A Linguistic Argument for Indeterministic Futures*

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Philosophers since Aristotle have debated whether the the concept of the future should be treated as deterministic or indeterministic – whether it is already decided what will take place in the future, or whether it is genuinely open. Although there are good philosophical arguments for indeterminism, for most purposes in compositional semantics, the simpler deterministic models have been sufficient. In this paper, however, I argue that in some languages, an indeterministic model is necessary, in order to account for the behavior of future modals under what are apparently aspectual operators. Of course, this result has nothing to say about the actual ontology of the future, only about its semantic representation in certain languages.[1]

In particular, I will argue that the future operator found in both English *be going to* and *will* must support at least some indeterminacy. First, in section 1, I argue that the denotation of *be going to* results from the combination of a progressive operator and a future operator. In the second, briefer section, I argue that the future operator in *be going to* has to be indeterministic,

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[1] Even within a language, this result does not distinguish between the two sides of the philosophical debate: the side that treats the future as onotlogically deterministic admits that the future is in some sense indeterministic, but treats the indeterminacy as epistemic In this paper, I will use an ontologically indeterministic future, but an epistemically indeterministic future would work as well, provided the case could be made for epistemic operators as low in the structure as the future operator (but see Cinque 1999, von Fintel & Iatridou 2001, e.g., for evidence that epistemic modals are found higher).

and finally, drawing from Copley (2001), that *be going to* and *will* share the same future operator.

1. The meaning of *be going to*

The purpose of this section is to argue that *be going to* (henceforth *bgt*) is composed of a progressive operator and a future operator. Later, in section 2, we will see that precisely this combination constrains our choice of future operators to indeterministic ones. But I will start by presenting a puzzle which can be explained by this combination.

1.1 A puzzle about offering

Driving along the highway in California one day, I saw a billboard advertising a mechanic's shop in Madera. It included the sentence in (1a). The puzzle is: Why couldn't it instead have included the sentence in (1b)?

(1) A sign seen (and one not seen) on the highway
  a. We'll change your oil in Madera.
  b. # We're going to change your oil in Madera.

The relevant component of the context is that the author of the billboard is making an offer. The difference between (1a) and (1b) seems to be that *will* can be used to make an offer, while *bgt* cannot; (1b) sounds more like the author of the billboard is informing the motorist of a fact, or indeed making a threat, rather than making an offer. So the puzzle becomes: Why can't *bgt* be used to make an offer?

Suppose we consider in more depth what it is to make an offer. The nature of offering implies that the eventuality being volunteered by the speaker is not necessarily going to happen anyway. It would certainly be rude for someone to make an assertion, in the appropriate context, that entails that in some worlds where you do not want them to change your oil, they do it anyway. For an utterance to count as an act of offering, the volunteered eventuality must be contingent on the interlocutor's preferences.

Let's assume the following pragmatic condition on acts (speech or otherwise) that are offers.

(2) *Condition on offers.* A person has offered to bring about Q for you only if they can, consistently with their other utterances, assert both:
  a. If (at some point) you want Q, Q will be the case.
  b. If (at some point) you want not-Q, not-Q will be the case.

The point here is that both the antecedent and the consequent must have the same time of evaluation; the time at which your wanting Q is evaluated must be the same time that the hearer is prepared to carry out Q. The parenthetical is there because what matters for the offer is not whether you want Q now. Suppose someone says they will bring you food tomorrow if you are hungry now, and won't if you are not hungry now. But perhaps you are full now; that means the speaker will not bring you any food tomorrow! Under the assumption that your being hungry now does not have anything to do with whether you are hungry tomorrow, this speech act is not a real act of offering.

Naturally, there are other felicity conditions as well (note the "only if"'). For example, the speaker must believe that they can bring about Q, and so forth. These will not concern us here.

Returning to our billboard, we can now say that in order for the author of the billboard to truly be making an offer, they must be able to assert both of the following:

(3) a. If you want us to change your oil in Madera, we will change your oil in Madera.
b. If you don't want us to change your oil in Madera, we won't change your oil in Madera.

Let's assume that the utterance (1a) really is (3a), but with the antecedent elided. Then a revised version of our billboard utterances would be in (4); (4b) sounds odd or rude.

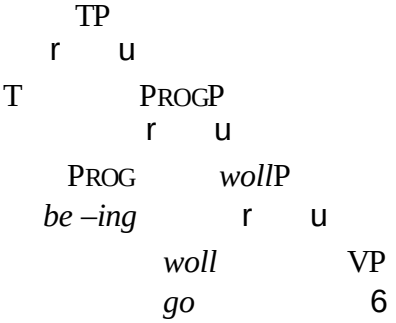
(4) Revision of the billboard utterances
a. (If you want us to change your oil in Madera,) we will change your oil in Madera.
b. #(If you want us to change your oil in Madera,) we are going to change your oil in Madera.

