* can stretch the PTS back until the first seizure that it meets, which is effectively the most recent seizure (the example is schematized with the RB at UT, as in a Present Perfect):

(43) Seizure 1……………….Seizure 2……………………………. RB: UT
    ←-----------------------------------

The occurrence of an event of the relevant sort is thus necessary because it enables the resolution of conflicting requirements on *in years*, to both set the LB and to set it as far as possible backwards from RB. This explains why with *in years*, there *must* be an event of the relevant sort (Constant’s observation), why that event *must* occur at LB (TI), and why the time of the event is earlier than any other contextually salient alternatives (BEI). We saw that none of these facts holds with other PTS adverbials.

This, then, derives Constant’s observation, i.e. the non-cancellability of the AI with *in years*, as well as the non-cancellability of the TI inference, and the BEI. Crucial is that the occurrence of the prior event is not asserted by the semantics of the negated Perfect, unlike in Chierchia’s semantics for *in years*. However, a negated Perfect, like any Perfect, presupposes that the LB of the PTS exists, as the PTS, like any interval can only be defined by virtue of its boundaries. In the case of *in years* the LB can only be set if there is a prior event: no other option

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\(^8\) Naturally, this leads to question as to how the inherent stress of *in years* must be encoded. We remain agnostic as to whether that is lexically encoded (i.e., *in years* would be inherently accented or stressed), or whether this follows from the prosodic configuration that *in years* appears in. As Edward Fleming (p.c.), pointed out to us, it does not seem possible to check this phonetically because given that *in years* has to be in the scope of negation, and appears therefore at the right edge of the clause, the stress contour that it receives would be the same regardless of the presence or absence of stress. However, the fact that empirically *in years* always carries some stress, suffices for our argument.
is logically possible. Therefore, the unacceptability that arises when there is no prior relevant event, is the result of a presupposition failure. To be precise: the presupposition is not that there be an actual event; the presupposition is that there be a LB to the PTS (see section 10 for more discussion). But with the specific LB-adverbial, satisfying the latter presupposition, leads to the existence of an event that functions as the LB. This is different from the case of in (the last) five years, where the two inferences (the AI and the TI) are conversational implicatures and therefore cancellable, and where BEI is absent.

5 Until-adverbials

Next let us look at until, the head of an adverbial that looks superficially quite different from in years. We will provide arguments that the two should be studied in juxtaposition because despite appearances, they share many properties, including the non-cancellable AI/TI and the BEI. We will explore their similarities and differences and draw larger conclusions.

5.1 Two types of until

There is a lexical item often called ‘durative until’ (henceforth ‘until-d’) which appears with statives or progressives (basically predicates with the subinterval property, differently put, predicates with the imperfective) and which sets the RB of an interval throughout which the predicate holds. We will name this interval after its RB, UTS (‘Until Time Span’). The argument of until-d can be an NP or clausal:9

(44) He was asleep/sleeping until 5pm/my departure
(45) He was asleep/sleeping until I left

Unsurprisingly, nothing is said about whether the predicate holds after the time specified by until-d, that is, outside the UTS. Examples (44)-(45) may suggest that the sleeping ended at 5pm or at my departure. We call this inference the Change of State Inference (CoSI), an inference very similar to the earlier discussed cluster of AI and TI, but since (44)-(45) involve states and not events we use different terminology. The sentences in (44)-(45) have nothing to say about what goes on beyond that interval, and CoSI, based on Gricean reasoning, should always be cancellable. This is the case when, for instance, ignorance is expressed (46) or when it is explicitly stated that the predicate holds beyond the RB of the UTS (47).

(46) He was asleep until 5pm and possibly well beyond that. I’m not sure.
(47) He was asleep until 5pm and well beyond that.

So until-d sets the RB of the UTS, not unlike what we saw in the earlier sections, where PTS-adverbials like since and in years set the LB of the PTS.10 We will use the term boundary

9 In the examples we use in this and the next few sections, the arguments of until are all points in time, leaving open for now the question of how the RB is set when the argument of until refers to a (longer) time interval, as in I was working in Paris until the nineties. We will come back to such examples towards the end of the paper.

10 As with the PTS, Tense manipulates RB, which means that Tense tracks the time of the argument until-d:

i. She was asleep until 9pm yesterday
ii. She will be asleep until 9pm tomorrow
adverbial for adverbials that set the boundary of an interval, regardless of whether they set the LB or RB. In other words, *in years, since, in (the last) 5 years, until-d* and others, are boundary adverbials.\textsuperscript{11} But we also see that until-d is a mirror image boundary adverbial compared to *since* and *in years* in that they set opposite boundaries.

When a sentence with until-d and a durative predicate is negated, an ambiguity arises:

(48) He was not asleep until 5pm/ until I left

The sentence in (48) merely asserts that there was no sleeping that reached the RB of the UTS. It is not specified whether there was no sleeping at all, or whether there was some sleeping which terminated before the RB of the UTS. We will use the existing and transparent terms *throughout-not* and *not-throughout* for the two cases respectively. From (48) it is unclear whether we are dealing with vagueness or ambiguity. However, (49) seems to argue in favor of scopal ambiguity, since these sentences have the *throughout-not* reading much more pronounced. (possibly *not-throughout* is marginally acceptable if the sentence is understood as containing meta-linguistic negation):

(49) Until 5pm/ Until I left, he was not asleep.

Perfective predicates provide a contrast with sentences like (44)-(45):

(50) *She left until 5pm / my departure / I left

One might say that the ungrammaticality of such a sentence is not surprising, if *until* truly requires a predicate with the subinterval property. However, later on we show that a different approach to the ungrammaticality of (50) is necessary.

Famously, upon the introduction of negation, the sentence becomes grammatical (cf. Karttunen 1974 among many others):

(51) She didn’t leave until 5pm / my departure / I left

Equally famously, this sentence has a non-cancellable CoSI (the joint effect of the non-cancellable AI and TI in the previously used terminology). That is, it is not possible to deny that she left at the specified time, as evidenced by the contrast between (52) and (53):

(52) She didn’t leave until 5pm / my departure / I left

# … I don’t know if she left later
# … in fact, she didn’t leave at all.

(53) She didn’t leave when I left …

… I don’t know if she left later
… in fact, she didn’t leave at all.

5.2 *The lexical ambiguity approach to until*

\textsuperscript{11} This also shows that the term *until-d* is not appropriate, since it is not the adverbial clause that is durative but the predicate it modifies. We will continue using the term for now, however.
The fact that *until* in (51) comes with a non-cancellable AI has traditionally been considered a strong argument in favor of the position that the occurrence of *until* in these sentences is a different lexical item from *until*-d, whose CoSI is cancellable. And, as we showed above, it is not actually just an AI, but a CoSI, which is a combination of an AI and a TI, which conveys that the event took place at the RB of the UTS, that differentiates *until* in (51) from *until*-d (see also Condoravdi 2008). The occurrence of *until* in (51) has been called *punctual until* (*until*-p), and is considered an NPI, since the non-cancellable CoSI (the flagship characteristic of *until*-p) surfaces only under negation.

Karttunnen (1974), Declerck (1995), Giannakidou (2002), Condoravdi (2008), inter alia, argue that there are two arguments in favor of a lexical ambiguity (*until*-d and *until*-p): The first one is that there are languages with different phonetic exponents for the two meanings. The second one concerns the behavior of the AIs/CoSIs mentioned. There are a few difficulties with both arguments, however. In addition, the lexical ambiguity approach faces certain problems of its own. We will explore both types of problems. We start with the alleged advantages of the lexical ambiguity approach.

5.2.1 *The cross-linguistic argument*

Let us start with the claim that there are languages that have two different items for the two *untils*. Despite prior claims in the literature about such languages, for instance Greek and Czech, we will see that those languages there is actually no morphological *until*-p versus *until*-d distinction.

**Greek**

Giannakidou (2002) and Condoravdi (2008) argue that *until*-d in Greek is *mexri*, while *until*-p is *para* (*mono*). Here is one example of *para* *mono* from each paper, with the glosses and translations as given by the authors:

(54) I prigipisa dhen kimithike para monon ta mesanixta Giannakidou (2002)

The princess not slept.prf.3s but only the midnight
‘The princess didn’t sleep until midnight’ =
It was only at midnight that the princess fell asleep

(55) Dhen thimose para mono htes Condoravdi (2008)

Neg get-angry but for only yesterday
‘He didn’t become angry until yesterday’

However, it is far from clear that *para* *mono* is the Greek version of NPI *until*-p. First of all, *para* *mono* has a broader life than *until*-p, in that it is an NPI exceptive (similar to French *ne*… *que*):

(56) Dhen vlepo para mono tin Miranda

neg see.1sg para mono the Miranda
‘I see no one except Miranda’ / ‘I see only Miranda’

---

12 It is important to note the equivalence of the English sentences with *only*, though it is hardly surprising that what some languages do with exceptives, other languages do with *only*. See von Fintel and Iatridou (2007) for another such phenomenon.
What we see in (56)-(61) is the exceptive *para mono* on a variety of arguments and adjuncts. Giannakidou’s and Condoravdi’s examples in (54)-(55) can be analyzed exactly as instances of this exceptive with a temporal adjunct as its argument:

(62)  I prigipisa dhen kimithike para mono ta mesanixta
     The princess not slept para mono the midnight
     ‘The princess didn’t fall asleep except at midnight’ / ‘The princess fell asleep only at midnight’

(63)  dhen thimose para mono htes
     Neg get-angry para mono yesterday
     ‘He didn’t get angry except yesterday’ / ‘He got angry only yesterday’

We see that if we look at temporal adjuncts within the paradigm of the exceptive uses of *para mono*, we can reproduce exactly Giannakidou’s and Condoravdi’s alleged until-p sentences. The meanings of (62)-(63) are exactly those described in the until-p narratives: There was no falling asleep/getting angry except at midnight/yesterday. That is, the falling asleep / getting angry is part of the assertion of sentences with *para mono*.

