



HAL
open science

The interpretation of indefinites in future tense sentences: A novel argument for the modality of will?

Fabio Del Prete

► **To cite this version:**

Fabio Del Prete. The interpretation of indefinites in future tense sentences: A novel argument for the modality of will?. Philippe De Brabanter, Mikhail Kissine, and Saghie Sharifzadeh. Future Times, Future Tenses, Oxford University Press, 2014, Oxford Studies of Time in Language and Thought, 9780199679157. 10.1093/acprof:oso/9780199679157.003.0003 . hal-00920890v3

HAL Id: hal-00920890

<https://hal.science/hal-00920890v3>

Submitted on 11 Feb 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

The interpretation of indefinites in future tense sentences.

A novel argument for the modality of *will*?*

Fabio Del Prete

Università degli Studi di Milano

(DRAFT: 11/15/2010)

1. Introduction

This paper is focused on the interpretation of indefinite noun phrases in future tense sentences in English. For descriptive purposes, a distinction is assumed between *specific* and *non-specific* interpretations of indefinites, pretty much along the lines of Karttunen's (1976) inaugural work on discourse referents.¹ More specifically, this paper will address the following question:

(Q) Is it possible for the indefinite object of an extensional transitive verb to have a non-specific interpretation in a future tense sentence?²

* I am thankful to Sandro Zucchi for discussion of many aspects of this paper.

¹ The distinction can be illustrated by considering sentence (i.a), along with its two possible readings (i.b) and (i.c):

- (i) a. Mary didn't find a misprint.
- b. $\neg\exists x [\text{misprint}(x) \wedge \text{found}(\text{Mary}, x)]$
 ('Mary found no misprints.')
- c. $\exists x [\text{misprint}(x) \wedge \neg\text{found}(\text{Mary}, x)]$
 ('There is a particular misprint that Mary didn't find.')

The indefinite *a misprint* has a non-specific interpretation in reading (i.b). The characterizing feature of this interpretation is that there is no particular individual in the semantic representation which the indefinite corresponds to. By contrast, the same indefinite has a specific interpretation in reading (i.c). On this interpretation, there *is* a particular individual in the semantic representation – a certain misprint – that the indefinite corresponds to.

The distinction between specific and non-specific (interpretations of) indefinites is not to be intended as implying that the English indefinite determiner *a* is semantically ambiguous. In particular, the distinction should not be understood in terms of the semantic opposition referential *vs.* quantificational, as suggested e.g. by Fodor & Sag (1982).

² The attention in (Q) is restricted to *extensional* transitive verbs for an obvious reason. Indefinite objects of *intensional* transitive verbs can naturally obtain non-specific interpretations, both in past and in future tense contexts, as shown in (i) and (ii):

- (i) Mary looked for a white horse, but she didn't find one.
 ('Mary looked for some white horse or other, but she didn't find any white horse.')
- (ii) Mary will look for a white horse, but she won't find one.
 ('Mary will look for some white horse or other, but she won't find any white horse.')

It will be shown that, once we provide an answer to (Q), we will be in a position to put a constraint on the semantic analysis of the future. In this connection, the long-standing issue will be reconsidered whether the future auxiliary *will* should be better analyzed as a tense or as a modal operator, and this will be done from the particular vantage point provided by (Q)'s perspective.

The main empirical data to be accounted for are what I will call *Stalnaker's Asymmetry*, introduced in section 2, and a future tense version of what I will call *Karttunen's Puzzle*, presented in section 3. Stalnaker's Asymmetry has to do with the fact that the inferences in (1) and (2) below differ in logical status: the inference in (1) is valid only under a particular reading of its premise, one in which President Carter's obligation is in relation to a certain woman; the validity of the inference in (2), however, does not seem to depend on a particular interpretation of the premise in a similar way.³

- (1) a. President Carter has to appoint a woman to the Supreme Court.
b. Therefore, there is a particular woman that the president has to appoint.
- (2) a. President Carter will appoint a woman to the Supreme Court.
b. Therefore, there is a particular woman that the president will appoint.

Karttunen's Puzzle is the twofold observation that the specific interpretation of the indefinite *a rich man* in (3a) below correlates with an epistemic interpretation of *must*, while the non-specific interpretation of the same indefinite correlates with a deontic interpretation of the modal. I will suggest that the same observation can be made about (3b), and that the availability of a deontic interpretation of *must* in this discourse can be used to show the possibility of non-specific indefinite objects in future tense sentences with extensional transitive verbs.

- (3) a. Mary wants to marry a rich man. He must be a banker. [Karttunen 1976]
b. Mary will marry a rich man. He must be a banker.

The non-specific interpretation of *a white horse* in (i) and (ii) has the same source: it depends on the intensionality of the verb *look for*, thus it doesn't tell us anything about whether the future tense itself has some feature that makes it possible for the indefinite object to be interpreted non-specifically. For one thing, from the non-specific interpretation of *a white horse* in (ii) one could not correctly infer that the future has an intensional nature.

³ Sentences (1a) and (2a) are from Stalnaker (1981).

In sections 4 and 5 I consider some objections to the claim that the deontic interpretation of *must* in discourses like (3a,b) requires a non-specific interpretation of the indefinite object. Taking care of these objections will give me the opportunity to clarify the structure of Karttunen's Puzzle and to show that the non-specific interpretation of the indefinite object is indeed necessary for *must* to obtain the relevant deontic interpretation. To account for the data presented in the earlier sections, in section 6 I propose an analysis of *will* on which its semantic contribution is that of a tense in referential/presuppositional analyses of tense (Heim 1994), namely a temporal variable whose value is presupposed to be a situation in the future of the utterance situation. The analysis is built in a temporal/modal framework with world-histories asymmetrically branching towards the future, as in branching time models (Thomason 1985). A side effect of universal quantification over alternatives, however, is produced by a pragmatic supervaluation-like strategy which hearers rely on in certain contexts to overcome the plurality of possible futures that are eligible candidates for the sentence's truth-conditional evaluation in those contexts. The idea, in a nutshell, is the following: the conversational participants who are dealing with (3b) are not in a position to single out a unique future history as the one that will actually take place, as a result the statement made by uttering the future tense part of (3b) is required to hold for *any* of all the accessible futures, i.e. on any accessible history Mary marries a rich man at some future situation; furthermore, this plurality of accessible futures provides the domain for the interpretation of *must*: in all the accessible histories which are most compatible with the relevant norms, the rich man is a banker. The "anti-plurality" strategy referred to above thus introduces a modal feature in the interpretation of future tense sentences, which will enable us to account for the non-specific construal of the indefinite object *a rich man* in (3b), and for the related deontic interpretation of *must* in the same example. At the same time, the hypothesis that such modal feature is not part of the semantics of the future auxiliary itself will help explain the asymmetry between *will* and *have to* (and other intensional verbs) with respect to the availability of non-specific interpretations of indefinite objects in out-of-the-blue contexts. I will argue that the invoked strategy, far from being an *ad hoc* hypothesis, has the status of a general pragmatic process which speakers resort to when they have to deal with pluralities of potentially relevant values for a given evaluation parameter.

An advantage of the proposed analysis is that the apparent modal force of *will* is not treated as an accidental property of this particular tense marker, but is derived from a general assumption about the branching structure of the futures that are eligible for the truth-conditional evaluation. A prediction this analysis makes is that apparent necessity modal interpretations for the future tense should be available cross-linguistically, what seems to have a large empirical support. Arguably, the proposed analysis would fare better than a necessity modal analysis in accounting for some puzzling cases in which *will* co-occurs with quantifying adverbs of varying quantificational forces (Kissine 2008), as in the naturally occurring examples (4) and (5):

- (4) Some of us here today will possibly have lost infants and young children from our own families.⁴
- (5) It will hardly have gone unnoticed that Step 9 has been crammed with do's and don'ts, all worthy of close revision.⁵

2. Stalnaker's Asymmetry

Against an intensional analysis of *will* as a modal of necessity, it has been contended that the answer to question (Q) (which I repeat below) is negative (see Stalnaker 1981).

- (Q) Is it possible for the indefinite object of an extensional transitive verb to have a non-specific interpretation in a future tense sentence?

To appreciate this negative stand, consider the contrast between the inference in (6) and the one in (7):

- (6) a. John will date a blond woman.
b. Therefore, there is a particular woman that John will date.
[unconditionally valid]
- (7) a. John wants to date a blond woman.

⁴ From: *beehive.govt.nz*, the official website of the New Zealand Government, 28 May 2004 (<http://www.beehive.govt.nz/node/19875>).

