

Quantifier Dependent Readings of Anaphoric Presuppositions

Sigrid Beck, Universität Potsdam

Abstract

It has been observed (e.g. Cooper (1979), Chierchia (1993), von Stechow (1994), Marti (2003)) that the interpretation of natural language variables (overt or covert) can depend on a quantifier. The standard analysis of this phenomenon is to assume a hidden structure inside the variable, part of which is semantically bound by the quantifier. In this paper I argue that the presupposition of the adverb 'again' and other similar presuppositions depend on a variable that gives rise to the same phenomenon.

1. Introduction

Von Stechow (1994), following Heim (1991), notes that (1a) has the reading paraphrased in (1b) and proposes the analysis sketched in (1').

- (1) a. Only one class was so bad that no student passed.
b. Only one class was so bad that no student in that class passed.
- (1') a. $[[\text{noC}]] (A)(B) = 1 \text{ iff } (g(C) \sqcap A) \sqcap B = \{\}$
b. $[[\text{only one class}] [\lambda x [t_x \text{ was so bad that } [IP [DP \text{ nof}(x) \text{ student}] [\text{passed}]]]]]$
b. only one class x : x was so bad that $\text{nof}(x)$ student passed
c. $f: x \rightarrow \{y: y \text{ is in } x\}$

The crucial property of the analysis is that the quantifier is assumed to have a covert restriction variable (cf. e.g. Westerstahl (1984), Rooth (1992), von Stechow (1994)), its resource domain variable (C in (1'a)). The value of this restriction varies depending on the quantifier 'only one class'. Hence it is proposed that the resource domain variable itself has a hidden internal structure, consisting of a variable x bound by 'only one class' and a free function variable that assigns to x the set of students in x .

The suggestion that an expression of natural language that normally functions as a variable (this is meant in the following when I say 'natural language variable') is internally complex and can for this reason co-vary with a quantifier is not new. It has been made by Cooper (1979) to analyze certain

pronouns, and extended to traces by Chierchia (1993). Interesting consequences especially for the theory of Logical Form have been investigated by Marti (2003).

In this paper I argue that the adverb *again* gives rise to interpretations that similarly show co-variation with a quantifier, and that the analysis sketched for the resource domain variable case can be extended to *again*. To give an example, consider (2), (3).

(2) Bill was sick on his birthday. He was sick again on Thanksgiving.

(2') Bill's birthday is before Thanksgiving.

(3) In 1995, 1996 and 1998, Bill was sick on the day of the department party.
Every time, he was sick again on Thanksgiving.

(3') Every time the department party was before Thanksgiving.

Intuitively, the adverb *again* makes reference to a time preceding the time that the sentence with *again* talks about. Thus (2) triggers the inference (2'), because the use of *again* in the second sentence requires there to be a previous time at which Bill was sick, and the only relevant time in the context is the one mentioned in the first sentence, Bill's birthday. The example in (3) shows that which earlier time is picked can depend on a quantifier - here: 'every time'. Example (3) triggers the inference (3'). The use of *again* requires that for each of the years 1995, 1996 and 1998, the department party that year precedes Thanksgiving that year. I will extend the analysis of (1) to (3) and related examples.

Section 2 of this paper introduces *again* and the theory of *again*'s presupposition I will use. In section 3 I examine the quantifier dependent cases and develop an analysis for them. Conclusions are presented in section 4.

2. The Presupposition of *Again*

2.1. Basics

The adverb *again* indicates repetition, as illustrated by the simple example below. (4a) is only appropriate if (4b) holds. Thus it is standardly assumed that (4a) presupposes (4b). (4b) is given slightly more formally in (4c). **t1** stands for the time interval that the sentence (4a) is about.

- (4) a. John snored again.
 b. John had snored before.
 c. $\Box t'[t' < \mathbf{t1} \ \& \ \text{John snored at } t']$

I adopt a view of presuppositions according to which they are restrictions on appropriate contexts (compare Stalnaker (1973), Heim (1990), Kadmon (2001) among others). The restriction that (4a) imposes on contexts in which it can be uttered is given in (5a) (informally) and (5b) (more precisely); c is Stalnaker's context set; c entails p iff c is a subset of p .

