A note on conditionals and restrictors

Daniel Rothschild*

Abstract

Within linguistic semantics, it is near orthodoxy that the function of the word 'if' (in most cases) is to mark restrictions on quantification. Despite its linguistic prominence, this view of the word 'if' has played little role in the philosophical discussion of conditionals. This paper tries to fill in this gap by systematically discussing the impact of the restrictor view on the competing philosophical views of conditionals. I argue that most philosophical views can and should be understood in a way that is compatible with the restrictor view, but that accepting the restrictor allows for new responses to some prominent arguments for non-truth-conditional account of conditionals.

Introduction

Within linguistic semantics, it is near orthodoxy that the function of the word 'if' (in most cases) is to mark restrictions on quantification. Just as in the sentence 'Every man smokes', the common noun 'man' restricts the quantifier 'every', in the sentence 'Usually, if it's winter it's cold', 'it's winter' acts as a restrictor on the situational quantifier 'usually'. This view, originally due to Lewis (1975), has been greatly extended in work by Heim (1982) and, most notably, Kratzer (1978, 1981,

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1986, 2012) into a rich theory of almost all uses of the word 'if'. I call this the *restrictor view* of 'if'.

Despite its linguistic prominence, this view of the word 'if' has played little role in the philosophical discussion of conditionals. Fairly recent philosophical surveys such as Bennett's (2003) book-length introduction or Edgington's (1995; 2008) review articles do not even mention the restrictor view. Stranger still, in his seminal work on conditionals and probability, Lewis (1976, 1986) does not discuss the restrictor view that he pioneered, despite the intimate relation noted by Kratzer (1978, 1986).[1] This paper tries to fill in the gap left by these omissions.[2]

I make four main points. First, I argue that given the current state of affairs our best bet is to accept the 'restrictor view' and to assume that 'if' is not ambiguous, so that we should accept some variant of the full Heim/Kratzer account of conditionals. Second, I argue that the restrictor view is compatible with all major philosophical views of conditionals, if they are understood in the right way, namely as theories about the meaning of certain sentences that include 'if', rather than as theories about the meaning of the word 'if' itself. Third, I argue that the restrictor view undermines an important argument from the probabilities of conditionals to a non-propositional view of conditionals (an argument which Lewis played a large role in developing). Fourth, I argue that consideration of embeddings of conditionals, while not decisive, provide some evidence for a combination of the restrictor view with the view that indicative conditionals express propositions.

Not all these points are completely novel, but I think together they paint an important picture of the current state of our understanding of conditionals, one which is not easily found elsewhere.

[1] It seems to me that Lewis must have thought 'if' was three-ways ambiguous: it acts as a pure restrictor under adverbs of quantification (Lewis, 1975), it is the material conditional in cases of indicative conditionals (Lewis, 1976), and it is a variably strict conditional in counterfactuals (Lewis, 1973).

[2] Many of the points made here expand on observations in Kratzer's own work, unpublished lectures by von Fintel (1994a), as well as Cozic and Égré (2010), and Rothschild (2013).

Conditionals and Semantic Theory

When linguists and philosophers discuss conditionals they are mostly talking about sentences that include the word 'if', such as these:

(1) If a man comes in, he'll be angry.

(2) Usually, if a man comes in, he'll be angry.

(3) If a man comes in, he'll probably be angry.

Philosophers often discuss rival theories of conditionals: the material conditional (e.g. Grice, 1967/1989; Jackson, 1987), the Stalnaker conditional (e.g. Stalnaker, 1968), the (related) strict and variably strict conditionals (e.g. Lewis, 1973; Ellis, 1978), the non-propositional theories (e.g. Adams, 1975; Edgington, 1995). In order to assess how these views relate to the restrictor view, we need to relate these theories to semantics generally.

For this reason I'll say a bit here about the structure of semantic theory. Semantics aims at a systematic account of the meaning of sentences in terms of the meaning of their parts and how they are put together. This typically involves assigning meanings to words (lexical items) and specifying rules of semantic composition (i.e. rules that get you from syntactic structures with meaningful components to the meanings of the whole structures). In combination, then, we can assign meanings to entire sentences. In the case of a complete declarative sentence, a standard semantic theory will assign a proposition to it, in particular the proposition that the sentence expresses.[3]

Empirically this enterprise is constrained by what propositions sentences actually express, as revealed by such things as our truth-value judgments of sentences in different situations, our judgments of entailment and so on. Further constraints

[3]Of course doing so will often rely on using contextual information. I'm abstracting away from this here, as I don't think it's relevant to the particular points I am making.

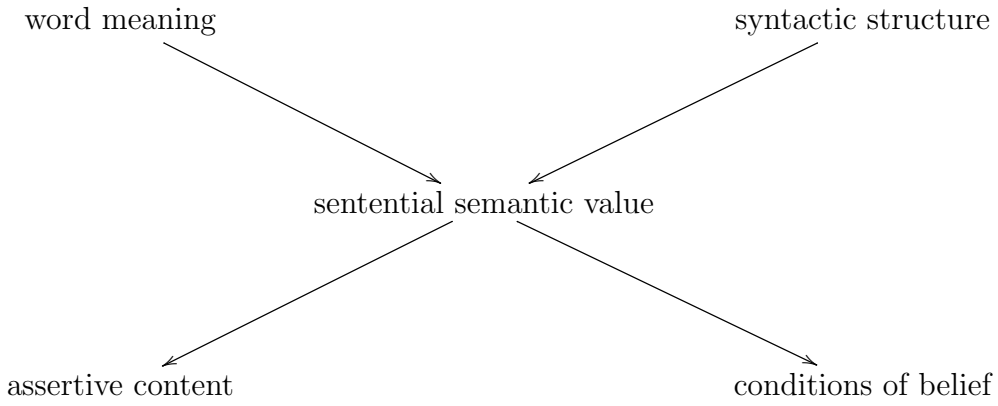

Figure 1: Structure of semantic theory for declaratives

on the project come through the related concerns of simplicity and learnability. These concerns push for simple, clear rules of composition and simple, unambiguous meanings assigned to lexical items. Of course, there is ambiguity and complexity in language but we aim to build simple theories to capture these complexities. In addition, of course, the actual syntactic structure of sentences will constrain our theorizing as it is this structure that the composition rules need to work with.[4]

Semantics connects to the more personal-level notions of communication and belief mostly by way of the semantic values of entire sentences.[5] Figure 1 shows the structure of the situation: assertive content and conditions of belief only connect to word-meaning *via* sentence meaning. The way in which sentential semantic values connect up to assertion and belief is mostly simple and familiar: If our semantic theory assigns a proposition p to a sentence S, then an assertive utterance of S is an assertion of p. Likewise, believing S is true amounts to believing p is true.[6]

[4]Constraints like compositionality, which are motivated by concerns of simplicity and learnability, provide particularly sharp constraints on which theories are acceptable for given syntactic structures.