⁵ From: Len Weinreich, *Eleven steps to brand heaven*, Kogan Page Publishers 2001.

- b. Therefore, there is a particular woman that John wants to date.
[conditionally valid]

On the one hand, it seems that for (6a) to be true there must be a particular woman of whom it is true that John will date her at some point. We may not know who that particular woman is, John himself may not know her identity; furthermore, the woman may even not have been born yet. Still, the truth of (6a) seems to require that there *is* (in a temporally unrestricted sense) a particular woman that John will date. On the other hand, for (7a) to be true there need not be a particular woman of whom it is true that John wants to date her. Accordingly, if we take the quantificational idiom *there is* in (6b) and (7b) to express temporally unrestricted quantification (over a domain which includes future individuals, as well as present ones), we feel that the inference in (6) is unconditionally valid, whereas the validity of the inference in (7) is contingent upon a construal of the premise in which the indefinite *a blond woman* is interpreted specifically; indeed, only on the specific interpretation is there a particular individual that the indefinite corresponds to. Crucially, the premise (7a) has an alternative reading, one on which John's will could be fulfilled by his dating anyone of different blond women. On the latter interpretation, there is no particular individual corresponding to the indefinite, and the inference in (7) does not go through. I will refer to the contrast between the unconditional validity of (6) and the conditional validity of (7) as *Stalnaker's Asymmetry*.

One could explain the envisaged ambiguity of (7a) by assuming a standard Hintikka (1962)-style account of *want* as a universal quantifier over possible worlds: the possible worlds in which everything that John wants in the actual world w_0 is realized - i.e. John's *bouletic alternatives* with respect to w_0 . If *want* expresses universal quantification over bouletic alternatives, the contrast between the two readings of (7a) can be easily explained in terms of a scope interaction between the universal quantifier corresponding to the modal verb and the existential quantifier corresponding to the indefinite NP. On the specific construal, it is the same blond woman that is picked out across different bouletic alternatives, and this is captured by the wide scope construal of the indefinite, given in (7a'). On the non-specific construal, different women can be selected relative to different alternatives, and this is captured by the narrow scope construal of the indefinite, given in (7a'').

- (7) a'. $\exists x [\text{blond-woman}(x) \wedge \forall w [\text{Alt}_{\text{bouletic}}(w_0, w, \text{John}) \rightarrow \text{date}(\text{John}, x, w)]]$
 a". $\forall w [\text{Alt}_{\text{bouletic}}(w_0, w, \text{John}) \rightarrow \exists x [\text{blond-woman}(x) \wedge \text{date}(\text{John}, x, w)]]$

Now, so the argument runs, if *will* too were to introduce universal quantification over a domain of modal alternatives (for example, a domain of historically possible futures), the same ambiguity should be present in (6a), as has been found in (7a), and the validity of the inference in (6) should also be contingent on the specific construal of its premise. But (6) is felt to be *unconditionally* valid. A straightforward conclusion, by *modus tollens*, is that the auxiliary *will*, unlike the modal verb *want*, does not introduce universal quantification over alternatives.

An option that one could consider at this point is that *will* should be analyzed as a tense operator, on a par with the past tense morphology *-ed*. The semantics of *will* should thus be thought of in terms of existential quantification over times.⁶ The unconditional validity of (6) would thus be explained as follows: (6a) says that there is a time t such that t follows the time of utterance t_0 and John dates a blond woman at t ; but from this it follows that there is (in the temporally unrestricted sense) a woman x and there is a time t following t_0 such that John dates x at t .

This theory, however, faces an empirical challenge. We will consider this challenge in the next section.

3. Karttunen's Puzzle revisited

In this section I present a future tense version of a semantic conundrum, *Karttunen's Puzzle* (after Karttunen 1976).⁷ The puzzle originally described by Karttunen has to do

⁶ Pretty much in the same way as the semantics of the Priorian tense operators P and F is given in first-order temporal logic. See Kissine (2008) for a recent proposal in which the future auxiliary *will* is seen as a Priorian tense operator.

⁷ Karttunen introduces the puzzle in question in footnote 3 of Karttunen (1976). I report the full text of his footnote here:

“What remains unexplained here is the fact (pointed out to me by John Olney) that *must* in [(4a)] [*Mary wants to marry a rich man. He must be a banker.*] has two meanings depending on the specificity of the NP *a rich man* in the preceding sentence. If the first sentence is about a specific man, then *must* in the second sentence is interpreted in a rather weak sense: ‘It is likely that he is a banker’. But if the NP *a rich man* is nonspecific, the second sentence means: ‘It is necessary that he be a banker’.”

Notice that the weak sense of *must* which Karttunen is alluding to is what I call *epistemic reading*, whereas the other sense of *must* is what I call *deontic reading*. Karttunen himself in Karttunen (2007) uses the terminology *epistemic / deontic* to describe the puzzle in question.

with the correlation between the specific/non-specific interpretation of the indefinite *a blond woman* and the type of interpretation of the modal *must* in (8):

(8) John wants to date a blond woman. She must be twenty years old.

Karttunen's observation is that the specific reading of the indefinite in the left sentence is only compatible with the epistemic reading of the modal in the right sentence, which could be paraphrased as 'It is likely that she is twenty years old', while a non-specific reading of the indefinite forces a deontic reading of the modal, paraphrasable as 'It is required that she be twenty years old'.

A point that I want to stress, following a further observation that Karttunen makes, is the following: if we go for a specific interpretation of the indefinite *a blond woman*, we have to use a definite pronoun (or description) in order to obtain an anaphoric relation to the indefinite in question – at least if we intend to refer back to the individual corresponding to the indefinite.⁸ On the other hand, if we go for a non-specific interpretation of the same indefinite, we can only use a *one*-anaphora in order to obtain an anaphoric relation to it – unless the pronoun is interpreted in the scope of an intensional operator, as in contexts of so-called modal subordination (Roberts 1987), where a definite pronoun is indeed possible. These patterns of anaphoric back-reference are shown by the continuations of (8) given in (9) and (10).

(9) John wants to date a blond woman_i. She_i must be twenty years old. I saw her_i at the local bar yesterday. [only epistemic *must*]

⁸ It is certainly possible to use an indefinite NP α in a specific interpretation, and still to obtain an anaphoric relation to α by using a *one*-anaphora instead of a definite pronoun, as shown in (i) (the indefinite *a blond woman* is necessarily specific here, as the sentence is past-tensed and the verb extensional; still, the *one*-anaphora makes perfect sense):

(i) John dated a blond woman. I too dated one.

This possibility, however, is not at stake here. The only point that is relevant for our discussion is this: whenever an indefinite NP α is used in a specific interpretation in a discourse δ , a definite pronoun anaphorically related to α *can* occur later in δ , and indeed one *has* to use a definite pronoun in order to refer back to the particular individual corresponding to α in δ .

- (10) John wants to date a blond woman_i. She_i must be twenty years old. I saw one_i at the local bar yesterday (whom John might want to consider for dating).⁹

[only deontic *must*]

The reverse patterns are not possible, as shown by the unacceptability of the following variants of (9) and (10):

- (9') John wants to date a blond woman_i. She_i must_(epistemic) be twenty years old. I saw *one_i at the local bar yesterday.

[(9') cannot mean: 'there is a blond woman whom John wants to date, that woman must be 20 years old, and I saw that same woman at the local bar yesterday']

- (10') John wants to date a blond woman_i. She_i must_(deontic) be twenty years old. I saw *her_i at the local bar yesterday.

On the one hand, discourse (9') is bad because a *one*-anaphora cannot serve to pick out a previously established referent. On the other hand, discourse (10') is bad because there is no previously established referent for the definite pronoun *her* to pick out. Such morphosyntactic facts are important as they provide a less disputable evidence for the distinction *specific/non-specific* that I am assuming than ordinary semantic intuitions could provide.

My future tense version of Karttunen's Puzzle is the discourse in (11), which admits of the two paraphrases (12) and (13):¹⁰

- (11) John will date a blond woman. She must be twenty years old.

- (12) John will date a blond woman. The woman he will date, Jane, must be twenty years old.

⁹ The second sentence in (10) has a definite pronoun, *she*, which is anaphoric to a non-specific indefinite, *a blond woman*, occurring in the preceding sentence. This fact, however, is not in contrast with the observation made in the main text concerning the relation between *one*-anaphora and non-specific indefinite antecedents: that observation is restricted so as to exclude contexts of modal subordination, but the second sentence in (10) is precisely a context of this type.