Having gotten this far, what can we say about our puzzle? The speaker of the *will* sentence in (1a) (or the conditionals in (3a) and (4a)) can of course also assert (3b), which fits nicely with the intuition that a *will* sentence can be an offer, because in order to make an offer, one must be able to assert both (3a) and (3b). As for *bgt*, we would like to know whether the speaker of (1b) (or (4b)) can assert both (3a) and (3b), the conditions on offering. There seems to be no problem with the speaker of (1b)/(4b) asserting (3a). Rather, the problem seems to be that the speaker of (1b)/(4b) cannot then agree with the statement in (3b). So the final version of our puzzle is: Why wouldn't the speaker of (1b)/(4b) be able to agree with (3b)?

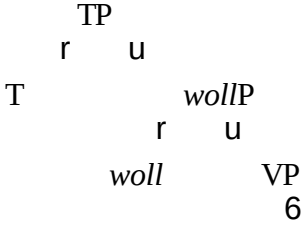
1.2 Proposal

I would like to propose that *bgt* consists of a progressive (PROG) and a future operator (*woll*, following Abush (1985) and many others), as in (5a). *Will* and *would*, for the sake of comparison, are as in (5b); the difference between *will* and *would* is one of tense.

(5) a.



b.



Let's consider these components in turn.[2]

The morpheme *to* will be ignored, since it seems not to have an independent syntactic existence of its own (Copley, 2001).

The progressive in *bgt* is realized as *be –ing*, though it need not have exactly the same meaning as the progressive that is found on main verbs. In fact, it is an empirical question whether it does or not; for now I will use a very simple progressive (based on Bennett and Partee, 1978, except with the relation between the intervals limited to proper inclusion, following Klein (1997)), and leave to later investigation (Copley, in progress) the question of how the progressive in *bgt* relates to the main verb progressive.

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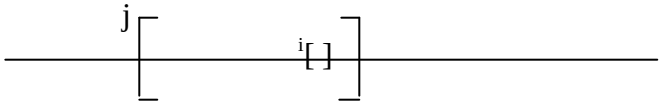
[2] The formal denotations are in an intentional system based on the compositional semantic framework of Heim & Kratzer (1998). As usual, there is a valuation function "|| ||" that takes a morphosyntactic object and returns a denotation. The intentionality is achieved through evaluation times (type i, variables i, j, k, etc.) and worlds (type w, variables w, w', etc.), written as superscripts on the valuation function. Truth values are type t, and propositions are type <i,<w,t>>. I will assume the VP-internal subject hypothesis (Koopman & Sportiche 1988), and ignore movement of the subject out of the VP; this last move will enable us to forgo variable assignments. A VP is expressed by an italized uppercase letter (*P, Q,* etc.), and its denotation (a proposition) is expressed by the same letter, but not italicized (P, Q, etc.).

(6) A simple progressive (modified from Bennett & Partee, 1978)
For any interval i and world w,
$||\text{PROG } P||^{iw} = 1$ iff $\exists j \supset i$: [P(j)(w)]

That is, $||\text{PROG } P||^{iw} = 1$ iff on world w, there is an interval j which properly includes i, such that P holds over j.

(7)



The future operator in *bgt* is realized as *go*. As I have argued elsewhere (Copley, 2001), and will argue below, it has the same meaning as the future operator in *will*, which has been called "*woll*". For the meaning of *woll*, here is a version of the Thomason (1970) branching time future operator.

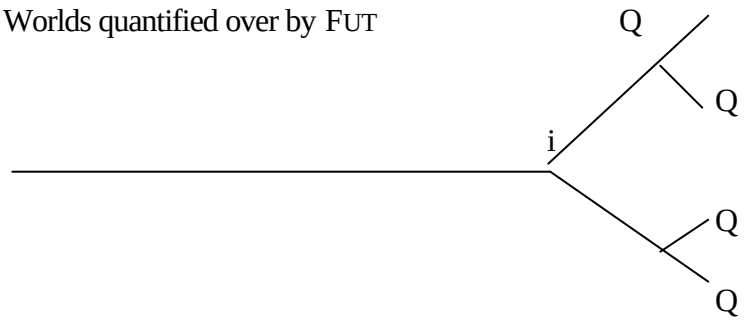
(8) A complex future (Thomason, 1970)
For any instant i and world w, $||\text{FUT } Q||^{iw}$
= 1 if $\forall w'$, w' a world that agrees with w up to i:
$[\exists k: [i < k \text{ and } Q(k)(w') = 1]]$;
= 0 if $\forall w'$, w' a world that agrees with w up to i:
$\sim[\exists k: [i < k \text{ and } Q(k)(w') = 1]]$;
and is undefined otherwise.

The notion of two worlds "agreeing" is defined as follows: A world w agrees with a world w' up to a time i just in case for all propositions P, for all times $j \leq i$, P(j)(w) = 1 if and only if P(j)(w').

What (8) says is that for any instant i and world w, $||\text{FUT } Q||^{iw}$ is defined just in case all the worlds share a truth value for Q at the time in question. If $||\text{FUT } Q||^{iw}$ is defined, it is true if on all worlds that agree with w up to i, there is some time k which is later than i, at which Q is true; and it is false if on all worlds that agree with w up to i, there is no time k which is later than i at which Q is true.

If we were to envision worlds as timelines, and disagreement between two worlds as a binary branching, we might represent the set of worlds quantified over by FUT, evaluated at i and the actual world, as in the diagram below (which shows a state of affairs in which $||\text{FUT } Q||^{iw}$ is true).

