

# Conditionals and Propositions in Semantics\*

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## 1 Introduction

The project of giving an account of meaning in natural languages goes largely by assigning truth-conditional content to sentences. I will call the view that sentences have truth-conditional content *propositionalism* as it is common to identify the truth-conditional content of a sentence with the proposition it expresses. This content plays an important role in our explanations of the speech-acts, attitude ascriptions, and the meaning of sentences when they appear as parts of longer sentences. Much work in philosophy of language and linguistics semantics over the last half-century has aimed to characterize the truth-conditional content of different aspects of language.

There are different kinds of worries one might have about this project. There are general methodological worries about truth-conditional semantics that have had some currency in the philosophical literature. In my view, the enormous progress in semantics made in its brief history suggests these are misplaced. However, many sympathetic to the general project of truth-conditional semantics have argued that specific constructions are not themselves amenable to assignment of propositional content. Conditionals, ‘if ... then ...’ constructions, have been one of the most

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prominent such examples. My goal here is to take stock of the current debate over the status of conditionals with respect to propositionalism.

Some disclaimers. For the most part, I will focus on indicative conditionals rather than subjunctive or counterfactual ones. I will not explore in detail any of the non-propositional accounts of conditionals, rather I will mostly look at the challenges to propositionalism about conditionals that might motivate these accounts. This strategy suggests a kind of conservative view that we should stick with propositions when possible. I am sympathetic to this view, but do not want to justify it here.

## 2 Propositions in semantics

Before discussing the particular challenge conditionals raise, we need to clarify the commitments of propositionalism. The dominant paradigm in semantics, truth-conditional semantics, associates declarative sentences with satisfaction conditions, i.e. the situations in which they are true [Montague, 1973, Lewis, 1970, Heim and Kratzer, 1998].

Formally, we think of a sentence (in a context) as determining a mapping from worlds to truth-values. I do not want to go so far as to *identify* the semantic value of a sentence with such a mapping, or equivalently, a set of possible worlds. There are two reasons not to equate these semantic values with such objects. First, as Lewis [1980] persuasively argues, the semantic value of a sentence must be something more complex than simply a set of possible worlds. This is because an adequate treatment of the embedding of sentences under operators (such as modal or temporal operators) requires assigning semantic values to sentences that are functions from times and worlds and other indices to propositions.<sup>1</sup> Second, I do not want to rule out the possibility that sentences determine something more fine-grained than a set of truth-conditions, such as a structured proposition [as in e.g. Salmon, 1986, Soames, 1985]. To be more concrete, take a sentence such as ‘Johnny is in the basement’. Associated with this sentence (in a context) is a mapping from worlds to truth-values that

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<sup>1</sup>While there has been some controversy over this claim, recent work has strengthened the case for disassociating sentential semantic values from the propositional content of a sentence [Ninan, forthcoming, Rabern, 2012].

returns true if and only if Johnny is in the (contextually relevant) basement. When you assert this sentence, something you do is put forward this proposition. When the sentence is embedded in a belief report such as, ‘Bill thinks Johnny is in the basement’, the belief attributed to Bill is in this proposition. These are the basic tenants of propositionalism, and as I said, for simple sentences like ‘Johnny is in the basement’ they are uncontroversial.<sup>2</sup>

The question about conditionals is whether this story can be extended to conditional sentences such as ‘if Bill is in China, then Ted is in Japan’. That is, does a sentence like this have associated with it a mapping from world to truth-values that plays the role in belief and assertion outlined above? In the next few sections, I’ll bring out a number of challenges to this thesis.

### 3 Material conditional

It will be useful to review briefly some problems with the most straightforward way of vindicating propositionalism: the material conditional account of conditionals, according to which ‘if  $A$  then  $C$ ’ is just equivalent to the disjunction of the negation of  $A$  and  $C$ .

The inadequacy of this account is now widely accepted. It is not very difficult to see that there is a major semantic difference between ‘if  $A$  then  $C$ ’ and ‘either not  $A$  or  $C$ ’. Here are a number of related considerations showing this difference. First, consider a case in which  $A$  is false: ‘either not  $A$  or  $C$ ’ seems to be clearly true in this case, but it is much less clear that ‘if  $A$  then  $C$ ’ is true. Second, consider evidence that  $A$  is false. This is clearly evidence for the disjunction ‘either not  $A$  or  $C$ ’, but it is not evidence for ‘if  $A$  then  $C$ ’. Third, it seems that the probability of ‘either not  $A$  or  $C$ ’ cannot be lower than the probability that  $A$  is false. On the other hand, it seems that the probability that ‘if  $A$  then  $C$ ’ can be arbitrarily low even