¹⁰ Strictly speaking, (12) is not a paraphrase of (11), as it contains a proper name, *Jane*, that doesn't occur in (11). The only point of having the proper name *Jane* in (12) is to make it clear that the subject definite description *the woman he will date* is used here to make reference to a particular individual, of whom it is said that she is likely to be twenty years old.

- (13) John will date a blond woman. The woman he will date, whoever she will be, must be twenty years old.

This version of the puzzle shows that the same epistemic/deontic ambiguity of *must* as we observe in (8) is attested when we replace the left sentence of (8) with a future tense sentence. The epistemic interpretation of *must* is shown by the paraphrase of (11) given in (12): this makes it clear that the indefinite *a blond woman* corresponds to a particular individual here, a certain woman, namely Jane. The deontic interpretation of *must* is shown by the paraphrase in (13): this shows that the indefinite does not correspond to a particular individual in this context.¹¹

Interestingly, for the future tense version of the puzzle, too, we can apply the test of definite *vs.* *one*-anaphora to tell the two readings apart. This is shown by the continuations of (12) and (13) given in (14) and (15), respectively:

- (14) John will date a blond woman_{*i*}. The blond woman he will date_{*i*}, Jane, must be twenty years old. I saw her_{*i*} / *one_{*i*} at the bar yesterday.
- (15) John will date a blond woman_{*i*}. The blond woman he will date_{*i*}, whoever she will be, must be twenty years old. I saw one_{*i*} / *her_{*i*} at the bar yesterday.

For the sake of being explicit, let's state the relevant empirical generalization as follows:

- (K) In a discourse of the form **NP will / want (to) V [a N']_{*i*}. He_{*i*} / She_{*i*} must be P:**
1. the deontic interpretation of *must* requires that the indefinite [a N'] be non-specific;

¹¹ Against this claim, one might object that the parenthetical phrase *whoever she will be* in (13) only has an epistemic interpretation, conveying that the speaker does not know who that particular woman is that John will date, but the interpretation of the indefinite antecedent would still be specific. This objection, I think, would obliterate the semantic difference between *whoever she will be* and *whoever she is*. Consider the following pair of discourses:

- (i) John will date a blond woman. The woman he will date, *whoever she is*, must be twenty years old.
- (ii) John will date a blond woman. The woman he will date, *whoever she will be*, must be twenty years old.

My intuition concerning (i) and (ii) is the following: on the one hand, the phrase *whoever she is* has an epistemic interpretation, which makes it possible to interpret *a blond woman* as specific and, accordingly, *must* as epistemic in (i); on the other hand, the phrase *whoever she will be* has an interpretation in which it is not just the speaker's knowledge which is at stake, but a more objective kind of indeterminacy in reference, and this makes it possible to interpret *a blond woman* as non-specific and, accordingly, *must* as deontic in (ii). I am thankful to Liz Coppock for her judgement about these examples.

2. the specific interpretation of the indefinite [**a N'**] is only compatible with the epistemic interpretation of *must*.

In view of generalization (K), considering the fact that a deontic interpretation is indeed possible for *must* in (11) (as shown by [13] and [15]), the contention that the indefinite *a blond woman*, being the object of an extensional verb in a future tense sentence, has to be specific would be problematic. It seems that one can make a case here for the idea that *will* should be analysed as a universal quantifier over modal alternatives after all.

The problem with a modal analysis of *will*, of course, is that it would still have to account for the difference between (1) and (2) that we started out with: if the modal analysis is on the right track, how does it come that, out of the blue, the indefinite object of a future tense sentence with an extensional verb is interpreted specifically, whereas the indefinite object of the complement of *want* (and of similar modal verbs) is neutral between the specific and the non-specific interpretation?

In the next section, I will consider an objection against the claim that the deontic interpretation of *must* in (11) requires the indefinite *a blond woman* to be non-specific. Hereafter, I will use the term *Karttunen's Puzzle* to refer to both Karttunen's original conundrum and my future tense version of it.

4. Non-specific indefinite or lack of knowledge about the referent's identity?

As we saw in the previous section, the interpretation of (11) expressed by the paraphrase (13) (both repeated below) seems to point to the existence of non-specific interpretations of indefinite objects of future tense sentences.

(11) John will date a blond woman. She must be twenty years old.

(13) John will date a blond woman. The blond woman he will date, whoever she will be, must be twenty years old.

Against generalization (K), however, it could be objected that the interpretation of *a blond woman* in (13) has only a superficial resemblance to the genuine non-specific interpretation of indefinite objects in the complement of *want*. Consider the following dialogues (adapted from Stalnaker 1981):

- (16) Bill: John will date a blond woman.
Jane: Which one?
Bill: Nobody (not even John) knows that / ? No one in particular. But she must be twenty years old.
- (17) Bill: John intends to date a blond woman.
Jane: Which one?
Bill: Nobody (not even John) knows that / No one in particular. But she must be twenty years old.

Notice that the answer ‘Nobody knows that’ is good in both dialogues, but the answer ‘No one in particular’ is good only in (17), while giving rise to oddness in (16). Furthermore, a deontic interpretation of *must* seems to be possible both in (16) and (17). Focusing the attention on (16), it could be objected that there actually is no non-specific interpretation of the indefinite in this context, and that the only thing one could say is that there is ignorance on the part of the conversational participants with regard to the identity of the actual referent; also, it could be claimed that the deontic interpretation of *must* in Bill’s reply is made possible precisely by the fact that the identity of the referent is not known, not by the fact that there is no particular individual the indefinite corresponds to. This line of argumentation can be criticized by pointing out a particular feature of the example under discussion: provided that people normally decide themselves for their own dates, the fact that John doesn’t know yet which woman he will date makes it objectively, not only epistemically, indeterminate which woman that will be, i.e. it makes it the case that there actually is no particular woman of whom it is true that he will date her; so, the conclusion remains that the indefinite *a blond woman* is genuinely non-specific in (16). This criticism can be tested by considering a variant of (16) in which the verb phrase *date a blond woman* is replaced by a verb phrase which does not allow for the inference from epistemic uncertainty to objective indeterminacy that, as we just saw, *date a blond woman* makes possible.

Consider the variant (16’), as occurring in the context described below:

[Context: The director of John’s company has established that John will meet a colleague from the office of Public Affairs tomorrow morning to discuss a certain issue. She has

also established which colleague from the Public Affairs John will meet. Bill only knows that John will meet some colleague or other from the Public Affairs tomorrow, while only the director knows the colleague's identity.]

(16') Bill: John will meet a colleague from the Public Affairs office tomorrow morning.

Jane: Which one?

Bill: Nobody except the director knows that. But she must be an expert on budget issues.

My intuition about this case is twofold: (a) Bill's first assertion in (16') features a specific interpretation of *a colleague from the Public Affairs office* – as Bill makes his utterance, there is a particular individual the indefinite corresponds to, namely the particular colleague who has been chosen by the director; (b) more importantly, the modal *must* in Bill's reply is necessarily epistemic. The way the example and the relevant context are constructed makes it clear that the fact the identity of the referent is not known by the conversational participants is accompanied by the fact that it is objectively determinate which colleague John will meet, so that the former fact does not force a non-specific interpretation of the indefinite in this case. Thus, what (16') shows, against the line of argumentation given above, is that epistemic uncertainty on the part of the conversational participants is not enough to license the deontic interpretation of *must*. A non-specific interpretation of the indefinite antecedent seems to be required to this effect.

There is something, however, that has to be taken into account: the answer 'No one in particular' is odd in the context of (16), even if we go for a deontic interpretation of *must*, and hence, according to (K1), even if we force a non-specific interpretation of the indefinite. I will explain this fact in terms of a processing clash: given that *will*'s semantic contribution is the one of a tense marker, the default interpretation of the indefinite in (16) is specific, thus when we reach the point of the dialogue at which the answer 'No one in particular' occurs, we face a clash between the meaning of this answer and the specificity of the indefinite. Since this clash is produced during the linear left-to-right processing of the dialogue, the subsequent deontic interpretation of *must* in the last

sentence, which on my proposal has the effect of triggering a reinterpretation of the indefinite as non-specific, cannot do anything to avoid it.

5. What is the rationale beyond generalization (K)?

Generalization (K) has the status of an empirical claim. It is not *a priori* clear why things should be the way it requires them to be.¹² In particular, it may not be clear why (as sanctioned by [K1]) the deontic interpretation of *must* should require a non-specific interpretation of the indefinite in discourses of the relevant form, repeated in (18):

(18) NP will / want (to) V [a N']_i. He_i / She_i must be P.

