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# Ordering and Reasoning

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DRAFT  
November 7, 2005

3in 0pt

Shaven Yak: Why do you need an app on your computer to tell you the weather? Wouldn't a static text box saying "It's cold!" be sufficient?

YetAnotherDave: it's the distinction between "it's snowing" and "it'll snow soon" that we need from a slashdot.org thread, <http://slashdot.org/articles/04/11/19/2331210.shtml>

## Abstract

This paper proposes a semantic distinction for modals. This distinction, "reasoning," is the difference between imperfective modals, such as those that form part of the meaning of progressives and generics, and future modals, such as those that form part of the meaning of *be going to* and *will*. Traditionally, it has been presumed that imperfectives place their event overlapping the local evaluation time, while futures place it following the local evaluation time. But this generalization breaks down when cases involving intentions, manmade laws, and certain natural laws are considered. To determine the correct difference between these modals, it is necessary to examine more closely the conceptual underpinnings of the inertial ordering sources that pick out the worlds of quantification for these modals. Inertia is argued to be calculated from both natural forces and manmade forces (i.e., plans or rules); however, in general, only the latter can be applied at any temporal distance. This conceptual difference between the manmade and natural finally points us to the grammatical difference between imperfective and future modals: the former use only forces in the local situation when calculating the inertial ordering source ("direct reasoning"), while the latter permit extrapolation to forces resulting from those in the local situation ("extrapolative reasoning"). Certain odd physical forces, and the viability of a possible third value of reasoning, are also considered.

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<sup>0</sup>Many thanks to Barry Schein for originally making me think about vectors. Thanks also to Jim Higginbotham, Sabine Iatridou, several anonymous reviewers, and audiences at MIT, NELS 35, UCLA, and USC.

# 1 Introduction

The progressive and habitual meanings of imperfectives have long been claimed to be modal, with universal quantification over “normal” or “inertial” worlds or situations (Cipria and Roberts, 2000, e.g.). Futures such as *be going to* and *will* have also been claimed to be modal in the same sense (Copley, 2002b, e.g.). Assuming that both claims are correct, an account of the difference between imperfective and future modality is needed. In this paper I will propose a general outline for such an account, with a view towards an eventual full formal implementation.

The structure of the paper is as follows. In section 2, we will compare the modality found in imperfectives with the modality found in futures. Section 3 attempts to account for the pattern of judgments observed in section 2, by appealing to a conceptual distinction between physical and intentional forces, both of which can be involved in providing the modal’s ordering source. In section 4 we return to the grammatical distinction between imperfectives and futures, and explain it in terms of a new notion, “reasoning”.

But to begin with, let us define some terminology for the forms we will be discussing.

## 1.1 Imperfectives

The term “imperfective” refers to any verb form in any language that has progressive, habitual, and/or durative meaning. Since English does not have a durative “general imperfective” (Smith, 1991), we will be considering progressives and habituais here.

Progressives in English are marked with *be -ing*, as in (1) below, and (traditionally) convey that the event described by the predicate is ongoing at the time under discussion.

- (1) a. John is making pizza.
- b. It was raining.

I will be calling the time under discussion the “local evaluation time.” The local evaluation time varies with tense. For instance, (1a) conveys that a John-make-pizza event is ongoing at the time of utterance, and (1b) conveys that a rain event was ongoing at a certain past time.

Habituais in English are typically unmarked; i.e., the verb is bare except for any agreement and tense morphology. Habituais convey that in all normal situations of a particular kind, within an interval that surrounds the local evaluation time, the event described takes (or took) place. Examples of habituais are provided in (2).

- (2) a. John makes pizza.
- b. It rained (often last year).

The sentence in (2a), for example, conveys that in an interval surrounding the

present, in all normal situations with certain unspecified properties, there is a John-make-pizza event.<sup>1</sup> Likewise, (2b) can convey that most normal situations of an unspecified kind, in a certain past interval, were situations in which there was a rain event. The parenthetical rules out the episodic meaning, which (for some reason) would otherwise be preferred.

## 1.2 Futures

We will be considering two English futures: *be going to* and *will*. *Be going to* sentences do not present any special problems of terminology; we will call them simply “*be going to* sentences”. *Will* is another story, however. Sentences with *will* can have a number of meanings; in particular for the purposes of this paper we will be considering what I will call the dispositional meaning. Note that (3) can either express a prediction about something that will happen, or a statement of John’s willingness to eat beans, should you care to serve them.

(3) John will eat beans.

This second meaning is the dispositional meaning, and the one that we will be interested in.<sup>2</sup>

## 2 Two kinds of modals, two kinds of forces

The aim of this section is to compare the kind of modality found in imperfectives with the kind of modality found in futures; in later sections the goal will be to appropriately characterize the difference between the two kinds of modality.

We will do the comparison between imperfectives and futures twice: once comparing progressives (imperfective) to *be going to* (future), and once comparing habituais (imperfective) to dispositionals (future). In addition, we will examine two kinds of data: an initial data set of simple sentences, and a further set of data involving conditionals.

### 2.1 Initial data

We begin by comparing progressives to *be going to*. Let us consider a null hypothesis for how they are different. We might at first assume that progressives place their event overlapping with the local evaluation time, while *be going to* sentences place theirs following the local evaluation time (again, whether the local evaluation time is past or present is determined by tense). Contrasts such as the one in (4), for example, support such a generalization.

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<sup>1</sup>Or, with focus on *pizza*, that all normal situations in which John makes something are situations in which John makes pizza. The mapping of elements in the sentence to restriction or nuclear scope is sensitive to topic-focus information structure; however, this fact will not concern us here.

<sup>2</sup>The idea that these are different meanings is supported by the fact that in at least one language (Indonesian, for some speakers) these meanings are expressed by different morphemes (Copley, 2004).

- (4) a. #John is getting sick tomorrow. imperfective, physical<sup>3</sup>  
 b. John is going to get sick tomorrow. future, physical

Here, although both the progressive and *be going to* share some sort of “ongoingness” in their meaning,<sup>4</sup> they differ in their compatibility with the future temporal adverbial *tomorrow*. The sentence *John is getting sick* can only refer to an event that is ongoing at the local evaluation time, which in this case is the utterance time. The generalization seems fairly straightforward: the progressive talks about the local evaluation time, and *be going to* talks about some time that is in the future with respect to the local evaluation time. Let’s call this generalization “G1”:

- (5) G1: The progressive places its event overlapping the local evaluation time; *be going to* places its event after the local evaluation time.