In other words, with the right semantics for the general exceptive applied to the temporal argument, we can create the same meaning as the highly specialized until-p. But this undermines the position that *para monon* is until-p. If we took the position that *para monon* is until-p, we would have to explain why the general exceptive cannot take a temporal argument which would produce the very same meaning. That is, we would have to exclude the derivation of (62)-(63) via the exceptive route. In addition, we would have to explain why Greek until-p has a homophony with an exceptive. And of course the position that *para mono* is ambiguous between an exceptive and until-p is even harder to defend in itself.

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13 Here is a place where Greek *para (mono)* differs from the French *ne...que...*: the latter cannot appear on subjects, but *para (mono)* can, as long as the subject is post V(P). Maybe this fact reduces to the fact that French does not have post-VP subjects the way Greek, a pro-drop language, does.
The position that *para mono* is until-*p* becomes even more untenable when we see that *para (mono)* is compatible also with non-punctual, i.e. imperfective predicates. This seems hard to reconcile with the meaning of until-*p*, and the semantics for this item given by Giannakidou and Condoravdi. On the other hand, compatibility with imperfective predicates is exactly what would be predicted under the view of *para (mono)* as an exceptive:

(64) Dhen kimate para mono otan kani krio
    neg  sleeps  para  mono when makes cold
    ‘He doesn’t sleep except when it is cold’ /
    ‘He sleeps only when it is cold’

(65) I sikies dhen epivionun ton ximona para mono otan ine tsouvali
    the figtrees not survive  the winter  para mono when are covered  with burlap
    ‘Figtrees don’t survive the winter except when they are covered in burlap’ /
    ‘Figtrees survive the winter only when they are covered in burlap’

(66) Dhen itan eftichismeni para mono tin dekaetia tu 60
    neg was  happy       para mono  the decade 60
    ‘She wasn’t happy except in the 60s’ / ‘She was happy only in the 60s’

(67) I Miranda dhen ine edho para mono tis Trites
    the Miranda neg is here    para mono the Tuesdays
    ‘Miranda isn’t here except on Tuesday’ / ‘Miranda is here only on Tuesdays’

As can be seen in (64)-(67), there is nothing punctual, perfective or inchoative about these sentences. They are sentences containing exceptives with a temporal argument, with imperfective predicates in the matrix and in the exceptive clause.\(^\text{14}\)

In short, we gain nothing from saying that *para monon* is until-*p*, given that the existing exceptive use of this item already predicts the correct meaning. Moreover, if we identify *para mono* with until-*p*, we have additional things to explain. As for the fact that the falling-asleep and getting-angry events occurred in (54) and (55), this may look like a non-cancellable CoSI, but it is actually part of the assertion of these sentences. All this means that this particular argument from Greek in favor of the lexical ambiguity of *until*, is not valid.\(^\text{15}\)

\(^{14}\) We will take *para mono* to have the meaning as in (i), after von Fintel and Iatridou 2007:

i. \[\{[[\text{para monon} \text{ tin Miranda }]] : \lambda P. \exists x (x /=\text{ Miranda} \& P(x) = 1)\]

When the meaning in (i) is placed under negation, we derive the meaning for, e.g. (56), as follows:

ii. \[\{[\text{dhen... para monon} \text{ tin Miranda }]] : \lambda P. \forall x (x /=\text{ Miranda} \rightarrow P(x) = 0)\]

The same holds for when the argument of the exceptive is a temporal adjunct (e.g. in (66)):

iii. \[\{[\text{dhen... para monon} \text{ tin dekaetia tu 60 }]] : \lambda P. \forall t (t /=\text{ 60s} \rightarrow P(x) = 0)\]

\(^{15}\) In other words, there is nothing necessary about languages using a lexical item like until-*p* to express the relevant meaning. Greek uses a general exceptive, as we saw. Dutch and German have *pas and erst* respectively, and these also yield sentences with non-cancellable occurrences of events. But these items do not co-occur with negation (and so are not NPIs like until-*p*), and their non-cancellable CoSI is an expected entailment of the sentence.

i. Hij is pas gisteren weggegaan
Czech

Giannakidou (2002) mentions that Czech also has two expressions for *until* (via Hana Filip, p.c.) though the actual forms are not provided in the Giannakidou paper. Indeed, Czech has two items that can be translated as ‘*until*’, *dokud* and *až do*, but they differ in what sort of complement they take, they do not differ along the *until*-d versus *until*-p dimension.\(^{16}\)

*Dokud* can only take a clausal complement, whereas *až do* can only take an NP complement. It is not the case that there is one *until* that functions always as an NPI. This is shown in (68)/(69)

\[(68)\] Spal \{dokud/*až do\} jsem neodešla.
slept.M.SG.IMP until aux.1sg not-left.F.SG
‘He was asleep until I left.’

\[(69)\] Spal \{*dokud/až do\} pěti.
slept.M.SG.IMP to until five
He was asleep until 5pm

We see that neither item is an NPI, that is, they are both fine in non-DE environments, and both can accompany an imperfective predicate. These are not the characteristics of the elusive *until*-p.\(^{17}\) However, like in English, the perfective in an affirmative sentence cannot be modified by *until* (i.e., by either of the two forms):

\[(70)\] *Napsal dvě básně, dokud jsem neodešla.
Wrote.pfv two poems until aux.past.1sg neg.left.pfv.f.sg
‘He wrote 2 poems until I left.’

\[(71)\] *Napsal dvě básně až do pěti.
wrote.pfv two poems until five
‘He wrote 2 poems until 5.’

Like in English, such examples become grammatical if negation is included:

\[
\begin{align*}
\text{He is pas yesterday left} \\
\text{‘He left only yesterday’}
\end{align*}
\]

\[
\begin{align*}
\text{i. Er is erst gestern krank worden} \\
\text{He is erst yesterday ill become} \\
\text{‘He became ill only yesterday’}
\end{align*}
\]

Similarly, in the English *Miranda only left yesterday*, there is a non-cancellable CoSI, but this is no mystery either, as in most accounts of *only*, this sentence presupposed that Miranda left yesterday (cf. Horn 1969).

\(^{16}\) Dočekal (2012) explicitly argues in favor of a unified approach regarding *dokud* but the questions as he presents them are differently oriented from the ones we are presenting, and therefore, here we will discuss Czech on the basis of our own explorations of this language. We are very grateful to Ivona Kucerová and Radek Simík for patient discussion of Czech with us. However, we refer the reader to Dočekal (2012) for a detailed discussion of Czech negative concord and other issues.

\(^{17}\) Notice that *dokud* contains a negative marker in its argument, which, in fact, is obligatory, but does not yield a semantic negation, but rather an instance of expletive negation or an element establishing a Negative Concord relation with *until*. This does not come up for *až do*, as it cannot take a clausal argument to begin with (see Zeijlstra 2004, 2014 for discussion).
Here, a difference shows up between *dokud* and *až do*. According to speakers that we asked, (72) has a non-cancellable CoSI but (73) does not. The tests are the usual ones but we don’t include them here for reasons of space.

So it seems that *dokud* is quite like English *until*, in that it shows both until-d and until-p behavior: it is a right boundary adverbial, but its argument must be clausal, unlike English *until*, which can take clauses or NPs. Moreover, like English *until, dokud* goes only with imperfective predicates in an affirmative matrix and then has a cancellable CoSI, but with negation present in the matrix clause, it can go with a perfective predicate, in which case it has a non-cancellable CoSI. In addition, *až do* is also a bit like English *until*: it is a right boundary adverbial, but one whose argument can only be an NP. It goes only with imperfective predicates in an affirmative matrix, but with negation, it can go with a perfective predicate, but then still has a cancellable CoSI. So it seems like *dokud* behaves like English *until*, that is, it has both until-p and until-d behavior. *až do* behaves somewhat differently from *dokud*, but it is definitely not until-p. Consequently, Czech is not a language that has a separate lexical item for until-p.

Note that this does not mean that à priori there couldn’t be a language that has two different expressions, one corresponding to until-d and one to until-p. An example of such a language might be Icelandic, which has two expressions meaning ‘until’: *(flanga) til* and *fyrr en* (Giannakidou 2002, Johannes Jonsson p.c.). *(Flanga) til* shows characteristics of until-d, in that it can go only with durative predicates (with or without negation). On the other hand *fyrr en* behaves like until-p in that it is a NPI. Giannakidou does not say if *fyrr en* has a non-cancellable CoSI but our own (one) native speaker says that it does. On the other hand, Faroese, which has several similarities with Icelandic, also has an NPI *fyrrenn*, but according to 6 out of 6 speakers, it has a cancellable CoSI. These languages need to be explored further then. However, the original cross-linguistic evidence in favour of a lexical ambiguity approach is much weaker than is generally assumed.

### 5.2.2 *The non-cancellable CoSI argument*

Next we come to the other argument in favor of a lexical ambiguity for *until*, namely the non-cancellability of the CoSI of until-p, as opposed to the cancellability of until-d’s CoSI. As said before, and according to the literature, the following sentences are contradictions, and indeed for the speakers that we have tested, they are:

---

18 Possibly this has to do with the presence of (expletive) negation / Negative Concord inside the *dokud* clause. This negative marker does not induce a semantic negation of its own. This is not a unique property of Czech. Such semantically redundant negative markers can be attested in until-clauses in other languages too, e.g., Hebrew. While in Czech this negative marker is obligatory, in other languages, like Hebrew, it is optional. However, when it is present, there are certain non-cancellable implicatures. See Margulis (2017) and references in there. See also Dočekal (2012) specifically for Czech.

