NEGATED PERFECTS AND TEMPORAL *IN*-ADVERBIALS[*]

SABINE IATRIDOU[**]
Massachusetts Institute of Technology
HEDDE ZEIJLSTRA
University of Göttingen

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") 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.

[*]We are grateful to Noah Constant, without whom this paper would have been on a different topic, and to Kai von Fintel for his helpful remarks. We would also like to thank two anonymous reviewers who gave comments on a different version of this paper.

[**]The very existence and size of this volume speaks for itself about David's contribution to the field just in terms of the linguists he has created – even putting aside his intellectual contributions. Our gratitude, as his students, is enormous. This paper is not on questions that David himself would be likely to work on, but that does not matter. David's students have grown up to populate all corners of linguistic life. And I was a student of David's in every sense of the word: I learned facts and theories about them, I learned to think, I learned to judge, I learned to turn a question on its head. Thank you so much, David! -Sabine

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, IAI henceforward), describe a Perfect like (4) as in (5-7):

(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[1]

(6) ∃t : RB(UT, t) and LB (1990, t) and ∃t', t'', t''' ⊆ t : I visit Cape Cod at t', t'', t'''

(7)
1990				UT
LB	✔	✔	✔	RB
|…….....|				

(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 have entered the US)

Now consider a negated Perfect:

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

Everything in (5a-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 (5a-c), we have (10-11) instead of (5d-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) ∃t : RB(u, t) and LB (1990, t) and ~∃t' ⊆ t : 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 temporal adverbial like *since 1990* or *in 3 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 the

[1]The (Im)Perfective in the Perfect, which plays a crucial role in IAI, is here ignored.

event in a specific time span? This, in a few words, is Iatridou's (2014) explanation for the actuality inference, as well as of its cancellability.

Noah Constant (p.c.) made the striking observation that unlike (1-3), in (12) the actuality inference 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 / before I started working here.
b. He hasn't had a seizure in years. #In fact, he has never had one.

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 actuality inference with *in years* is not a cancellable conversational implicature. It is this question that we address in this paper.

Constant's observation is important because the semantics for the Perfect given in IAI and elsewhere predicts no difference in cancellability of the actuality inference between in (1) and (12). Does this mean that the theory of the Perfect has to change or can we explain the difference between (1) and (12) by understanding these adverbials better? In other words, can we explain Constant's observation without changing our theories for the Perfect?

We argue that the cancellability of the actuality inference follows directly from the semantics of the Perfect as summarized above from Iatridou (2014) and that what needs to be explained is the behavior of the adverbial class represented by *in years*.

2 A Deeper Truth

We saw that the actuality inference is not cancellable when the negated Perfect contains *in years*. Now we will see that there is a further inference that is cancellable with negated Perfects, unless, again, the adverbial is *in years*. Look at (1) again. In addition to the actuality inference, there is an inference that the (last occurrence of the) seizure was five years ago, or in 2011. In other words, there is an inference that the event happened at the LB of the PTS. We call this the "LB-time-of-event inference". The source of this inference 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 the 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 actuality inference. Consider the context in (14) and, in that context, utterances (14a-b):

(14) *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.*
a. Sue has not had a seizure in the last 5 years, so she is eligible to apply.
b. Five years ago it was 2011. Sue has not had a seizure since 2011, so she can apply.

In the context in which (14a-b) are uttered, there clearly is an event of the relevant sort, since Sue had a seizure in 2007. So this is not a case where we want a cancellation of the actuality inference. But what we see, is that the event happened well before the last 5 years/2011. In other words, with *in the last 5 years*/*since 2011*, we have a way to compute the LB of the PTS and it is clear that the event is not at LB. In short, (1) has a cancellable actuality inference, as well as a cancellable LB-time-of-event inference. Moreover, we saw that the LB-time-of-event inference can be cancelled even when the actuality inference is not cancelled. The two seem independent.[2]

With *in years*, though, it is not just the actuality inference that is uncancellable, the "LB-time-of-the event" inference is uncancellable too (or the complex "actuality-at-LB" is uncancellable; see fn. 2). That is, with *in years*, the event must be at 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 (14). There are, in principle, two other candidates for the LB: *in years* could stretch backwards from RB until it finds and "hooks onto" either another kind of contextually salient event or the beginning of the subject's life. But we will see that neither of them is the case.

Imagine a scenario in which Fred had a paralyzing accident when he was 2. He is now 50 and it is 2016. Now consider (15):

(15) a. Fred had a paralyzing accident when he was little…
b. #...so he hasn't driven a car in years.