Yet in many languages, English included, G1 is not valid. It is well known that some progressives can be used to talk about the future when the event under discussion is something that is planned or scheduled, as in (6a), and indeed *be going to* in (6b) seems to make a similar reference to an ongoing intention for John to make pizza.

- (6) a. John is making pizza tomorrow. imperfective, intentional  
 b. John is going to make pizza tomorrow. future, intentional

So although in some cases, namely those that are non-intentional as in (4), the initial generalization holds, it does not hold for all cases. When intentions (schedules, plans) are considered, as in (6), the generalization is simply wrong, and we are left without an idea of the difference between the modality in imperfectives and the modality in futures.

The kind of progressive exemplified in (6a) is often called a *futurate* reading. One may object here that futurate readings are entirely different animals from other readings of imperfectives, and so do not properly belong in a discussion of “normal” imperfectives. But as I will argue, this different animal – a more future-like behavior when it comes to intentional cases – shows up elsewhere, and therefore the futurates are deserving of inclusion in this initial collection of facts.

Another objection is that futurates are too normal for consideration; it has become common, since Dowty (1979), to treat the intention or planning stage as a preparatory stage to the event, and then this preparatory stage is what the progressive operates on. But it seems very strange to consider planning as an early stage of the event. For example, the planning can have an independent temporal adverbial, and participate in anaphora, as shown in (7a) and (7b).

<sup>3</sup>The reasons for this annotation will become clear shortly.

<sup>4</sup>Elsewhere (Copley, 2001, 2002a,b, 2004) I have argued that this “ongoingness” corresponds to sharing a Kleinian (Klein, 1997) imperfective component, i.e., inclusion of the topic interval within a larger interval over which branching takes place.

- (7) a. **When I talked to the baseball commissioner last week**, the Red Sox were playing the Yankees three times in the first week in May.
- b. **That** made me think I should get some tickets.

Thus, while the intention or plan is required to include the local evaluation time in futurates, it is implausible to consider it an early stage of the event itself. (Later we will see that this impulse to make the intention part of the event is really unnecessary.)

A similar pattern to the one we have just seen for progressives and *be going to* can also be observed in habituals and dispositional *will* sentences, both of which assert a lawlike connection between the subject and the event. The difference, at least initially, appears to be that habituals, as in (8a), require the event to have been instantiated at least once. We may conclude this because the continuation *though thankfully it's never come to that* induces a contradiction. On the other hand, the dispositional in (8b)<sup>5</sup> does not contradict the continuation, and therefore does not seem to require instantiation of the event.

- (8) a. #Our grad students are so tough, they even eat cardboard, though thankfully it's never come to that. imperfective, physical
- b. Our grad students are so tough, they will even eat cardboard, though thankfully it's never come to that. future, physical

Thus, our initial generalization concerning the difference between habituals and dispositionals is G2:

- (9) G2: Habituals require the event to have been instantiated at least once before the local evaluation time; dispositionals do not require the event to have been instantiated before the local evaluation time.

However, G2 turns out to be as untenable as G1 – and in a suspiciously similar way. As pointed out by Carlson (1995), some habituals do not require instantiation (he did not discuss dispositionals). One such habitual is given in (10a); as with the dispositional in (10b), the continuation does not induce a contradiction.

- (10) a. Our grad students answer the mail from Antarctica, though there hasn't been any so far. imperfective, intentional
- b. Our grad students will answer the mail from Antarctica, though there hasn't been any so far. future, intentional

Crucially, the event there is intended by someone; the exceptionality to G2 must stem from the fact that the lawlike connection between the subject and the event is manmade rather than physical. What is interesting about the fact that the law is manmade is that it should remind us of the exception to G1, which also

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<sup>5</sup>There is of course another reading of (7b), placed in better context as: 'There's nothing you can do about it, the students will just keep on eating cardboard.' This reading corresponds to the additional reading of (3) above. We will ignore this reading here.

involved a manmade law of a sort, in the form of a schedule or plan. So perhaps G1 and G2 are somehow analogous, in a manner yet to be explicated.

Before offering an explication, I would like to forestall a possible objection to this analogy. In what sense (the objection goes) is (9a) not intentional? Surely the students are agents of eating-cardboard events, and being agents, have intentions to carry out these events. Therefore, the difference between (9a) and (10a) is not one of physical laws versus intentional laws. Therefore, G2 is not analogous to G1.

This objection is not valid, however. Mere agenthood does not entail intentionality of the agent to carry out the event; agents can certainly do things accidentally. If I knock the bookcase over accidentally, I was still the one who did it, even though I did not mean to do it. But let us suppose that the agents in question in (9a) do actually intend to eat cardboard. Their intentions to eat cardboard have nothing to do with the analogy between G1 and G2, because the intentionality of the agent to carry out the event is not where the distinction lies between (9a) and (10a). Rather, the distinction is in the source of the lawlike connection between the agent and the event. The connection is physical in (9a) in that it has to do with properties of the students that dispose them to eat cardboard. The connection is manmade in (10a), to the extent that it results from an obligation, rather than a disposition. This is the reason why the objection is not valid. Yes, agents may very well intend to carry out events, but this kind of intention is not the kind of intention under discussion.

With that objection out of the way, let us consider how to unify G1 and G2 (and their exceptions). What does overlapping the local evaluation time (as in G1) have to do with having at least one instantiation before the local evaluation time (as in G2)? Here it will be useful to think a little about the difference between the meaning of progressives and habituals, to subtract that difference from the equation, and hopefully to be left with equals on either side. Progressives involving physical forces, on any account, predicate a single occurrence of the event, ongoing at the local evaluation time, while habituals involving physical forces say of an event that in any of a contextually supplied kind of situation, the event holds, as result of an ongoing lawlike connection between the subject and the event. What these have in common, though, is the requirement that at least part of the event(s) be before the local evaluation time. The exceptions to G1 and G2, the intentional cases, are exceptions precisely in that this requirement is not obeyed.

The table in (11) sums up this new generalization; the imperfective “no!”’s are the exceptions to G1 and G2.