In this section, I consider two objections that could be leveled against (K). Addressing them will enable me to make the import of (K) clearer, and, relatedly, to shed light on the structure of Karttunen's Puzzle. Also, the discussion will give me the opportunity to clarify what is the relevant deontic interpretation of *must* which is involved in (K).

One objection to (K) has been raised by Sandro Zucchi, who has pointed out to me (p.c.) that the discourse (19) is naturally interpreted as having a specific indefinite in the left sentence and a deontic necessity modal in the right sentence. This would show that the relation between specific indefinite and epistemic modal that is stated in (K) is not a necessary implication.

(19) John dated a blond woman. She had to be 20 years old.

Notice, however, that (19) differs significantly from Karttunen's original example, in that the temporal perspective is not the same for the two sentences: if the right sentence is interpreted deontically (as it is in fact most naturally interpreted), then its temporal perspective is shifted backward with respect to the time of the dating event reported by the left sentence. To sustain this point, I observe that (19) could be coherently expanded

¹² It's interesting to note the following remark by Karttunen (2007): "Looking back at my old paper [Karttunen 1976], [...] I am also impressed by the fact some of the problems it uncovered, such as the deontic/epistemic contrast in (6) [*The director is looking for an innocent blonde. She must be 17 years old.*], apparently remain unsolved."

as in (19'), where it is made clear that the temporal perspective relative to which the deontic modal is evaluated is a time preceding the time of the dating.

(19') John dated a blond woman. She had to be 20 years old. In the end, however, he dated a 30 years old woman.

Secondly, it may be objected that example (20) has a natural interpretation which directly counters (K):

(20) John will examine a linguistics student tomorrow morning. She must be well prepared in syntax.

The interpretation in question is that John will examine a certain student, say Jane, and it is required that this particular student be well prepared in syntax on the day of the exam. So, in this case too (as in the case of [19] above), we have both a specific indefinite and a deontic *must*. Moreover, it's likely that this objection could not be dismissed in the same way as the previous one, as the temporal perspective is likely to be the same for the two sentences in (20). To address this threat, I make the following observation: Karttunen's original example (3a), as well as my own examples (8) and (11) (repeated below as [21], [22], and [23], respectively), all exemplify the general schema (18) by having 'P' instantiated to a predicate that, unlike *well prepared in syntax*, patterns with Individual-Level (IL) predicates in relevant respects.¹³

(21) Mary wants to marry a rich man. He must be a banker.

(22) John wants to date a blond woman. She must be twenty years old.

(23) John will date a blond woman. She must be twenty years old.

¹³ Evidence that *be twenty years old* and *be a banker* pattern with Individual-Level predicates while *be well prepared in syntax* does not is provided by the following minimal pairs (see Chierchia 1995):

- (i) a. John is sometimes well prepared in syntax.
b. * John is sometimes *twenty years old / a banker*.
- (ii) a. There is a student well prepared in syntax.
b. * There is a student *twenty years old / a banker*.
- (iii) a. John was well prepared in syntax yesterday.
b. ? John was *twenty years old / a banker* yesterday.

To see how the predicates *be a banker* and *be twenty years old*, on the one hand, and *be well prepared in syntax*, on the other, differ in their interaction with *must*, consider the semantic contrast between (24a) and (24b):

- (24) a. Bill must be *twenty years old / a banker*.
b. Jane must be well prepared in syntax.

While (24b) has a natural interpretation in which *must* is deontic and the state of being well prepared in syntax is shifted to the future, (24a) appears to only allow for an interpretation in which *must* is epistemic and the state of being twenty years old (or being a banker) is present.

From the above discussion, it should be clear that the deontic interpretation of *must* which is at stake in (K) is to be kept distinct from the more common deontic meaning of *must* that one finds in prescriptive sentences like *Jane must go to jail* (or *Jane must be well prepared in syntax*, in the natural interpretation given above), where the predicative complement of the modal is an eventive predicate or a Stage-Level stative predicate, and the time of the eventuality is characteristically shifted to the future. The deontic interpretation of *must* which is relevant to us (let's call it 'K-interpretation') has the following essential property:

K-interpretation of 'must'

The K-interpretation of *must* expresses a general requirement that an object of a certain type satisfy a certain property – as in sentences of the form *Any individual of type T must have property π* (cf. *An Italian woman must be a good cook*). Thus, it essentially differs from the interpretation of *must* in sentences of the form *The particular individual x must ψ* , where the modal expresses a dynamic relation between an individual subject *x* and an event-type ψ .

Given this property of the particular deontic interpretation of *must* that we are considering, the following restriction follows:

Restriction on the K-interpretation of 'must'

In a sentence [NP must P] in which *must* gets the K-interpretation, the subject NP cannot refer to a particular individual but has to have a generic interpretation.

For example, consider the contrast between (25a) and (25b) below. The subject NP *an Italian woman* has a generic interpretation in (25a), which is compatible with the K-interpretation of *must*, and the sentence does indeed feature this interpretation. The subject NP *that woman* in (25b), on the other hand, doesn't have a generic interpretation, as it refers to a particular individual. The result is that the K-interpretation of *must* is not possible here, and we are left with the epistemic interpretation of the modal as the sole semantic possibility.

- (25) a. An Italian woman must be a good cook.
 ['It is required that any Italian woman be a good cook.']
 b. That woman must be a good cook.
 ['That woman is likely to be a good cook.']

Let's go back to Karttunen's original example (21) (repeated below) to see how the suggested informal analysis of the K-interpretation applies to it.

- (21) Mary wants to marry a rich man. He must be a banker.

We can now see why the deontic interpretation (i.e. the K-interpretation) of *must* requires a non-specific interpretation of the indefinite *a rich man*. On the basis of the informal analysis sketched above, the reasoning goes as follows:

- (a) Suppose that *must* is interpreted deontically in (21).
(b) From (a), it follows that the subject NP *he* must have a generic interpretation – in particular, *he* cannot be a referential pronoun referring to a particular rich man, because in this case *must* would be interpreted epistemically.
(c) If the indefinite *a rich man* were to be interpreted specifically, however, the pronoun *he* would have to be interpreted as a referential NP referring back to the particular man that the indefinite would correspond to.

- (d) Therefore, the indefinite *a rich man* cannot be specific in (21), hence it must be non-specific.

In what follows, I'll be simply talking of deontic interpretation of *must*, but in all cases I'll intend to refer to the K-interpretation.

Before concluding this section, it will be opportune to say something more about the generic interpretation of *he* supposedly triggered by the deontic interpretation of *must* in (21). Indeed, one might wonder what a generic interpretation of a definite pronoun might come down to. First of all, observe that under the deontic interpretation of *must*, the pronoun *he* occurs in a modal subordination context: given that the indefinite antecedent is non-specific, only a *one*-anaphora would be allowed, were the context of occurrence of the anaphoric pronoun a purely extensional one (see sect. 3 above). This means that the pronoun *he* has no referential status under the relevant interpretation, as it has to be interpreted in the scope of *must*. If we wanted to break down the anaphoric relation that makes the second sentence in (21) semantically dependent on the first sentence, so as to specify its meaning independently from the meaning of the first sentence, we could propose the following paraphrase:

- (26) A man who is an eligible candidate for being married by Mary must be a banker.

This paraphrase of the second sentence in (21) should give a rough idea of what the generic interpretation of *he* may come down to – this would be something akin to the generic interpretation of the indefinite subject of (26), *a man who is an eligible candidate for being married by Mary*.^{14, 15}

¹⁴ By giving sentence (26) as a paraphrase for the meaning of the second sentence in (21), I do not intend to suggest that the pronoun *he* in the latter sentence has the same underlying semantic representation as the indefinite subject of the former sentence - in particular, I am not suggesting that the pronoun *he* is proxy for an indefinite description in (21). In fact, in sect. 6 I will propose a uniform e-type analysis of definite pronouns in contexts of discourse-anaphora, according to which they are construed as definite descriptions whose uniqueness requirements are relativized to minimal situations (Heim 1990, Elbourne 2002).