(9) Worlds quantified over by FUT



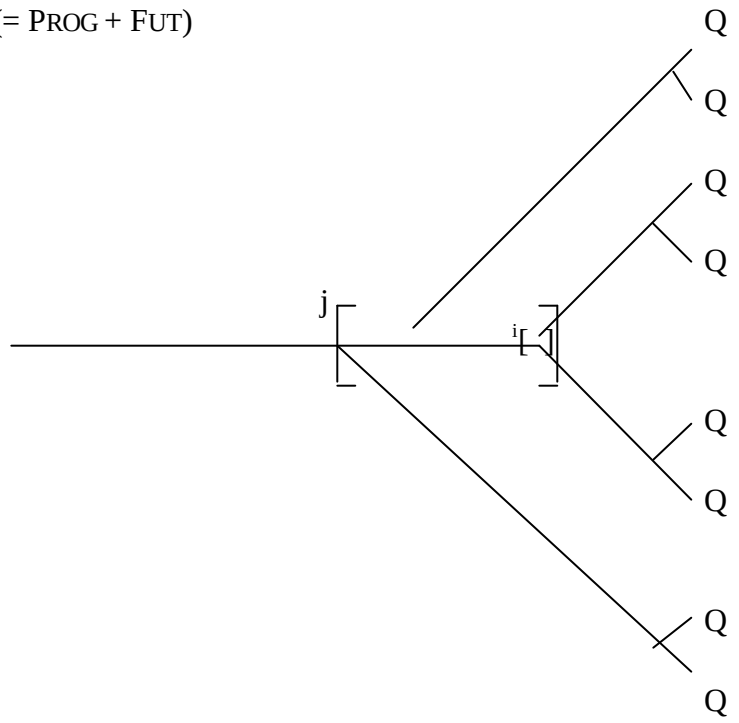
Now that we have introduced the players, the question becomes, what happens if we stack the progressive on top of the future? Recall that our denotation of the progressive composed with a VP *P*, evaluated at i and w, yields a truth value of 1 just in case P holds over a superinterval of i in w (j, in the denotation of PROG). For present purposes, we would like to consider the case where *P* = Fut *Q*. This means that the evaluation time for Fut *Q* is not a point, as in Thomason's original conception, but at an interval: j, a superinterval of i, where i is the time of evaluation of the entire expression PROG FUT *Q*.

As things stand this cannot be done. Thomason's future is defined over instants, not intervals, and what the progressive gives it is an interval. This conflict is, however, easily remedied. To put Thomason's future under the Bennett & Partee progressive, we need to make sure that the result of feeding FUT *Q* an interval is defined. One way to fix this problem is to alter the denotation of FUT to say that FUT quantifies over all the worlds that branch off from w *at any time during* the interval of evaluation; i.e., that agree with w at least up to the beginning of the interval of evaluation. The changes in the definition below are italicized:

(10) Thomason future redefined for intervals
For any *interval* i and world w, $||\text{FUT } Q||^{iw}$
= 1 if $\forall w'$, w′ a world that agrees with w up to *the beginning of i:*
$[\exists k: [i < k \text{ and } Q(k)(w') = 1]]$;
= 0 if $\forall w'$, w′ a world that agrees with w up to *the beginning of i:*
$\sim[\exists k: [i < k \text{ and } Q(k)(w') = 1]]$;
and is undefined otherwise.

This allows us to compose PROG with FUT *Q*, because the new denotation for FUT *Q* is a function that takes an interval as its evaluation time. We would represent the worlds quantified over by *bgt* (= PROG + FUT), evaluated at i, as below in (11). *Bgt* quantifies over not only the worlds that FUT quantifies over, but also over worlds that branch off during j but before i. Thus a *bgt* sentence actually makes a stronger claim than the corresponding sentence with FUT does.

(11) Worlds quantified over by *be going to*
(= PROG + FUT)



The meaning of bgt would be as follows:

(12) $||\text{PROG FUT } Q||^{iw}$
= 1 iff $\exists j \supset i$: [$||\text{FUT } Q||^{iw}(j)(w)$]
= 1 iff $\exists j \supset i$: [$\forall w'$, w' a world that agrees with w up to the beginning of j:
[$\exists k$: [j < k and Q(k)(w′) = 1]]];
= 0 if $\exists j \supset i$: [$\forall w'$, w' a world that agrees with w up to the beginning of j:
[$\exists k$: [j < k and Q(k)(w′) = 1]]];
and is undefined otherwise.

We are now in a position to return to the puzzle about offering and explain why the speaker of (4b) (i.e., (1b) with the elided antecedent made explicit) cannot consistently assert (3b) (both repeated below).

(4) b. #(If you want us to change your oil in Madera,) we're going to change your oil in Madera.

(3) b. (But) if you don't want us to change your oil in Madera, we won't change your oil in Madera.