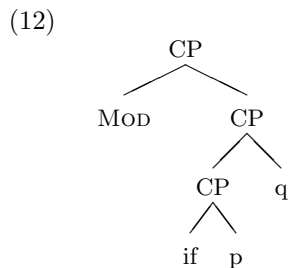
- (11) Must the event or events be at least partly before the local evaluation time?

		physical	intentional
imperfective	progressive	yes	no!
future	<i>be going to</i>	no	no
imperfective	habitual	yes	no!
future	dispositional	no	no

To look at these data in slightly different light, we might observe that imperfectives are sensitive to the difference between intentional and physical cases, while futures are insensitive to that difference. The pattern of imperfective sensitivity and future insensitivity, which we will need to explain, is exemplified further by certain conditional examples. We turn now to these cases.

## 2.2 Modals in conditionals

The generalization noted for imperfectives and futures applies to conditionals as well, as demonstrated in (13) through (16) below. A sidebar: We are only considering conditionals in which the modal takes wide scope. I have argued elsewhere (Copley, 2002b, 2004) that in conditionals like those in (13) through (16), the imperfective or future modal element takes scope over the entire conditional, as in (12).



While conditionals can have other structures (for example, the modal could be interpreted inside the conditional), this structure is the one we are interested in, as it guarantees that the modal will take the utterance time as its temporal argument.

These wide scope conditionals exhibit the same pattern of judgments observed above: intentional cases of imperfectives are allowed to be somewhat “looser” than physical cases of imperfectives, and behave more like the futures do. The imperfectives are thus sensitive to the physical/intentional distinction, while the futures are not.



If you drop that vase...

- |      |                                   |                           |
|------|-----------------------------------|---------------------------|
| (13) | a. #...it's breaking.             | imperfective, physical    |
|      | b. ...it's going to break.        | future, physical          |
| (14) | a. ...you're picking it up.       | imperfective, intentional |
|      | b. ...you're going to pick it up. | future, intentional       |
| (15) | a. #...it breaks.                 | imperfective, physical    |
|      | b. ...it will break.              | future, physical          |
| (16) | a. ...you pick it up.             | imperfective, intentional |
|      | b. ...you will pick it up.        | future, intentional       |

The contrast in (13) shows that in physical cases, the progressive are not acceptable the way *be going to* is. However, in an intentional case as in (14a), the progressive is possible. This looks very similar to what we just saw above: In intentional cases, the imperfective is, surprisingly, permissible. Likewise, the contrast in (15) demonstrates that physical habituals are not as permissive as dispositional *will*. Actually, not all physical habituals are bad; those in (17) are fine.

- |      |  |
|------|--|
| (17) | a. If you drop a vase, it breaks.            |
|      | b. If you drop this kind of vase, it breaks. |

But this is exactly the point: the examples in (17) are fine just to the extent that these kinds of events have already been instantiated. The example in (15a) presumably, if true, describes a non-repeatable event, so it can't already have happened. And it is exactly in this case that the physical habitual is bad. The intentional habitual, in (16a), however, is fine. Thus we can see that the same patterns hold here as with the other data.

So: While the futures are apparently insensitive to any variation between physical facts and intentions, the imperfectives are sensitive to them, behaving more like futures in the intentional cases. What could account for this pattern?

### 3 Ordering

First let us look at the imperfectives, as they are more discriminating than the futures, and hence (with any luck) more informative. Recall where we are in the argument: We have seen so far that there is a difference between imperfectives and futures; the difference lies in their different sensitivity to variation between physical and intentional facts. Now we will attempt to understand why the difference between physical and intentional facts is relevant, by relating these intuitions to the notion of ordering source. In a subsequent section, we will return to the difference between imperfectives and futures, and explain it as "reasoning".

### 3.1 Unasking the question

The pattern of the imperfective data is still rather unsatisfying at the moment; there are glaring exceptions to our generalizations. So let us try to look at the pattern from another perspective. Instead of asking what requirements are placed on the event time in all four cases of imperfectives, let us ask instead what it is (call it “X”) that is required to overlap the local evaluation time in all four cases, taking it for granted that such an X exists.

It seems clear that X cannot be the event time. Of the four kinds of imperfective sentences, only the physical progressive cases seem to require the event time to overlap the local evaluation time. In the intentional progressive (i.e., the futurate) cases, the event time does not overlap the local evaluation time; it is in the future. And certainly no one has ever suggested of habituais that an instantiation of the event needs to overlap the local evaluation time. This is a prominent property of habituais, that an instantiation of the event need not be taking place at the local evaluation time. In habituais, rather, what overlaps the local evaluation time is the lawlike connection between the subject and the event. For physical habituais, this amounts to the combination of properties that engenders the lawlike connection (so this combination of properties would be X). In intentional habituais, it is the manmade law or rule. Likewise, in intentional progressives (furate readings), it is the manmade plan or schedule that must overlap the local evaluation time.

We have then three plausible candidates for X, and one mystery. The three plausible candidates are: plans in intentional progressives (furates), manmade laws in intentional habituais, and physical properties in physical habituais. The mystery is what X would be in physical progressives. If this story is correct, the fact that the event time overlaps the local evaluation time in physical progressives is actually a red herring. *There is no requirement in the grammar for the event time to overlap the local evaluation time.* It is, rather, always X that must overlap the local evaluation time. X is obviously not an intention in the physical cases, but it is something else, and it just so happens that X in the physical cases either corresponds to the event, or is something that in progressives has the same run time as the event.

Perhaps we can shed light on the mystery X by considering what role the other Xs play. Since two of the Xs deal with intention, shading into obligation, let us turn to the semantics of intention and obligation. Fortunately, intention and obligation are known to have formally similar meanings, and there is no need to start from scratch in understanding them.

### 3.2 Intentions and forces

Intention and obligation are both treated formally as ordering sources; the concept of the ordering source was created in order to solve a problem having to do with modality in a possible worlds framework (see, e.g., Lewis, 1986; Kratzer, 1991).

As background to this problem, note that a modal such as *must* is taken to

quantify universally over possible worlds that satisfy some particular propositions. In the case of epistemic *must*, the propositions are those that the speaker knows to be true. Epistemic *must* thus quantifies over the set of worlds that satisfy those propositions that the speaker knows to be true. Since knowledge cannot be contradictory, there will always be such a set.<sup>6</sup>

Now consider *must* of practical necessity. At first glance it looks as though it quantifies over the set of worlds that satisfy those propositions that represent (manmade) laws or ideals. But suppose that I only have enough clean clothes to make it through tomorrow. Suppose also that the propositions in (18) are true.