- (5) a. (4a) is only felicitous in a context that entails that John had snored before.
 b. $c \Rightarrow \Box w. \Box t'[t' < \mathbf{t1} \ \& \ \text{John snored in } w \ \text{at } t']$

Again triggers this presupposition. It is associated with a lexical entry like the one in (6) (see for example Stechow (1996), Fabricius-Hansen (2001), Jäger & Blutner (2003), van der Sandt & Huitink (2003) for recent discussion; the entry in (6) will serve as a starting point for present purposes). The definition (6) entails that the truth value of a sentence containing *again* may be undefined in a world. I take it that a sentence S is felicitous in a context c only if the presuppositions of S are true in all worlds in c ; or in other words, S can only be added to c if c entails the presuppositions of S (cf. (7')). This is how presupposition as undefinedness in simple sentences is mapped to appropriateness in a context (von Stechow (2003) calls (7') 'Stalnaker's Bridge'). The application to the example is illustrated in (7); $t1$ is a free time variable that is assigned a time interval by the variable assignment function g ; in the example, suppose that is the interval $\mathbf{t1}$. Thus (4a) can only be uttered felicitously in context c if (5b) is the case, as desired.

- (6) $[[\text{again}]](p < \Box \langle s, t \rangle \rangle)(t)(w) = 1$ if $p(t)(w) \ \& \ \Box t'[t' < t \ \& \ p(t')(w)]$
 $= 0$ if $\sim p(t)(w) \ \& \ \Box t'[t' < t \ \& \ p(t')(w)]$
 undefined otherwise.

- (7) $[[[\text{John snored}] \ \text{again} \] \ t1 \]]]^g(w)$ is defined only if
 $\Box t'[t' < g(t1) \ \& \ \text{John snored in } w \ \text{at } t']$
 If defined, it is true iff John snored in w at $g(t1)$.

- (7') p is only felicitous in c if for all $w \in c$: $p(w)$ is defined.

As a general notational convention, I try to use boldface **t1**, **t2** etc for free metavariables over time intervals and regular t1, t2 etc as time pronouns in the object language (the linguistic structures of English). Later on, the notation in (7") for the information in (7) will be handy, where @ marks presupposed material (cf. Beaver (2001)).

(7") John snored in w at g(t1) & @($\Box t'[t' < g(t1)]$ & John snored in w at t')

While (6) is (roughly) what is standardly used, it seems upon closer inspection that we need a more sophisticated version of *again*'s presupposition. It has been argued by Soames (1989) (who refers to unpublished work by Kripke), and by Heim (1990) that the presupposition introduced by *again* is about a specific time, not existential. An example I take from Heim (1990) is given below.

- (8) a. We will have pizza on John's birthday, so we shouldn't have pizza again on Mary's birthday.
 b. We will have pizza on John's birthday, so we shouldn't have pizza on Mary's birthday.

In (8a) but not in (8b) one infers that John's birthday precedes Mary's birthday. This must come from the presence of *again* in (8a). But as long as we take the appropriateness constraint imposed by *again* to be (9a), there is no explanation for the inference: presumably, we had pizza plenty of times in the past, so this presupposition would be met, independently of John's birthday. Intuitively, however, one takes John's birthday to be the relevant prior time at which we had pizza. This follows if the appropriateness condition imposed on the context is as in (9b): of a particular earlier time, the context must entail that we had pizza at that time. The presupposition of *again* is thus specific rather than existential: (10a). In the example, the prior time is assumed to be the time of John's birthday (since this is the only time relevant in the context), hence the inference that John's birthday is earlier than Mary's.

- (9) a. $c \Rightarrow \Box w. \Box t'[t' < \mathbf{t1}]$ & we have pizza in w at t'
 b. $\Box t'[c \Rightarrow \Box w. t' < \mathbf{t1}]$ & we have pizza in w at t'

- (10) a. that we have pizza at t' & $t' < \mathbf{t1}$
 b. $t' :=$ "on John's birthday"

This argument amounts to the claim that the content of the presupposition triggered by *again* depends on an anaphoric element (as pointed out by Kripke and emphasized in the semantic discussion of Kamp & Rossdeutscher (1994)). I will follow the argument and represent that element, like other implicit anaphoric elements, as a free variable, to be assigned a value by the contextually relevant variable assignment. A revised lexical entry for *again* is given in (11). The free variable is the first argument of *again* in (11) and shows up as a subscript in the syntactic structure in (12) (see also Beck (in prep.)). (12) gives the interpretation of the example. Note that the fact that the content of the presupposition *again* gives rise to depends on an anaphoric element makes it necessary to give *again* that variable as another argument. This was not necessary in the old version (6). The analysis in (11)-(12) assumes that *again*'s first argument is represented in the syntactic structure.