[5]Of course, there are also the more elusive, sub-sentential speech-act notions of reference and predication that might constrain our semantic theorizing.

[6]I am putting issues of context dependence aside here.

It is important to note that even orthodox semantic theories do not always work by assigning propositions to sentences. Semantic theories typically do not assign propositions to 'wh'-questions—e.g. 'Who came?', 'Where is Kate?'— as their meaning. Rather the semantic values assigned to wh-questions tend to be *sets* of propositions or partitions of logical space (Hamblin, 1973; Karttunen, 1977; Groenendijk and Stokhof, 1984). That is because the speech act of questioning does not amount to the assertion of a proposition, but something more like a request for information.

In all cases, we implicitly or explicitly use *bridging* principles that connect up semantic values with the personal-level acts and states associated with the sentences (e.g. assertion and belief in the case of normal indicative sentences, asking and wondering in the case of questions). In the case of declarative sentences these bridging principles, evoked implicitly above, are trivial, i.e. if a sentence S has the semantic value p then an assertive utterance of S is an assertion of the proposition p.[7] In figure 1, the bridging principles are what connect the sentential semantic value to the assertive content and the conditions of belief; semantic theory, by contrast, takes us from word meaning and syntactic structure to sentential semantic value.

The point of this sketch of the semantic theory is to illustrate the number of different levels at which claims about conditionals can be understood. I will argue here that the most charitable interpretation of philosophical theories of conditionals is as claims about a) the semantic values of entire sentences that include conditionals, and b) what it is to assert/know/wonder about those sentences, i.e. how we should understand the speech-acts and psychological states associated with conditional sentences. My main claim is negative: philosophical theories of conditionals should *not* be viewed as direct claims about the meaning of the word 'if' and the compositional rules that govern sentences with 'if'. In terms of figure 1 philosophical theories only

[7]Except to the extent that semantic values of declarative sentences might be index-dependent as argued by Lewis (1980). See also Stanley (2002), Ninan (2010) and Rabern (2012).

cover the middle and the bottom sections of the picture. Thus, philosophers should not be seen as giving semantic theories of 'if' in the usual sense.

This claim may be surprising. After all, philosophical theories of conditionals tend to come as complete packages: theories of the meaning of the connective 'if', the meaning of entire sentences that include 'if', what is asserted by sentences that include 'if', and what it is to believe such sentences. Indeed, theories are often classified according to their view of the connective 'if': hook (the material conditional), the Stalnaker conditional, the strict conditional, etc (as in Edgington, 2008).

My claim about how to best understand philosophical theories of conditionals does not, however, rest on the intentions of those propounding the theories. Rather it relies on the principle of charity: philosophical theories of conditionals are most plausible if understood at the higher level.

Conditionals and Adverbs of Quantification

Here I will sketch Lewis (1975), Kratzer (1978, 1981, 1986), and Heim's (1982) view that 'if' is a device for marking the restriction of a quantifier. I believe this is one of the best established claims in semantic theory due to it simplicity and explanatory power. Lewis, in 'Adverbs of quantification', considered sentences like (4), where, intuitively, a conditional is embedded under an adverb of quantification.

(4) Usually, if Mary is here, she is angry.

It seems reasonable to assume here that 'usually' functions as a quantifier over times or situations.[8] In this case both 'Mary is here' and 'she is angry' will be true or

[8]In fact, Lewis rejects the *general* claim that adverbs of quantification are always situation quantifiers. He argues instead that they are unselective quantifiers that can quantify over any free variable. However, this aspect of Lewis's theory is not generally accepted. In cases like (4), anyway, even Lewis would presumably think the right analysis has the 'usually' bind a time, event, or situation variable. I will assume in this note, following von Fintel (1994b, 1995), that adverbs of quantification always bind situation variables, though nothing essential rides on this assumption.

false relative to different times or situations. This leaves the question of what the meaning of the conditional connective 'if' is in this case. We might think, as is standard in logic, that it is a connective that joins together the sentences 'Mary is here' and 'she is angry' to produce some complex sentence which itself is true relative to different situations. Lewis argued that this is not the right way to think about examples like (4). Rather, Lewis suggested, the entire 'if'-clause, 'if Mary is here', acts as a restrictor on the the quantification over times or situations. So we can paraphrase (4) as follows:[9]

(5) Most situations in which Mary is here are situations in which she is angry.

Thus, the function of 'if' in sentences like (4) is simply to mark the fact that 'Mary is here' is a *restrictor* of the situational quantifier 'usually'. More explicitly: we think of all situational quantifiers, such as 'usually', as binary quantifiers that take both a restrictor and a matrix predicate.[10] The semantic contribution of 'if' is to mark the fact that the material following it serves as part of the restrictor. The other material, what we traditionally call the consequent, goes into the matrix.

We can write a binary quantifier Q acting on the restrictor ϕ and the matrix ψ as Q$[\phi][\psi]$. Thus (4) has the schematic form in (6):

(6) Usually[Mary is here][Mary is angry].

To my knowledge there is no serious rival theory to Lewis's account of the role of 'if'-clauses under adverbs of quantification.[11] As Lewis points out, it follows from

[9] I am putting aside here the various difficulties in counting situations which affect the interpretation of (5). See von Fintel (1997/2005); Kratzer (2011).