- (18) a. I want to have clean clothes.  
 b. I don't want (= want not) to do my laundry. , I don't want to (= want to not) have someone else do my laundry.  
 c. I don't want to (= want to not) buy new clothes.

Assuming that the only ways I am going to get clean clothing are by washing my clothes myself, having someone else do it for me, or buying something new to wear, then there is no world in which all of the desires expressed in (18) are true, because taken together they are contradictory. And yet the desires in (18) are perfectly natural simultaneous desires, and I can have these desires while maintaining that I must (or *have to*) do my laundry. Why is this possible?

One solution is to weight the desires and have *must* quantify over the worlds that come closest to being ideal, by satisfying the most important desires. The desires thus provide an ordering source for the possible worlds: based on the weighting of the desires, the worlds will be ordered according to how well they satisfy these desires. In this case, on the most natural weighting of the desires in (18), the most ideal worlds would be those in which I give in and do my laundry, because presumably my desire to avoid doing my laundry is not as strong as the other desires.

Returning to the argument at hand: recall that we are trying to determine a general rule for what X is, where X is the thing that must overlap the local evaluation time in imperfectives. We have three plausible Xs, two of which have to do with intentions (i.e., plans, manmade laws and the like). Since intentions provide ordering sources, we may assume that in these intentional cases, X provides the ordering source.<sup>7</sup>

Now, what about the physical cases? Recall that X for physical habituals

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<sup>6</sup>If it were mere belief that were involved, this might not be the case, as beliefs might be contradictory.

<sup>7</sup>Carlson also pointed out other habituals that do not require instantiation. These are habituals that involve machines of some kind.

- (i) a. This car goes 180 miles per hour.  
 b. This machine crushes oranges.

What is the nature of the laws in these examples, that allow the lack of instantiation? I suggest that the fact that there is a designer means there is a manmade law, and therefore the designer could have in mind situations that haven't arisen yet.

was whatever properties of the subject cause the lawlike connection between subject and event. We had no good idea about X for physical progressives. However, now that we know we are looking for an ordering source, there is a good candidate, namely *inertia*.

In physics, inertia is the principle that the motion of an object, or the lack thereof, continues unchanged unless a force is applied to change it. Dowty (1979) introduced the idea of inertia for analyzing the progressive in a possible worlds framework. “Inertia worlds,” according to Dowty, are those worlds which proceed normally, without interference.<sup>8</sup>

Inertia worlds are useful in the analysis of the progressive because of a non-entailment schema Dowty called the “imperfective paradox.” The proposition expressed by the sentence in (19a) does not entail the proposition expressed by the sentence in (19b), because John could have been interrupted and never finished the circle, but (19a) could still express a true proposition.

- (19) a. John was drawing a circle.  
b. John drew a circle.

This fact is problematic if all the progressive does is say that a particular event was “ongoing” at the local evaluation time. How can an event that is just at that point interrupted be “ongoing” at that point? Dowty’s answer is that such an event is ongoing if you consider only the possible “normal” or “inertial” worlds; possible worlds in which events proceed normally.

What makes inertia an ordering source is that it picks out the best worlds. This idea of an inertial ordering source looks appropriate as well for physical habituals. “Normal cases according to some law” are like “inertia worlds”: If nothing disturbs the lawlike connection, the connection actually holds. This would then be why habituals admit exceptions: The habitual in (20), for instance, can be true even though in some exceptional cases John does not walk to work.

- (20) John walks to work.

The existence of exceptions does not affect the truth of (20), because (20) is only about the normal situations. All the cases in which John doesn’t walk to work are in fact non-normal situations. Thus we can justify a hypothesis that treats X in the physical cases, both progressive and habitual, as being inertia.

Furthermore we should note that inertia, like intention, can be treated as an ordering source (see for instance Portner, 1998). For just as there may be desires of varying strengths, that may oppose each other, so too there may be physical forces or dispositions of varying strengths, that oppose each other. In

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<sup>8</sup>Of course the devil is lurking here in the details; what exactly does it mean for a world to proceed normally? See, among others, Landman (1992), Portner (1998), Higginbotham (2004) for some elucidation of this notion in terms of event arguments. My own preference would be to define a local situation and then say that it proceeds normally if no forces from outside the situation intervene. In fact, discussions of inertia tend to make reference to intervention or interference, concepts that are natural in a framework that includes forces, but perhaps a bit less so in a framework that only includes events.

general, physical forces have an underlying conceptual similarity with intentions. An intention or desire is an impetus towards worlds of the maximum possible contentment of the person holding the intention or desire; a physical force is an impetus towards worlds of the maximum possible entropy (we might think of this as maximum contentment of the physical universe).

One question that arises is whether intentional forces and physical forces are involved in the same ordering source, or whether a modal can have only one or the other. It seems that the former is true; they actually compete to form a net force, and it is the net force that is X. If they didn't compete, it would be possible to felicitously say (21) simply on the basis of wanting it to be so.

(21) I am winning the election tomorrow.

But these are not the felicity conditions for (21). The only way in which (21) could be uttered felicitously is if the speaker had knowledge of forces that ensured his or her winning. Wanting is not enough, unless the speaker actually has the ability to turn their desires into reality. That is, the modal doesn't just pick out the best worlds according to the "net desire," it has to take other forces into account. So it seems that there are not two ordering sources, just one that considers both intentional and physical forces.

But intentional and physical forces do seem to have a major difference. Intentional forces such as plans and laws can have local application but spatiotemporally distant effects. That is, one can place an obligation on someone else to carry something out later.<sup>9</sup> But physical forces are typically limited to the here and now. One apparent exception might be gravity, which seems to act at a distance. (Later we will see a problematic example involving gravity.) But of course, we don't expect even Newtonian physics to interact with the grammar directly. Knowing of Newton's theory is clearly not a prerequisite for having this kind of grammar in one's brain. Rather, we expect some sort of naïve physics, part of our cognitive birthright, to have some sort of interaction with the grammar. And equally, some sort of naïve psychology, with which to understand intentions.

Returning to the main argument, here then is a plausible reason why X was so hard to see in physical progressives, but so easy to see in intentional progressives. The physical forces are spatiotemporally close to their effects, while intentional forces need not be. Physical forces often (though not always, as we will see below) are exerted at the same time as their effects are manifested. So physical forces disappear into their effects, as it were, while intentional forces are more flexible. But both are apparently treated similarly in the modal semantics.