19 Many thanks to Hjalmar Petersen for discussion of the Faroese data.
She did not leave until 5pm and maybe she didn’t leave at all
She did not leave until I left and maybe she didn’t leave at all

Similar tests with until-d do not yield such contradictions, meaning its CoSI is cancellable:

She was asleep until 5pm and maybe she was asleep afterwards
She was asleep until I left and maybe she was asleep afterwards

The fact that until-d and until-p behave differently in this respect has formed a strong argument for the hypothesis that until-d and until-p are different lexical items.

Before we continue with our analysis of the non-cancellable CoSI, however, a short discussion about the validity and significance of the cancellability tests in (74)-(77) is necessary. Negation has been argued to create predicates with the subinterval property (Mittwoch 1974, Krifka 1989, De Swart 1996, De Swart and Molendijk 1999, Verkuyl 1993 i.a.). This can also be seen with for-adverbials, which require the subinterval property:

* The plant died for 5 weeks
*For 5 weeks, the plant died
For 5 weeks, the plant didn’t die. Finally, it succumbed to the extreme draught
For 5 weeks, no plant died. Finally, they succumbed to the extreme draught

Intuitively it is clear why the application of negation should yield a predicate with the subinterval property: if an interval i has no subinterval at which the predicate holds, then none of its subintervals do either. This conclusion is unassailable. However, it raises a problem in the debate around until: if negation creates a predicate with the subinterval property, then any negated predicate should be compatible with until-d, on the throughout-not reading. But if that is possible, then (74)-(75) should not have been contradictions: a parse with until-d should have been possible as well, and as until-d has a cancellable CoSI, these sentences should have been just fine. They should simply mean that the predicate of not-leaving held until 5pm or until the time of my departure, with nothing being said about what happens outside the UTS.

In order to circumvent this problem, Giannakidou 2002, also relying on arguments from Karttunen 1974, takes issue with the position that negation can create predicates with the subinterval property. If she is correct, that would be an explanation for why there is no parse with until-d for sentences like (74)-(75). However, it would remain a big question why the entailments that test for the subinterval property still apply with negated perfectives.

The first argument, from Karttunen 1974, is the contrast between (82) and (83). If negation could change the telic predicate into a predicate with the subinterval property, (82) and (83) should behave similarly, which they do not:

Nancy didn’t get married until she died
Nancy remained a spinster until she died

Indeed, (82) is distinctly odd. If negation could have yielded a predicate with the subinterval property, the sentence would be ambiguous between the reading assigned to until-p (which would be odd) and the throughout-not reading that would go with until-d (which would be fine,
just as in (83)). One might conclude that as the parse with until-d is not available, negation does not alter the aspectual profile of a predicate. But these sentences do not show that negation does not yield the subinterval property. As we will see later on, it is very well possible that it does and that the reason that (82) is out is that the CoSI is non-cancellable in (82), resulting in the sentence bumping into a real-world impossibility, whereas the CoSI is cancellable in (83). And this distinction between the two CoSIs we already know.

Giannakidou presents a further argument to show that negated perfectives do not have the subinterval property. Imperatives are not good with statives, yet they are good with negated perfectives. Hence, the argument goes, negated perfectives are not statives:

(84)   *Gnorise tin apandisi!
       *Know the answer
(85)   Diavase to grama!
       Read.perf the letter
       ‘Read the letter’
(86)   Mi diavasis to grama!
       Not read the letter
       ‘Don’t read the letter’

But here there is a confusion between stativity and the subinterval property. The reason that imperatives resist statives is not because of their temporal properties (the subinterval property) but because of the fact that statives are typically non-agentive, which violates a condition of use of imperatives, which presuppose that they be in the control of the addressee (cf. Kaufmann 2012 among many others). Once stative verbs are understood as being in the control of the hearer, an imperative is fine: \textit{Know the answer by Friday!} So therefore, the fact that imperatives don’t readily allow statives is not an argument in this debate. What is at issue is whether negation yields predicates with the subinterval property, not whether it yields agentless predicates.

Similarly, the progressive yields predicates with the subinterval property, and these are fine in the imperative, showing again that there is no issue combining an imperative with a predicate that has the subinterval property:

(87)   a. Be saluting as the queen walks in!
   b. \textit{(Stage directions:) Be talking to the person next to you as Macbeth walks onto the stage!}

Giannakidou mentions two more arguments from Karttunen (1974). One test relies on \textit{how long} and the other on \textit{while}. Both tests are intended to distinguish statives from negated

\footnote{The confusion between stativity and the subinterval property is very common, in fact. Predicates that are stative in the Vendler sense (i.e., +durative, -dynamic, -agentive, like adjectives and verbs like love, know, etc.) have the subinterval property. But following Dowty (1979), Vlach (1993) and some others, any predicate that has the subinterval property is often called “stative”. That is, by this criterion sentences like the following, with the progressive, for example, test positive for the subinterval property and are called stative \textit{He is building a house}, \textit{She is throwing bricks}. It is clear that this notion of “stative” has nothing to do with Vendlerian stativity. What is relevant for us is the question of whether negation yields predicates with the subinterval property. The question is not whether negation yields Vendlerian statives.}
perfectives. We will look at these two tests, but again, we will cast the discussion in terms of the subinterval property, not stativity.

The first argument goes as follows: *how long* requires the subinterval property, and if negated perfectives had the subinterval property, (88)-(89) should both be good, contra to fact (the sentences below are both from Karttunen 1974):

(88) How long did the princess sleep?
(89) *How long did the princess not wake up?

The second test is the *while*-test, which is also meant to distinguish predicates with the subinterval property from negated perfectives (examples all from Karttunen 1974):

(90) I washed the dishes while you slept
(91) I washed the dishes while you were not in the kitchen
(92) *I washed the dishes while you didn’t wake up

Do these two arguments by Karttunen force us to the conclusion that negation does not yield predicates with the subinterval property?

Let us focus on the *how long* test and its reliability. Karttunen shows that *how long* is not good with negated perfectives, but what he does not show is that it is also bad with negated statives:

(93) *How long wasn’t she asleep?
(94) *How long didn’t she sleep? (unless we are talking about chronic insomnia)

So if *how long* requires the subinterval property *and* if negation does not change the aspectual character of the underlying predicate, (93)-(94) should be just fine. But they are not, which means that something basic about *how long* escapes us. This means that in light of the ungrammaticality of (93)-(94), we should not base too much on the ungrammaticality of (89).

A further point of evidence that we do not understand *how long* well enough is that it seems possible with predicates with which bare temporal adverbials are not possible. More specifically, it is not surprising that (95)a, is good, given that (95)b is grammatical:

(95) a. How long did she sleep?
   b. She slept 3 hours

But then how is it possible that (96)a is good, given the ungrammaticality of (96)b? Similarly for (97)a-b:

(96) a. How long did she drink beer?

---

21 Giannakidou rightly shows that these tests work the same with appropriate aspectual distinctions in Greek. We will not address the Greek cases here for reasons of space. While her observations introduce interesting points in the debate, the introduction of Greek aspect would take us too far afield.

22 Giannakidou has a more involved discussion about Greek aspect and its interaction with negation. But again, delving into Greek aspect is not possible here, and at any rate, it is English that is relevant since it is the existence of until-p in this language that is at issue. We have already clarified where Greek stands on this matter.
b. *She drank beer 3 hours

(97)  a. How long did she build houses? (i.e. how long was she in construction)
b. *She built houses ten years

So our point is that the behavior of how long is not well understood and so we should not rely on it to draw conclusions that trump the fact that on the basis of entailments, negated perfectives do test positive for the subinterval property.

Even so, it would still be interesting to explore what the puzzling behavior of how long in (89), (93)-(94) is due to (we leave (96)-(97) aside, as they do not involve negation and so are less relevant to our main narrative). One possibility that presents itself is the following: one can explain the contrasts above, by postulating that A-bar moving how long can only start at the v/VP level or AspP, which means that it is generated under negation when the latter is present. The relevant operator cannot be generated higher up in the tree after negation has applied, where, by assumption, the subinterval property of the negated sentences is located, because it needs the proximity of an AspP. As a result, the bad sentences are bad because the moving element cannot be generated up high. And they could not have been generated under negation either: in the case of the negated perfectives low generation is ruled out because of aspectual incompatibility of the adverb with the perfective. Moreover, the inner island effect will block the adverb from crossing negation. In the case of negated predicates that underlingly have the subinterval property (93)-(94), the inner island may well be the culprit.²³

Be that as it may, our point is that a negated perfective may well be a predicate with the subinterval property, but may be incompatible with how long for different reasons, as negated statives like (93)-(94) also have trouble with this adverbial. In other words, the subinterval property is a property of a predicate when the associated time interval observes the entailments that test for the subinterval property. However, being capable of containing operators like how long is also a property of a syntactic environment. And that should not be equated with the subinterval property. This means that negation may be able to create a predicate with the subinterval property but the predicate may still not be able to contain operators like how long.²⁴

One might object to this line of reasoning by saying that even though it captures some of the facts, it is not falsifiable and that it does not make any predictions. But this is not true. Recall the sentences that showed that negation can yield predicates that are compatible with for-adverbials, even though the predicates under negation are not, as in (78)-(81), repeated below:

(98)  * The plant died for 5 weeks
(99)  *For 5 weeks, the plant died
(100) For 5 weeks, the plant didn’t die. Finally, it succumbed to the extreme draught

²³ Possibly this is supported by the fact that making the adjunct more referential or discourse-connected, a trick known to overcome an inner island since Kroch 1989, improves the sentences:

i. Last week Miranda took naps of all sorts of lengths. On Monday, she slept 3 hours, then 4, and then 2. On Tuesday she slept 1 hour in the morning, 4 in the afternoon, and 1 in the late evening etc.
   How long did Miranda not sleep last week?