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<sup>2</sup>I do not even consider the dynamic tradition of Heim [1982] and Kamp [1981] to represent a very serious departure from propositionalism. While it is true that certain uses of indefinite descriptions do not have *just* propositional content, there are still, in most cases, easily recoverable propositions expressed in these semantic systems. However, I do think dynamic test semantics [Veltman, 1996] is a non-propositionalist theory. Regardless there is not a clear all-or-nothing distinction here.

when the probability that  $A$  is false is high—consider for instance the probability of statement ‘if the world ends tomorrow, it will end at precisely 3:03pm’.<sup>3</sup> All these differences suggest that the proposition expressed by a conditional, if any, is not the material conditional.

There have been attempts to rescue the material conditional view with a pragmatic story, either by explaining the difference between natural language conditionals and the material conditional by means of conversational or conventional implicatures [Grice, 1967/1989, Jackson, 1987]. The former strategy has seemed to most unworkable: there is no plausible conversational implicature which would bridge the gap between the material conditional and the natural language conditional. The latter strategy requires so divorcing the meaning of conditionals from their use in communication that it is unclear what role the meaning (the material conditional) has left to play. We will take for granted, then, that natural language conditionals are not material conditionals.

## 4 Inference arguments

The failure of the material conditional analysis of conditionals itself is the first step in a set of powerful arguments against propositionalism generally. These arguments go by raising considerations that indicate that the material conditional view of natural language conditionals is the only propositional view that captures crucial logical properties of conditionals. If this is right, then propositionalism is doomed since the material conditional view is untenable.

These arguments, first of all, generally take for granted that if conditionals express propositions they express propositions that are at least as strong as the material conditional. A simple argument for this assumption can be made on the basis of the validity of *modus ponens*. If  $A$  is true and  $C$  is false then it seems that ‘if  $A$  then  $C$ ’ must be false. If this were not the case, then modus ponens would not be a universally valid inference.<sup>4</sup>

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<sup>3</sup>I base all these claims not just on widely-held intuitions about cases, but also on empirical studies [see, e.g., Evans et al., 2003].

<sup>4</sup>However, note that there are some challenges to modus ponens in the literature: such as

As Stalnaker [1975] notes, if we go the other direction and accept the inference from ‘not  $A$  or  $C$ ’ to ‘if  $A$  then  $C$ ’, the OR-TO-IF inference, then we have accepted that the truth-conditions of the indicative conditional exactly match that of the material conditional. The OR-TO-IF inference, moreover, seems intuitively plausible.<sup>5</sup>

There is a more complex argument, along these same lines, due to Gibbard [1981].<sup>6</sup> As well as assuming that that natural language conditionals entail the material conditional, Gibbard assumes the following two plausible principles:

IMPORT/EXPORT ‘if  $A$  then (if  $B$  then  $C$ )’ iff ‘if  $A$  and  $B$  then  $C$ ’

CONSEQUENCE  $A \models C \supset$  ‘if  $A$  then  $C$ ’

Gibbard shows that these two principles, plus the entailment of the material conditional by the natural language conditional suffice to show that that the natural language conditional is logically equivalent to the material conditional. CONSEQUENCE seems uncontroversial: whenever  $C$  follows logically from  $A$  then ‘if  $A$  then  $C$ ’ is true. Likewise, IMPORT/EXPORT has been widely endorsed [e.g. McGee, 1985] and seems intuitively valid. So, Gibbard’s proof forms the basis of an argument for the material conditional capturing the truth conditions of conditionals, and, hence, an argument against propositionalism.

## 5 Probability arguments

Earlier we saw that the probability of the conditional ‘if  $A$  then  $C$ ’ does not correspond to the probability of the material conditional ‘either  $\neg A$  or  $C$ ’. It has long been observed that the probability of a given conditional, in fact, always seems to be the conditional probability of the consequent given the antecedent. Thus, the following equation, often referred to as ADAMS’ THESIS, STALNAKER’S THESIS or just THE EQUATION,  $p(\text{‘if } A \text{ then } C\text{’}) = p(C|A)$  is taken to govern the probability of

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McGee’s [1985] much discussed case, and, in the more recent literature, more subtle cases have arisen [Kolodny and MacFarlane, 2010, Khoo, 2012].

<sup>5</sup>However, more recently, Stalnaker [2011] has given a case which he takes to be a counterexample to the inference.

<sup>6</sup>See also Gillies [2009], Kratzer [2012], Khoo [2012] for further discussion.

conditionals [Stalnaker, 1970, Adams, 1975]. The plausibility of ADAMS' THESIS is easily confirmed by thinking about particular examples, and it has been empirically tested [Evans et al., 2003].