Let:

(13) P = the proposition expressed by *you want us to change your oil in Madera* (in the context in question)
Q = the proposition expressed by *we change your oil in Madera* (in the context in question)
i = a time possibly after the time of reading the billboard

(4b) and (3b) turn out as follows:[3]

(14) a. [If P, PROG FUT Q](i)
b. [If ~P, FUT ~Q](i)

Assuming that conditionals quantify over possible worlds (Kratzer, 1986), what we really mean is the following:

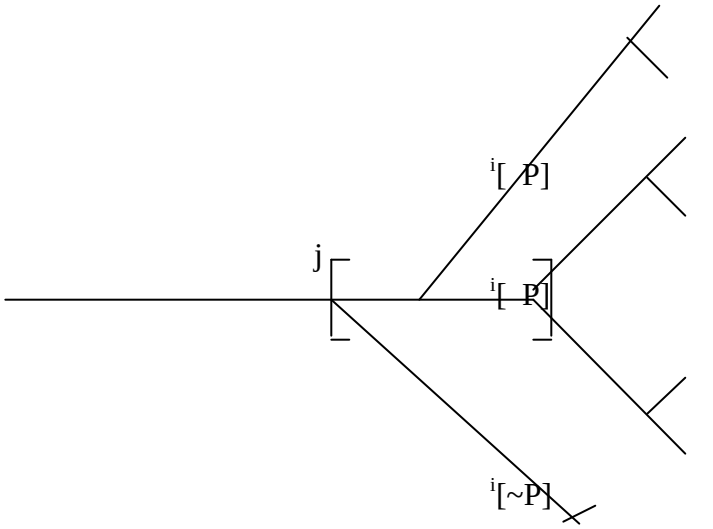
(15) a. All worlds w such that P(i)(w) are such that [PROG FUT Q](i)(w)
b. All worlds w such that ~P(i)(w) are such that [FUT ~Q](i)(w)

Recall our intuition that (the English versions of) (15a,b) are incompatible. I will show now how the current proposal derives this intuition.

Suppose now we consider one of the worlds that makes P true at i, and represent it with a horizontal line that branches off at i. We can imagine possible worlds in which P is not true at i (i.e., assuming contradictory negation, worlds in which not-P is true at i). These worlds branch off before i. Of course, not all of the worlds that branch off before i are worlds that make not-P true at i; some of the worlds that branch off before i make P true at i. In general, for any interval j which properly includes i, there will be some worlds that branch off from the actual world during j such that not-P is true at i. This state of affairs is represented below:

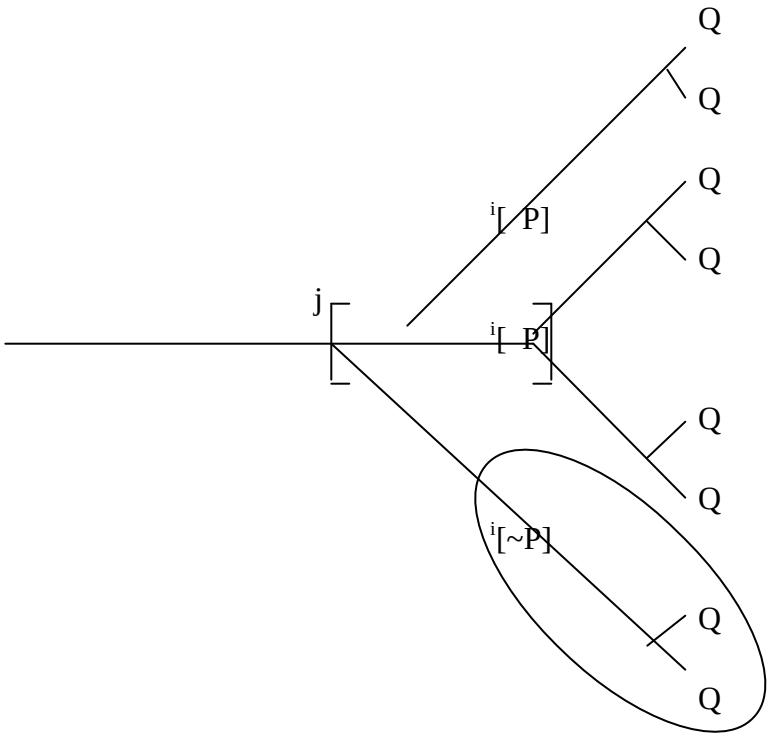
[3] Any issues arising from the interaction of negation with the future will be glossed over here; what is written in (14b) is accurate and plausible enough for our purposes.

(16)



Now, let us further suppose that (15a) is true. So in this case, on any world that makes P true at i, there is an interval j such that all the worlds that branch off during j make Q true at some later interval k. This state of affairs is given below.

(17)



But now notice that in a situation in which (15a) is true, there can be a ~P world that is also a world in which Q will happen at some future time k; I have circled two such worlds. This is inconsistent with the condition in (15b) that all ~P worlds are worlds in which ~Q will happen at k (assuming that Q and not-Q are inconsistent at the future time k). That, then, is why *bgt* sentences like the one in (1b) (=(15b)) can't be used to make an offer. This incompatibility with a condition on offering explains the infelicity of a *bgt* sentence such as (1b) in this context, and is the correct characterization of the puzzle.