$$(11) \quad [[\text{again}]_t] (t') (p) (t) (w) \quad = 1 \text{ if } p(t)(w) \ \& \ p(t')(w) \ \& \ t' < t \\ = 0 \text{ if } \sim p(t)(w) \ \& \ p(t')(w) \ \& \ t' < t \\ \text{undefined otherwise.}$$

$$(12) \quad [[[\text{we have pizza}]_{\text{again}_t'}] t_1]]^g (w) \\ \text{is defined only if we have pizza in } w \text{ at } g(t') \text{ and } g(t') < g(t_1). \\ \text{If defined, it is true iff we have pizza in } w \text{ at } g(t_1).$$

On this analysis, notice, there is no relevant difference between the variable called t' in (11) and natural language variables like pronouns, traces and quantifier domain restrictions. They all show up in the syntactic structure that is the input to compositional interpretation, and if one kind can be internally complex, so should the other. We will exploit this to provide an analysis of examples like (3) from the introduction.

For completeness, I will mention an aspect of the interpretation of *again* that has attracted much attention in the literature. Sentences with *again* often exhibit the so-called repetitive/restitutive ambiguity illustrated in (13).

(13) Otto opened the door again.

(13') a. (13) presupposes that Otto had opened the door before. Then, it is true iff Otto opened the door.

- = Otto opened the door, and he had done that before. (repetitive)
- b. (13) presupposes that the door had been open before. Then, it is true iff Otto opened the door.
 = Otto opened the door, and the door had been open before. (restitutive)
- (14) a. Jack opened his lips to speak, but shut them again, [...]
 ('Jack and Jill', by Luisa May Alcott; from the Project Gutenberg official homepage <http://promo.net/pg/>)
- b. 'shut them again' is appropriate because there is a previous time at which Jack's lips were shut (namely the beginning of the opening).

I will assume a structural analysis of this ambiguity in the style of von Stechow (1996) (see Stechow (1996), Fabricius-Hansen (2001), Jäger & Blutner (2003), Beck (2005), among others, for discussion). Application of the structural theory to our example in (13) is illustrated informally in (15) - (17). Crucial is the decomposition of the transitive verb *open* into the adjective *open* and an agentive empty verb.

- (15) a. Otto opened the door.
 b. underlying structure: [VP Otto [ØV [SC openAdj [the door]]]]
 c. surface structure: [VP Otto [[Ø + openAdj]V [SC t [the door]]]]

- (16) a. [[ØV]] = $\lambda p \lambda x \lambda t \lambda w. x$ does something in w at t that causes that p comes to be in w at t
 b. [[SC]] = $\lambda t \lambda w. \text{the door is open in } w \text{ at } t$

- (17) $\lambda t \lambda w. \text{Otto does something in } w \text{ at } t \text{ that causes that the door comes to be open in } w \text{ at } t$

Decomposition creates two possible adjunction sites for the adverb *again*, above and below the empty verb: (18a,b). The two structures lead to two different interpretations, paraphrased in (19a,b), which correspond to the repetitive and the restitutive reading respectively. The ambiguity is thus analysed as a scope ambiguity between *again* and the empty verb.

- (18) a. [VP [VP Otto [ØV [SC openAdj [the door]]]] again]
 b. [VP Otto [ØV [SC [SC openAdj [the door]] again]]]

- (19) a. Once more, Otto did something that caused the door to become open.
 b. Otto did something that caused the door to become once more open.

Under this analysis, the semantics of *again* remains the same on the restitutive reading as on the repetitive reading, and whatever effects we find regarding the presupposition should show up on both readings.

2.2. Anaphoricity

Again on both the repetitive and restitutive reading should be recognizably anaphoric, given the analysis in section 2.1. That is, we should always be able to identify the relevant prior time of an occurrence of *again* in discourse. It has been observed (Fabricius-Hansen (2001), Kamp & Rossdeutscher (1994), Klein (2001), and following them Beck (in prep.)) that this is indeed a property of *again*. Below are some of Fabricius-Hansen's examples as well as some that I myself collected that illustrate this. I underline the predicate that *again* combines with as well as the preceding predicate that causes *again*'s presupposition to be satisfied. The relevant prior time that the presupposition triggered by *again* refers to would be the time interval associated with the first predicate.