So far, we have only discussed forces with respect to imperfectives; this afforded us a different understanding of why our original generalizations about the difference between imperfective and future modals failed. However, we still have to say what the correct difference is between imperfective and future modals.

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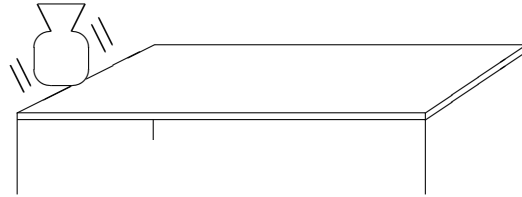
<sup>9</sup>Also, intentional forces necessarily involve an animate entity to carry out plan, since inanimate objects don't listen to our plans. This difference seems, so far, to be a minor one.

## 4 Reasoning

I have suggested that imperfectives require “X” to overlap the local evaluation time, where X was the net force, composed out of intentions (“forces of will”) and physical forces alike. Now we turn to future modals, and what distinguishes them from imperfective modals. The proposal is that future modals require X, the net force, to be future with respect to the local time of evaluation. (Of course the local time of evaluation for futures such as *will* and *is going to* is present.) It is this grammatical difference that is the semantic distinction promised in the title of this paper by the term “reasoning.”

To argue for this idea, let us consider the case of a vase sitting on a table. When the vase is sitting on the edge of the table, teetering, as depicted below, it is possible to use felicitously either the imperfective in (22a) or the future in (22b).<sup>10</sup>

- (22) a. The vase is falling.  
b. The vase is going to fall.

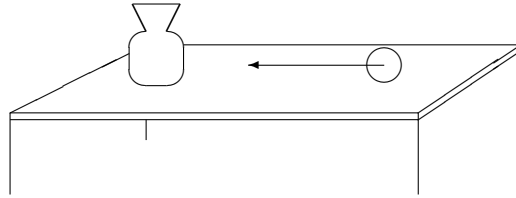


However, in the following situation, where the vase is sitting solidly in the center of the table, with a ball rolling towards it, it is only possible to felicitously use the future modal.

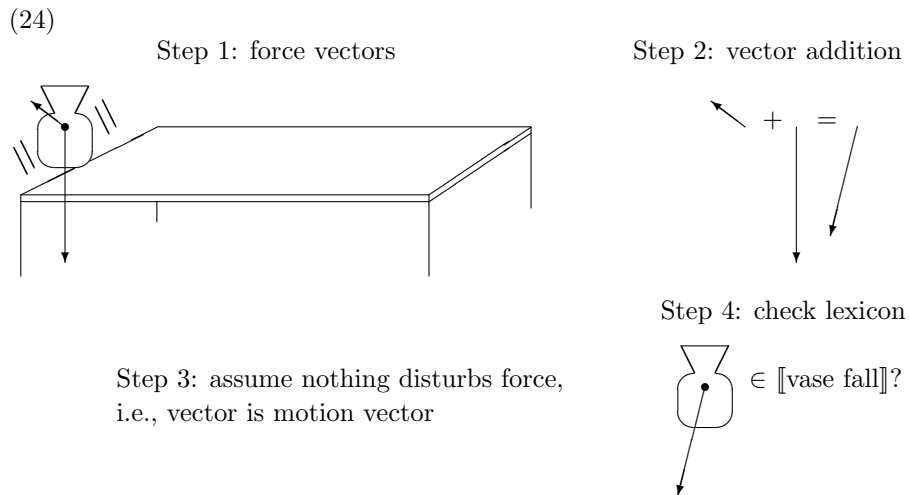
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<sup>10</sup>An anonymous reviewer noticed that it is impossible to say (21b) when the vase is already falling. This fact makes me suspect that the only reason (21b) is good when the vase is teetering is that it uses the telic meaning of *fall* that is ‘fall to the ground’ rather than the atelic ‘fall through the air.’ So even though the vase is falling-atelicly, it is still going-to-fall-telicly. It will be necessary to investigate other predicates in order to determine if this is the right analysis.

- (23) a. #The vase is falling.  
 b. The vase is going to fall.



This minimal pair of physical cases (progressive and *be going to*) will help us determine the distinction between imperfectives and futures in general. As I have proposed, the progressive requires there to be a force overlapping the local evaluation time (here the utterance time) that is a vase-falling kind of force. To determine if there is such a force in this situation, we use vector addition to add up the force vectors.<sup>11</sup> Then we look in the lexicon to see if the effect caused by the force counts as a vase-falling motion. Note that we are only interested in what would happen in the absence of other disrupting forces; this is inertia. This process is diagrammed below in (24).

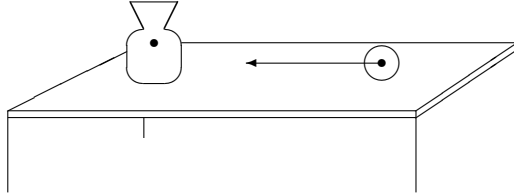


Because in this situation we do end up with a vase-falling vector, the progressive is possible. But in the situation where the vase is not moving, if we apply the same process (shown below), the vase vector is zero, and does not count as a vase-falling vector; so the progressive is not possible.

<sup>11</sup>This vector addition has to be a cognitive skill, not a grammatical one. In domains other than physical motion, the “vector space” will be quite abstract.

(25)

Step 1: force vectors



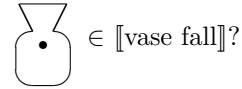
Step 2: vector addition

(nothing to add)



Step 4: check lexicon

Step 3: assume nothing disturbs force,  
i.e., vector is motion vector



However, in the same situation, *be going to* is possible, even though the progressive is not. This suggests that *be going to* must be able to consider all of the forces in the following diagram, not just the current forces on the vase, and work out how they will eventually affect the vase. That is, in evaluating future modals, we calculate from forces in the current situation to future forces, which have a future effect.

How might intention come into this discussion? In fact, it is possible to use *be going to* even in a situation where the vase is sitting on the table and no ball is rolling towards it. You could still say felicitously that it's going to fall if you had an intention to knock it over or knew someone else to have such an intention. You could only use the progressive if there was a current schedule for such a thing to happen. The basic idea is still the same; the future modal requires only that there be a future intention (calculated to follow from current conditions) while the progressive requires that there be a current intention, i.e., a plan.

Likewise, in more familiar cases, the progressive seems to be about plans or obligations, as in (26a), while the future leaves room for one to not have made up one's mind yet, as in (26b):

- (26) a. I think I'm teaching tomorrow.  
b. I think I'm going to teach tomorrow.