²⁴ Similar, though not identical, explorations will be relevant for the while-test. But even if we do not have these at our fingertips yet, the while test alone cannot carry the burden against the evidence from (102)-(103) and the other points made in this section.
For 5 weeks, no plant died. Finally, they succumbed to the extreme draught.

By the rational of our narrative, one would have to conclude that *for*-adverbials *can* be generated above negation, as they are fine with the subinterval property that results from negation. If *for*-adverbials could be generated only under negation, (100)-(101) would have been as bad as the negated perfective sentences with *how long* and *while*. But this also predicts that we should be able to ask a *‘how long’* question if it is part of a *for*-adverbial set-up. And this is borne out:

(102) For how long did the princess not wake up?
(103) For how long did the plants not die?

So in summary, the ambiguity accounts have to find a way to deny that negation produces a predicate with the subinterval property, even though it clearly should: for an interval during which an event did not take place, it is clearly entailed that the event did not take place during any subinterval either. The reason that the ambiguity approach is forced to do this is, is that otherwise, negated perfectives would be expected to combine with until-d and yield a cancellable (as opposed to non-cancellable) CoSI, contrary to fact. But as we saw, none of the arguments presented for this position are conclusive.

However, we have now painted ourselves into a corner: if negation does yield the subinterval property, and if a predicate with the subinterval property suffices for until-d, then why are (74)-(75) contradictions? After all, with until-d, CoSI is cancellable. What to do then? We will argue that there is no until-d and until-p distinction, and that the question of why until-d can’t appear in (74)-(75) is not well-formed because there is no until-d versus as such. We will derive these sentences as contradictions within a unified approach to *until*.

6 More differences between until-d and until-p

In the previous section, we saw that there have been proposals for a lexical ambiguity of English *until* and that there were basically two arguments for this position in the literature: the fact that Greek (and some other languages) have a separate lexical item for until-p, and the fact that the CoSI is not cancellable with until-p but is with until-d. We saw that the first argument has not been shown to hold. As for the second, we agree that indeed in the relevant cases, CoSI is not cancellable, but this is not straightforwardly predicted by the lexical ambiguity approach, since it is unclear why until-d cannot combine with negated perfective predicates. For that, one would have to prove that negation does not create the subinterval property, which is difficult to do.

However, until-d and until-p differ in various other respects as well. We saw earlier that until-p, unlike until-d, is an NPI. In fact, it is a strong NPI. It needs an anti-additive environment. DE-contexts that cannot license strong NPIs, such as *few*, the first argument of a universal quantifier, or the antecedent of an *if*-clause cannot appear in matrix clauses that are modified by until-p:

(104) a. Nobody left until 5pm
    b. Nobody left until I left
(105) a. She never left until 5pm

25 Some of our speakers prefer preposition stranding here, but that is not relevant for us.
b. She never left until I left

(106) a. *Few people left until 5pm
b. *Few people left until I left

(107) a. *Every student who left until 5pm ...
b. *Every student who left until I left ...

(108) a. *If she left until 5pm ...
b. *If she left until I left ...

But there are more differences between until-d and until-p. We saw earlier that until-p and until-d are boundary adverbials, in that they set up the RB of the UTS. Now, consider the following sentences with until-d, which show that when it sets the RB, there is no prior expectation about whether this RB would be later or earlier than expected:

(109) a. I expected her to sleep until 5pm, but she slept until 7pm
b. I expected her to sleep until 5pm, but she slept until 3pm.

And the same holds for overtly negated until-d:

(110) a. I expected her to sleep until 5pm but she didn’t sleep until 5pm. She slept until 7pm.
b. I expected her to sleep until 5pm but she didn’t sleep until 5pm. She slept until 3pm.

The reality is different with until-p:

(111) a. I expected her to arrive at 5pm but she didn’t arrive until 7pm
b. *#I expected her to arrive at 5pm but she didn’t arrive until 3pm

(112) I expected her to arrive at 5pm but she arrived at 3pm

In the contrast between (111)a-b, we see that the temporal argument of until-p can be later than expected, but not earlier than expected. Until-p is subject to the BEI, just like in years, but unlike until-d. Given this fact, it is not surprising that (111)b and (112) are not equivalent. That is, she didn’t arrive until 3pm does not simply mean she arrived at 3pm. In other words, until-p does not just yield a non-cancellable CoSI. There is a comparison to a contextual alternative, and the argument of until-p is later than that. Put differently, with until-p, the UTS is longer than contextually given or expected alternatives.

The contextual alternative does not have to be a matter of expectation/likelihood. Any other contextual time interval will do, as long as until creates a longer, not shorter UTS, by comparison. That is, as long as the argument of until-p is more to the right on the timeline.

(113) a. The paper was due at 5pm, but she didn’t submit it until 6pm
b. #The paper was due at 5pm, but she didn’t submit it until 4pm
a. The paper was due at 5pm but it is well-known that nobody submits anything until 6pm.

b. #The paper was due at 5pm but it is well-known that nobody submits anything until 4pm.

That the non-cancellable CoSI includes a non-cancellable TI is shown in the following example.

She didn’t leave until 6pm. #In fact, she left at 7pm.

On the other hand, until-d lacks a TI:

She did sleep until 6pm. In fact she slept until 7pm.

We argue that the properties of until-p that set it apart from until-d are not independent from each other. That is, the fact that until-p is an NPI and the fact that it has a non-cancellable CoSI, and BEI are not independent properties. This is where the comparison with in years becomes relevant. In the first part of this article, we argued that in years has a non-cancellable AI, a TI and a BEI. Until-d has a non-cancellable CoSI (equivalent to a non-cancellable AI and TI) and a BEI too. For in years, we argued that the fact that it comes with a non-cancellable AI, a TI and a BEI, is intricately connected to the fact that it is a domain widening NPI (as opposed to most other LB-adverbials). Here, we will develop a similar argument for until-p.

We start by pointing out that the BEI of until-p follows, if we assume, fully analogously to our analysis of in years, that until-p is a domain widening NPI that tries to make the UTS larger than the other domain alternatives. That is, by putting the RB later than other contextual alternatives. Both in years and until-p make the time span they are related to larger than contextual alternatives but in years, being an LB-adverbial, does it by aiming towards the “left” on the timeline, i.e. towards earlier time points, while until-p, being a RB-adverbial, does so by aiming towards the “right”, i.e. towards later time points. By merely building in references to earlier time points in the semantics of until, as Giannakidou and Condoravdi do, we miss this larger picture.

Moreover, we argued that in years (as opposed to in 5 years) stretches the PTS to the left as much as is logically possible, which is until an occurrence of the event. This explained why in years not only has a BEI, but also a non-cancellable AI/TI. Similarly, assuming that until-p is a domain widening NPI, just like in years, explains why until-p also comes with a non-cancellable CoSI. It stretches the RB of the UTS until it is logically possible, that is until an occurrence of the relevant event. Until-d, by contrast, is not a domain widening NPI, and does not yield a non-cancellable CoSI, or BEI.

In short, the non-cancellable CoSI and BEI of until-p are due to the same mechanisms as that of in years, and in this they both differ from their non-domain-widening counterparts, which can set their relevant boundary freely, and therefore have a cancellable CoSI and BEI.

---

26 We argue that with both in years and until-p, the time expands until it is not more logically possible to do so, i.e. at the first occurrence of the relevant event. This means that in both cases, the non-cancellable event is at the relevant boundary. This is a difference with other, non-NPI, boundary adverbials, as we saw in the discussion on in years. One might think that examples like (i), from Horn 1972, provide a counterexample to this, with (ii) the equivalent potential counterexample of in years:

i. He didn’t leave until Sunday, if not later. (Horn 1972)
To summarize this section, we have seen that there is a lot to be gained if we analyze until-p in parallel terms to in years: we take both to be domain wideners. We can capture a number of similarities, as well as understand the mirror image profile of some differences. However, at this point it also looks like we have reached a paradox (just as at the end of the previous section). On the one hand, we provided arguments that show that the original motivation for a lexical ambiguity approach are weaker than presented in the literature, if not outright problematic. At the same time, we introduced a number of other differences between until-d and until-p that at first sight seem to provide further evidence for the ambiguity approach. Specifically, the discussion above provides strong motivation for the assumption that until-p is a domain widener, but until-d is not. The reader may be wondering how we can appear to be setting up for a unification account when at the same time we say that until-p is a domain widener while until-d is not.

In the next section we resolve this paradox and proceed to a unified analysis of until that explains why, in the contexts where it has so far been referred to as until-p, until is a domain widener, and in the contexts where it has so far been referred to as until-d, it is not a domain widener. The crucial ingredient will be that domain-widening is the result of an element introducing subdomain alternatives finding itself in an environment of contrastive stress (following Chierchia 2013). In the absence of contrastive stress, only the introduced subdomain alternatives are at play. So we will see that the unification account will have until always introducing subdomain alternatives (as a lexical property), but the domain widening effect only appears under contrastive stress, in which case we get the constellation of properties that the literature has called “until-p”.

7 A unified analysis of until-p and until-d

ii. I haven’t seen him in weeks, if not months

But these are not counterexamples and should be seen as being modified by a covert at least (or the pragmatic equivalent). In fact, several speakers have volunteered that they prefer (iii) to (i).

iii. He didn’t leave until at least Sunday, if not later.