Once we accept ADAMS' THESIS we get into trouble almost immediately. There are a wide range of technical results that show that ADAMS' THESIS when combined with other plausible assumptions leads to paradoxical conclusion. Lewis's [1976, 1986] celebrated triviality theorems are the first and best known results, and there have been many extensions.<sup>7</sup> Adams, Edgington, Bennett [2003] and others have argued that the culprit here is propositionalism. They think that it is the very assumption that conditionals express propositions that have probabilities at all which leads to the problematic results. Thus, they suggest we should endorse ADAMS' THESIS, but deny propositionalism.

## 6 Gibbardian standoffs

Another prominent argument against a propositional view of indicative conditionals comes (again) from Gibbard's [1981] seminal article [see also Gillies, 2009, Kratzer, 2012, Khoo, 2012, for discussion]. Take a variant on Gibbard's [1981] Sly Pete example. Suppose three people know that a coin may or may not be flipped at noon. Alfred is told ahead of time that if it lands head he will be told that within a minute of it being flipped. Bob is told ahead of time that if it lands tails he will be told that within a minute of it being flipped. Catherine gets no information, but both Alfred and Bob are allowed to pass a note to Catherine. Suppose neither Alfred nor Bob has heard anything about the coin flip at 12:01. Alfred passes a note to Catherine that says, 'If it was flipped, it landed tails.' Bob passes a note to Catherine that says, 'If it was flipped, it didn't land tails'. Catherine concludes that it wasn't flipped.

My preferred way of looking at this sort of Gibbardian standoff case is that it forces us to abandon one of the following three plausible assumptions:

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<sup>7</sup>See Edgington [1995] and Hajek and Hall [1994] for an overview. Cozic and Égré [2010] make an important connection between the triviality results and the limitations of unary quantification.

- INCOMPATIBILITY    The propositions expressed by ‘if it flipped it landed heads’ and ‘if it flipped it landed tails’ in a single context cannot both be true .
- PUBLICITY            An act of successful communication requires the proposition in context asserted to be determinable by the hearer (and the case above is one of successful communication).
- NON-SUBJECTIVISM    The identity of the speaker does not play any semantic role in the proposition expressed by a conditional in these cases (i.e. the note from Alfred could have meant the same thing if it had been written by Bob).

The material conditional account rejects INCOMPATIBILITY, as both ‘if  $A$  then  $C$ ’ and ‘if  $A$  then  $\neg C$ ’ are true when  $A$  is false. However, it seems intuitively clear that a single speaker in a single context cannot assert both ‘if  $A$  then  $C$ ’ and ‘if  $A$  then not  $C$ ’. So, INCOMPATIBILITY is *prima facie* plausible. In the scenario the only publicly observable piece of context that differs for the two statements is the identity of the speaker. If only publicly observable pieces of context matter (PUBLICITY) and the identity of the speaker doesn’t matter (NON-SUBJECTIVISM) then the context is the same for the two utterances. But then the two notes cannot both be true, by INCOMPATIBILITY. Nonetheless it seems that in this situation both notes are true. Moreover, it seems hard to argue that this situation does not contain two standard successful communicative acts. I take both PUBLICITY and NON-SUBJECTIVISM to be plausible assumptions.

## 7 Propositionalism defended

We have seen a battery of arguments against the tenability of propositionalism about conditionals. Here I will outline a way in which propositionalism can be defended.

A good place to start is with a response to Gibbardian standoffs due to Kratzer [1986]. Kratzer essentially argues that in each case the conditional is a *strict con-*

*ditional* with a modal base being the knowledge of the speaker. Kratzer denies SUBJECTIVISM about indicative conditionals. She writes (about Gibbard’s case):

... these particular indicative conditionals behave like indexicals: They are interpreted with respect to the evidence available to their utterers. But this means they are implicitly modalized.

What she means is that each conditional expresses a conditional necessity about the evidence available to the speaker. So Alfred’s utterance of ‘if it was flipped it landed tails’ is true if and only if in all situations compatible with Alfred’s evidence in which the coin was flipped it landed tails, and Bob’s utterance of ‘if it was flipped it didn’t land tails’ simply means that in all situations compatible with Bob’s evidence in which it was flipped it landed didn’t land tails.<sup>8</sup> If Catherine learns that both these statements are true, then she can rule out the possibility that the coin was flipped. Do indicative conditionals really express claims about our evidence or knowledge? That is, can we deny NON-SUBJECTIVISM? Some see NON-SUBJECTIVISM as appealing. One argument goes as follows: if conditionals expressed propositions about one’s evidence or knowledge, then believing a conditional would seem to require having a belief about one’s own knowledge or evidence. But it is possible (and in the case of non-human animals routine) to believe a conditional without having any beliefs about one’s knowledge or evidence. Hence, NON-SUBJECTIVISM. Here we enter into similar territory to that explored in recent debates over the meaning of epistemic modals such as ‘might’ and ‘must’ [see, e.g., Yalcin, 2011]. The argument about conditionals not seeming to be about knowledge or evidence may weigh in favor of NON-SUBJECTIVISM, but it is not decisive.