[10] Unary quantifiers like $\forall x$ and $\exists x$ take a single open-formula, e.g. Fx. A binary quantifier, such as $\mathbf{most}_x$ takes two open-formulas, e.g. Fx and Gx, one of which is called the restrictor the other a matrix. For example, in the sentence 'Most men are tall', 'man' is the restrictor predicate and 'is tall' is the matrix predicate. See, e.g., Barwise and Cooper (1981) for further discussion.

[11] I consider Belnap's (1970) trivalent account of conditionals under quantifiers as one particular *implementation* of the restrictor view. Of course, if one does not have such a catholic view, then this would be a 'rival' to the restrictor view. There seems little point in quibbling about this issue.

well-known results on binary quantification that no truth-functional conditional connective can predict the same truth conditions.[12] There are also no extant, plausible non-truth-functional accounts of conditional propositions that capture this equivalence.[13]

A technical note: As we will see, the restrictor view admits of many implementations within specific semantic frameworks. One possible view, adopted by Heim (1982) and Kratzer (1978) gives a syntactic spin to the view. Quantifiers, generally, are seen as having two arguments. Whether a given piece of syntactic material occupies one argument place or the other is a syntactic matter, and 'if' serves a syntactic marker that what follows it is in the restrictor argument place. On this syntactic spin 'if' has no semantic value whatsoever, it merely serves to mark a syntactic place for the material after it. (I give a simple version of this syntactic story in the first appendix.) This is by no means the only view we can have and it does not fit well with current syntactic theory. We can also think that 'if' takes the material inside it and returns a function that modifies quantifiers by restricting them with that material. In this case, 'if' has a very specific meaning, it takes as input a sentence and returns something that can modify quantifiers or their parameters (Kratzer, 1981, 2012). This view fits well with the idea that 'if'-clauses are adverbial phrases (Geis, 1970). There are other possible views which we can think of as versions of the restrictor view, such as Belnap's (1970) trivalent view, which I will discuss later. Which view you want will depend, mostly, on a lot of detailed questions about your overall syntactic and semantic framework, and I don't think those questions much affect my discussion here.

[12]See Barwise and Cooper (1981) for discussion of this result which was originally proved by David Kaplan in 1965. Of course, this result only holds in a bivalent context, hence the possibility for Belnap's trivalent semantics of conditionals.

[13]Even elaborate dynamic accounts such as Gillies (2010) are not obviously capable of treating adverbs of quantification, as Khoo (2011) argues.

Uniformity

Semantic theories aim to be simple. Thus, in general, we should try to posit a non-ambiguous, simple meaning for 'if', as ambiguities add to the complexity of our semantic theories. Given that the restrictor analysis seems necessary for examples of conditionals under adverbs of quantification like (4), all else equal, we should apply it as widely as possible.

Kratzer (1981, 1986) and Heim (1982) showed the analysis can be expanded very widely. Kratzer noted that the analysis works well for conditionals that are embedded under various modal constructions. For instance, the analysis is easily extended to this set of examples:

(7) a. Necessarily, if Mary is here, she is angry.
b. Probably, if Mary is here, she is angry.
c. It's likely that if Mary is here, she is angry.
d. If Mary is here, she must be angry.

In all these cases it is natural to see the modals 'probably', 'necessarily', 'it is likely', ands 'must' as quantifiers over possible worlds that are restricted by the 'if' clause.[14] So, if we treat modals as binary quantifiers we can give the basic semantic structure of the sentences in (7) as in (8).[15,16]

(8) a. necessarily [Mary is here][Mary is angry]

[14]Of course, 'probably' isn't a normal quantifier over worlds, but rather one that depends on a probability measure over the worlds (see Yalcin, 2010, for discussion).

[15]I am assuming here that we assign suitable semantic values to the modal quantifiers, e.g. 'necessary' is a binary quantifier taking two sentences, a restrictor and a matrix, such that 'necessary[restrictor][matrix] is true iff in every world in which the restrictor is true, the matrix is true.

[16]I'm only using the idea that modals are binary quantifiers as one illustrative way of doing the syntax and semantics here, as I mentioned in the previous section, we could instead treat the modals as unary operators that are modified by 'if'-clauses. The relevant point here is that the 'if'-clause has a semantic value of its own that serves to restrict the modal operator, rather than combining directly with the consequent.

b. probably [Mary is here][Mary is angry]

c. it's likely [Mary is here][Mary is angry]

d. must [Mary is here][Mary is angry]

Kratzer, more controversially, argued that even in conditionals without explicit modal operators there are implicit modal operators. In particular, Kratzer argues that a bare indicative conditional—i.e. a conditional sentence without a higher modal operator, such as (9-a)—includes a silent necessity operator similar to 'must' or 'necessarily'. Thus, the semantic structure of (9-a) can be represented in (9-b)

(9) a. If Mary is here, she is angry.

b. Must [Mary is here] [She is angry]

While the syntax and motivation of this view is novel, it follows in a long tradition of viewing bare conditionals as expressing a form of conditional necessity. So, in terms of its sentential semantics, it is a familiar view of bare indicative conditionals.

I should note that this is not the only theoretical option for treating conditionals without overt quantifiers. Another kind of view assumes that the conditional expression (i.e. a bare conditional with both antecedent and consequent, like (9-a)) has some semantic value X. When a binary quantifier, like 'necessarily', applies to X we get restricted quantification. Our semantics, though, also assigns an interpretation to X of some sort when there is no syntactically present quantifier. An instance of this kind of view, perhaps the most minimal implementation, is Belnap's (1970) trivalent view, which I turn to in the next section.[17] What differentiates this type of view from the traditional Kratzer/Lewis view is that it assigns a single syntactic entity to the conditional expression 'if Mary is here, she is angry', rather than splitting it into two distinct entities. For this reason this view is not compatible

[17]Lewis (1975) discusses this as a possible treatment of adverbs of quantification. In the context of probability operators the view can be found originally in de Finetti (1936). See Huitink (2008); Rothschild (forthcominga) for further discussion of the trivalent view from a linguistic perspective.

with the syntactic construal of the restrictor hypothesis: 'if' has a semantic value here, it doesn't just mark a syntactic place. However, when bare conditionals are embedded under quantifiers the results are equivalent to the syntactic construal: the antecedent restricts the quantifier.