The same can be said for (iv), as all numerical and count expressions are known to be able to be understood as a lower bound:

iv. He has written 5 books, if not more

Moreover, as Horn 1972 points out, pushing the boundary can happen in one direction only:

v. He didn’t leave until Sunday, if not later / #if not earlier (Horn 1972)

This also follows from the fact about lower bounds, and has nothing to do with until-p being an NPI, as it can also be shown to hold for until-d:

vii. He has written 5 books, if not more / *#if not fewer

viii. She was asleep until 5pm, if not later / *#if not earlier

We can arrange the same set-up for in years, but the legitimate direction is, unsurprisingly the opposite, of until:

ix. I haven’t seen him in weeks, if not months /#if not days
7.1 Until-p is a domain widener

To show the workings of until-p, let us apply the same mechanism to it as we applied to in years. If until-p is a domain widener, exhaustification has to apply and falsify stronger alternatives, just as was the case with in years. So let us assign the following (simplified) semantics of (118) to (117) (with \( t^0 \) a contextually set LB, and 7pm the RB of \( \tau \)).

(117) Sue didn’t arrive until 7pm

\[
\exists \tau[\tau = [t^0, 7] \& \neg \exists e.\text{arrive}(e, \text{Sue}) \land e \subseteq \tau]
\]

(118) denotes that there is a time span \( \tau [t^0, 7] \) and there is no arriving event with Sue as the agent in \( \tau \). It is clear that if no such event took place in \( \tau \), no such event took place in any subinterval \( \tau' \) of \( \tau \). Hence, all of the subdomain alternatives of \( \tau \) in (118) form sentences that are entailed by (118). Every subdomain alternative has the form in (119):

\[
\exists \tau'[\tau' \subseteq [t^0, 7] \& \neg \exists e.\text{arrive}(e, \text{Sue}) \land e \subseteq \tau']
\]

This means that (118) has no stronger subdomain alternatives, and so exhaustification of (118) takes place vacuously, and no contradiction arises, while all the demands on a domain widener have been satisfied. A contradiction would arise if the negation was absent. To see this, take the positive counterpart of (117):

(120) *Sue arrived until 7pm

Given the perfective in the matrix predicate and treating the UTS as Topic Time, (120) should have the denotation in:

\[
\exists \tau[\tau = [t^0, 7] \& \exists e.\text{arrive}(e, \text{Sue}) \land e \subseteq \tau]
\]

(121) means that there was an arriving event somewhere in between \( t^0 \) and 7. Now, let’s see what happens when we try to exhaustify (121). The relevant alternatives of (121) are for every \( \tau' \):

\[
\exists \tau'[\tau' \subseteq [t^0, 7] \& \exists e.\text{arrive}(e, \text{Sue}) \land e \subseteq \tau']
\]

In our case, two alternatives are:

\[
\begin{align*}
& (123) \quad a. \quad \exists \tau'[\tau' = [t^0, 6] \& \exists e.\text{arrive}(e, \text{Sue}) \land e \subseteq \tau'] \quad \\
& \quad b. \quad \exists \tau'[\tau' = [6, 7] \& \exists e.\text{arrive}(e, \text{Sue}) \land e \subseteq \tau']
\end{align*}
\]

Now if an event took place in between 6pm and 7pm, or in between \( t^0 \) and 6pm, it also took place in between \( t^0 \) and 7. This means that the alternatives in (122)/(123) are stronger than (121), i.e. they entail (121). This in turn means that they need to be falsified under exhaustification. In other words, this exhaustification makes the following true:
(124) \[ \neg \exists \tau'[\tau' = [t^0, 7] & \exists e. [\text{arrive}(e, \text{Sue}) \land e \subseteq \tau']]. \]

But, of course, (124) is the negation of (121) and the two cannot both be true: we have arrived at a contradiction. This, again, is the contradiction that under Chierchia’s and Gajewski’s system, makes the sentence in (120) ungrammatical: the demands that until-p brings with it can never be satisfied in this sentence, yielding ungrammaticality. This explains why until-p can only be used with negated predicates. We also see that we do not need to specify aspectual restrictions on until to create an until-d. The affirmative perfective sentence is independently ruled out.

If until-p has a domain-widening property, also the BEI, TI, and the non-cancellable CoSI follow from the domain widening. If until-p is a domain widener that stretches its domain of quantification beyond any contextual restrictions (with \( t^0 \) being fixed), fully analogous to our treatment of in years, its RB can only be set by the moment the event takes place.

7.2 Until-p and until-d

In the previous section we analysed until-p along the line of our analysis of in years. In this section, we explore until-d and address the question of whether there are two untils, which happen to sound alike. That is, we will address the lexical ambiguity hypothesis. Remember that the lexical ambiguity hypothesis derives support from two types of arguments: the claim that in some languages the two different untils have different exponents, a position that we have already addressed, and the claim that until-p has a non-cancellable CoSI. We discussed the non-cancellable CoSI of until-p in the previous section and showed that it is should be the result of the same conspiracy of factors involving domain wideners as derived Constant’s observation and the other facts about in years.

At first blush, until-d looks immediately different from until-p, since unlike the latter, until-d can appear both in positive and in negative sentences:

(125) a. He was here until yesterday  
b. He wasn’t here until yesterday

Moreover, until-d does not have a BEI inference, as we saw, nor a non-cancellable CoSI. One would think that all these differences would justify the ambiguity hypothesis. However, we derived the non-cancellable CoSI of until-p in the previous section and showed that it is is the result of the same conspiracy of factors involving domain wideners as derived Constant’s observation and the other facts about in years.

So one option would be to keep the ambiguity hypothesis “minimal” in some way and postulate that until-d is the polarity neutral counterpart of until-p. This would still be a semi-lexical ambiguity of sorts, as until would be described as optionally introducing subdomain-alternatives. With the idea that the minimal difference between until-d and until-p is that the latter unlike the former is a domain widener (given that domain wideners are required to introduce subdomain alternatives), we do derive certain facts, namely that non-cancellable CoSI and BEI will only accompany until-p. However, just like the other lexical ambiguity accounts, we do not derive one important fact: that non-polarity-until can only modify imperfective
sentences. If non-polarity *until* could appear in perfective sentences, (126) should be good, with the meaning as in (127), contrary to fact.²⁷

(126) *She broke a glass until 7pm

(127) \( \exists \tau'[\tau' = [t^0, 7] \land \exists e.\text{[break(e, Sue, glass)} \land e \subseteq \tau'] \).

If *until-d* was just the polarity-insensitive counterpart of *until-p*, and no further restriction, aspectual or otherwise, set it apart from until-p, nothing would rule (126) out. Even though this hypothesis would correctly predict a cancellable CoSI and an absent BEI for until-d, it would not capture the aspectual restriction of until-d to predicates with the subinterval property (a restriction which is present in Czech as well). So we conclude that the view of until-d as simply non-polarity until cannot be correct and a different path needs to be attempted.

Let’s therefore try another path, namely one in which until-d, just like until-p, introduces subdomain alternatives. This would be an ultimate unification account. Then (125)a still has the meaning in (128), but also introduces alternatives as in (129):

(128) \( \exists \tau[\tau = [t^0, YD] \land \exists s.\text{[be_here(s, John) } \land \tau \subseteq s] \)

(129) \( \exists \tau'[\tau' \subset [t^0, YD] \land \exists s.\text{[be_here(s, John) } \land \tau' \subseteq s] \)

All subdomain alternatives in (129) are entailed by (128). If he has been there throughout the interval whose RB is yesterday, he has also been there in any of its subintervals. So there are no stronger alternatives and exhaustification takes place vacuously. In other words, one could actually maintain the introduction of domain alternatives for both *until-p* and affirmative *until-d* sentences.²⁸

Now let’s look at negated until-d sentences. Recall that (125)b is ambiguous between the throughout-not and not-throughout readings and that this results from negation taking scope under or over until-d. Let us look at both cases, starting with the throughout-not reading. This would be the meaning in (130), with the subdomain alternatives as in (131):

(130) \( \exists \tau[\tau = [t^0, YD] \land \exists s.\neg\text{[be_here(s, John) } \land \tau \subseteq s] \)

(131) \( \exists \tau'[\tau' \subset [t^0, YD] \land \exists s.\neg\text{[be_here(s, John) } \land \tau' \subseteq s] \)

The sentence is fine and no contradiction arises: if throughout the entire interval there is a state in which John has not been there, he has not been there in any subinterval either so no alternative in (131) is stronger than (130). This means that exhaustification applies vacuously and no problem arises.

Now, let’s look at the not-throughout reading of (125)b. Here, one cannot exhaustify all domain alternatives. To see this, let’s assume the following meaning for the not-throughout reading

(132) \( \neg\exists \tau[\tau = [t^0, YD] \land \exists s.\text{[be_here(s, John) } \land t \subseteq s] \).

²⁷ This example is similar to (120), whose ungrammaticality was attributed to a contradiction that resulted from exhaustification. Obviously, the ungrammaticality of (126) cannot be attributed to the same cause, as under the assumption currently entertained, a separate until-d does not introduce domain alternatives.

²⁸ In other words, the subinterval property is equivalent to Downward Entailment on intervals.
Let’s introduce the domain alternatives:

(133) \[ \neg \exists \tau' [\tau' \subset [t^0, \text{YD}] \& \exists s. [\text{be_here}(s, \text{John}) \& \tau' \subseteq s]]. \]

The domain alternatives in (133) all entail (132) and should be false. Then the exhaustification results in (134), which is a contradiction:

(134) \[ \neg \exists \tau [\tau = [t^0, \text{YD}] \& \exists s. [\text{be_here}(s, \text{John}) \& \tau \subseteq s]] \& \exists \tau' [\tau' = [t^0, \text{YD}] \& \exists s. [\text{be_here}(s, \text{John}) \& \tau' \subseteq s]]. \]

Does this mean that the non-throughout reading of negated until-d falsifies the hypothesis that both untils are domain wideners? It does not. Following the idea, already applied above, that the not-throughout reading is the result of negation scoping over until instead of scoping below it (which yields the throughout-not reading), it is possible to first exhaustify the complement of negation before applying negation itself (see Zeeijlstra 2017 for a similar analysis of certain universal quantifiers that behave like Positive Polarity Items). The not-throughout reading is then derived as follows. To see this, first take (135):

(135) \[ \exists \tau [\tau = [t^0, \text{YD}] \& \exists s. [\text{be_here}(s, \text{John}) \& \tau \subseteq s]] \]

As a next step the obligatorily introduced alternatives in (136) are exhaustified. As seen before, this exhaustification takes place vacuously, so that EXH((135)) is identical to (135). Then negation applies and we get (135). In this way, both until-d and until-p can be taken to be elements that introduce subdomain alternatives. This is one significant step closer to a unification account.