Kratzer’s account of conditionals is structurally equivalent to the standard *variably strict* semantics for conditionals developed by Lewis [1973] and Stalnaker [1968].<sup>9</sup> Lewis, however, does not extend his account to indicative conditionals and Stalnaker

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<sup>8</sup>It’s important to note that Kratzer explicitly argues that only certain conditionals are subjective in this respect: all are moralized for Kratzer but the modal base varies in different cases.

<sup>9</sup>Although Kratzer treats conditionals as strict her account of modals [Kratzer, 1981] makes strict conditionals equivalent to variably strict ones [see Lewis, 1981, for details].



says very little about the exact interpretation of indicative conditionals, focusing rather on their basic logical properties.<sup>10</sup>

Even if we accept the basic plausibility of an epistemically-flavored strict conditional view, there is still the question of how we answer the other challenges to propositionalism. With respect to the arguments discussed in section 4, it seems that the only response is to deny that conditionals really have the entailments attributed to them in these arguments. Stalnaker [1975] argues that his semantics for conditionals, with a suitable pragmatic constraint, can explain the *pragmatic* validity of the OR-TO-IF inference. He argues, however, that the inference is not logically valid, so we do not need to equate the natural language conditional with the material conditional.<sup>11</sup> Gibbard's proof that natural language conditionals are equivalent to material conditionals based on IMPORT/EXPORT and CONSEQUENCE has received less attention, but as we will see in the next section there may be a suitable response.

Perhaps the most serious challenge to propositionalism is the set of arguments about conditionals and probability discussed in section 5. However, here too there are a variety of ways in which proponents of propositionalism can respond. Rothschild [2013] argues that a semantics like Kratzer's or Stalnaker's can predict both why ADAMS' THESIS generally holds and why it fails in certain cases long recognized in the literature [e.g. McGee, 2000], thus avoiding the problems raised by the Lewis's triviality proofs. On the empirical front, Douven and Verbrugge [2013] have suggested that while ADAMS' THESIS might hold in simple cases, the generalization of it necessary for the triviality proofs does not seem to be empirically valid. As things stand, the status of the argument from probability against propositionalism is far from clear.

The scorecard so far? There are responses to the arguments against propositionalism about conditionals. However, there is clearly detailed work to be done in weighing the plausibility of the full basket of responses needed. There is a serious worry about propositionalism with respect to conditionals in way that there isn't about many

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<sup>10</sup>Though in later work Stalnaker [1984, 2011] elaborates more about what propositions, if any, he thinks conditionals express.

<sup>11</sup>More recently, Stalnaker [2011] has even suggested that the inference is not always even pragmatically valid.

other classes of sentences (such as conjunctions and disjunctions). More generally, it seems that conditionals are special; for one thing, we seem to have less access to their logical properties than we seem to have to the logical properties of other natural language expressions. Even the most basic properties like modus ponens [McGee, 1985] and modus tollens [Yalcin, 2012] have been challenged, while other alleged properties like ADAMS' THESIS and IMPORT/EXPORT are more controversial. This unclarity about the meaning of conditionals, however, is not itself a strong argument against them expressing propositions.

As we will see in the next section, the case for propositionalism may be strengthened by detailed considered of the meaning of the word 'if' itself and the syntax of conditionals.

## 8 The meaning of 'if'

Regardless of the overall tenability of the propositional approach it needs to be supplemented by a more serious syntactic/semantic analysis of the natural language conditionals. So far, after all, we have just discussed the meaning of an individual indicative conditional sentence considered in isolation, without respect to either how it embeds under operators or how the individual parts of it go into making up the meaning of the whole. This might seem a harmless abstraction, as the details of the compositional semantics are not always relevant to our basic understanding of the meaning of some classes of expressions. However, Kratzer [1981, 1986, 2012] has forcefully argued that a picture of the meaning of 'if' clauses due to Lewis [1975] has important ramifications for some of the issues discussed above.