So it is feasible (in more than one way) to give a unified analysis of bare conditionals and conditionals under adverbs of quantification and modal operators. Methodological considerations strongly support a unified analysis.

Restrictor-based theories

I argued above that the most promising account of the meaning of the word 'if' is that it serves to mark the material after it as restricting some sort of quantification. This view usually does not even get mentioned in standard philosophical discussions of conditionals (e.g. Bennett, 2003; Edgington, 1995). There is a good reason for this: philosophical views focus on unembedded conditionals without explicit modal operators:

(10) If Mary is here, she is angry.

Bare conditionals are obviously the toughest cases for the restrictor analysis since there is no explicit operator for the 'if'-clause to restrict. When focusing on examples like (10) the restrictor analysis is unintutive. Nonetheless, as I argued above, the restrictor analysis is the only game in town for examples like (4), and is both unintuitive and bad methodologically to treat the 'if' in (10) as different from the 'if' in (4). So philosophers, if they are seriously interested in the word 'if', should presumably adopt as one of the most plausible hypotheses that 'if' in (10) is doing what it is doing in cases with adverbs of quantification. Since they generally do not do this, we might be tempted to dismiss philosophical theories as implausible.

Instead, I suggest we understand the major philosophical theories of conditionals as views about the semantic value of entire sentences with conditionals and views about which speech-acts are associated with such sentences. When viewed in this way the restrictor view of 'if' poses no challenge to the philosophical theories, since they are, as such, compatible with the restrictor view.[18]

Strict Conditional

Kratzer and Heim's view is that a bare indicative conditional such as (10) contains an implicit modal operator. So the logical form of (10) is something more like this:

(11) necessarily [Mary is here][she is angry]

As I noted above, this amounts to the view that bare conditionals express conditional necessity: in all worlds in which Mary is here, she is angry.[19] So the restrictor view is obviously compatible with the strict conditional view, once we understand that as a view about bare conditional sentences rather than a view about the connective 'if'.

Material conditional

We can get the material conditional as a sort of limiting case of the strict conditional. Simply assume the necessity modal only quantifies over worlds that are actual. Since there is only one, the one question is whether the consequent is true at that world if the antecedent is. If the antecedent is not true at the actual world, the quantification is vacuous and so the sentence is true. Thus we get the truth-

[18]Kratzer, herself, made this point with respect to most of the propositional views of conditionals, my main contribution here is to extend this point to non-propositional views of conditionals.

[19]It is widely recognized that this view is only plausible if we view the necessity operator as quantifying over a sharply restricted set of worlds (rather than, say, all metaphysically or physically possible worlds). However, in natural language semantics it is normal to think that all quantifiers are sharply restricted by context, so this does not seem like a problematic discussion.

conditions of the material conditional. Of course, it is widely acknowledged that the material-conditional view is hopelessly implausible as a semantics for the conditional: it simply does not account for much basic data about truth-value judgments of conditionals.[20] Nonetheless, it is useful to see that the material conditional view, as a view about the semantics of bare conditional sentences, is not ruled about the restrictor view alone.

Stalnaker/Lewis conditionals

Stalnaker and Lewis propose that to evaluate conditionals one needs to look at the 'closest' possible worlds in which the antecedent is true.[21] Kratzer implements the variably strict semantics for conditionals within her general approach to modality: all modals introduce both a base (a set of worlds) and an ordering on those worlds. 'If'-clauses are still simply restrictors, but the modals do the work of ensuring that the worlds where the consequent are evaluated are the 'closest' worlds.[22]

Non-propositional

The compatibility of the view of 'if'-clauses as restrictors with the major propositional views of conditionals was emphasized by Kratzer. However, there is little discussion in the semantics literature of the relationship of non-propositional views of indicative conditionals to the restrictor view, despite the prominence of non-propositional views in the philosophical literature. There are a variety of non-propositional views that accord with the restrictor hypothesis. I will discuss two

[20] I think the assumption that all indicative conditionals with false antecedents are true flies in the face of many of our truth-value intuitions, and no amount of pragmatics can explain this fact away.

[21] Lewis, of course, only thought this view should be used for counterfactual conditionals, while Stalnaker thought it should apply to all uses of conditionals.

[22] Kratzer (1981) provides a battery of arguments that modals themselves need ordering (see Swanson, 2008, for critical review). Lewis (1981) proved the equivalence between the structure of Kratzer's semantics and his own.

such views here: a trivalent view and a view that combines a non-propositional semantics for epistemic modals with the restrictor view of 'if'. Before doing so, I will make some general comments about non-propositional views of conditionals.

It is often at least implicitly assumed that non-propositional views of conditionals are premised upon a rejection of the project of formal semantics at least insofar as it extends to include conditionals. This is a mistake.

It is true that the standard assumption underpinning almost all work in semantics is that when the semantic value of a sentence is a proposition then an assertion of the sentence is an assertion of that proposition and belief in the sentence is belief in that proposition. If sentences do not have propositions as semantic values, however, that does not mean we cannot do semantics. What we need, in this case, is new bridging principles connecting non-propositional semantic values with assertion and belief. The semantics in combination with these principles then makes predictions about what people can do with the relevant sentences. Even orthodox semantic views sometimes use non-propositional semantic values for complete sentences and, associated with them, non-standard bridging principles. As I mentioned earlier, a salient example where orthodox theories need such non-standard bridging principles is the semantics of questions. Groenendijk and Stokhof (1984), for instance, assign questions partitions of logic space as their semantic value. Asking a question, is inquiring which cell of the partition the actual world lies in. Wondering about a question is wondering which cell the actual world is in. With this class of semantic values and bridging principles we can then judge whether certain assignments of semantic values are reasonable or not.

Non-truth-conditional programs about conditionals are not generally put forward as full-fledged semantic theories with explicit semantic values and bridging principles. This is often taken (by semanticists and linguistically-inclined philosophers of language) as an implicit rejection of the methodology of semantics. This does not seem fair to me. As I understand Edgington's (1995; 2008) view, she is not commit-

ted to a particular account of the semantic value of conditional sentences. What she pushes is primarily the negative claim that conditionals do not have propositions as their semantic values. This is an important claim for the non-propositional view since if conditionals did have propositions as their semantic values we would expect the normal bridging principles to kick in so that assertions of conditionals would simply be assertions of propositions.