- (20) Fabricius-Hansen (2001):
- a. Er konnte sich an nichts erinnern, nicht einmal daran, dass ich ihn gebeten hatte, sich diese drei Dinge zu merken. Ich wiederholte den Test und liess ihn diesmal die Bezeichnungen der drei Gegenstaende aufschreiben; **wieder** hatte er sie vergessen [...]
 He remembered none of them or indeed that I had even asked him to remember. I repeated the test, this time getting him to write down the names of the three objects; again he forgot [...]
- b. Elias hoerte nicht bloss, er sah das Toenen. Sah, wie sich die Luft unaufhoerlich verdichtete und **wieder** dehnte.
 Elias not only heard the sounds, he also saw them. He saw the air incessantly contracting and expanding [again; SB].

- (21) Project Gutenberg - repetitive uses:

- a. She rather suspected it to be so [...] from his listening to her so attentively while she sang to them; and when the visit was returned by the Middletons' dining at the cottage, the fact was ascertained by his listening to her **again**. ('Sense and Sensibility', Jane Austen)
- b. [...] the old lady shook the bottle with the air of a general who had routed the foe before and meant to do it **again**. ('Jack & Jill', Luisa May Alcott)

(22) Project Gutenberg - restitutive uses:

- a. As she said this, she sunk into a reverie for a few moments;--but rousing herself **again**, [...] ('Sense and Sensibility', by Jane Austen)
- b. And away she went; but returning **again** in a moment, [...] ('Sense and Sensibility', by Jane Austen)

I should point out that while Fabricius-Hansen (2001) also calls the presupposition of *again* anaphoric, there is a difference in what we mean by this. According to her, the presupposition of *again* is anaphoric in the way that all presuppositions are anaphoric - in the sense of van der Sandt (1992). This is not what is meant here. I do not regard the presupposition triggered by *again* itself as an anaphor. For me, it is an admittance condition. But its content depends on an anaphoric element - i.e. what presupposition precisely is triggered depends on the context. This is not a property of all presuppositions. The content of the presupposition triggered by the definite article, for example, does not (necessarily) depend on an anaphor.

2.3. Discourse Inferences

The data we have seen show that anaphoric presuppositions play an important role for discourse coherence. They guide us in organizing the information provided by individual sentences into a coherent whole. This becomes most obvious when they lead to inferences that would not otherwise have been justified. The pizza example repeated below illustrates this.

(23) We will have pizza on John's birthday, so we shouldn't have pizza again on Mary's birthday.

The observation is that (23) supports the inference (24a). Why does it do that? The context to which the second sentence of (23) is added entails of a time *t'* that we had pizza at *t'* ((24b)). The use of

again imposes on the context the requirement (24c). The context does not entail that $t' < \mathbf{t1}$. It seems that we assume that $t' < \mathbf{t1}$ is in fact the case - i.e. we accommodate the missing part of the presupposition of *again*. This 'partial' accommodation surfaces as an inference. Crucially, the anchor for the inference is the time t' about which we already have some information in the context. We then infer additional information about t' .

- (24) a. John's birthday precedes Mary's
 b. $c \implies$ that we have pizza at t'
 c. $c \implies$ that we have pizza at t' & $t' < \mathbf{t1}$
 d. accommodate: $t' < \mathbf{t1}$

The pizza example is not unique in supporting such inferences, and is therefore not unique as an illustration of the anaphoric nature of the presupposition that *again* gives rise to. Both of the following examples support inferences that are partial presupposition accommodations, and both times the key to what is accommodated is the anaphoric first argument of *again*. In neither of the examples would this particular inference arise if *again* were not anaphoric, i.e. did not make reference to a particular time. Kamp & Rossdeutscher (1994) call such effects 'presupposition justification'.

(25) A group from Jehova's witnesses was on my doorstep at 1pm. An hour later, they were there AGAIN.