This is exactly the same as what we saw in the physical cases: the progressive requires current forces (where in this case the current forces, being intentions, can have effects in the future). *Be going to*, as before, can talk about future developments; future forces that follow causally from current forces.

So far, then, we have a story about the difference between progressives and *be going to*. But recall, the larger project is to explicate the difference between



imperfective modals and future modals in general. Is the difference between habituals and dispositionals the same kind of difference as that between progressives and *be going to*? Consider, for instance, the pair in (27).

- (27) a. Norvin eats doughnuts.  
b. Norvin will eat doughnuts.

Our theory predicts that habituals require the force that results in the Norvin-eating-doughnuts action – that is, Norvin’s properties that cause him to eat doughnuts – to overlap the local evaluation time. In the dispositional, we predict that it should be true just in case the current situation will develop into one with such a force. Indeed that seems to reflect the contrast in (27). And similarly, in cases that involve manmade laws, as in (28), the contrast is as expected.

- (28) a. Mary answers the mail from Antarctica.  
b. Mary will answer the mail from Antarctica.

The example in (28a) feels like a current law, while the example in (28b) seems to express a more distant law.

All of these contrasts are difficult to tease apart. However, this fact should not deter us. There are two choices in the face of such subtle (though real) contrasts. We could of course abdicate, and give up trying to come up with a more precise characterization of these contrasts, because we cannot find truth-functional contrasts. The other choice is to find easier cases, where the contrast *is* truth-functional, and which are closely related to the more difficult cases. Then that analysis can be justifiably exported to account for the more subtle cases. This is the route we have taken here. It is predicated on the assumption that progressives are to *be going to* sentences exactly in the same way that habituals are to dispositionals; the same distinction is at work in both domains.

From here on, I will refer to this distinction as a distinction of *reasoning*. The idea behind this name is simply that depending on whether the modal is imperfective or future, there is a different constraint on the chain of reasoning from the local situation to the event. In both cases you begin with a local situation (some salient situation overlapping the local evaluation time). Imperfective modals can only look at forces within the local evaluation time; these modals, let us say, have “direct” reasoning, as all you are allowed to do is to look at the current situation. For future modals, the net force is determined through a causal chain from the current situation to a later one; let us say that these modals have “extrapolative” reasoning.

Before moving on to consider whether reasoning will be a useful distinction, I would like to step back a bit and consider how this proposed distinction is different from a more familiar distinction, that of tense.

Tense helps determine what situation is used to calculate the net force, by telling us what time is the local evaluation time, that the situation must overlap.<sup>12</sup> Tense is oblivious to whether the net force that the modal is interested

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<sup>12</sup>I have outlined a role for aspect elsewhere (Copley, 2004); in this discussion, aspect would also have a role constraining the situation.

in is a current force or a chain of forces. In either case the same situation – a current one – is used.<sup>13</sup>

Now I would like to offer some suggestions about two problematic cases: progressive achievements and physical (“clockwork”) futurates.

#### 4.1 Progressive achievements and the falling penny

Achievements are commonly held to be instantaneous events (Vendler, 1967; Smith, 1991). If indeed this is the case, and if progressives require the event to include the present time (this would be the contribution of the “ongoingness” part of the meaning of progressives), there is an apparent conflict between the meaning of achievement predicates and this requirement of the progressive. Thus we would not expect to find progressive achievements at all. But in some languages, including English, progressive achievements are possible. Two examples of progressive achievements are given in (29).

- (29) a. Mary is arriving at the station.  
b. The economy is hitting rock bottom.

The meaningfulness of the examples in (29) has been explained (Rothstein, 2000; Higginbotham, 2004) by means of coercion of the achievement predicate into something like an accomplishment predicate; there arises some sort of preparatory event that the progressive operates on. (29a) means that Mary is doing some activity that is bringing her very close to an arrival; likewise, (29b) means that the economy is involved in some activity that will soon culminate in a rock-bottom-hitting achievement.

This preparatory event has to be very closely connected to the achievement itself, a requirement that is not evident in the *be going to* examples in (30).

- (30) a. Mary is going to arrive at the station.  
b. The economy is going to hit rock bottom.

But it does seem to be a separate event; it can have its own temporal adverbial, as can the achievement:<sup>14</sup>

- (31) a. Last spring, the economy was hitting rock bottom when Alan Greenspan suddenly lowered interest rates again, driving it back up.  
b. The economy was hitting rock bottom soon.

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<sup>13</sup>Aspect is also different from this new distinction. I take aspect to provide both a binder for a temporal variable, and a relation between that variable and the local evaluation time. Like tense, it has the effect of modifying the time of the local situation used to determine the net force (or ordering source). The “ongoingness” that progressives and *be going to* share, I have argued in Copley (2004, etc.) is a kind of aspect, namely the Bennett and Partee (1978) progressive:  $\lambda t \exists t' : t \subset t'$ .

<sup>14</sup>Although for some reason they do not co-occur: #*Last spring the economy was hitting rock bottom within a few weeks.*

Progressive achievements, then, are a real exception to the generalization G1 about progressives. The event described by the predicate must take place after, not at, the local evaluation time; and a preparatory event (where that designation is a bit obscure) is what must include the local evaluation time.

Note the similarity between this case and the futurate progressive case discussed earlier. In both cases, the event described by the predicate does not overlap the local evaluation time, but rather is in the future of the local evaluation time. In both cases a standard methodology has been to hold on to the assumption that the progressive requires the event to overlap the local evaluation time, and then to try to explain why these anomalous cases do not appear to have such a requirement.

With our current analysis, we recognize that there is no such requirement; the event need not overlap the local evaluation time. We expect that what overlaps the local evaluation time is the net force. It so happens that in these progressive achievement cases the force (at least partly) precedes the event. Yet there is something additional involved. For suppose you drop a penny off the side of a tall building. As it begins to fall, why can't you say (32)?

(32) That penny is hitting the ground.

You can only say (32) when the penny is very, very close to hitting the ground. Apparently (and this has been often noted), there has to be some sort of strong connection between the force and the event. The imperfective paradox – the non-entailment of *X V-ed* from *X was V-ing* – does not, for instance, apply here. In the cases below in (33), Mary does arrive at the station, and the penny does hit the ground.<sup>15</sup>

- (33) a. Mary was arriving at the station when she realized she had to go back.  
b. The penny was hitting the ground when I came in.