For any given claim about what belief and assertion of conditional sentences amounts to, there will be a host of different combinations of semantic values and bridging principles that support that claim. So it is not obvious why you should choose one particular combination; if your main aim is to say what assertions of conditionals and belief in conditionals amount to, then it may be wise to remain neutral on which semantic values and bridging principles you think are correct. This is not to say that giving semantic values and bridging principles for conditionals is not an interesting project for those sympathetic to the non-propositional view, it is just to say that not everyone who argues for the non-propositional view needs to engage in it.

Nonetheless, if we are going to show that non-propositional views are compatible with the restrictor view we need to sketch how. This is what I turn to now with two different non-propositional semantics for conditionals, a trivalent account and a covert modal account.

Trivalent

Belnap (1970) gives a trivalent semantics for conditionals and a semantics for quantifiers that allows quantifiers to take trivalent formulas as their sole argument. The trivalent semantics is the usual one: $A \to C$ has the truth value of C when A is true and otherwise is undefined.[23] If there is an open variable, x, in $A \to C$ then we can

[23]There are a number of different options for what to do when A or C is undefined, but these aren't relevant here.

quantify over conditionals with quantifiers defined like this:

(12) **Most**$_x$ ϕ is true iff for most objects o s.t. $\phi_{x \to o}$ is defined, $\phi_{x \to o}$ is true.

The technical point is that a trivalent conditional can encode both the restriction (i.e. where it is defined) and the truth values when the restriction is satisfied. So, it is possible to get a unary quantifier that takes a single trivalent formula that is equivalent to a restrictive binary quantifier that takes two bivalent formulas.

Since trivalent formulas do not correspond to ordinary propositions, they can act as a plausible *semantic value* of an indicative conditional for a non-propositional account.[24] There is no need to posit a covert modal operator for bare indicative conditionals, then. The trivalent semantic value still leaves open what personal-level account we give of conditionals; that depends on what bridging principles we use. The trivalent semantics is compatible, for instance, with Edgington's view of assertion of conditionals as suppositional/conditional assertion.[25]

Let me illustrate these points by going through a simple example. Take the sentence 'If Mary is here, she is angry.' On the trivalent view this has as its semantic value something that is true in worlds in which Mary is here and she is angry, false in which Mary is here and she is not angry, and undefined in worlds in which Mary is not here. Suppose we take as basic the notions of conditional assertion and conditional belief, as Edgington seems to. Then our bridging principles for assertions and belief can be stated as follows: if ϕ has a trivalent semantic value, then 1) an assertion of ϕ is a conditional assertion of the proposition that ϕ is true given that ϕ is defined and, 2) a belief in ϕ is a conditional belief that ϕ is true, given that ϕ is defined.[26]

[24]Of course, this is a terminological issue: you might think trivalent truth-conditions do correspond to ordinary propositions. However, given the work they do here, that does not seem to be the right way to divide up the space of possibilities for conditionals.

[25]The crucial point is that the trivalent semantic value has enough information to both retrieve the supposition (the worlds where the semantic value is either true or false) and the division of the supposed worlds into those where the conditional is true and those where it is false.

[26]It is worth noting these bridging principles do not work well for other proposed instances of trivalence, such as that arising from vagueness: when I say that someone is tall, I do not assert that

Non-propositional modals

The trivalent route is not the only non-propositional view of conditionals. Recent work on epistemic modals has resulted in a variety of proposals according to which sentences with epistemic modals do not express propositions (Yalcin, 2007; Swanson, 2006). We can combine these non-propositional views of modals with Kratzer's hypothesis that bare conditionals contain silent necessity modals to get a non-propositional view of bare conditionals. This view needs three components:

- syntax/semantics of 'if' clauses are restrictors of modals
- silent epistemic necessity modals in indicative conditionals like (10)
- non-propositional semantics for epistemic modals which can allow restrictions

To make the view complete we also need to posit bridging principles between the non-propositional values for epistemic modals and the personal-level notions relating to them such as assertion and belief. Yalcin (2007) and Swanson (2006) provide both of these in their compositional systems.

While Yalcin (2007) does not endorse the restrictor view, the semantic values he assigns to bare indicative conditionals and epistemic modals are available to someone with the restrictor view. (I give this variation on Yalcin's semantics in the second appendix.)

Conditional Commands

Treating philosophical views of conditionals as theories of the meaning of entire sentences with bare conditional, can help clarify some issues about conditional com-

he is clearly tall, conditional on him not being a borderline case. An adequate trivalent semantics for conditionals and vagueness would need somehow to avoid this problem. This relates to the problems Soames (1989) raised for trivalent accounts of presupposition projection.

mands. Edgington (2008) makes the following argument against the material conditional account of conditionals:

> Conditional commands can [...] be construed as having the force of a command of the consequent, conditional upon the antecedent's being true. The doctor says to the nurse in the emergency ward, "If the patient is still alive in the morning, change the dressing". Considered as a command to make Hook's conditional true, this is equivalent to "Make it the case that either the patient is not alive in the morning, or you change the dressing". The nurse puts a pillow over the patient's face and kills her. On the truth-functional interpretation, the nurse can claim that he was carrying out the doctor's order. Extending Jackson's account to conditional commands, the doctor said "Make it the case that either the patient is not alive in the morning, or you change the dressing", and indicated that she would still command this if she knew that the patient would be alive. This doesn't help. The nurse who kills the patient still carried out an order. Why should the nurse be concerned with what the doctor would command in a counterfactual situation?

Edgington is correct to find conditional commands puzzling if we think the material conditional account ['Hook'] is correct. However, even an advocate of the material conditional view of bare conditionals is entitled to a more sophisticated account of conditional commands if he endorses the restrictor view of 'if'. The obvious direction to go is to assume that imperatives include some sort of modal operator, and that the antecedent in a conditional command restricts this operator. If some account like this works, then the material conditional as a view about full sentences is completely compatible with an account of conditional commands that does not reduce them to material conditionals in the way Edgington suggests.