- (25') a. (25) \implies they left in between 1pm and 2pm
 b. $c \implies$ that a group from Jehova's witnesses was on my doorstep at t'
 c. $c \implies$ that a group from Jehova's witnesses was on my doorstep at t' and $t' < \mathbf{t1}$
 d. accommodate: $t' < \mathbf{t1}$
 (i.e. t' properly precedes $\mathbf{t1}$ - the relevant interval does not extend to $\mathbf{t1}$)

(26) In January 2000, we were skiing in Grafton. In January 2001, we were skiing in Vermont AGAIN.

- (26') a. (26) \implies Grafton is in Vermont
 b. $c \implies$ that $t' < \mathbf{t1}$ & we were skiing at t'
 c. $c \implies$ that $t' < \mathbf{t1}$ & we were skiing at t' & we were in Vermont at t'

- b. For every host x: x bought just one bottle of wine and x served the bottle that x had bought with dessert.

- (28') a. For every host x: x bought just one bottle of wine and
x served [the [R x]] with dessert
- b. "it" = [the [R x]]
R := $\lambda u. \lambda v. u$ had bought v and v is a bottle of wine

Chierchia (1993) applies a similar strategy to traces in so-called functional wh-questions. An example and its analysis is given in (29)-(29').

- (29) a. Who does every Italian love?
b. example answer (functional reading): his greengrocer

- (29') a. [who_i [every Italian_k loves t_{i,k}]]
b. which f: for every Italian x, x loves f(x)?
c. t_{i,k} = [t <_i, <e,e>> pro <k, <e>>]
[[t_{i,k}]]^g = g(ti) (g(tk)) = f(x)

We are already familiar with example (30)-(30') from the introduction, in which the variable - the domain restriction of the quantifier - is itself covert. It seems to be a general properties of the expressions that appear function as variables in natural language that they permit an analysis in which they consist of a free variable part combining with a part that can be bound.

- (30) a. Only one class was so bad that no student passed.
b. Only one class was so bad that no student in that class passed.

- (30') a. [[no_C]] (A)(B) = 1 iff (g(C) \square A) \square B={}
b. [[only one class] [lx [t_x was so bad that [IP [DP no_{f(x)} student] [passed]]]]]
b. only one class x: x was so bad that no_{f(x)} student passed
c. f: x --> {y: y is in x}

Marti (2003) provides arguments to the effect that such covert variables, while invisible, are nonetheless syntactically real. This supports an analysis that assumes additional internal structure

including a bound variable as in (30'). The view that emerges from this discussion is that quite generally, natural language variables can be more complex than appearance would indicate, and that that complexity is reflected in their syntactic structure.

3.2. *Again* and Quantifiers

We are now ready to consider the interaction of *again* and quantifiers. Section 2 established that the presupposition of *again* contains an anaphoric variable, and subsection 3.1. showed that variables in natural language can be quantifier dependent. We expect that *again*'s anaphoric variable should be able to depend on a quantifier as well, and this is going to be our view of example (3) from the introduction and related data.

We begin with a slightly simpler example, (31) below.

- (31) a. Context: I am decorating Dirk's birthday cake. Anna-Lena (age 3) is fascinated and keeps getting in the way. I ask her to play elsewhere.
 b. Anna-Lena always went away,
 c. but was standing there again right away every time.

Intuitively, (31c) says that each leaving by Anna-Lena was followed by an immediate return. The earlier time that *again* makes reference to is the time before the relevant departure. Thus there is not one earlier time, but as many times as Anna-Lena went away. In other words, the anaphoric variable in the semantics of *again* depends on the quantifier 'every time'. I propose the analysis in (32) for the slightly simplified version (32a) (I omit the world parameter in these examples for simplicity).

- (32) a. Anna-Lena was there again every time.
 b. $\Box t [C(t) \rightarrow [[\text{again}]] (f(t)) (\Box t'' . \text{AL was back at } t'')]$
 c. $f: t \rightarrow t-1$ (the time immediately preceding t)
 $C = \Box t. \text{AL had left at } t$
 d. $\Box t [t \text{ is one of the times when AL had left } \rightarrow$
 $\text{AL was back at } t \ \& \ @(\text{AL was there at } t-1)]$
 e. $\Box t [t \text{ is one of the times when AL had left } \rightarrow \text{AL was there at } t-1]$

- (33) a. Every player brought her TV Derendingen warm-up t-shirt.
 b. **PSP:** Every player had a TV Derendingen warm-up t-shirt.