¹⁵ To give another example of a definite NP which is generically interpreted in contexts of the relevant type, consider sentence (i):

- (i) My girlfriend must be sexy.
(possible interpretation: 'I only choose sexy girlfriends')

This sentence, in the interpretation which is relevant for us, can be interpreted as the generic sentence *A woman who is an eligible candidate for being my girlfriend has to satisfy the property of being sexy*. The

The above discussion has shed light on two important aspects of generalization (K), and consequently on two features of Karttunen’s Puzzle: first, (K) has to be understood as restricted to discourses in which the temporal perspective of the two sentences involved is one and the same; second, the predicate variable ‘P’ in the schematic description in (K)’s statement has to be restricted to IL-like predicates, i.e. to predicates P that characteristically do not allow a forward shifting of the time of the P -event in sentences of the form [NP must P]. Furthermore, the above discussion has made it clear what particular deontic interpretation of *must* is at stake in (K). Importantly, a central property of this interpretation has been individuated, which we have characterized as the requirement that the subject NP in [NP must P] be a non-specific, generically interpreted NP.

6. Analysis of the previous data

6.1 The semantic framework

I adopt a semantic framework that I have elsewhere called *Partial Branching Time* (PBT; Del Prete 2010a, 2010b). A PBT-model encompasses a domain of Kratzerian situations: maximal moments of classical Branching Time¹⁶ (i.e. instantaneous events maximally extended through space) are replaced by partial situations as basic elements which are ordered by the relation of temporal precedence. The central idea of Branching Time is extended to PBT: every situation comes with a unique past but many possible futures. Formally, this means that the relation of temporal precedence \leq_S will not be a linear order, but a partial order generating tree structures. Given any two situations s_1, s_2 , the interpretation of the relational statement $s_1 \leq_S s_2$ (adapting a suggestion by Belnap 1992) is that s_1 *did* occur from the perspective of s_2 , while s_2 *might* occur from the perspective

relevant reading of (i) is represented by the logical formula (ii) (the operator \Box is to be understood as the deontic necessity ‘it is required that...’):

(ii) $\Box \forall x [\text{my-girlfriend}(x) \rightarrow \text{sexy}(x)]$

Notice that the definite description *my girlfriend*, as it occurs in (i), can pick out different individuals at different times. So, in (i) we don’t have a unique particular individual picked out by the description, with the result that the deontic interpretation of *must* can arise.

¹⁶ By *classical Branching Time*, I refer to the conception of BT which is proposed in Prior (1967) and Thomason (1984). The reader is referred to Belnap et al. (2001) for an in-depth investigation of BT-models and a proposal of semantic analysis of natural language constructions based on such models.

of s_1 , the occurrence of s_2 being expected given some relevant facts in s_1 and in its past. World-histories are defined as maximal chains of situations. Given any two world-histories h, h' , and given any situation s , the relational statement $h \approx_s h'$ means that h and h' are identical up to and including situation s and diverge from s onwards – in other terms, h' is a historical alternative to h at s . The relation \approx_s will play a crucial role as the accessibility relation that underlies the modal reinterpretation of the future tense *will* in Karttunen’s Puzzle (see sect. 6.3 below). For a full-fledged presentation of a PBT-model, the reader is directed to Del Prete (2010a, 2010b).

The type system contains the basic types **e** (for individuals), **t** (for truth values), **i** (for situations), and **s** (for world-histories). Notice that the system does not contain a type for times; this is because in the adopted model situations play the role that is played by time intervals in other semantic systems. The letters **h**, **h₁**, **h₂**..., **s**, **s₁**, **s₂**..., and **x**, **y**, **x₁**, **y₁**... are used as variables over world-histories, situations, and individuals, respectively. **c** is a context of utterance, i.e. a sequence of parameter values among which we find the time of utterance **c_t** (a given situation containing the utterance) and the circumstance of utterance **c_h** (a given history passing through the situation of utterance). Two value-assignments are used: **f** is a one-place function which assigns an individual to any variable of type **e**, while **g** is a two-place function which assigns a situation to any variable of type **i** relative to any world-history: given variable k of type **i** and world-history h , $g(k, h)$ is a situation belonging to h . The symbol \wedge (reminiscent of Montague’s cap operator) denotes the intensionalizing operator: this takes an expression E as argument and yields an expression $\wedge E$ that denotes a function from world-histories h to the extension of E relative to h . The symbol \forall^* in the leftmost position of a future tense sentence’s LF denotes an operation of universal quantification over world-histories which is pragmatically triggered whenever many such histories have become eligible for truth conditional evaluation (see sect. 6.3 below for the exact semantics of \wedge and \forall^*).

I adopt Heim & Kratzer’s (1998) λ -notation, where the lambda-term $\lambda x: \varphi. \psi$ represents a partial function f which is defined for an object x if and only if condition φ is satisfied (here φ is Heim & Kratzer’s *domain condition*); if f is defined for x , then the value it assigns to x is whatever value is described by ψ . I further introduce a notation that will enable us to represent the result of applying a partial function f to an object x ,

while keeping track of the definedness condition of f in the description of the output: if $\lambda x: \varphi[x]. \psi[x]$ represents the partial function f , then the result of applying f to an object denoted by a constant a is described by the notation $\{\varphi[a]\} \psi[a]$, which means that we get $\psi[a]$ *provided that* $\varphi[a]$ is satisfied.

The evaluation function $\llbracket \]$ is relativized to a context c , assignment functions f and g , and a possible world-history h (sometimes called *circumstance of evaluation*). The metalinguistic expression $\llbracket E \rrbracket^{c, f, g, h}$ has to be read as ‘the denotation of E relative to context c , assignments f and g , and history h ’.¹⁷ When the circumstance of evaluation h is set up by the context (i.e. when h is the circumstance of the context – also called the *actual circumstance*), we have the case of *denotation in context*, which, for sentential utterances, coincides with *truth in context*. In what follows, I’ll only be interested in truth in context, hence the evaluation parameter h in $\llbracket E \rrbracket^{c, f, g, h}$ will always take the actual circumstance as its value. I will make the crucial assumption that contexts normally (but not invariably) set up a determinate value for their circumstance parameter, exactly as they set up a determinate value for the agent parameter, the time parameter, and so on.¹⁸

I assume that verbal and nominal predicates alike introduce a situation argument into the semantic representation, besides the individual arguments that are predictable from their surface argument structures. Situation and individual arguments alike get locally bound by λ -operators in the usual way. This is shown in (27) for the transitive verb *date* and in (28) for the noun *woman*:

$$(27) \quad \llbracket \text{date} \rrbracket = \lambda s. \lambda y. \lambda x. \text{date}(s, x, y)$$

$$(28) \quad \llbracket \text{woman} \rrbracket = \lambda s. \lambda x. \text{woman}(s, x)$$

Thus, the verb *date* denotes a function which takes a situation s , an individual y and another individual x as arguments and yields the true as value if and only if x dates y in s , whereas the noun *woman* denotes a function which takes a situation s and an individual x as arguments and yields the true as value if and only if x is a woman in s . A condition of

¹⁷ I will freely skip reference to any parameters whenever they are not necessary for the semantic evaluation of a linguistic expression.

¹⁸ The assumption that a context normally sets up a determinate value h for its circumstance parameter is not to be confused with the epistemic assumption that conversational participants know relevant aspects of h .

minimality on situations is assumed for any predication $\psi[s, \dots, x, \dots]$: if a predication $\psi[s, \dots, x, \dots]$ is true, then there must be no y different from x such that $\psi[s, \dots, y, \dots]$ is also true. For example: $[\text{date}(s, \text{John}, y) \wedge \text{woman}(s, y)]$ can only be true provided that there is no x different from y such that $[\text{date}(s, \text{John}, x) \wedge \text{woman}(s, x)]$ is also true. This means that s has to be a *minimal situation* in which John dates the woman y .

As is standard in Kratzer-style approaches to modality, I analyze both the epistemic and the deontic interpretation of *must* in terms of universal quantification over modal alternatives, where the difference between the two interpretations uniquely reduces to a difference in how the domain of quantification is defined. For the sake of simplicity, I will not make explicit reference to ordering sources, and I will instead use the simplified notation $\text{ALT}_{\text{epistemic}}(h, h')$ (respectively, $\text{ALT}_{\text{deontic}}(h, h')$) to mean that h' is an epistemic (respectively, deontic) alternative to h which is most compatible with the relevant norms holding in h . I will also use the following notation: where s_0 is a situation belonging to history h_0 and h_1 is any history (possibly the same as h_0), the term $[s_0](h_1)$ refers to the situation on h_1 that occurs at the same time as s_0 – of course, $[s_0](h_1)$ will be the same situation as s_0 if h_1 is the same history as h_0 .