If the LB could have been set by the contextually salient accident-event, the boundaries of the PTS and therefore the PTS itself would be defined, and (15b) would be predicted to be fine without Fred ever having driven a car. However, (15b) still has the non-cancellable inference that at some point Fred did drive a car and is therefore false in the context (since he was paralyzed at 2). In other words, *in years* cannot pick as LB an event other than that of the VP-sort, however high its salience. That is, in (15b), *in years* can only (try to) pick out as LB a previous driving occasion, and cannot pick as LB the paralyzing accident. As expected, the other adverbials behave differently:

(16) Anybody who has driven a car since Obama was first elected president is entitled to a $500 reimbursement from his insurance company. Fred had a paralyzing accident when he was little, so he has not driven a car since Obama was elected.

(17) Anybody who has driven a car in the last 5 years is entitled to a $500 reimbursement from his insurance company. Fred had a paralyzing accident when he was little, so he has not driven a car in the last 5 years.

Moreover, *in years* does not pick as LB the beginning of the subject's life. If it did, (18) and (19) would be equivalent:

(18) Mary hasn't been to Thailand.

[2]Actually, they do not need to be independent, and possibly are not. It is likely that the actuality inference is derivative from the LB-time-of-event inference: there would only be an "actuality-at-LB inference". In such a case, in (14), we would only have cancellation of "actuality-at-LB". This would work just as well in our account, possibly even better, in fact. But we do not have the space to prove that we are dealing with a single inference.

(19) Mary hasn't been to Thailand in years.

However, they are not: in (19), Mary must have at some point visited Thailand, whereas this is not the case in (18). In short, *in years* cannot pick out the beginning of the subject's life.

This is what we mean when we say that there is a deeper truth to Constant's observation. 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 two inferences. With *in years*, the LB of the PTS is necessarily the event described in the VP. This explains the lack of cancellability: the actuality inference and the LB-time-of-event inferences are not implicatures; they are part of the semantics. What we do not yet know is *why* with *in years*, the event described in the VP *must* be the LB. Next we discuss some properties of *in years* that will set the path to an answer to this question.

3 Two More Properties of the *in years* Class

As we have already seen, 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. The LB of the PTS, on the other hand, can be set by adverbials (or as we said above, contextually or by default to the beginning of the subject's life). PTS-adverbials set the LB either by specifically naming it, like *since*-adverbials, or by counting backwards from the RB, like the *for*-adverbial in (21) (see IAI 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), it stretches backwards from the RB, which is the UT because it is a Present Perfect. In (23), it stretches backwards from an RB that is before UT because the construction is a Past Perfect:

(22) He hasn't seen shaved in days.

(23) I saw him last week. He had not shaved in days.

However, *in years* is *only* a PTS-adverbial, that is, it cannot appear outside the perfect:[3]

[3] *For*-adverbials are both PTS-adverbials and VP-level adverbials (Dowty 1979, IAI). Similarly, *in 5 years* can appear both in perfect, as already seen, as well as in simple past sentences:

(i) He ate many bananas in (the last) 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

(24) *He didn't go to the movies in years. (vs. He hasn't been to the movies in years)

(25) *I didn't exercise in years. (vs. He hasn't exercised in years)

(26) *I didn't eat bananas in years. (vs. I haven't eaten bananas in years)

In short, *in years* is only a PTS-adverb, which sets the LB by stretching backwards from RB until it finds the first (i.e. the most recent) event of the VP-sort. It is this property that accounts for the lack of cancellability of the inferences that we saw. 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 as LB is due to it being a Perfect-level adverbial. What other property of *in years* might be relevant?

The characteristic of *in years* (and its cousins *in minutes*, *in days* etc.) that is crucial is that it is a (strong) Negative Polarity Item (NPI) (Horn 1971, Hoeksema 2006):

(27) a. He hasn't had a seizure in years.
b. *He has had few seizures in years.
c. *He has had a seizure in years.
d. *He has had two seizures in years.

(28) a. Nobody has had a seizure in years.
b. *Few people have had a seizure in years.
c. *Somebody has had a seizure in years.
d. *Somebody has had two seizures in years.

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

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

Below we will see how the fact that *in years* is an NPI derives Constant's observation.[4]

But with the Negated Perfect, the requirement for telicity goes away:

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

So *in 5 hours* is both a PTS- and a VP-level adverbial: the telic usage appears when it is a VP-level adverbial (i-ii), the non-telic usage when it is a PTS-adverbial (iv). The non-telic usage is not restricted to negative sentences, as is shown in (v). The fronted position is compatible only with PTS-level readings of the adverbial (cf. Dowty 1979, IAI):

(v) In 5 years, he has written a book and 5 papers.