Given the general facts of presupposition projection in the scope of a quantifier illustrated by example (33), the analysis makes the prediction that the presupposition of the sentence with *again* is as in (32e). This seems right, and the presupposition can reasonably be assumed to be met in (31) as an entailment of (31b). (34) would be the presupposition of (32a) using the semantic analysis of *again* in (11) but without a functional analysis of the anaphoric variable. This amounts to the claim that Anna-Lena was there at a time preceding all her departures - which strikes me as too weak. (35) would be the result of using the original semantics of *again* in (6), with the predicted presupposition (35b) from (35a). This looks better, even if it is still weaker than (32e). But of course it uses an analysis of *again* that we had retired for independent reasons already.

(34) $\Box t$ [t is one of the times when AL had left \rightarrow AL was there at t' & $t' < t$]

(35) a. $\Box t$ [t is one of the times when AL had left \rightarrow

AL was there at t & $@(\Box t' [t' < t \ \& \ \text{AL was there at } t'])$]

b. $\Box t$ [t is one of the times when AL had left $\rightarrow \Box t' [t' < t \ \& \ \text{AL was there at } t']$]

I think that the analysis in (32) is the most intuitive view of what happens in (32a). The case for functional anaphoric variables in *again*'s presupposition can be strengthened when we consider examples that require partial presupposition accommodation (like the pizza example), hence give rise to additional inferences. I have constructed a quantificational version of the pizza example below. The sentence intuitively supports the inference in (36b). It is analysed in (37). Following the same steps as in the previous example, we arrive at (37d) as the presupposition of (37a). The context establishes that we had pizza at John's birthday every year, but it is not asserted that John's birthday preceded the department picnic. In the same way as in the non-quantificational version, we assume that this part of the presupposition is in fact true. The assumption surfaces as an inference.

(36) a. Every year, we had pizza on John's birthday, and decided that we shouldn't have pizza again at the department picnic.

b. Every year, John's B-day preceded the department picnic

(37) a. $\Box t$ [we have pizza at John's B-day in t &

we decide that shouldn't [*again*($f(t)$) ($\Box t'$. we have pizza at t')(the picnic in t)]]

b. $f: t \rightarrow$ John's B-day in t

- c. $\Box t$ [we have pizza at John's B-day in t & we decide that shouldn't [we have pizza at the picnic in t] & @ (we have pizza at John's B-day in t & John's B-day in t < the picnic in t)]
- d. **PSP:** $\Box t$ [we have pizza at John's B-day in t & John's B-day in t < the picnic in t]

Suppose that we had used a standard, simple first argument of *again*. The predicted presupposition is then (38): that a particular time t' precedes all annual picnics, and we had pizza at t' . That would be John's birthday in the first of the years talked about. The presupposition is not suitable to support the intuitive inference.

(38) $\Box t$ [we have pizza at t' & $t' <$ the picnic in t]

Similarly, the existential analysis of the presupposition of *again* (given below) is not suitable to support that inference - it is too weak. Thus we can conclude that we have found further support for an analysis of the presupposition of *again* as involving an anaphoric element. The support comes from the additional, quantificational data themselves as well as from the general fact that our hidden variable in the semantics of *again* behaves like other hidden variables.

- (39) a. $\Box t$ [we have pizza at John's B-day in t & we decide that shouldn't [we have pizza at the picnic in t] & @ ($\Box t'$ [we have pizza at t' & $t' <$ the picnic in t])]
- b. **PSP:** $\Box t$ [$\Box t'$ [we have pizza at t' & $t' <$ the picnic in t])]

Example (3) from the introduction is of course just the pizza example in disguise. I add example (40) as a plausible case of quantifier dependent restitutive *again*. The verb *forget* is decomposed into BECOME + 'not know'. Once more the presupposition in (41e) seems more appropriate to me than the one in (42).

- (40) a. She has told me her name three times.
- b. Every time / mostly /... I forgot it again five minutes later.