6.2 Indefinite NPs and discourse-level definite pronouns

Indefinite NPs are assumed to semantically contribute existential quantification, as in standard Russellian treatments. More specifically, indefinites are Generalized Quantifiers over individuals (usual semantic type $\langle\langle e, t \rangle, t \rangle$). As such, they undergo Quantifier Raising (QR) at LF, leaving a coindexed trace behind which gets bound by a local λ -operator (Heim & Kratzer 1998). By QR, an indefinite may end up being adjoined to a VP. On my analysis, VPs have semantic type $\langle i, t \rangle$ (the semantic type of properties of situations). This means that when QR targets an indefinite α in a structure $[_{VP} \dots \alpha \dots]$, the resulting adjunction site $\lambda_i[_{VP} \dots t_i \dots]$ will end up having semantic type $\langle i, \langle e, t \rangle \rangle$, not $\langle e, t \rangle$. For cases of this sort, I assume that the indefinite is shifted from its basic GQ type (i.e. $\langle\langle e, t \rangle, t \rangle$) to the type $\langle\langle i, \langle e, t \rangle \rangle, \langle i, t \rangle \rangle$.¹⁹ I further assume an *e*-type analysis of

¹⁹ A type-shift of this kind is a particular instance of what has come to be known as *Geach's Rule* in flexible categorial grammars.

definite pronouns in discourse-level anaphoric relations, along the lines of Heim (1990) and Elbourne (2002).

To show how these assumptions work in the analysis of a particular case, consider the discourse (29):

(29) John dated a blond woman. She was twenty years old.

For the sake of simplicity, let's assume that the LF of (29) is as in (30):

(30) $[_{TP} \text{PAST } [_{VP} [\text{a blond woman}]_1 \lambda_1[_{VP} \text{John date } t_1]]] [_{TP} \text{PAST } [_{VP} \text{she}_1 \text{be 20 years old}]]$

The semantic values of the LF-constituents **[a blond woman]₁**, $\lambda_1[_{VP} \text{John date } t_1]$, and **she₁** are given in (31a-c) below, while the truth conditions of the whole discourse are given in (31d). For simplicity, I assume that the situation arguments projected by the noun *woman* and the verb *date* have already been saturated by the past tense (so that the semantic types of **[a blond woman]₁** and $\lambda_1[_{VP} \text{John date } t_1]$ are $\langle\langle e, t \rangle, t \rangle$ and $\langle e, t \rangle$, respectively); furthermore, I assume that the past tense in the second sentence refers to the same situation s_0 that is introduced by the past tense in the first sentence, so the meaning of the second sentence is correctly predicted to be that the relevant blond woman was 20 years old at the same time that John dated her.

(31) a. $[[[\text{a blond woman}]_1]] = \lambda P_{\langle\langle e, t \rangle, t \rangle}. \exists x [\text{blond-woman}(s_0, x) \wedge P(s_0, x)]$
 b. $[[\lambda_1[_{VP} \text{John date } t_1]]] = \lambda x. \text{date}(s_0, \text{John}, x)$
 c. $[[\text{she}_1]] = [\iota x][\text{blond-woman}(s_0, x) \wedge \text{date}(s_0, \text{John}, x)]$
 d. $[[(30)]] = 1 \text{ iff } \exists x [\text{blond-woman}(s_0, x) \wedge \text{date}(s_0, \text{John}, x)] \wedge 20\text{-years-old}(s_0, [\iota x][\text{blond-woman}(s_0, x) \wedge \text{date}(s_0, \text{John}, x)])$

Satisfaction of the uniqueness requirement of the definite description $[\iota x][\text{blond-woman}(s_0, x) \wedge \text{date}(s_0, \text{John}, x)]$ is guaranteed by the minimality condition imposed on s_0 , by which this situation has to contain only one blond woman dated by John.

6.3 The future auxiliary *will*

Turning to the future auxiliary *will*, I propose that it has the semantics of a simple tense marker: it introduces a temporal variable into the semantic representation, whose value is presupposed to be in the future of the utterance situation. No quantification whatsoever over modal alternatives is semantically contributed by *will*. Hence, *will* is fundamentally different from modal verbs like *want* or *intend*, that do semantically contribute quantification over a domain of modal alternatives, and are thus compatible with a non-specific construal of indefinite objects (which results from the indefinite scoping below the universal quantifier contributed by the intensional verb).

The lexical entry for *will* is (32) (the subscript ‘*k*’ on *will* is the situation variable introduced by this tense):

$$(32) \quad [[\text{will}_k]]^{c, g, h} = \lambda P_{\langle i, t \rangle} : c_t \leq_S g(k, h). P(g(k, h))$$

On this analysis, *will* takes a property of situations as argument and yields a truth value, provided that a certain condition is satisfied. The domain condition $c_t \leq_S g(k, h)$ in (32) is the presupposition triggered by *will* according to which the value of the temporal variable ‘*k*’ has to be in the future of the utterance situation c_t along the history of evaluation h .

To see how this analysis works on a concrete case, consider sentence (33), given along with its LF (34). The truth conditions of (34) are compositionally derived in (35) (evaluation parameters are omitted whenever not relevant).

(33) John will date a blond woman.

(34) $[\text{TP will}_k [\text{VP}_3 [\text{NP a blond woman}]_1 \lambda_1 [\text{VP}_2 \text{John} [\text{VP}_1 \text{date } t_1]]]]$

(35) $[[\text{John}]] = \text{John}$

$[[\text{date}]] = \lambda s_i. \lambda y_e. \lambda x_e. \text{date}(s, x, y)$

$[[[\text{VP}_1 \text{date } t_1]]]^{c, f, h} = \lambda s. \lambda x. \text{date}(s, x, f(t_1))$

$[[[\text{VP}_2 \text{John} [\text{VP}_1 \text{date } t_1]]]^{c, f, h} = \lambda s. \text{date}(s, \text{John}, f(t_1))$

$[[\lambda_1 [\text{VP}_2 \text{John} [\text{VP}_1 \text{date } t_1]]]^{c, f, h} = \lambda s. \lambda x. [[[\text{VP}_2 \text{John} [\text{VP}_1 \text{date } t_1]]]^{c, f[x], h}]^{20}$

$[[[\text{a blond woman}]]^{c, f, h} = \lambda P_{\langle i, \langle e, t \rangle \rangle}. \lambda s. \exists x [\text{blond-woman}(s, x) \wedge P(s, x)]$

²⁰ Where n is an individual variable and α an individual, $f[n/\alpha]$ is a value-assignment such that, for any individual variable $m \neq n$, $f[n/\alpha](m) = f(m)$, and $f[n/\alpha](n) = \alpha$.

$$\begin{aligned} & [[[\text{VP}_3 [\text{NP a blond woman}]_1 \text{ I } [\text{VP}_2 \text{ John } [\text{VP}_1 \text{ date } t_1]]]]]^{c, f, h} = \lambda s. \exists x [\text{blond-woman}(s, x) \wedge \text{date}(s, \text{John}, x)] \\ & [[[\text{TP will}_k [\text{VP}_3 [\text{NP a blond woman}]_1 \text{ I } [\text{VP}_2 \text{ John } [\text{VP}_1 \text{ date } t_1]]]]]]^{c, g, h} = 1 \text{ iff} \\ & \text{iff } \{c_t \leq_s g(k, h)\} \exists x [\text{blond-woman}(g(k, h), x) \wedge \text{date}(g(k, h), \text{John}, x)] \end{aligned}$$

The analysis predicts that (33) is true (relative to world-history h) if and only if there is an individual who is a blond woman in the situation $g(k, h)$ contributed by the future tense and whom John dates in that same situation – provided that $g(k, h)$ follows the utterance situation c_t along h . Notice that from this truth condition it follows that there is (in a temporally unrestricted sense) a woman whom John will date. The analysis thus predicts the inferential pattern of future tense sentences in Stalnaker’s Asymmetry, since it predicts that (out of the blue) the indefinite object of a future tense sentence is interpreted specifically.