That this is the right approach to the puzzle becomes clear when we consider contexts in which not-P worlds are non-existent. In these contexts, *bgt* sentences suddenly don't sound so rude. Consider, for example, another possible billboard (suppose you are already in Madera):

(18) We're going to make you happy in Madera.

It is safe for the speaker to assume that there are no not-P worlds; that is, conceivably there are no possible worlds in which you don't want to be happy. The utterance of (18) doesn't entail that any not-P worlds are Q worlds. Hence no contradiction emerges.

The puzzle illustrated in this section, i.e., that bgt cannot be used to make an offer, provided empirical support to the proposal that this construction involves two ingredients: progressive and (an indeterministic) future. Indeed the semantic result of composing these two operators is incompatible with what it means to make an offer.

1.3 A potential alternative analysis

Before moving on, I would like to remark on a potential alternate hypothesis for the difference between *be going to* and *will* in their ability to be used for offers, which will lead to a short digression.

We know that *will* has a second meaning, also called a "dispositional use". The sentence in (19a) has a reading on which what is claimed is not that John, at some point in the future, will eat beans, but rather that he is willing or disposed to eat beans. *Bgt* apparently cannot express anything about John's dispositions; (19b) can only be a claim about the future.

(19) a. John will eat beans.
b. John is going to eat beans.

The question that arises at this point is whether the difference between *will* and *bgt* in offering contexts is rather due to the availability of dispositional readings, since plausibly making an offer might have something to do with being willing to follow through on the offer.

When we look at languages other than English, we discover that such a unified account is actually undesirable. Indonesian, for example, has two future particles, *akan* and *mau*, and in

at least some dialects, these two particles correspond to *will* and *bgt* respectively in many, but not all, ways.[4] First, as in English, one of the futures resists certain present tense contexts (Copley, 2001):

(20) a. #Oh look, it'll rain.
b. Oh look, it's going to rain.

(21) a. #Aduh, akan hujan.
Oh.look *woll* rain
'Oh look, it'll rain'

b. Aduh, mau hujan.
Oh.look, *bgt* rain
'Oh, it's going to rain.'

Second, and most crucially, one can be used to make an offer, and one cannot. For example, (22a) could be used to respond to "I need a volunteer. Who will make coffee?" The sentence in (22b) could not, unless the answerer was already going to make coffee (regardless of what the asker wanted).

(22) a. Saya akan membuat kopi.
I *woll* make coffee
'I'll make coffee.' (offer ok)

b. Saya mau membuat kopi.
I *bgt* make coffee
'I'm going to make coffee.' (offer not possible; only possible as description of pre-existing plan)[5]

In these respects it appears that *akan* is much like *will* (*woll*, really, since there is no present tense) and *mau* is much like *bgt*. However, when we turn to the possibility of dispositional uses, the situation is reversed. It is *mau* that has a dispositional use, not *akan*.

[4] In other dialects, both behave like *bgt*.

[5] In the dialects in which both *akan* and *mau* behave like *bgt*, *bisa* 'can' is what is used to make an offer. E.g. *Saya bisa membuat kopi*, 'I can make coffee.'

(23) a. Ali akan makan ikan.
Ali *woll* eat fish
'Ali will eat fish (later)'
*'Ali is willing to eat fish.'

b. Ali mau makan ikan.
Ali *bgt* eat fish
'Ali is going to eat fish.'
'Ali is willing to eat fish.'

Given this, while we might have thought that the two phenomena under consideration (offering and willingness) were naturally related, the Indonesian data show that these two phenomena can be disjoint. This makes the alternative hypothesis a much less attractive as the germ of a (so far non-existent) explanation for the English facts about offering, since whatever the explanation is, it won't work for Indonesian; on the other hand, the explanation I have proposed can be used to capture the facts of both languages (leaving the dispositional use in both languages unexplained).

So far we have seen that the PROG + FUT analysis of *bgt* accounts for the fact that *bgt* cannot typically be used to make an offer. This analysis turned on the idea that (normally) the use of *bgt* in the consequent of a conditional *If P bgt Q* entails that some ~P worlds are Q worlds. In sections 1.4 and 1.5, we will examine other kinds of conditionals that have something to say about ~P worlds, and demonstrate further differences between *will* and *bgt* that can be explained in a similar fashion. Specifically, section 1.4 deals with relevance conditionals, and section 1.5 treats causal and acausal contexts.

1.4 Relevance conditionals

Relevance conditionals are conditionals in which the antecedent seems to be a condition on the relevance to the hearer of the information in the consequent. Some examples of relevance conditionals are given below.

(24) Relevance conditionals
a. If you want to know, there's some beer in the fridge.
b. If I may be frank, Frank is not looking good.

Differently from various other kinds of conditional utterances, the speaker of a relevance conditional *if P, Q* is certainly not committed to *if not-P, not-Q*.

(25) a. If you don't want to know, there isn't any beer in the fridge.
b. If I may not be frank, Frank is looking good.

Therefore, in the context in which a relevance conditional *if P, Q* is uttered, not all not-P worlds are not-Q worlds. That is, some not-P worlds are Q worlds. But actually, a stronger entailment can be demonstrated, namely, all not-P worlds are Q worlds. Iatridou (1994) notes that *then* does not appear in relevance conditionals.