These cases contrast with the typical imperfective paradox case in (34) (Dowty, 1979), which does not entail that John drew a circle:

- (34) John was drawing a circle, but he got a phone call in the middle and never finished it.

To reflect these facts about progressive achievements, I would like to suggest that achievements lexically refer to a force connected to the event in such a way that the event cannot but happen; there is no way to interrupt the force in such a way that the event fails to happen. Perhaps this has something to do with the telicity of the event; at this point the matter is rather unclear. I would only point out here that viewing the achievement in terms of a force plus an event makes more sense than viewing it in terms of a preparatory event plus another event. If it is viewed as a force plus an event, it is in line with what we have said about other imperfective modals: that it is the force, not an event, that

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<sup>15</sup>There is a similar intuition about (31a).

must overlap the local evaluation time.

## 4.2 Clockwork futurates

Here is a second issue that seems problematic for the proposed analysis. Not all futurates are intentional. Some are entirely physical, as in (35).

(35) The sun rises at 5 am tomorrow.

Presumably this has something to do with the idea that the gravitational forces causing the sun's eventual rising at 5 am tomorrow are already in place; there is a natural law that is in effect. Things will proceed like clockwork. The acceptability of (35) stands in contrast to the following unacceptable utterance:

(36) #It rains tomorrow.

Why does this contrast exist in English?<sup>16</sup> Here is a possible (but flawed) source for an explanation for the contrast. Could it have something to do with the fact that (35) is repeated year after year, whereas the rain event is not repeated so predictably? Apparently, this repetition is not relevant; (37) does not refer to a repeated event, but is also acceptable.

(37) The meteor hits the Earth tomorrow.

Moreover, (38), like (36), is normally quite bad (as we saw above), but improves in a context where there is, e.g., a movie of an experiment, in which a physicist is reporting on the event with respect to the natural law that makes it happen.<sup>17</sup>

(38) This penny hits the ground in five minutes.

Sut since the context required to make (38) acceptable is somewhat unusual, let's put it aside and continue on, using the meteor example in (37).

What, then, is the relevant distinction between the meteor-hitting-earth event and the raining event?<sup>18</sup> It is not true to say that only the meteor behaves according to natural laws; presumably the raining need not involve breaking laws of physics. Yet somehow there must still be a difference.<sup>19</sup>

Let me raise an analogy between this difference, and the difference between lawlike and accidental generalizations.

(39) a. Every dog has a wet nose.

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<sup>16</sup>Again it should be kept in mind that this contrast does not exist in every language.

<sup>17</sup>Thanks to Barry Schein for this context. It's not clear to me whether the acceptability of (37) in that context has to do with the use of the present tense in screenplays, instead of or in addition to the "natural law" consideration.

<sup>18</sup>There is in fact a difference in Aktionsart: the hitting is viewed as an achievement, while raining is viewed as an activity. Aktionsart may indeed be relevant to this discussion. But if it is, I am not sure how to understand its role.

<sup>19</sup>Jim Higginbotham (p.c.) tells me that Sidney Morgenbesser proposed a distinction between "lawful" and "lawlike" that might address this difference between the hitting event and the raining event.

- b. Every coin in my pocket is silver.

What is the difference between a lawlike generalization and an accidental generalization? Having a wet nose seems to be in the nature of dogs, and this is why we may call the generalization in (39a) lawlike. But it's not that the generalization in (39b) is not "lawlike" because it requires any laws to be broken; none of the coins mentioned in (39b) need have gotten into my pocket by breaking the laws of physics. Rather, the "accidental" label reflects that the fact that they all happen to be silver is not due to any persistent facts about silver coins, or about my pocket. It just happened that way. Perhaps it even happened that way deterministically. But in any case it was due to a motley collection of facts about a number of different things, not due to a fact about silver coins that holds by virtue of their being silver coins, or a fact about the abilities of my pocket that holds by virtue of its being my pocket (such as the magical ability to, for example, turn things into silver coins).

Some philosophers, such as Lipton (1999) and Cartwright (2002), have taken an approach to these generalizations<sup>20</sup> that makes reference to forces. Lipton (1999) refers to such persistent properties as "dispositions" or, tellingly, as "forces:"

"Instead of seeing a cp [(ceteris paribus)] law as a description of what happens when there are no interfering forces, the suggestion is that we see some cp laws as descriptions of one force that is present even in situations where many other forces are in play, and even if there is no situation where the first force acts alone." (p. 164)

Note how similar Lipton's characterization of ceteris paribus laws is to what we have already said about imperfective sentences. According to him, ceteris paribus laws describe a force that is present (i.e., overlaps the local evaluation time) even in situations where there are other outside forces. So it is quite reasonable to use ceteris paribus laws to help us understand the clockwork futurates.

Returning then to the clockwork futurates, recall that the issue is the difference between (40a) and (40b):

- (40) a. The meteor hits the Earth tomorrow.  
b. #It rains tomorrow.

We were hoping to be able to link the contrast in (40) to a conceptual difference between different kinds of physical forces. We were also hoping that the difference between "lawlike" and "accidental" generalizations would help. True, the examples in (40) are episodic, not habitual or generic. But still, the event described in (40a) we attribute to stable forces or properties of the sun, and the event described in (40b) cannot be attributed to any stable forces or properties. This distinction is reminiscent of the distinction between (39a) and (39b).

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<sup>20</sup>I take this class of ceteris paribus laws to be the same as the class of generalizations; i.e., things that are not falsified by the existence of an exception.

There is an apparent snag, however, that must be dealt with if we are to take this analogy seriously. The problem is that the sentence in (39b) is acceptable, while the sentence in (39c) is not. Do they not need to have the same status for the analogy to be appropriate? I think not. The analogy is about how we conceive of the forces; but also relevant to the judgments is the meanings of the words used in (39b) and (40b) and how they are composed. Without getting into a detailed analysis of the meanings of these sentences, we can at least suppose that (39b) does not presuppose the existence of a stable force or disposition, while (39c) does. Exactly how and why these meanings arise is a question for another paper, but it does not impede our use of generalizations to understand clockwork futurates; what we are trying to understand is not the grammatical but the conceptual underpinnings of these sentences.