This, however, is not the whole story about *will* – it’s just the whole *semantic* story. The other part of the story is that, though acting semantically as a tense marker, *will* has a “modal potential” which is grounded in the forward branching structure of the model of possible world-histories. More precisely, I propose that the selection of the particular world-history c_h (the circumstance of the context of utterance) as value for the circumstance parameter of the evaluation function can be overridden in some cases. The whole range of historical alternatives to c_h at c_t becomes then relevant for the truth conditional evaluation, with any history within this range being eligible as circumstance of evaluation. I propose that in these cases hearers resort to a supervaluation-like strategy to overcome the plurality of histories that are equally eligible for the semantic evaluation, with the result that the future tensed statement is required to hold for any such history. I assume that this process comes to affect the LF itself of the sentence considered, by introducing a universal quantifier with maximum scope in the LF. In order to distinguish this universal quantifier from others that correspond to quantifying expressions occurring overtly in the sentence, I denote it as \forall^* . The semantics of \forall^* is given in (36).²¹ Given

²¹ To be precise, the supervaluational operator \forall^* should be defined in the following way (see Del Prete 2010b):

(i) $[[\forall^*]]^{c, g, h} = \lambda P_{\langle s, t \rangle} : \forall h_1 [h_1 \approx_{c_t} h \rightarrow P(h_1)] \vee \forall h_1 [h_1 \approx_{c_t} h \rightarrow \neg P(h_1)]. \forall h_1 [h_1 \approx_{c_t} h \rightarrow P(h_1)]$

that \forall^* requires its argument to be a proposition (a type $\langle s, t \rangle$ function), we need to apply the intensionalizer \wedge to the target sentence before applying the supervaluational operator \forall^* . The intensionalizer is defined in (37).

$$(36) \quad [[\forall^*]]^{c, g, h} = \lambda P_{\langle s, t \rangle}. \forall h_1 [h_1 \approx_{c_t} h \rightarrow P(h_1)]$$

$$(37) \quad [[\wedge E]]^{c, g, h} = \lambda h_1. [[E]]^{c, g, h_1}$$

To see how this proposal applies to a concrete case, consider (33) again. The LF of this sentence, after the supervaluation-like strategy has had its course, will no longer be (34), but (34'), and the corresponding truth conditions will be computed as in (38):

$$(34') \quad [{}_{TP} \forall^* \wedge \text{will}_k [{}_{VP3} [{}_{NP} \text{a blond woman}]_1 \lambda_1 [{}_{VP2} \text{John} [{}_{VP1} \text{date } t_1]]]]]$$

$$(38) \quad [[[{}_{TP} \wedge \text{will}_k [{}_{VP3} [{}_{NP} \text{a blond woman}]_1 1 [{}_{VP2} \text{John} [{}_{VP1} \text{date } t_1]]]]]]^{c, g, h} = \\ \lambda h_1. \{c_t \leq_S g(k, h_1)\} \exists x [\text{blond-woman}(g(k, h_1), x) \wedge \text{date}(g(k, h_1), \text{John}, x)] \\ [[[{}_{TP} \forall^* \wedge \text{will}_k [{}_{VP3} [{}_{NP} \text{a blond woman}]_1 1 [{}_{VP2} \text{John} [{}_{VP1} \text{date } t_1]]]]]]^{c, g, h} = 1 \text{ iff} \\ \text{iff } \forall h_1 [h_1 \approx_{c_t} h \rightarrow \{c_t \leq_S g(k, h_1)\} \exists x [\text{blond-woman}(g(k, h_1), x) \wedge \text{date}(g(k, h_1), \\ \text{John}, x)]]]$$

The analysis predicts that (33) is true (under its modal reinterpretation) relative to world-history h if and only if every historical alternative h_1 to h at the utterance situation c_t is such that there is an individual who is a blond woman in the situation $g(k, h_1)$ contributed by the future tense and whom John dates in that same situation – provided that $g(k, h_1)$ follows the utterance situation c_t along h_1 . Notice that from this modalized truth condition it no longer follows that there is a woman whom John will date, as on different historical alternatives there might be different women dated by John. The analysis thus accounts for the possibility of non-specific interpretations of indefinite objects in sentences like (33), hence paving the way for an account of the future tense variant of Karttunen's Puzzle. We will come to this point in the following two sections.

The domain condition $\forall h_1 [h_1 \approx_{c_t} h \rightarrow P(h_1)] \vee \forall h_1 [h_1 \approx_{c_t} h \rightarrow \neg P(h_1)]$ is the presuppositional requirement that the predicate of histories which is the argument of \forall^* either be true of all accessible histories or be false of all such histories (this is called *settledness condition* in Bonomi & Del Prete 2008 and Del Prete 2010b). To avoid unnecessary complications, I skip this condition in (36).

6.4 Modal subordination in Karttunen’s Puzzle

When discourse (23), repeated below as (39a), obtains the “non-specific indefinite + deontic *must*” reading, it provides an instance of modal subordination (see sect. 3 above). This means that the definite pronoun *she* is interpreted in the scope of *must* and fails to refer to an individual salient in the discourse-context. The same holds true for (39b).

- (39) a. John will date a blond woman_i. She_i must be twenty years old.
b. John wants to date a blond woman_i. She_i must be twenty years old.

If (39a,b), under their relevant reading, were not a case of modal subordination, then the definite pronoun would be unacceptable, as there would be no individual for this pronoun to pick out (we would then have a case like *John wants to find a unicorn. I saw *it in the garden*).

I will assume that in discourses of the form **NP will / want (to) V [a N']_i. He_i / She_i must be P**, under their “non-specific indefinite + deontic *must*” reading, the interpretation of *must* is dependent on the interpretation of the intensional item in the preceding sentence (either on the verb *want* or on the modally reinterpreted *will*), in the following sense: *must* inherits the domain of quantification of the intensional item and imposes a further condition on the modal alternatives in this domain, by which any such alternative is required to be a deontic alternative to the actual history c_h which is most compatible with the relevant norms holding in c_h . In the case of (39b), intuitively, it is the *want*-sentence itself which fixes the relevant norms: the blond woman has to be twenty years old according to John’s bouletic standards. Thus the meaning of the whole discourse can be paraphrased as ‘In each one of John’s bouletic alternatives, John dates a blond woman, and each one of such alternatives that is also most compatible with John’s bouletic standards is such that the blond woman John dates there is twenty years old. In the case of greatest interest to us, namely (39a), the relevant norms for the interpretation of *must* are not fixed by the interpretation of the *will*-sentence in a similar way, because *will* (unlike *want*) is devoid of any lexical meaning, and semantically the *will*-sentence does not involve reference to anybody’s standards of whatever kind. Thus, I will assume that in the case of (39a) the relevant norms are contextually salient norms: they *could*

coincide with John’s bouletic standards, but they need not, for instance they could coincide with the speaker’s bouletic standards.

6.5 Analysis of Karttunen’s Puzzle

My proposal is that the deontically interpreted *must* in (39a) triggers a modal reading of *will*. The mechanism producing the modal reading of *will* is pragmatically driven: the main pragmatic reason for triggering this mechanism is to avoid a clash between the generic subject restriction on the K-interpretation of *must* and the referential status that would be forced on *she* by the specific interpretation of *a blond woman*.

In greater details, my story about (39a) is as follows. The hearer of (39a), by default, interprets the indefinite *a blond woman* in the first sentence as specific – given that *will* is a pure tense marker and the verb *date* is extensional. When she gets to the modal *must* in the second sentence, however, she is presented with two options:

- (a) The less expensive option (in terms of processing costs) is to go for the epistemic interpretation of *must*, in which case no reinterpretation of the first sentence is required, and *she* is interpreted as a definite anaphora which simply picks up the individual that the specific indefinite *a blond woman* corresponds to.
- (b) The other, more expensive option is to go for the deontic interpretation of *must*, in which case a modal reinterpretation of the first sentence is called for so as to make a non-specific construal of the indefinite possible.

The truth-conditions corresponding to option (a) are computed on the basis of the LF (40) and are expressed in (41):

(40) [TP will_k [VP3 [NP a blond woman]₁ λ₁[VP2 John [VP1 date t₁]]]] [ModP must [VP she₁ be 20 years old]]

(41) [[(40)]]^{c, g, h} = 1 iff
iff {c_t ≤_S g(k, h)} ∃x [blond-woman(g(k, h), x) ∧ date(g(k, h), John, x)] ∧ ∀h₁
[ALT_{epistemic}(h, h₁) → twenty-years-old([c_t](h₁), [tx][blond-woman(g(k, h), x) ∧ date(g(k, h), John, x)])]

The analysis predicts that discourse (39a) is true under the relevant reading if and only if there is a particular blond woman x at a salient future situation $g(k, h)$ whom John dates in $g(k, h)$ and every alternative world-history h' which is epistemically accessible from the actual circumstance h is such that the particular blond woman x whom John dates in $g(k, h)$ is twenty years old in the situation on h' which is at the same time as the utterance situation c_t . Notice that the uniqueness requirement of the definite description $[\lambda x][\text{blond-woman}(g(k, h), x) \wedge \text{date}(g(k, h), \text{John}, x)]$ is guaranteed by the minimality condition on $g(k, h)$ that is built in the formula $[\text{blond-woman}(g(k, h), x) \wedge \text{date}(g(k, h), \text{John}, x)]$. Furthermore, this definite description does not contain any occurrence of variable ' h_1 ' bound by the universal quantifier ' $\forall h_1$ ', thus it picks up the same woman across different epistemic alternatives, and that same woman is said to be twenty years old at the present time on every epistemic alternative. This seems intuitively correct.