- (41) a. $\Box t$ [t is one of the three times -> I forgot it again at t+5min]
- b. $\Box t$ [t is one of the three times -> BECOME (t+5) ([[again]] (f(t)) ($\Box t$ ".I do not know it at t"))]

- c. f: $t \rightarrow t-1$ (the time immediately preceding t)
- d. $\Box t[t$ is one of the three times \rightarrow
 BECOME ($t+5$) ($\Box t$ ".I do not know it at t ") & @ (I do not know it at $t-1$)
- e. **PSP:** $\Box t[t$ is one of the three times \rightarrow I do not know it at $t-1$]

(42) $\Box t[t$ is one of the three times \rightarrow I do not know it at t' & $t' < t$]

The phenomenon discussed here is natural enough; an informal search via Google turned up the following two instances:

(43) From the diary of a cat owner:

Heute haben unsere Schätzchen Besuch gehabt. Wir haben Nachbarskater Thommy herein gelassen. Erstes Problem war, dass Merlin in der Zeit, bis Thommy sich bequemt hat, reinzuhüpfen, schon 3x nach draußen geflitzt ist. Otto hat ihn dann jedes Mal wieder geschnappt und hineingetragen.

Today our darlings had a visitor. We let in the neighbours' cat Thommy. The first problem was that until Thommy agreed to hop in, Merlin had run out three times. Otto caught him again every time and carried him inside.

http://www.janko.at/WM/Tagebuch2004_09.htm

(44) Description of a grassroots group party event:

Höhepunkt war für viele das Modell der Castor-Strecke von Lüneburg nach Dannenberg. Die mehr als sechs Meter lange Modellbahnstrecke, mit unendlicher Liebe zum Detail gebaut, hatte alles, worauf man sich schon mal wieder vorbereiten sollte: Jede Menge bunte protestierende Leute, viel Polizei, ein rollender Castorzug, ein als Hochsicherheitstrakt ausgebauter Verladekran, [...] und als Höhepunkt eine Brücke die rechtzeitig vor dem Zug zusammenbricht. Das machte sie während des Festes 471-mal. Der Zug musste jedes Mal wieder zurückfahren.

For many the highlight was the model of Castor's train line from Lüneburg to Dannenberg. The model railway was longer than six meters, constructed with endless love for detail, and had everything one ought to be prepared for: loads of colourful protesting people, a lot of police, a rolling Castor train, a high security crane, [...] and as the highlight a bridge that collapses in time in front of the train. It did that 471 times during the party. The train had to

go back again every time.

<http://www.graswurzel.net/281/castor.shtml>

A final remark: I think that there are data that receive a natural analysis in terms of *again's* hidden variable being dependent on a nominal quantifier. A candidate is given below (let the notation t_x stand informally for the time at which x is told x 's password). I leave the details of the analysis for another occasion.

- (45) a. The principal called us into the study and told us our individual password.
b. Everyone forgot it again immediately/within the hour.
- (45') a. $\Box x[\text{BECOME}(t_x+1\text{hour}) (\text{again } f(x) (\Box t.x \text{ does not know } x\text{'s password at } t))]$
b. $f: x \rightarrow$ the time just before x was told x 's password
c. **PSP:** $\Box x[x \text{ does not know } x\text{'s password at } f(x)]$

3.3. Some further instances: *also, stop*

The adverb *again* is not the only expression in natural language that has been suggested to trigger a presupposition dependent on an anaphoric element. The literature (once more Soames (1989) following Kripke, and Heim (1990); see also Beaver (2001)) points out that a similar argument can be made for *too/also* and *stop*. Let's look at *too/also*. Standardly, it is assumed that (46a) (in which *Laura* associates with *too*) has the presupposition in (46b). According to our understanding of presupposition, this means (46c). A semantics for *too/also* in this spirit is given in (46d), where I combine directly with the associate for simplicity (instead of using a focus semantics).

- (46) a. LAURA was at the conference, too.
b. $\Box x[x \neq \text{Laura and } x \text{ was at the conference}]$
c. $c \Rightarrow \Box w.\Box x[x \neq \text{Laura and } x \text{ was at the conference in } w]$
d. $[[\text{also}]](y)(P)(t)(w)$ is defined only if $\Box x[x \neq y \text{ and } P(x)(t)(w)]$.
If defined, it is true iff $P(y)(t)(w)$.

This analysis runs into a problem with the contrast in (47a) vs. (47b). It is not clear why (47b) should be bad, since the first sentence states that the conference was well-attended.

- (47) a. Peter was at the well-attended recent conference in Mount Kisco.
LAURA was at the conference, too.
- b. # Peter wasn't at the well-attended recent conference in Mount Kisco.
LAURA was at the conference, too.