[4]One might wonder whether the non-cancellability inference is the result of the adjunct scoping under negation, as in Linebarger's (1987) example in (i). Under the reading with scopal order *because* > *not*, there is no starving of the cat, but under the reading with scopal order *not* > *because*, there is a non-cancellable starving-the-cat inference.

(i) George doesn't starve his cat because he loves her.

So one might think that in the order Neg>*in years* (which would be the only scopal order, given that *in years* is an

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 for tem is (partly) responsible for NPIs being NPIs. Kadmon & Landman (1993:360) present the following famous example to show this:

(30) 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.

The choice of the NPI adverbial *in years* (and *in days, in minutes*) can be seen to have a similar effect. It conveys that the domain of quantification is larger than a contextually salient amount of years; *in minutes* conveys that the domain of quantification is larger than a contextually salient amount of minutes, etc.:

(31) 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.

(32) a. He hasn't taken a breath in minutes.
b. #He hasn't taken a breath in seconds.

Chierchia (2006, 2013) adopts Kadmon & Landman's insight that this widening of the domain of quantification (and therefore the reduced tolerance for exceptions) is the property that underlies NPI-hood.

Under Chierchia's approach, NPIs obligatorily introduce alternative domains of quantification, which are all subsets of the domain of quantification. Furthermore, NPIs require that the sentences they occur in are obligatorily exhaustified. In general, exhaustification results in all alternatives that are stronger than the assertion being made false and this is what happens in this case as well. With indefinites/existentials and other lower scalar endpoints, the result of

---

NPI), we get a non-cancellable inference. That is, it would be as if (13) was read as *He has had a seizure but not in years*. However, not every adjunct taking scope under negation gives rise to a non-cancellable inference. *Often* in (ii) also takes scope under negation, reflecting the surface order, but (ii) lacks a non-cancellability inference.

(ii) She hasn't often done that; actually, she may have never done that.

Neither is it the case that an NPI in the adjunct causes a uncancellable inference:

(iii) She was not photographed in front of any tall buildings. In fact, I am not sure she was photographed in front of buildings at all.

The non-cancellable inference only shows up with some but not all adjuncts, and so should not be easily accepted as the source behind Constant's observation.

these requirements is a logical contradiction that is responsible for the ungrammaticality judgment when the NPI is outside a downward-entailing context.

To see this, suppose there is a domain of quantification involving three potatoes ($\{p_1, p_2, p_3\}$). Then the denotation of *I have any potato* (without the exhaustifier applying) would be that I have at least one of these three potatoes (given that *any* is an indefinite/existential). Then, for Chierchia, a sentence like *I have any potato* introduces (smaller) domain alternatives, such as 'I have a potato that is a member of the set $\{p_1, p_2\}$', or 'I have a potato that is a member of the singleton-set $\{p_3\}$'. These alternatives with smaller domains of quantification are logically stronger than the original sentence: for instance, 'I have a potato that is a member of the set $\{p_1, p_2\}$', entails 'I have a potato that is a member of the set $\{p_1, p_2, p_3\}$', not the other way round. Now, when the sentence *I have any potato* is exhaustified, all stronger alternatives must be false. In other words, 'I have a potato that is a member of the set $\{p_1, p_2\}$' will be false, and 'I have a potato that is a member of the singleton-set $\{p_3\}$ will be false, as these are the stronger alternatives.

But then we have arrived at a contradiction: the assertion of *I have any potato* is that I have at least one of the potatoes of the set $\{p_1, p_2, p_3\}$, but the exhaustification of alternatives conveys that I don't have a potato of the set $\{p_1, p_2\}$ and that I don't have a potato of the set $\{p_3\}$. This is a contradiction, and it is this contradiction that for Chierchia renders sentences with an NPI like *I have any potato* ungrammatical.

Once an NPI is embedded under scale-reversing, i.e. downward entailing, operators, before it is exhaustified, the domain alternatives are no longer stronger, as the entailment relations are reverse: 'I don't have a potato that is a member of the set $\{p_1, p_2, p_3\}$' entails 'I don't have a potato that is a member of the set $\{p_1, p_2,\}$', not the other way round'. Therefore the domain alternatives of a sentence like *I don't have any potatoes* are no longer false under exhaustification. Consequently, a sentence with an NPI under the (direct) scope of a downward entailing operator is no longer contradictory and therefore fine. 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*.[5]

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, as in example (30), the domain of quantification must be stretched beyond their contextual restrictions and they act as domain-wideners in the sense of Kadmon & Landman. Since there is always some stress involved with temporal *in*-adverbs such as *in years*, we take *in years* (and the other temporal in-adverbial NPIs) as domain wideners in the aforementioned sense.