Can we now capture the restriction to imperfective predicates in the absence of negation? That is, can we explain why (126) is bad? In fact, we already have! Given that now we have only one until, we can explain the ungrammaticality of (126) the way we did for (120). The question of ‘why is there a separate until that is restricted only to imperfective sentences?’ is not a well-posed question anymore. There is no such separate until.

So far so good! The unification approach seems to work. But there is a remaining big question. When we were still talking about until-d and until-p, we showed that the latter has a BEI and non-cancellable CoSI (including a non-cancellable TI) but until-d does not. How can we deal with these differences under our unified semantics for until?

Following Chierchia (2013), NPIs act as domain wideners only when used contrastively, an argument that we laid out in Section 4. We also saw that the non-cancellability of CoSI and other inferences of in years follows from the fact that in years is a contrastively stressed NPI and therefore a domain-widener. This opens up the following possibility: the fact that until sometimes comes with BEI and non-cancellable CoSI and sometimes not, despite always introducing domain alternatives, is the result of the fact that sometimes it is contrastively

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29 And given that exhaustification after the application of negation yields a contradiction, it is not just possible, but necessary to exhaustify before applying negation.
focused, in which case it functions as a domain widener and the inferences are there, and sometimes it is not contrastively stressed, in which case the inferences are absent. The question then morphs into the following question: why is it that (negated) perfective predicates require until-modification with contrastive stress, whereas imperfective predicates do not do so?

We argue that the answer to this lies in the interaction between negation, the exhaustifier and until. The three grammatical examples, repeated in (137), all involve an exhaustifier and the ones in (137)b and (137)c, negation as well.

(137) a. He was here until yesterday
b. Sue didn’t arrive until 7
c. He wasn’t here until yesterday

Let us now look at the relevant scopal construals. Given the fact that the exhaustifier must scope over until, there are in principle the following possible scopal orders:

(138) a. EXH>UNTIL
b. EXH>NEG>UNTIL
c1. EXH>UNTIL>NEG
c2. NEG>EXH>UNTIL

We can now map each of these to a meaning:

The order in (138)a is the one the literature calls until-d (in positive sentences), as in (137)a. The order in (138)b is the one the literature calls until-p, as in (137)b. The orders in (138)c1-2 are the ones the literature calls the throughout-not reading and the not-throughout reading, the two readings (137)c may receive.

We will assume, following Rooth (1985, 1992), Chierchia (and others), that contrastive stress under negation is not possible when EXH intervenes between negation and the focused item. The reason is that contrastive stress requires the presence of weaker alternatives under the scope of negation, and therefore these alternatives cannot be applied to by the exhaustifier first. Then, the only configuration where negation has immediate scope over (unexhaustified) until is (138)b. This means that only in (138)b can until receive contrastive focus by negation. Until in (138)b can then be a domain widener. Until in (138)a, c can never be a domain widener. The reason is that they only introduce domain alternatives to their UTS, which are to be exhaustified, but these are not contrastively stressed under negation. Thus, they cannot be domain wideners. This way it follows that only those instances of until that the literature calls until-p can yield the BEI and the non-cancellable CoSI.

The above captures why what the literature calls until-p can give rise to the BEI and the non-cancellable CoSI. It does not capture why it must, though. In other words, it does not follow yet why this until must take contrastive stress when it directly scopes under negation. If it was only optionally contrastively stressed, it would only optionally be a domain widener and the BEI and the non-cancellable CoSI would not necessarily emerge. Note, however, that the same question arises in the case of in years, where we accepted, following Chierchia, that in years is also always emphatic and therefore always stressed (see section 4). If we assume that until is also
always stressed, so that when it appears under the direct scope of negation, it becomes contrastively stressed, everything follows.  

We have good reasons to believe that this reasoning is on the right track. A prediction that the assumption that until is normally contrastively stressed under negation makes, is that when some other constituent is (contrastively) stressed, and until is not, it should no longer give rise to the non-cancellable CoSI. Now, take a scenario in which John, contrary to expectation, stayed longer at some party than usual and only left at midnight. Then one can felicitously utter (139). However, as a response, the examples in (140) seem fine. The continuations indeed show that until lacks the non-cancellable CoSI here.

(139) John didn’t leave the party until midnight.

(140) a. MARY didn’t leave the party until midnight either…
    … In fact, she stayed until 3
    … In fact she is still there.
   
 b. NOBODY left the party until midnight …
    … Everybody else stayed until 3
    … Everybody else is still there.

If this is indeed correct, and speakers we asked for judgements seem to confirm it, it does not only follow why only those instances of until that the literature calls until-p can yield the BEI and the non-cancellable CoSI, but also why they must do so. We conclude then, that a unification approach to English until is possible and that the duality of its behaviour is due to the scopal ordering or the elements involved, as well as the (resulting) presence/absence of contrastive stress, triggering domain widening effects.

8 Comparing in years and until

Given our assimilation of until to in years, the question naturally arises as to why in years behaves differently from until with respect to its appearance in affirmative clauses. If both in years and until are elements that obligatorily introduce domain alternatives, why couldn’t in years have the same distribution as both types of until instead of only that of until-p?

As a first step we need to explain why in years can only appear with negated predicates and not with affirmative predicates with the subinterval property. Or in other words, in the paradigm of (141)-(142), why is (142)b out?

(141) a. He didn’t break the glass until 7pm (\textsuperscript{OK}negated predicate plus until)
    b. He hasn’t broken a glass in years (\textsuperscript{OK}negated predicate plus in years)

(142) a. He was asleep until 7pm (\textsuperscript{OK}affirmative predicate plus until)
    b. *He has been asleep in years (*affirmative predicate plus in years)

\textsuperscript{30} As mentioned before, Edward Fleming (p.c.) pointed out that while the assumption that until (and in years) are always stressed yields the right result, it does not seem possible to verify this phonetically. Given that they have to be in the scope of negation, and appear therefore at the right edge of the clause, the stress contour that they receive would be the same regardless the presence or absence of stress.
The answer to this question has several components. We have treated the adverbial *in years* as a polarity version of *in (the last) 5 years*. This latter class of adverbials is compatible only with E-Perfect, not the U-Perfect:

(143) He has been sick in the last 5 years (E-Perfect; *U-Perfect)

We will not try to explain here why the U-Perfect is impossible with *in (the last 5) years* (possibly because of ‘in’) but it is clearly a fact. This means that *in years* inherits this property as well, and any derivation of *in years* in which a U-Perfect plays a role will thereby be excluded. For starters, this means that (142)b is out as a U-Perfect. However, this is not enough to derive the ungrammaticality of (142). For that, we would have to exclude the E-reading of this sentence as well. Then the next question is why (142)b is out on the E-Perfect reading. Given that (142)b has the E-Perfect reading, the reason for the absence of this reading must be located where *in (the last) 5 years* differs from *in years*: the fact that the latter but not the former introduces domain alternatives and is subject to exhaustification. But then we realize that we already have an explanation for the absence of the E-Perfect reading of (142)b: Since *in years* introduces domain alternatives, it renders a contradiction on the E-Perfect reading in the very same way in which (126) did. As the discussion would be a word-for-word repetition, we refer the reader to our discussion of (126) above. In sum, (142)b is ungrammatical because the existential and the universal readings of the Perfect are independently ruled out.

Then, for a full comparison between *in years* and *until*, we run through the scopal possibilities of *in years* the way we did for *until* in (138):

(144) a. EXH>IN YEARS
    b. EXH>NEG>IN YEARS
    c1. EXH>IN YEARS>NEG
    c2. NEG>EXH>IN YEARS

The grammatical *in years* is (144)b, in which *in years* is contrastively stressed in the immediate scope of negation.

The order in (144)a we already excluded above: it is ungrammatical because the E-Perfect and U-Perfect readings are independently excluded. This leaves (144)c1-2. Recall that for *until*, this were the negated “until-d” readings: not-throughout in (138)c1 and throughout-not in (138)c2. That is, these were possible scopal configurations for *until*. Do we want to include them as possible scopal configurations for *in years*? The answer is clearly no: recall that these were part of the so-called until-d cases, which lack a non-cancellable CoSI and BEI. The boundary adverbial *in years* lacks such such readings. Its CoSI is never cancellable: Recall Constant’s observation!

So how do we exclude (144)c1-2 for *in years* while permitting the corresponding scopal configurations for *until*? What is it that *until* can do that *in years* cannot? The answer again can be found in (143): *in years* does not permit a U-Perfect reading, but *until* does permit the equivalent reading; only in the case of *until* it is referred to as the ‘throughout’ reading.

Indeed, the c1 orders correspond to the throughout-not reading of *until*, and would for *in years* as well. On the other hand, the c2 orders, correspond to the not-throughout readings of the two adverbials. But neither of these scopal configurations is permissible for *in years*, as this adverbial lacks the throughout/U-Perfect reading independently.
What we have derived then is exactly the facts as we want them: \textit{in} years can appear in every scopal configuration in which what was traditionally referred to as ‘until-p’ may appear. However, \textit{in years} cannot appear in the scopal configurations in which what was traditionally referred to as ‘until-d’ appears, because of its own, independent aspectual restrictions.