Intuitively, the problem in (47b) is Peter. We just stated that Peter was NOT at the conference, and Peter seems to be what *too* wants to relate to. This can be captured once we recognize that the presupposition triggered by *too/also* is specific rather than existential, as described in (48). The context must provide a particular person of which it implies that that person was at the conference. The only person specifically mentioned is Peter, but Peter was not at the conference. The presupposition is thus met in (47a) but not in (47b), and (47b) is correctly predicted to be infelicitous. Thus we revise our (simplified) lexical entry for *too/also* to (48c), in which it first combines with a hidden anaphor.¹ The analysis of the example is given in (49). The same point is usually made on the basis of the infelicity of examples like (50) out of the blue.

- (48) a. $\Box x[x \neq \text{Laura and } c \Rightarrow \Box w.x \text{ was at the conference in } w]$
b. that x was at the conference & $x \neq \text{Laura}$
c. $[[\text{also}]](x)(y)(P)(t)(w)$ is defined only if $x \neq y$ and $P(x)(t)(w)$.
If defined, it is true iff $P(y)(t)(w)$.

- (49) $[[\text{LAURA } t1 \text{ be at the conference, } \text{too}(x)]]\text{g}^g(w)$
is defined only if $g(x) \neq \text{Laura}$ and $g(x)$ was at the conference in w at $g(t1)$.
Then, it is true iff Laura was at the conference in w at $g(t1)$.

- (50) Sam is having dinner in New York tonight, too.

The similarity of *again* to *too/also* is particularly clear when we consider examples like (51). Assume that *too* associates with with 'in the fall of 1997'.

- (51) a. In the fall of 1997, the conference was in Mount Kisco again.
b. In the fall of 1997, the conference was in Mount Kisco, too.

¹I have put the non-identity requirement for the associate and the antecedent in the semantics of *also*. See Beaver (2001) for an argument that this may not be the right place.

The only difference between the two sentences is that (51a) requires a context that establishes for some other time than fall 1997 that the conference had been in Mount Kisco, whereas in (51b) the other time has to be earlier than fall 1997. So in the semantics of *again*, we have $t_i < t_j$ and with *also*, $t_i \neq t_j$.

Given the above, we expect that the anaphoric element in the semantics of *too/also* should be able to be quantifier dependent. Below is an example that indicates that *too/also* indeed behaves in a way parallel to *again* with respect to quantified antecedents for the hidden variable.

- (52) a. Every boy invited his girlfriend.
 b. Every boy also invited LUISE / HIS CLIMBING PARTNER.
 c. inference: Luise/his climbing partner is not the girlfriend of any of the boys

- (52') a. λx : also (f(x)) (Luise) (λz . x invited z)
 b. f: $x \rightarrow$ x's girl friend
 c. λx : x invited Luise & @(x's girlfriend \neq Luise & x invited x's girlfriend)
 d. **PSP**: λx : x's girlfriend \neq Luise & x invited x's girlfriend

A final example for an anaphoric presupposition I will mention is the one triggered by *stop*. Consider (53), once more from Heim (1990).

- (53) John is cooking now. He will stop cooking when tomorrow's basketball game starts.

The discourse suggests that John will be engaged in a continuous cooking event from now until tomorrow. If 'John stopped cooking' simply presupposed that John had cooked at some immediately preceding time interval, we should not have to interpret the discourse in such an implausible way. Once more, the presupposition is anaphoric in that it refers back to a salient time interval in the discourse, and that is the cooking John is engaged in now. We must suppose that this time interval extends until the basketball game. (53') is a quantificational version.

- (53') During the World Championship last year, John would cook the evening before an important match.
 Every time / mostly / ... , he stopped cooking when the match began the next day.

We see that there is a class of presuppositions that share with *again* the property of depending on an anaphoric element, as well as the empirical consequences this property has.

4. Conclusions and Consequences

We have investigated a set of data in which the content of the presupposition triggered by *again* depends on a quantificational element. I have proposed an analysis for these data in which the presupposition that *again* introduces is determined by an anaphoric element. That element is represented in the syntax and makes the first argument of the adverb *again*. It can be internally complex, like other natural language variables. Thus the quantifier dependent examples receive an analysis parallel to other examples in which the content of a variable depends on a quantifier, for instance quantifier domain restrictions. The quantifier dependent data lend further support to the analysis of *again*'s presupposition containing a free variable. A similar argument can be made for other anaphoric presuppositions.

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