If that is correct, *in years* is a domain widener that stretches its domain of quantification beyond any contextual restrictions. The domain of quantification in the case of *in years* is the PTS. In other words, 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/NPI, 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) but by stretching backwards from the RB (which is set by Tense). Putting the last two

[5]See also Chierchia (2013:217) for a discussion, not relevant for our purposes here, why NPIs like *in years* are strong and not weak NPIs.

properties together, the result is that *in years* must stretch backwards as far as possible from the RB.

In other words, there are 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. 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.

The *in years*-adverbial stretches backwards as much as is logically possible. That is, it stretches backwards from RB until the point where the sentence would become false. Where is that point? The point in time beyond 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):

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

In other words, the occurrence of an event of the relevant sort is 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 both why with *in years,* there *must* be an event of the relevant sort, as well as why that event *must* occur at LB. We saw that neither of these facts holds with other PTS adverbials.

This, then, derives Constant's observation, as well as its "deeper" truth that the event must be at LB. The occurrence of the prior event is not asserted by the semantics of the negated Perfect. 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 is logically possible. Therefore, the unacceptability that arises when there is no prior relevant event, is the result of presupposition failure. This is different from the case of *in (the last) five years*, where the inference is, as explained before, a conversational implicature and therefore cancellable.

Naturally, one may wonder why the LB of the PTS cannot be set by something else. As we saw in Section 2, other salient events or even the beginning of the subject's life cannot function as LB in the case of *in years*. For instance, in the scenario in (15), repeated here as (34a), where Fred had a paralyzing accident when he was 2 and is now 50, (34b) is impossible.

(34) a. Fred had a paralyzing accident when he was little…
b. #...so he hasn't driven a car in years.

Why would this be the case? After all, as one usually only starts to drive cars around the age of 16, setting the LB 48 years back from now, already seems like it should be a substantial and, therefore, adequate extension of the time span in comparison to what would be contextually required. Shouldn't such an extension suffice for the domain widening compulsion of *in years*? However, if domain wideners like *in years* are to ignore any contextual restrictions and only look at what is logically impossible, it follows why such extensions do not suffice. The fact that people generally do not drive cars at the age of 2 is still a contextual restriction and therefore

does not stop *in years* from stretching back beyond it. Hence, the paralyzing accident cannot set the LB in this case. It is overridden (or ignored) on the stretching-back-as-much-as-possible-from-RB-path of domain widenening *in years*.

For a similar reason, the subject's lifetime does not provide an insurmountable limit for the PTS. That is, a PTS is not necessarily restricted to lifetimes, the subject's lifetime is at most a contextual restriction. Suppose that some environmental organization wants to reward everybody who has not driven a car in the last 70 years. Then, naturally, Fred would be eligible for a reward, even though he is only 50 years old. That means that the PTS in (35) exceeds Fred's lifetime, which shows that the PTS does not have to be set at the subject's birth.

(35) Fred has not driven a car in the last 70 years.

In other words, lifetimes may only form a contextual PTS restriction in the course of a conversation. And since they are only contextual restrictions, *in years* does not set its LB by the subject's birth either and has to stretch back further.

References

Chierchia, Gennaro. 2006. Broaden your views. Implicatures of domain widening and the "Logicality" of language. *Linguistic Inquiry 37*:535–590.

Chierchia, Gennaro. 2013. *Logic in Grammar. Polarity, Free Choice, and Intervention*. Oxford: Oxford University Press.

Hoeksema, Jack. 2006. In Days, Weeks, Months, Years, Ages: A class of temporal negative polarity items. In D. Gilbers & P. Hendriks (eds.), *Rejected papers*: *Feestbundel voor Ron van Zonneveld*. Groningen: RUG.

Horn, Laurence. 1971. Negative transportation: unsafe at any speed? In P. Peranteau, J. Levi & G. Phares (eds.), *Papers from the Seventh Regional Meeting of the Chicago Linguistic Society*. Chicago: University of Chicago. 120–133.

Iatridou, Sabine. 2014. About determiners on event descriptions, about time being like space (when we talk), and about one particularly strange construction. *Natural Language Semantics 22*:219–263.

Iatridou, Sabine, Elena Anagnostopoulou & Roumyana Izvorski. 2001. Observations about the form and meaning of the perfect. In M. Kenstowicz (ed.), *Ken Hale: A life in language*. Cambridge, MA: The MIT Press. 189–238.

Kadmon, Nirit & Fred Landman. 1993. Any. *Linguistics and Philosophy 16*:353–422.

Linebarger, Marcia. 1987. Negative Polarity and Grammatical Representation. *Linguistics and Philosophy 10*:325–387.