(26) a. *If you're interested, (then) there's some beer in the fridge.
b. *If I may be frank, (then) Frank is not looking good.

Iatridou argues that the use of *then* in a conditional *if P, then Q* presupposes that not all not-P worlds are Q worlds. Therefore the impossibility of adding *then* to a relevance conditional *if P, Q* must signify that all not-P worlds are Q worlds. Recall that the use of *bgt* (normally) entails that some not-P worlds are Q worlds.

The prediction we make is that *bgt* should be possible in relevance conditionals, since if all not-P worlds are Q worlds, some not-P worlds are Q worlds. The prediction is borne out. Compare (27a) and (27b). While the conditional in (27a), using *will*, is not a good relevance conditional (but makes a fine offer), the conditional in (27b), using *bgt*, is a good relevance conditional (and as expected, is not a good offer).

(27) a. If you're interested, we'll go get some beer. (*relevance, ok offer)
b. If you're interested, we're going to go get some beer. (ok relevance, *offer)

1.5 Acausal and causal contexts

We have just seen that relevance conditionals discriminate between *will* and *bgt* sentences in a way that is expected by my proposal. In this section we will consider conditionals that can occur in both acausal and causal contexts, and find another difference between *bgt* and *will*. Suppose that you are planning to talk to an eccentric professor whom you have not yet met. A fellow student tells you:

(28) If he hits his forehead with his hand ...
a. ... he's going to tell you something important.
b. ... he'll tell you something important.

Note that (28a) and (28b) are different with respect to an acausal context (though not with respect to a causal context):

(29) a. *Acausal context:* The forehead-hitting lets you know that he is about to tell you something important. (28a) only
b. *Causal context:* The forehead-hitting causes him to say important things (so try to contrive a way to get him to hit his forehead.) (28a,b)

To prove to yourself that the causal context is really possible with *bgt*, consider (30), which only supports a causal context (it is not plausible that an action you perform should be an indication to you about the professor's likely behavior).

(30) If you hit his forehead with your hand, he's going to tell you something important.

Similarly, the sentences in (31a) and (31b) differ as well. Once again, in the acausal context only *bgt* is possible, while in the causal context either *bgt* or *will* is possible.

(31) If the baby cries ...
a. ... she's going to spit up.
b. ... she'll spit up.

(32) a. *Acausal context:* The crying tells you that she is about to spit up. (31a) only
b. *Causal context:* The crying causes her to spit up (so don't let her cry). (31a,b)

Similarly, (33) confirms that *bgt* really is possible in the causal context.

(33) If you hold the baby horizontally, she's going to spit up.

What causes the difference between *bgt* and *will* in acausal contexts? Remember that in the consequent of a conditional, *bgt* makes a claim about the not-P worlds, but *will* does not. As we did for offering and relevance contexts, let's try to determine what acausal and causal contexts entail for the not-P worlds. A first try might look something like the following:

(34) *Cause condition (first try):* if P causes Q, not all not-P worlds are Q worlds (because there might be another cause for Q)

However, this condition is not correct, because of the apparent inference, if inference it is, from (35a) to (35b). It seems that other causes for the consequent (someone else striking the match, spontaneous combustion, etc.) are not considered.

(35) a. If you strike this match, it will light.
b. If you don't strike this match, it won't light.

What needs to be added is the restriction of the quantification over possible worlds, not just to accessible possible worlds, but to those that are closest to the actual world (Kratzer, 1986). This yields (36) for our cause condition:

(36) *Cause condition (second try):* if P causes Q, all (appropriately restricted) not-P worlds are not-Q worlds

Recall that the use of *bgt* in a conditional *if P, bgt Q,* typically entails that some not-P worlds are Q worlds. Thus we predict that *bgt* should be possible in acausal contexts, but not in causal contexts. The prediction that *bgt* is possible in acausal contexts is borne out, which is good news for the proposal. But unexpectedly, *bgt* appears to also be possible in causal contexts. This possibility appears at first to be a problem for the present proposal. Let's look more closely at what happens in these cases.

I, and some of the other English speakers I have asked, have the intuition that in the causal cases, *bgt* actually takes scope over the entire conditional in (30), (33), and the causal context readings of (28a) and (31a). What is already going to happen is the following: if P, Q. If this intuition is correct, then with the aspectual semantics removed from the conditional, the sentence no longer makes any claim about not-P worlds. It merely claims that $\|\text{Fut}\ [\textit{if P, Q}]\|^{jw}$ for some j which includes the time of utterance. Therefore, there is no conflict with the cause condition.

If this story is right, we would also expect to be able to use the same trick to force an offer reading of a *bgt* sentence. And in fact, we can:

(37) Wide scope *bgt* used to make an offer:
We're going to take good care of you in Madera. If you want a manicure, we're going to give you a manicure. If you want an oil change, we're going to change your oil.

These conditionals do present the manicure and the oil change as contingent on the hearer's desires. What is not negotiable is the idea that the speaker is going to take care of the hearer. Much more could be said here pursuing this suggestion that *bgt* takes wide scope, but for now I will leave it to further research (but see Copley, in progress).