So we will assume that one salient difference between (40a) and (40b) is that (40a) refers to a situation that is caused by stable forces, while (40b) is not. Furthermore, it seems, (40a) is acceptable because the forces involved are ones that can act at a temporal distance from their initial application.<sup>21</sup> That is, the following can be true: the force is present both now and later, and has an effect that is not now (and need never have happened) but later. Gravity, which is responsible for the meteor, is a force of this kind. Certain biological forces can also be forces of this kind. For example, some species of cicadas have an extremely long larval period, burrowing into the ground soon after hatching, and developing underground for 13 years. The cicadas, then, have a stable disposition to emerge after 13 years. Not surprisingly, given the idea that a stable disposition is sufficient to make a clockwork futurate acceptable, the following sentence is acceptable:

(41) Cicadas born this year emerge in 2018.

Thus, like intentional forces, certain physical forces are apparently able to have their effect at a temporal distance from their initial application. There seems, however, to be a difference between these physical forces, and intentional forces. Recall that with intentional forces, we linked the ability to have futurate readings to the ability to have true habituals in which the events described had never been instantiated. That is, we linked the acceptability of (42a) to the acceptability of (42b): Both were due to intentions being able to act at a temporal distance from their initial application.

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<sup>21</sup>The “stability” requirement I suspect to be contributed by the generic/habitual meaning of the simple form of the verb. By contrast the progressive version of the futurate, “The sun is rising at 5 am tomorrow,” is said (Leech, 1971, e.g.) to be slightly degraded with respect to the non-progressive version. I suspect this has to do with the aspectual difference between progressives and the simple form of the verb. Progressives, with the Bennett and Partee aspectual operator, say that there is a time that includes the local evaluation time, and we calculate the force from a situation with that run time. But it may be odd to treat the force of gravity or other natural laws as holding within “a” time that includes the topic time, since they hold at all times.

What is much more puzzling to me is the fact that some speakers find *%It's raining tomorrow* acceptable. It is not clear to me whether this judgment arises from a conceptual difference or a grammatical difference.

- (42) a. John is making pizza tomorrow.  
b. The Speaker of the House succeeds the Vice President (but it's never happened yet).

Is the same true for generalizations that make reference to these special physical forces? Apparently not; the habituals in (43), unlike the one in (42b), need to have been instantiated, as shown by the fact that the parenthetical continuations below feel like contradictions.

- (43) a. In general, cicadas born in a certain year emerge 13 years later  
#(but they never have yet).  
b. In general, asteroids that fall into this orbit spiral into the sun  
#(but so far it hasn't happened).

These physical forces therefore seem to be different from intentions. Note that this result does not vitiate either the previous argument about intentional forces, nor the discussion here about special physical forces; it merely indicates that we have more thinking to do about how certain physical forces behave.

## 5 Conclusions and further directions

The preceding discussion provides merely a sketch of both the grammatical and cognitive elements that would need to be marshalled in order to account for the judgments under discussion. I will have to leave a more detailed investigation of both of these components, and therefore more detailed predictions, to later work. However, it is possible to outline the impact of this general line of inquiry both on typology – i.e., what ought to be possible grammatically – and on ontology – i.e., what ought to be possible conceptually.

One typological expectation is that distinctions in reasoning should occur with other modals besides the ones we have discussed (just as tense occurs with other modals, e.g.). This expectation seems to be borne out. Cross-linguistically, root modals can be realized with either aspectual or future morphology. The Tagalog abilitative, which expresses physical ability, is one such modal (as shown in (44) below). Compositionally, such forms are obscure; e.g., a future-marked abilitative does not mean ‘will be able to.’ But the imperfective-marked form requires instantiation, while the future-marked form does not, as expected if the contrast is the grammatical distinction of reasoning argued for above.

- (44) Dell (1987) (physical forces only)
- a. Nakakainom siya ng sampung bote nang sunod-sunod.  
 abil-impf-drink he-nom gen ten bottle nang follow-follow  
 ‘He can drink ten bottles in a row.’ (must have at least started to do so)
  - b. Makakainom siya ng sampung bote nang sunod-sunod.  
 abil-future-drink he-nom gen ten bottle nang follow-follow  
 ‘He can drink ten bottles in a row.’ (need not ever have done so)

Interestingly, Tagalog is a so-called “tenseless” language, which has been taken not to mark tense morphologically, but instead to mark “aspect”: perfective, imperfective, and future (what Schachter and Otnes (1972) call “contemplative”). Note that this is a bit strange, as we are not used to thinking of futures as “aspects”. But with the new distinction of reasoning, we have another option: perhaps what Tagalog marks is values of reasoning, not values of aspect, and perhaps the perfective is a third value of reasoning, one in which only the local situation itself is accessible from the local situation. Then we would have three values of reasoning:

- (45) Values of reasoning (speculative!)
- a. zero: consider local situation only?
  - b. direct: consider situations that casually follow directly from local situation , extrapolative: consider situations that causally follow in chain of events from local situation

As yet this line of thinking provides no precise prediction for the meanings of “zero reasoning” forms, but we expect something like a perfective.<sup>22</sup>

As far as ontological issues, this line of inquiry raises intriguing issues. First, it promises a framework under which “forces of will” and physical forces have a connection both to modality and to events. It does this by recognizing that forces have a double role: They are used in the calculation of the ordering source, but they also intuitively have effects (resulting events). Whatever formal mechanism is ultimately used to model forces (functions from situations to properties of situations, perhaps), I expect that taking forces seriously will allow us to revisit problems that have in the past not yielded cleanly to an event-based analysis: “accidental” action, for instance (e.g. Dell, 1987, for Tagalog), or indeed the problem of whether statives have an event argument, the key notion about (many) states being that there is no associated net force.

Secondly, this way of looking at modals rests on the idea that there may

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<sup>22</sup>Another potentially fruitful use for such a distinction is for evidentials. We can export reasoning into the evidential domain by noting that information can also be thought of as a force: A piece of information is an impetus towards an ideal set of worlds or situations, namely, those worlds or situations that best fit the information as long as there is no other information. Tibetan (Garrett, 2001) has certain evidential forms that require the evidence to be known without perception, other forms that require direct perception of the evidence, and others that involve a chain of reasoning. This pattern looks formally, for the informational domain, very similar what I have proposed here for the metaphysical domain.



be conceptual distinctions (like the distinction between intentions and physical forces) that are not necessarily grammatical distinctions, but are part of our general cognitive model of the world. The study of semantics, then, may have something to say about this cognitive model; and research on cognitive models may have something to say about semantics.

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