The argument from probability and restrictors

So far, we have not seen any serious impact of the semantic insights of Lewis and Kratzer on the philosophical debate over conditionals, even on the debate between propositional and non-propositional views. In this section, I want to explore one way in which the restrictor view can be used to undermine an argument for the non-propositional view.[27]

There is a well-known argument that goes from a simple observation about the probabilities that we assign to conditionals to the view that conditionals do not express propositions. The observation about the probabilities of conditionals is often called *Adams' Thesis*, the view that the probability of a conditional is its conditional probability, formally $P(A \rightarrow C) = P(C|A)$. Suppose we accept Adams' thesis. There are a number of simple mathematical results demonstrating that there is no proposition whose probability satisfies Adams' thesis. These results always depend on auxiliary assumptions of various sorts, but there is a wide-literature suggesting these assumptions are minimal and plausible.[28] So, the argument goes, $A \rightarrow C$ cannot be a proposition since there is no proposition that has the same probability as we think it does.

The restrictor view can undermine this argument for the non-propositional view by undermining some of the motivation for Adams' thesis. Recall that according to Adams' thesis the probability we assign to an indicative conditional is the probability of its consequent given its antecedent. One consideration in favor of Adams' Thesis goes by way of sentences like (13).

(13) It's likely that if Mary is here, she is angry.

[27]Some of the points here can be found in Cozic and Égré (2010) and Rothschild (2013), as well as in von Fintel's unpublished lectures (von Fintel, 2007, e.g.).

[28]This literature begins with Lewis's (1976) famous triviality results; further stronger results are discussed in Edgington (1995) and, more formally, in Hajek and Hall (1994). Cozic and Égré (2010) make an important connection between the triviality results and the limitations of unary quantification referred to in footnote 12.

It seems (13) is something we would believe/assert just in case the probability that we assign to Mary being angry on the condition that she is here is high (say above .5). How do we explain this fact? Well, Adams' thesis would explain it nicely: for on Adams' thesis whether or not we think an indicative conditional is likely just depends upon whether or not we think the consequent is likely given the antecedent. In this way Adams' thesis *explains* how we understand sentences like (13), and this itself is a consideration in favor Adams' thesis.

The explanatory use of Adams' thesis above depends on the assumption that (13) involves an ascription of probability to an indicative conditional. The restrictor hypothesis, however, would favor a different account of the semantic structure of (13). On the restrictor hypothesis this is a classic instance in which an 'if'-clause restricts a probability operator. The probability judgment is simply a judgment of the probability of the consequent *restricted* to the worlds in which the antecedent is true. Assuming a reasonable semantics of probability operators such as 'likely' this will be true just in case the conditional probability is greater than .5 (see Yalcin, 2010, for a comprehensive discussion of the semantics of probability operators).

To make clear: the reason this strategy is compatible with the rejection of Adams' thesis is that on this strategy we do not concede that indicative conditionals themselves conform to Adams' thesis. The strategy works rather by denying that our apparent judgments of the probabilities of conditionals are really judgments of the probabilities of the propositions expressed by bare conditionals. On Kratzer's full view, for instance, indicative conditionals have silent necessity modals and express propositions.

So, given the restrictor view of 'if'-clauses, our judgments about sentence like (13) do not provide support for Adams' thesis. However, all cases of graded belief do not involve explicit probability operators. We can simply have a high degree of confidence in the indicative conditional 'If Mary is here, she is angry', without explicitly saying or thinking (13). Our confidence in a conditional seems to depend

just on our conditional confidence in the consequent given the antecedent: this is another piece of evidence in favor of Adams' thesis. For the restrictor view to undermine this consideration, more assumptions about how 'if' operates need to be made than are standard in the restrictor literature. In particular, we need to allow that 'if'-clauses can act not just to restrict linguistically present modals but also can restrict aspects of *thoughts* involving probabilistic belief. This idea has not been much explored but it seems a promising approach to explain intuitions supporting Adams' thesis without actually endorsing Adams' thesis. Note, however, that if we follow this strategy, we seem to be already accepting one of the main tenets of the non-propositional view: belief in conditionals does not directly target a proposition.

I am not going to argue here that we should reject Adams' thesis. I just want to suggest that a case can be made that Adams' thesis, taken as a thesis about bare indicative conditionals, is an illusion that can be explained away once we acknowledge that 'if'-clauses are restrictors.

Embedded Conditionals

Another area where semantic theory connects up with the philosophical debate over the meaning of conditionals is in the question of how conditionals embed under quantifiers. So far, we've discussed only one way in which conditionals can be embedded: under probability operators, modals and adverbs of quantification. The restrictor story seems to provide a clear unified analysis of 'if' in these embeddings: the 'if'-clause serves to restrict the operator. Given that the restrictor view is compatible with either propositional or non-propositional accounts of bare conditionals, these cases do not provide evidence for or against the idea that bare conditionals express propositions.

There are, however, a variety of constructions in which 'if'-clauses are embedded in more complex constructions. It is commonly noted that many embeddings of

conditionals in complex constructions do not seem interpretable. Sentence (14), as Gibbard (1981) notes, is not easily comprehensible.

(14) If Kripke was there if Strawson was, then Anscombe was there.

I want to put aside the question of the significance of the fact that many instances of embedded conditionals like this are hard to understand.[29] There are, in any case, many examples of embedded conditionals which are perfectly easy to understand. Here are some instances:
Conditionals under conjunction:

(15) If Mary is here then John is here, and John might be here.

Conditionals under disjunction:

(16) Either if Mary is in China then she's in danger or if Mary is in India then she's in danger.

Conditionals under quantifiers (Higginbotham, 1986):

(17) Some student will fail if he goofs off.