To conclude this first part of the paper: I have shown that a PROG + FUT analysis of *bgt* explains the distribution of bgt in four different kinds of conditional contexts: offering, relevance conditionals, acausal contexts, and causal contexts.[6] The future operator we have been using is Thomason's indeterministic operator. In the next section, I will first show that an indeterministic future operator would not work as the future component of *bgt*, and then present arguments

[6] For other evidence that there actually is a progressive in *bgt*, see also Copley (2001).

(following Copley (2001)) that the future operator in *bgt* is the same as *woll*, the future operator in *will*. Thus I will have argued that *woll* must be indeterministic.

2 *Woll* is indeterministic

First, it is necessary to define these terms that I have been using, "deterministic" and "indeterministic".

(38) For any operator F, verb phrase *P*, world w, time i:
- a. F is a *deterministic future operator* iff the truth of $||F\mathit{P}||^{iw}$ entails the truth of $||F\mathit{P}||^{jw}$ for all $j < i$.
- b. F is an *indeterministic future operator* iff the truth of $||F\mathit{P}||^{iw}$ does not entail the truth of $||F\mathit{P}||^{jw}$ for all $j < i$.

Intuitively, if a future operator is deterministic, claims about the future using that operator are always either true or false (though we may not know which), and the truth value of a claim about the future does not change over time. So if a claim about the future is true, it has always been true. But if a future operator is indeterministic, a claim about the future using that operator might be true now, without having always been true.

As mentioned above, most semantic work on futures has assumed deterministic models. The project now is to first argue that the future operator in *bgt* has to be indeterministic, and then to argue that the future operator is the same as *woll*, to get the result that *woll* must be indeterministic.

2.1 The future operator in *bgt* is indeterministic

Suppose instead of Thomason's indeterministic future operator, we try a deterministic future operator in *bgt*, FUT_D. The reader can easily verify that FUT_D is, in fact, a deterministic future operator, and with a little more difficulty, verify also that Thomason's future is indeterministic.

(39) $||\text{FUT}_D\ Q||^{iw} = 1$ iff $\exists k > i$: [Q(k)(w)]

Composing FUT_D with our progressive yields the following:

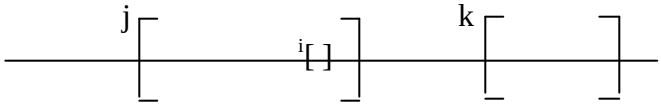
(40) $||bgt_D|| = ||\text{PROG}\ \text{FUT}_D\ Q||^{iw}$
$= 1$ iff $\exists j \supset i$: $[||\text{FUT}_D\ Q||^{jw}]$
$= 1$ iff $\exists j \supset i$: $[\exists k: > j$: [Q(k)(h)]]

The problem with this is that bgt_D and FUT_L turn out to be truth-conditionally equivalent. For:

(41) a. $\text{FUT}_D \rightarrow bgt_D$: If an interval i precedes an interval k, there will always be an interval j that includes i and precedes k.

b. $Bgt_D \rightarrow \text{FUT}_D$ If an interval j precedes an interval k, there will always be an interval i included in j that also precedes k.

(42)



Recall that we have been assuming, following Abusch (1985) and many others, that *will* = PRES + *woll*. In addition, I have argued that *bgt* = PROG + a future operator. Under the additional assumption that *woll* is the future operator in *bgt*, we would expect *will* and *bgt* sentences to be truth-conditionally equivalent. But we have seen that that is not the case. Contra (41a), as we have seen above, *bgt* cannot always be used when *will* can be used (as in, say, the offering examples discussed above, or the causal contexts without *bgt* taking wide scope).[7]

To summarize, a deterministic future does not capture the correct relation between *bgt* and *will*. By using an indeterministic operator, however, *bgt* sentences are correctly predicted to make a stronger claim than *will* sentences. What remains is to argue that *woll* is precisely the future operator in *bgt*.

2.2 The future operator in *bgt* is *woll*

While I do not have anything approaching a watertight argument that the future operator in *bgt* is *woll*, there are two pieces of circumstantial evidence that point in that direction, following Copley (2001). At the very least, there are two properties that *bgt* and *will/would* share with each other that other kinds of future reference (modals, futurates) do not share. Combining this result with the conclusions of sections 1 and 2.1 will allow us to conclude that *woll* must be indeterministic.

It is a fact about *would*, due originally to Stowell, that matrix *would* is ungrammatical when the event has not actually happened by the time of utterance. Indeed that is what (43a) entails, as we see from the fact that (43b) is something of a contradiction.

(43) a. This little boy would grow up to be king.

b. *This little boy would grow up to be king, but he didn't.

[7] The proposal from section 1 falsifies (41a), because *bgt* quantifies over a set of worlds which includes the set that *will* quantifies over. It also makes (41b) true; but this is all right, as long as a morphological blocking or Gricean account can be invoked to say why if *bgt* can be used, it must be used (if indeed that is true).

Other examples are below:

(44) a. *Pedro would pitch the following day, but then he caught a cold and didn't.
b. *Pedro would pitch a perfect game the following day, but then he caught a cold and didn't.