9 \hspace{1em} A possible counterexample

A potential counterargument against a non-cancellable CoSI of until-p is presented by De Swart (1996). She argued that the AI in her terms (CoSI in our terms) of \textit{until} is actually cancellable and argues for this with the following two examples, both containing \textit{woll}:

(145) She said she wouldn’t come until Friday. In the end, she didn’t come at all.
(146) I won’t leave until Friday, if at all.

However, sentence (145), given its embedding and the presence of \textit{would} is not an argument for cancellability. We see the same effect without negation or \textit{until}:

(147) She said she would come on Friday. In the end, she didn’t come at all.

Sentence (146) is more interesting, though, and we believe it sets us on two possible paths. One path concerns the fact that (146) contains an ‘if at all’ continuation. The other concerns that it contains a future.

The first path is to see (146) as a conditional. Basically, (148) would be an elliptical version of (146):

(148) I won’t leave until Friday if I leave at all,

What (148) shows us is that \textit{I won’t leave until Friday} is in the consequent of a conditional. This means that this proposition is not evaluated in the actual world, but in the worlds of the antecedent and this means, of course, that in the actual world, the event may not come about. This then would be one possible source of the apparently cancellable CoSI of (146). CoSI itself would still be non-cancellable in the worlds of evaluation. But in the actual world it gives the illusion of being cancellable. If this is the case then there is nothing special about the fact that (146) contains a future in the matrix and the following example is predicted to not be a contradiction either, which is borne out:

(149) She didn’t leave until Friday, if at all

However, de Swart’s example also invites us to consider \textit{until} in sentences other than with a past in the matrix, specifically, with the future.\footnote{In the Present, only the futurate seems possible, that is, the sentences talk about the existence of a plan (see Copley 2008)} And there, in fact, we will see that CoSI appears

\begin{enumerate}
\item She is asleep until 5pm
\item She is not leaving until 5pm
\end{enumerate}
indeed cancelable (which means that there are indeed two paths to the cancellability of CoSI in de Swart’s (146)).

That CoSI of a negated perfective with *until* is cancellable with the future may be a strange conclusion, but it appears that the same facts hold in Czech. In the earlier examples with *dokud*, all of which contained past tense (and negation) in the matrix, CoSI was not cancellable, but in (151) it is, just like English (150):

(150) She will not get married until she meets a man who speaks 23 languages, so I guess she may never get married.

(151) Nevďa se, dokud nepotká muže, který mluví 23 jazyky.

One possible explanation might be that with the future in the matrix, the meaning shifts to something like “before”. But in addition to this being a strange operation, it makes the wrong predictions. It predicts that (152) should be fine, which it isn’t, neither in English (nor in Czech).

(152) He is a confirmed bachelor. #He will not get married until he dies

How can we make sense of all these facts that surface when we have future in the matrix? What is the difference between (150)-(151)-(152)?

In (150)/(151), there is a priori a possible world in which she meets a man who speaks 23 languages and marries him. That is, the non-cancellable CoSI is satisfied in a world other than the actual one. In that world she will indeed marry such a man. This is not possible in (152), however. There is no possible world in which he dies and gets married (immediately) afterwards. In other words, what we see is that *until* is modal and CoSI is satisfied in a world (a future branch) other than the actual one.

The question then arises why in the absence of the future in the matrix clause, CoSI also cannot take us to a world other than the actual one. If that were possible, then CoSI would appear as cancellable in the actual world. In fact, one might in principle expect that the change from future to past should not affect the modality. After all, the progressive/imperfective is said to be modal (to include inertia worlds, for example), and there the modality is not lost in the past (cf. Landman 1992; see Arregui et al 2014 for a more recent discussion of the progressive as modal):

(153) She was crossing the street when she was hit by a car.

In (153) the event of crossing the street is completed in a world other than the actual one in the relevant accounts. So what is different in our cases with *until*?

The difference is that *until*, unlike the progressive in (152), describes the world in which the CoSI takes place. Given the future in (150)/(151), the event-argument of *until* also lies in the future. The model of branching futures permits CoSI to be realized in some branches but not in others. The one in (152) does not permit this, given that the past happens on one branch, so to
speak. Note that when the matrix shifts to the past, the argument of until also becomes past:

(154) She didn’t leave until I left
(155) *She didn’t leave until I am sick
(156) *She didn’t leave until I am leaving
(157) *She didn’t leave until I leave

And once the clausal argument of until is in the past tense, the event described there took place in the actual world. This makes it impossible for the CoSI of the sentence to be satisfied modally when the matrix is in the Past tense. In those cases, the world in which the CoSI is to occur is the actual world.

10 Setting the RB

We have argued that there is only one until, and that its argument is used to set the RB of the UTS. In all the examples that we have looked at so far, the argument of until was a point (until 5pm, until I left). In this section, we will look at more complex sentences, including sentences in which until’s argument is a clause. Specifically, there are three types of arguments of until: NP names of intervals (until 1991, until World War II), imperfective clauses, i.e. predicates with the subinterval property (until she was working at MIT, until she was sick), and perfective clauses (until she read Anna Karenina). The challenge with these more complex arguments of until is how we are supposed to set the RB of the UTS. Even so, we will see that we can predict the temporal properties of these sentences. Moreover, we should say that the effects are exactly the same with Czech dokud, as expected, but we will not show the Czech examples here for reasons of space.32

We will start with predicates with the subinterval property in the matrix. When the argument of until is a point (5pm, the moment at which I left, etc) setting the RB is easy.

(158) She was asleep until 5pm/I left

(159) a. …………………………5pm………………UT
    ______sleep_______________|RB
    b. …………………………I leave……………UT
    ______sleep_______________|RB

The imperfective has the temporal specification TT ⊆ST. We treat the UTS as the topic time, so a sentence like (159) asserts that the UTS (whose RB is 5pm or the moment at which I leave) is fully contained in the time of my sleeping. This is how we get the reading of what was called (affirmative) until-d: the predicate holds throughout the UTS.

Now let’s put a perfective (and telic) predicate as the argument of until (160). In both English and Czech, the reading is that the unhappiness lasted until the reading of Anna Karenina was completed, and not until she merely started reading Anna Karenina. That is, RB of the UTS is the completion subinterval of the AK reading:

32 We treat English statives as either containing or being identical temporally to the imperfective. In Czech such predicates have a visible imperfective. Many thanks to Ivona Kucerova and Radek Simik for discussions of Czech.
(160) She was unhappy until she read AK

(161) ........................|~AK~| ........................UT
________unhappiness ___|RB

To derive (161) we follow Iatridou, 2014, von Fintel and Iatridou 2005/2017 in that temporal adverbials like until, since, after contain a definite description over intervals, and that definite descriptions pick out the maximally informative interval.\(^{33}\) This means that in (161), the argument of until picks as RB the first moment at which the perfective event description ‘she reads Anna Karenina’ is true. This is the interval at which she completes the reading.

Now that we have the RB of the UTS, the rest proceeds as before, given the imperfective in the matrix, that is, TT ⊆ ST, etc. With the same reasoning, we can look at predicates with the subinterval property in the argument of until:

(162) She was happy until she was working at the grocery store
(163) She was happy until she was sick

In those sentences, we understand the unhappiness to have lasted not until the end of the working at the grocery store or the end of the disease, but rather the beginning.

(164) She was happy until she was working at the grocery store

(165) ........................|~working at grocery store~~~|~unhappiness ___|RB

The reason is again that we pick the most informative interval, and that is the first moment at which the imperfective event description ‘she is working at the grocery store’ is true. Now that we have RB, again the rest proceeds as expected with respect to the UTS and the imperfective in the matrix. Similar arguments will yield the beginning of 1990 or the beginning of World War II when these are the arguments of until.

The examples so far were with an imperfective in the matrix. Now let us go to negated perfectives in the matrix (the range of what was called until-p). The question now is about the temporal interpretation of the relevant sentences. There is a non-cancellable CoSI, which means that W&P is read at some point. English and Czech speakers report that in (9), the reading of W&P follows the complete reading of AK:

(166) She didn’t read War and Peace until she read Anna Karenina

(167) ........................|~AK~ | |~W&P~ |.................................

If we pretend for the time being that ‘didn’t read War and Peace’ were an imperfective marked predicate, then this case would be similar to (161)-(162) where the matrix imperfective predicate lasts until the final subinterval of AK-reading. Similarly in (166), the ‘non-reading

\(^{33}\) The idea of definiteness as maximal informativity was generalized to non-temporal descriptions in von Fintel, Fox & Iatridou (2014).
W&P’ predicate lasts until the final subinterval of AK-reading. Given the non-cancellable CoSI, W&P ends up being read outside of UTS, that is, to the right on the timeline of the interval in which AK was read. Moreover, given the discussion of the most informative interval, the inference is that W&P is read upon completion of AK, that is, at the closest interval (putting issues of density aside) to the endpoint of the AK reading.

This appears to work but there was one step that was ignored: the matrix predicate in (166) is not marked morphologically imperfective, the way (162) is. It is a negated perfective. How to bridge this gap? The answer here lies in the fact that predicates with the subinterval property interact with the TT the way imperfectively marked predicates do: they engulf the TT. That is, given the subinterval property of the matrix property, the TT (in this case the UTS) is one of the subintervals over which the matrix predicate (which has the subinterval property) holds. The absence of a morphological imperfective does not come into play.

Considerations of space do not permit us to discuss this topic in more detail here, but we hope the reader sees the general direction of the intuitions involved. There are obviously more complexities and intricacies in the combination of lexical aspects that can be involved. But we hope that in this section we have laid out the foundations from which further and more sophisticated questions about the possible temporal interpretations can be asked.