All of these sentences with embedded conditionals are easily comprehensible. I will focus on the cases of conditionals embedded under quantifiers, such as (17), as it is perhaps the best studied example.[30]

Some, such as Kölbel (2000) argue that sentences of the form of (17) provide ev-

[29]Should we follow Gibbard (1981) and Edgington (1995, 2008) in seeing this as itself evidence for the non-propositional view? It is not clear to me that we should. After all, if the non-propositional views need to account for *some* embeddings, then they would seem also to face the problem of explaining the lack of generality. Of course, if they had a *predictive* theory about when exactly embeddings were acceptable, that could be an advantage, but I know of no such theory.

[30]Conjunctions, in any case, do not present serious problems for any accounts, given that conjunctions can be paraphrased as consecutive assertions. Disjunctions of conditionals would seem (from a logical point of view) to present similar issues to those raised by existential quantifiers.

idence against the non-propositional view. Kolbel argues that the problem embeddings of conditionals raise is analogous to the Frege-Geach problem for expressivism. That problem, generally speaking, is the problem of accounting for how sentences that do not express propositions function under the standard truth-functional operators (for a recent review see Schroeder, 2008).

Assuming that cases like (17) are genuine cases of conditionals embedded under operators, nothing prevents the non-propositional approaches from giving extended semantics for the relevant operators to try to cover these cases. The non-propositional approach assigns non-propositional semantic values to conditionals, so all that is needed is to expand the meaning of the quantifiers to allow embeddings of non-propositional values. Of course, doing so requires a number of theoretical choices, in particular the assignment of particular semantic values to conditionals. Swanson (2006) aims to give exactly such an account of examples like (17) as well as other embeddings. An important point here is that it is already standard practice in linguistics to allow basic logical operators to operate on a range of different types of semantic values, so that extending the meaning of the quantifiers and logical connectives is by no means unorthodox, if done in a principled and systematic way (Partee and Rooth, 1983; Partee, 1995).[31]

One theoretical option for treating quantified conditionals, available to propositional or non-propositional theorists who endorse the restrictor view, is to see 'if'-clauses as directly restricting nominal quantifiers. Supporting this view is the seeming equivalence of the following two sentences (as noted by Higginbotham, 1986):

[31] In Yalcin's (2007) semantics for instance, the non-propositional nature comes in only through the interpretation of an index of evaluation. Thus, on his account we can simply use the off-the-shelf interpretation of all logical operators and get a complete semantic system. The interesting questions is whether the semantic values we get when we do this, combined with the relevant bridging principles, provides a plausible account of the constructions. Klinedinst and Rothschild (2012) give cases where they do not and propose some fixes.

(18) a. Every student passed the exam if he tried.

b. Every student who tried passed the exam.

This equivalence would be neatly explained by positing that 'if he tried' simply restricts the nominal quantificational phrase 'every student'. For then the logical form of (18-a) would be as in (19), which is clearly equivalent to (18-b).

(19) Every [student & tried] [passed the exam]

This option has been explored recently (von Fintel, 1998; Leslie, 2009). However a systematic examination of cases suggests that we cannot hold that *generally* 'if'-clauses can restrict nominal quantifiers. If they could, we would expect (17) to have a reading on which it is equivalent to (20)

(20) Some student who goofs off will fail.

It does not, however, which should make us suspicious of the idea that 'if'-clauses really can restrict nominal quantifiers such as 'every' and 'no'. For this and other reasons, the leading consensus is that accounting for the equivalence of (18-a) and (18-b) by appeal to the idea that 'if'-clauses restrict nominal quantifier is wrong (von Fintel and Iatridou, 2002; Huitink, 2010; Klinedinst, 2011).

Since direct restriction is not an option, embedded conditionals under quantifiers provide serious challenges for any semantic account of conditionals. It is not sufficient to merely assign *some* semantic value to embedded conditionals. We also want the semantic value assigned to match our judgments about what the sentence means. For instance, the material conditional view allows us to assign propositions to the embedded conditionals in (15)–(17), but no matter how we construe the logical form of these sentences it does not seem like we will get the right truth-conditions for these sentences.[32]

[32]For this reason I share with Edgington (1995) perplexity over why the existence of embeddings

Nonetheless a serious effort has been made to show that the strict-conditional view (or a variably-strict view) gives adequate truth conditions for most instances of quantified conditionals. von Fintel and Iatridou (2002); Klinedinst (2011) show that a strict/variable strict conditional account can explain subtle facts about the meaning of quantified conditionals, such as the seeming equivalence between (21-a) and (21-b).

(21) a. No student will pass if he goofs off.
b. Every student will fail if he goofs off.

The basic idea is that the logical form of both sentences involves the embedding of a bare conditional in the matrix clause of the quantifier as follows:

(22) a. No [student x] [if x goofs off, x will pass].
b. Every [student x][if x goofs off, x will fail].

If we now assume that the conditional excluded middle holds, i.e. in every case either $A \rightarrow C$ is true or $A \rightarrow \neg C$ is true, then the equivalence of (21-a) and (21-b) follows immediately. What is important to note is that this explanation of what is going on with the sentences such as (21-a) and (21-b) depends on conditionals expressing truth-valued propositions. At this point, then, propositional views would seem to have an advantage in treating quantified conditionals, but this is perhaps just a result of the fact that propositional theorists have worked more seriously on quantified conditionals than non-propositional theorists have.

Let me strengthen the consideration above by giving another case for which handling an embedded conditional is tractable on a propositional view but does not seem to be so on a non-propositional view. Consider the sentence (23) in which a quantified conditional is embedded under probability operator.

is so often used to argue for the material conditional account.

(23) It's likely that some student will pass if he tries.

Focus on the reading of this sentence in which it means that there is a high chance that at least one student is such that were he to take the exam he would pass. How do we capture this reading in our semantics? We cannot view this sentence as one where the probability operator 'it's likely' is restricted by the 'if'-clause. For (23) is not equivalent to either of the two readings which we can get if we restrict the probability operator by the 'if'-clause (the two readings depend on the scope of 'some').

(24) The conditional probability that a student will pass, given that some student takes the test is high.

(25) There is some student x such the conditional probability that x will pass given that x takes the test is high.