Lewis's basic idea is that 'if'-clauses serve to restrict adverbs of quantification in sentences like 'Usually, if a man enters a bar, he orders a drink.' We can understand 'usually' as a quantifier over situations which is then restricted by the 'if'-clause 'if a man enters a bar' to only quantify over situations in which a man enters a bar. This basic account, as far as I know, is the only viable account of the embedding of conditionals under adverbs of quantification.<sup>12</sup> Kratzer, as well as Heim [1982],

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<sup>12</sup>See Khoo [2011] for a discussion of the problems facing a dynamic account.

expand Lewis’s semantics to cover both interactions between ‘if’-clauses and modal operators, in such examples as ‘if John is here, he must be asleep.’ Furthermore, Kratzer argues that even in *bare conditionals*, conditionals without any explicit modal operators, there is silent modal necessity operator that is being restricted by the antecedent. This explains Kratzer’s view above about the Gibbard stand-off case: in this instance, there is a silent epistemic necessity modal in those uses.

Kratzer argues that her view allows for effective responses to the existing challenges to propositionalism. We have already seen her response to Gibbard’s standoff cases. Most significantly her view allows for an explanation of the appearance that conditionals obey Adams’ thesis. On her view, the embedding of conditionals under probability operators mirrors their embedding under adverbs of quantification [Kratzer, 1986, 2012, Cozic and Égré, 2010]. There is a slight wrinkle here. Kratzer’s account gives a simple explanation of when a sentence like ‘There’s a 50 percent chance, that if the coin is flipped, it will lands head’ is true. Her explanation is that the antecedent ‘if the coin is flipped’ restricts the modal ‘there is a 50 percent chance’. However, it is less clear how she explains why we judge the full sentence ‘if the coin is flipped, it will lands head’ to have a 50 percent probability, since on her account the full sentence should contain a hidden epistemic necessity modal [see von Fintel, 2007, Rothschild, 2013, to appear, Kratzer, 2012, for related discussion].

As for the arguments against propositionalism from the entailments of conditionals: Since Kratzer embraces a strict-conditional view similar to Stalnaker’s for bare conditionals she can help herself to his pragmatic explanation of the OR-TO-IF inference. The situation with IMPORT/EXPORT is more subtle. Kratzer [1986] claims that her theory allows us her to validate IMPORT/EXPORT and CONSEQUENCE without making conditionals equivalent to the material conditionals because she does not endorse the view that the conditional is a two-place operator. However, Khoo [2012] shows that Kratzer’s syntax does not itself allow her to escape Gibbard’s conclusion. Nonetheless, Khoo argues that Kratzer can and should deny certain instances of modus ponens to address this problem.

## 9 The way we live now

Non-propositional views of indicative conditionals are widespread in the philosophical and linguistic literature. These views can be divided into two main camps: on the one hand, views according to which conditionals do not express propositions because they lack a semantic value in the normal sense, and on the other hand, views according to which conditionals have semantic values but those values are not themselves compatible with propositionalism (i.e. they do not determine a proposition which is the content of the conditional in the normal sense). Adams [1975] and Edgington [1995] are generally considered to be in the first camp as they emphasize the norms of assertion of conditionals without assigning any particular semantic value to conditionals. These views face the challenge of relying on essentially ad hoc accounts of the embedding of indicative conditionals in different environments. Some such as Edgington [1995] and Gibbard [1981] have pointed to this as an advantage of their account as conditionals often do not felicitously embed under logical operators. However, recent work has showed that there is systematic data about the embeddings of conditionals, especially under quantifiers, which should be explained by a semantics of conditionals [von Stechow and Iatridou, 2002, Klöppel, 2011, Rothschild, to appear].

There are, on the other hand, a variety of views that assign semantic values to conditionals, but do not associate with them propositions in the usual sense. Three examples of such views are dynamic ‘test’ semantics [Veltman, 1996, Gillies, 2004, Willer, 2012], trivalent semantics [Belnap, 1970, Huitink, 2008, Rothschild, forthcoming], and expressivist semantics [Yalcin, 2007]. There are also some harder to classify theories, mostly designed to deal explicitly with the relationship between conditionals and probability. For example, McGee [1989], Jeffrey and Stalnaker [1994] and Bradley [2012] all give non-standard truth-conditions to conditionals to account for the relationship between conditionals and probability in a way compatible with Lewis’s triviality theorems and related results.

Given the obvious challenges to propositionalism it is important to have at hand viable non-propositional accounts of the meaning of conditionals. However, it remains an open question whether we ultimately need a non-propositional account of natural

language conditionals. This question is not going to be settled by reference only to the classic arguments against propositionalism sketched above. Rather detailed empirical and conceptual work is needed to work out which semantics of conditionals best captures the natural language conditional.

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