Let's call this the ``matrix *would* observation'':

(45) *Matrix* would *observation (MWO):*
would P → PAST P

Note that there is no corresponding matrix *will* observation such that *will* P → PRES P. So we will have to compare past tense *be going to (was/were going to, wgt)* and *would*, rather than present tense *bgt* and *will*.

Is there a corresponding observation for wgt? At first glance there appears not to be, because (46a), which is of the form *wgt* P & PAST P, is good. But on the other hand, (46b) is not good.[8]

(46) a. Pedro was going to pitch the following day, but then he caught a cold and didn't.
b. *Pedro was going to pitch a perfect game the following day, but then he caught a cold and didn't.

The difference between the event in (46a) and the event in (46b) is that the former is plannable, while the latter is not, which ought to make us think of futurate readings.

"Futurate" is the term for a kind of reference to the future that is (quite roughly) possible with plannable events, but impossible with unplannable eventualities (Vetter, 1979; Dowty, 1979, Copley, 2000), as in (47).

(47) The Red Sox are playing/*beating the Yankees tomorrow.

The futurate pattern of judgments – good with plannable eventualities, bad with unplannable eventualities – shows up for progressives only when the ongoing, present reading is ruled out. For example, (48) is good whether the eventuality is plannable or not. It is only when there is a future adverbial, as in (47), that the characteristic pattern of judgments is discernible.

[8] Speakers may find (46b) acceptable on the assumption that Pedro has some control over whether he pitches a perfect game or not. Those speakers may find it easier to exclude the possibility that rain can be controlled or planned; (i) makes the same point as (46b).

(i) *It was going to rain yesterday, but then it didn't.

(48) The Red Sox are playing/beating the Yankees right now.

In Copley (2001) I argue that bgt, having a progressive, has both an "ongoing future" and a "futurate future" reading. If we can rule out the ongoing future reading, we should be able to see the futurate judgment pattern.

The most plausible explanation for the fact in (46), I believe, is that the MWO rules out *wgt* on the ongoing future reading, but not on the futurate future reading. And in support of this hypothesis, it does appear that in (46a) the only reading is one where there was, at some previous time, a plan that Pedro would pitch the following day.

Why wouldn't the MWO rule out the futurate reading? The answer may have to do with the ``M" in the MWO. The MWO does not hold in embedded contexts, as in (49a), where *woll* VP is evaluated on John's belief worlds; (49a) does not entail (49b).

(49) a. John believed that Mary would go.
b. Mary went.

If we were to give a modal semantics for futurate readings, then in the futurate reading, *woll Q* would be evaluated on, speaking casually, the planned worlds, not the actual world. In that case, the MWO would not be expected to hold for the futurate reading. But in the ongoing reading, *woll Q* would be evaluated on the actual world, so it would still be expected to run afoul of the MWO. This would explain why the futurate pattern of judgments shows up; the ongoing reading is ruled out.

This similarity between *would* and *wgt* can plausibly be assumed to be because they share a similar means of referring to the future. For the sake of comparison, note that past modals and past progressive futurates do not obey the MWO; a continuation asserting that the eventuality didn't happen does not result in a contradiction.

(50) a. Pedro was supposed to pitch against the Yankees, but in the end he didn't.
b. (At that point) Pedro might have pitched/was pitching against the Yankees, but in the end he didn't.

So if both *would* and one of the readings of *wgt* obey the MWO, it is not just because they both involve future reference, but must be because they both refer to the future by the same, or at least similar, means.

One other commonality is that both *will* and *bgt* share the property of being felicitous under verbs such as *predict*, as Presque (2001) points out. Sentences without these are not felicitous, even if they make reference to the future in other ways.

(51) From Presque (2001)
- a. Mary predicts that John will push the button.
- b. Mary predicts that John is going to push the button.
- c. *Mary predicts that John pushes the button.
- d. *Mary predicts that John is pushing the button.
- e. *Mary predicts that John pushed the button.
- f. *Mary predicts that John was pushing the button.

To Presque's list we can also add modals:

(52)
- a. *Mary predicts that John may push/be pushing the button.
- b. *Mary predicts that John is supposed to push/be pushing the button.

This is again evidence that *will* and *bgt* share the same, or at least similar, means of refering to the future. Though it may be mysterious why predict is able to distinguish between the future reference of *will* and *bgt* on the one hand, and other kinds of future reference on the other hand, Along with the facts about the MWO, this should allow us to go ahead with the hypothesis that the same future element figures in both *will* and *bgt*.

To conclude this section: I have argued, first of all, that the future operator in *bgt* must be indeterministic, because putting a deterministic future under a progressive yields the wrong results. Secondly, I have shown that the future operator in *will/would* and the one in *bgt* share two semantic properties that are not shared by other means of future reference. I take this as evidence that the future operator in *will/would* and the future operator in *bgt* are in fact the same entity.

3 Conclusion

Conditional data show that there is good reason to think that *bgt* consists of some kind of progressive plus a future operator. The future operator in this configuration can only be indeterministic; evidence that it is the same future operator as *woll*, the future operator in *will* means that *woll* must be indeterministic.

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