11 Why strong?

Our unified approach to one until relies on our analysis of in years. We built on the many similarities these two elements have. But they have a further similarity that we have not highlighted so far: they are not just both NPIs; they are both strong NPIs. Only anti-additive environments will support them. Is it a coincidence that in years and until are strong NPIs? A few attempts have been made in the literature to account for the distinction between strong and weak NPIs, but these accounts, of which we will discuss a prominent one below, explained what the differences are between strong and weak NPIs. They did not address the question of why particular elements can only be strong or weak NPIs. Whether a particular NPI is weak or strong still seems arbitrary under these proposals. However, we argue that the fact that in years and until are both strong might actually not be coincidental. In this final part of the paper we will show that the fact that their PTS/UTS are presupposed and not asserted forces them to behave like strong NPIs. This may actually open up the window towards a better understanding of which NPIs are strong and which ones are weak.

Gajewski (2011) and Chierchia (2013), following Krifka (1995), take the weak-strong distinction to lie in the distinction between the exhaustifier looking only at the semantics of the NPI licenser, or also at its pragmatics (both the presupposition and the implicatures). Weak NPIs want EXH to look at the semantics of the licenser only; strong NPIs want EXH to also look at the licenser’s enriched meaning.

Let’s illustrate this approach with few N. Is the semantics of few ‘not many of’ or ‘not many of but some’? ‘If few meant ‘not many, but some’ nothing would follow about (168)b on the basis of the context in (168)a

(168) a. If all students pass the state exam, the school will receive a $10K bonus
   If half the students pass the state exam, the school will receive a $5K bonus
   If few students pass the state exam, the school will face budget cuts
b. This year, no students pass the state exam, so the department will face budget cuts
Yet, we feel that (168)b does follow, which means that ‘but some’ should be a (cancellable) inference. But this means that the semantics of few is just ‘not many of’, not ‘not many of but some’. And this is a good thing: if the semantics of few had been ‘not many of but some’, we would not have been able to understand why it licenses NPIs, which it does:

(169) a. Few MIT students have ever been to Antarctica
   b. Few Goettingen students have eaten anything with saffron in it

The reason why few would not have been able to license NPIs if it had meant ‘not many but some’ is that it would not have been DE: if not many but still some students wear a shirt, it is not entailed that not many but still some students wear a red shirt. But if its semantics is merely ‘not many of’, then it is DE, and (169) would be expected to be good. In short, a quantifier can have pragmatic inferences that would destroy its DE-ness, but if EXH looks only at its semantics and not at the pragmatic inferences, the environment can remain DE and it can shield an NPI from yielding a contradiction (and thereby ungrammaticality).\(^\text{34,35}\)

So NPIs like ever and any are fine even when there are existential inferences which would make the environment not DE, as long as these inferences are not included in the computation of DE-ness. These are the weak NPIs.

On the other hand, there are NPIs that do not survive in environments with pragmatic existential inferences. Those are the strong NPIs. For strong NPIs, there should be no existential inferences whatsoever, not even in non-asserted content. Another way to say that is that with strong NPIs, EXH operates also on non-asserted content. So strong NPIs can only survive in environments with no existential inferences whatsoever, not even in the enriched meaning. As Gajewski (2011) shows, DE elements that can give rise to an implicature that would ruin their DE-ness are DE elements that are not the strongest scalar end-points. Hence, the only DE elements that do not give rise to such non-DE implicatures, are scalar endpoints like not, nobody, never, no X, etc. Such DE elements are ‘anti-additive’. We refer the reader to Gajewski for details of this argumentation.

In summary, NPIs in anti-additive contexts do not trigger a contradiction even if the exhaustifier looks at the enriched meaning contribution of its complement. This, then, captures for Gajewski (2011) and Chierchia (2013) the difference between strong and weak NPIs. Crucial for our purposes is that strong NPIs require a DE context whose non-truth-conditional meaning contribution does not contribute a non-DE-inference either. That is, strong NPIs require also the non-truth-conditional meaning component to be free of existential inferences.

Gajewski (2011) and Chierchia (2013) present no fundamental reason why certain NPIs are strong and others weak, i.e., why certain NPIs require their exhaustifier to look at the

\(^{34}\) Now one might ask why elements like ‘few’ trigger existential inferences (not many but some). The reason is that there are competing scalar alternatives that make no existential inference. No students passed the exam is stronger than Few students passed the exam, so if the speaker utters the latter, the hearer may infer that the speaker does not hold the former to be true.

\(^{35}\) Gajewski (2011) points out that few on its proportional reading may be considered a scalar endpoint and therefore not give rise to an existential inference (see the previous footnote). In those cases, it is correctly predicted that few can license strong NPIs.
enriched meaning contributions of its complement. However, we think that more can and must be said here. That is, it seems possible to explain why in years is a strong NPI.

Strikingly, the existence of the PTS of temporal adverbs similar to in years is presuppositional in nature and not part of the assertion. The classical tests for presuppositions (projection above negation, questions and if-clauses) clearly show this.

(170) I have been there in the last 5 years
There is a PTS [t, UT], such that within [t, UT] I have been there.

(171) I haven’t been there in the last 5 years
There is a PTS [t, UT], such that within [t, UT] I haven’t been there.

(172) Have you been there in the last 5 years
There is a PTS [t, UT] and I wonder whether within [t, UT] you have been there.

(173) If you have been there in the last 5 years...
There is a PTS [t, UT] and if it is the case that you have been there within [t, UT] …

The same facts as above hold for since-adverbials. Here, we only apply the diagnostics for in the last 5 years, as the closest non-NPI cousin to in years, because in years itself cannot be licensed in positive sentences, questions or clauses. But if in the last 5 years and in years behave in this way the same, then it follows that the introduction of domain alternatives does not come from the assertion, but rather from the presupposition, where the existence of the PTS lives. Moreover, for in years it can be shown that the PTS also projects above negation. I haven’t been there in years means that there is a particular PTS in which it is not the case that I have been there. This is not an unexpected result.

The same also holds for until. The same diagnostics show that the UTS of until is also presupposed and not asserted:

(174) I lived there until 2010
There is a UTS [t, 2010], such that within [t, 2010] I lived there.

(175) I didn’t leave until 2010
There is a UTS [t, 2010], such that within [t, 2010] I didn’t leave.

(176) Did you lived there until 2010?
There is a UTS [t, 2010] and I wonder whether within [t, 2010] you lived there.

(177) If you lived there until 2010,..
There is a UTS [t, 2010] and if it is the case that you have been there within [t, 2010], …

Domain alternatives need to be exhaustified, and this can only be done by an exhaustifier that sees the alternatives. If the alternatives are introduced in the presupposition, the exhaustifier must have access to the enriched meaning contribution of its complement. An exhaustifier that would only look at the assertion cannot negate any stronger propositions if these propositions are alternatives to the presupposition. Since, it is the obligatory presence of an exhaustifier that looks at the enriched meaning contribution of its complement that renders NPIs strong NPIs, it follows that both in years and until must be a strong NPIs.

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36 Gajewski (2011: 19): “…implicatures and presuppositions introduced by an NPI licenser interfere with the licensing of strong NPIs, but not with the licensing of weak NPIs. At this point, I do not have an explanation of why this is so. Ultimately, the answer should be sought in the semantics of the NPIs themselves”.

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But this does not apply only to in-adverbials like in years. We are predicting that other NPIs that presuppose (as opposed to assert) the existence of particular domain of quantification that obligatorily introduces domain alternatives, should also be strong NPIs. Any boundary adverbial that is an NPI, we predict to be a strong NPI. In years and until confirm this prediction. It remains to be seen if there are any counterexamples.

12 Conclusions

In this paper we argued that in years and until are boundary-adverbials that to a large extent function as mirror images of each other when used as domain wideners. They tend to stretch their time spans beyond contextual alternatives. However, as they set opposite boundaries, in years stretches its time span (the PTS) by aiming towards the past, while until stretches its time span (the UTS) by aiming towards the future. We argued that in both cases, a cluster of non-cancellable implicatures arise, among them a non-cancellable actuality inference.

We argued that this non-cancellable actuality inference is the result of conflicting requirements on these adverbials: on the one hand they have to set their respective boundary, on the other hand they have to set it as far as possible. This conflict is resolved by setting the boundary at the furthest point at which the sentence can still be true: the point at which an event of the relevant sort occurs and beyond which the sentence (which asserts the absence of relevant events in the time spans) would be false.

Moreover, we argued that it is not a coincidence that given that they are NPIs, both adverbials are strong NPIs. The reason is that their domain widening function takes place on non-truth-conditional content, namely the stretching of the time spans whose existence is presupposed, not asserted. This is in line with Gajewski 2013, according to who the difference between weak and strong NPIs is that in the latter, exhaustification applies to non-truth-conditional material.

There are also differences between in years and until, and the most notable among these is that unlike in years, until also has usages in which it does not behave as a domain widener, does not have a non-cancellable actuality and other relevant inferences, and is even acceptable in affirmative sentences. This duality has given rise to proposals for a lexical ambiguity, which was assumed to also be supported by cross-linguistic arguments. We showed that the cross-linguistic arguments are not fully sound and proceeded to propose a unified approach to until. We argued that until always introduces domain alternatives and is thereby always subject to exhaustification. Its domain widening function surfaces, following Chierchia 2013, under contrastive stress. However, the scopal interplay of negation, the exhaustifier, and until is such that its domain widening function emerges only under certain configurations. We also showed why in years lacks these extra complications and is therefore always domain widener.

The last difference between the two adverbials that we briefly broached is that with until, one can detect elements of modality, possibly because it stretches towards the future, and not towards the past, like in years does.

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