The truth-conditions corresponding to option (b) are computed on the basis of the LF (42) and are given in (43):

$$(42) \quad [{}_{\text{TP}} \forall^* \wedge \text{will}_k [{}_{\text{VP3}} [{}_{\text{NP}} \text{a blond woman}]_1 \lambda_1 [{}_{\text{VP2}} \text{John} [{}_{\text{VP1}} \text{date } t_1]]]] [{}_{\text{ModP}} \text{must} [{}_{\text{VP}} \text{she}_1 \text{ be 20 years old}]]$$

$$(43) \quad [[(42)]]^{c, g, h} = 1 \text{ iff} \\ \text{iff } \forall h_1 [h_1 \approx_{c_t} h \rightarrow \{c_t \leq_S g(k, h_1)\} \exists x [\text{blond-woman}(g(k, h_1), x) \wedge \text{date}(g(k, h_1), \\ \text{John}, x)]] \wedge \forall h_1 [(h_1 \approx_{c_t} h \wedge \text{ALT}_{\text{deontic}}(h, h_1)) \rightarrow \text{twenty-years-old}([c_t](h_1), \\ [\lambda x][\text{blond-woman}(g(k, h_1), x) \wedge \text{date}(g(k, h_1), \text{John}, x)])]]$$

The analysis predicts that discourse (39a) is true under the relevant reading if and only if every historical alternative h' to h at the present time c_t is such that there is a particular blond woman x at a salient future situation $g(k, h')$ whom John dates in $g(k, h')$, and if h' is most compatible with the relevant norms holding in the actual circumstance h , then the particular blond woman x whom John dates in $g(k, h')$ is twenty years old in the situation on h' which is at the same time as the utterance situation c_t . Notice that, in contrast with the truth conditions for the previous reading of (39a), the definite description $[\lambda x][\text{blond-woman}(g(k, h_1), x) \wedge \text{date}(g(k, h_1), \text{John}, x)]$ does contain occurrences of variable ' h_1 ' that are bound by the universal quantifier ' $\forall h_1$ ', thus it picks up different women across

different deontic alternatives, and every such woman is said to be twenty years old at the present time on every deontic alternative. This seems intuitively correct.

Before concluding this section, I'll make the following observation. If the *will*-sentence in (39a) were not reinterpreted modally (as indicated in [43] above) and we still were to try a deontic interpretation of *must*, the truth conditions that we would obtain for (39a) would be expressed by the formula (43'):

$$(43') \quad \{c_t \leq_S g(k, c_h)\} \exists x [\text{blond-woman}(g(k, c_h), x) \wedge \text{date}(g(k, c_h), \text{John}, x)] \wedge \forall h_1 [(h_1 \approx_{c_t} h \wedge \text{ALT}_{\text{deontic}}(h, h_1)) \rightarrow \text{twenty-years-old}([c_t](h_1), [!x][\text{blond-woman}(g(k, c_h), x) \wedge \text{date}(g(k, c_h), \text{John}, x)])]$$

Here the definite description corresponding to the pronoun *she* does no longer contain a history variable bound by the quantifier ' $\forall h_1$ '. The term ' c_h ' occurs instead in this description, since ' c_h ' is the term occurring in the existential formula of the indefinite antecedent. Accordingly, the meaning expressed by the second conjunct of (43') is that a certain woman x is twenty years old in the present situation c_t on every deontic alternative. But this meaning is pragmatically odd (see sect. 5 above), thus the present analysis enables us to explain why the deontic interpretation of *must* requires a modal reinterpretation of *will*.

7. Conclusion

In this paper I have considered two main empirical issues, Stalnaker's Asymmetry and Karttunen's Puzzle. Consideration of the former points to a distinction between *will* and intensional verbs like *want*, and to the non-modal character of *will*. Consideration of the latter points in the opposite direction: *will* patterns like *want* in some cases, allowing for the non-specific interpretation of indefinite objects; this seems to require a modal feature in the interpretation of *will*. I have made a theoretical proposal that takes Stalnaker's Asymmetry at face value: *will* acts semantically as a tense, not as a modal, hence it doesn't contribute any quantifier over modal alternatives with which the indefinite object's existential quantifier could scopally interact. A modal feature, however, can be introduced in the interpretation of *will* through a pragmatically driven supervaluational

mechanism that universally quantifies over historical alternatives from a domain of forward branching world-histories. Such historical alternatives become available for the truth-conditional evaluation in certain contexts, amongst which are discourse sequences instantiating Karttunen's Puzzle. Since the above modal feature is not introduced as a part of the semantics of *will* but as a consequence of the forward branching structure of the model, the modal behaviour of *will* is not viewed as an idiosyncratic property of this tense marker. In fact, a prediction we could make on the basis of this analysis is that necessity modal interpretations of the future tense should be available cross-linguistically. This prediction, as far as I can tell, has a large empirical support. Finally, it would be interesting to consider the relative merits of the proposed analysis *vis à vis* a necessity modal analysis in accounting for cases where *will* interacts with modal adverbs of varying quantificational forces, as are discussed by Kissine (2008). My expectation is that the proposed analysis can do better than a necessity modal analysis in providing such an account. I leave the task of showing that this is actually the case for a future occasion.

References

- Belnap, N.: 1992, 'Branching Space-Time', *Synthese* 92.3, 385-434.
- Belnap, N., Perloff, M., & Xu, M.: 2001, *Facing the Future. Agents and Choices in our Indeterminist World*, Oxford University Press, Oxford.
- Bonomi, A. & Del Prete, F.: 2008, 'Evaluating future-tensed sentences in changing contexts', unpublished manuscript, Università degli Studi di Milano, available at: <http://www.filosofia.unimi.it/~bonomi/future.pdf>.
- Chierchia, G.: 1995, 'Individual-Level Predicates as Inherent Generics', in G.N. Carlson & F.J. Pelletier (eds.), *The Generic Book*, University of Chicago Press, Chicago and London.
- Del Prete, F.: 2010a, 'A Puzzle about Imperfective Habituals', paper presented at *WIGL8*, Madison, April 24th-25th 2010.
- Del Prete, F.: 2010b, 'Non-Monotonic Futures', paper presented at *PALMYR IX*, Amsterdam, June 28th-29th 2010.
- Elbourne, P.: 2002, 'E-Type Anaphora as NP-Deletion', *Natural Language Semantics* 9.3, 241-288.
- Fodor, J. D. & Sag, I.: 1982, 'Referential and Quantificational Indefinites', *Linguistics and Philosophy* 5, 355-398.
- Heim, I.: 1990, 'E-type Pronouns and Donkey Anaphora', *Linguistics and Philosophy* 13, 137-177.
- Heim, I.: 1994, 'Comments on Abusch's theory of tense', in H. Kamp (ed.), *Ellipsis, Tense and Questions*, University of Amsterdam Press, Amsterdam.
- Heim, I. & Kratzer, A.: 1998, *Semantics in Generative Grammar*, Blackwell, Oxford.
- Hintikka, J.: 1962, *Knowledge and Belief : An Introduction to the Logic of the Two Notions*, Cornell University Press, Cornell.
- Karttunen, L.: 1976, 'Discourse Referents', in J. D. McCawley (ed.), *Syntax and Semantics* 7, Academic Press, NY.
- Karttunen, L.: 2007, 'Word Play', *Computational Linguistics* 33.4, 443-467.
- Kissine, M.: 2008, 'Why *will* is not a modal', *Natural Language Semantics* 16.2, 129-155.

- Prior, A. N.: 1967, *Past, Present and Future*, Clarendon Press, Oxford.
- Roberts, C.: 1987, *Modal Subordination, Anaphora, and Distributivity*, Ph.D. dissertation, University of Massachusetts at Amherst.
- Stalnaker, R.: 1981, 'A Defense of Conditional Excluded Middle', in W. L. Harper, R. Stalnaker, and G. Pearce (eds.), *Ifs : conditionals, belief, decision, chance, and time*, Reidel, Dordrecht.
- Thomason, R.: 1984, 'Combinations of Tense and Modality', in D. Gabbay and F. Guentner (eds.), *Handbook of Philosophical Logic*, vol. II, Reidel, Dordrecht, 205-234.