For (24) requires that there actually be a high chance that if any students take the test one student will pass, which is not the intended reading (for it might be unlikely that the one student who would pass were he to take the test will actually take it). On the other hand, (25) requires that we be certain that there is one student who will likely pass if he takes the test, which is also not the intended reading. It seems safe to say, then, that we cannot explain the natural reading of (23) by allowing the 'if' to restrict 'it's likely'.

A natural explanation of what is going in (23) is as follow:

> For every student x there is a proposition expressed by the sentence 'if x tries, he will pass'. (23) is true just in case it is likely that one of those propositions is true.

If we accept this explanation, however we are accepting that there is some *proposition*

corresponding to the sentence 'if x tries, he will pass' for each x.[33] We need a proposition here because propositions are the sorts of thing we can assign probabilities to. If we accept that bare indicative conditionals (when embedded) can sometimes express propositions, then we have already rejected the non-propositional view in some cases.[34]

Conclusion

My goal in this paper was to relate the philosophical debate over conditionals to the linguistic literature on conditionals. In philosophy non-propositional views are both widely accepted and widely viewed with suspicion as being incompatible with the project of formal semantics. I argued here that we should not be so suspicious of non-propositional views, but I also suggested some challenges the views face.[35]

Appendix 1: Restrictor semantics

This is a a simple syntactic variant of the restrictor view. It is meant to cover conditionals under adverbs of quantification, modals, and bare conditionals. We have two classes of expressions: sentences, which are true or false relative to situations (which can be actual or possible), and situational quantifiers (including modals), which are binary quantifiers taking a restrictor sentence and a matrix sentence.

First, the semantic rules for sentences:

[33] On the restrictor view we might get that proposition by restricting 'will' (or a silent necessity modal) in 'if x takes the test he will pass'. The point I am making here is that the result of this process still yields a proposition which we can assign a probability to. This is exactly what the non-propositional view of bare conditionals seeks to deny.

[34] For one of the only attempts to deal with this general kind of example from a non-propositional perspective see Moss (forthcoming).

[35] This note is intended as a supplement to, rather than a review of, the debate between propositional and non-propositional views, and so I have not discussed many crucial issues such as the alleged *subjectivity* of conditionals. I discuss this and related issues in Rothschild (forthcomingb).

(26) $[\![$ Mary is here $]\!]^s$ is true iff Mary is here in situation s

(27) $[\![$ Mary is angry $]\!]^s$ is true iff Mary is angry in situation s

Now, the semantic rules for the situational quantifiers:

(28) $[\![$ usually $[\phi][\psi]\,]\!]^s$ is true iff in the world of s most situations, s', in which $[\![\phi]\!]^{s'}$ is true are situations in which $[\![\psi]\!]^{s'}$ is true.

(29) $[\![$ necessarily $[\phi][\psi]\,]\!]^s$ is true iff for all epistemically-possible-in-s-situations, s', if $[\![\phi]\!]^{s'}$ is true then $[\![\psi]\!]^{s'}$ is true.

This is our basic semantics. Now we need to give our syntactic construal rules, which allow us to handle sentences that include 'if' (which is itself not interpreted). For these rules we need a special tautological sentence T. Let Q be one of the situational quantifiers. Let ϕ and ψ be sentences without 'if' appearing in them. The syntactic construal rules are as follows:

(30) $Q\phi \Longrightarrow Q[T][\phi]$

This rule tell us that if a non-conditional sentence is embedded under an adverb of quantification, then it goes into the matrix of the adverb of quantification and the restrictor is vacuous, i.e. it is T.[36]

(31) Q if ϕ, $\psi \Longrightarrow Q[\phi][\psi]$

This rule tells us that if an adverb of quantification heads a conditional, then the antecedent becomes the restrictor and the consequent becomes the matrix.

(32) if ϕ, $\psi \Longrightarrow$ necessarily if ϕ, ψ

[36]See von Fintel (1994b, 1995) for discussion of pragmatic restrictions of adverbs of quantification.

This rule adds a a silent necessity modal to a bare conditional.

On these rules then sentence (33), by rules (31) and (32), is transformed into (34), which is true iff all epistemically-possible-in-s situations in which Mary is here are ones in which she is angry, which is a standard strict conditional.

(33) $[\![$ if Mary is here, she is angry $]\!]^s$.

(34) $[\![$ Necessarily [Mary is here][Mary is angry] $]\!]^s$

Appendix 2: Non-propositional modal restrictor semantics

This is a simple modification of the above semantics to yield Yalcin's (2007) non-propositional view of conditionals.

Following Yalcin we add an extra index i, which is an information parameter, and has as its values sets of situations.[37] We consider sentences that express truth or falsity in a way that is sensitive to the information parameter to be *non-propositional* (see Yalcin, 2007, for discussion).

Syntactic construal rules are the same as before, as are all truth definitions, except that for *necessarily*. The new entry for *necessarily* (which is understood as an epistemic modal) is as follows:

(35) $[\![$ necessarily $[\phi][\psi]$ $]\!]^{s,i}$ if for all situations s' in i in which $[\![\phi]\!]^{s',i}$ is true, $[\![\psi]\!]^{s',i}$ is true.

We now need a bridging principles for sentences whose truth is sensitive to i, such as sentences that include *necessarily*. The principle we will give, (36), takes sentences as recommendations to update one's belief states to make the sentence true if one's

[37] Yalcin uses worlds, not situations. I do not do this here to emphasize the parallels with adverbs of quantification.

belief state is used to select i:

(36) If an assertion of a sentence ϕ is made and ϕ is sensitive to i then that assertion should be understood as a recommendation to conform one's beliefs to the constraint: if b = set of all situations worlds possible according to one's belief state, then for all s in b, $[\![\phi]\!]^{s,b}$ is true.

Consider:

(37) $[\![$ if Mary is here, she is angry $]\!]^{s,i}$

By the syntactic construal rules this comes out as follows:

(38) $[\![$ Necessarily [Mary is here][Mary is angry] $]\!]^{s,i}$

This is true iff all situations s in i in which Mary is here are situations in which Mary is angry. Since it is sensitive to the information parameter, it is non-propositional.[38]

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[38]Note this semantics is only meant to deal with a fragment of the language, it does not give an adequate treatment of embeddings of non-propositional material in antecedents, for instance.

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