WHAT IF? AN ENQUIRY INTO THE SEMANTICS OF NATURAL LANGUAGE CONDITIONALS

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An Enquiry into the Semantics of Natural Language Conditionals

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I, Guðmundur Andri Hjálmarsson, hereby certify that this thesis, which is approximately 75,000 words in length, has been written by me, that it is the record of work carried out by me and that it has not been submitted in any previous application for a higher degree.

I was admitted as a research student in September 2006 and as a candidate for the degree of Doctor of Philosophy in September 2006; the higher study for which this is a record was carried out in the University of St Andrews between 2006 and 2010.

18 March 2010 ______________________________

Signature of candidate

I, Professor Stephen Read, hereby certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree of Doctor of Philosophy in the University of St Andrews and that the candidate is qualified to submit this thesis in application for that degree.

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Abstract

This thesis is essentially a portfolio of four disjoint yet thematically related articles that deal with some semantic aspect or another of natural language conditionals.

The thesis opens with a brief introductory chapter that offers a short yet opinionated historical overview and a theoretical background of several important semantic issues of conditionals.

The second chapter then deals with the issue of truth values and conditions of indicative conditionals. So-called *Gibbard Phenomenon* cases have been used to argue that indicative conditionals construed in terms of the *Ramsey Test* cannot have truth values. Since that conclusion is somewhat incredible, several alternative options are explored. Finally, a contextualised revision of the Ramsey Test is offered which successfully avoids the threats of the Gibbard Phenomenon.

The third chapter deals with the question of where to draw the so-called indicative/subjunctive line. Natural language conditionals are commonly believed to be of two semantically distinct types: *indicative* and *subjunctive*. Although this distinction is central to many semantic analyses of natural conditionals, there seems to be no consensus on the details of its nature. While trying to uncover the grounds for the distinction, we will argue our way through several plausible proposals found in the literature. Upon discovering that none of these proposals seem entirely suited, we will reconsider our position and make several helpful observations into the nature of conditional sentences. And finally, in light of our observations, we shall propose and argue for plausible grounds for the indicative/subjunctive distinction.

The fouth chapter offers semantics for *modal* and *amodal* natural language conditionals based on the distinction proposed in the previous chapter. First, the nature of modal and amodal suppositions will be explored. Armed with an analysis of modal and amodal suppositions, the corresponding conditionals will be examined further. Consequently, the syntax of conditionals in English will be uncovered for the purpose of providing input for our semantics. And finally, compositional semantics in generative grammar will be offered for modal and amodal conditionals.

The fifth and final chapter defends *Modus Ponens* from alleged counterexamples. In particular, the chapter offers a solution to McGee's infamous counterexamples. First, several solutions offered to the counterexamples hitherto are all argued to be inadequate. After a couple of observations on the counterexamples' nature, a solution is offered and demonstrated. The solution suggests that the semantics of embedded natural language conditionals is more sophisticated than their surface syntax indicates. The heart of the solution is a translation function from the surface form of natural language conditionals to their logical form.

Finally, the thesis ends with a conclusion that briefly summarises the main conclusions drawn in its preceding chapters.

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Contents

1 Introduction

1.1 Preamble: Conditionals

This thesis is about so-called conditionals. In particular, this thesis will deal with several central semantic issues concerning natural language conditionals.[1] However, before we can say anything interesting about conditionals, we ought probably to demarcate our subject matter to a certain degree.

Interestingly though, such demarcation is harder than one would think. As a partly linguistic phenomenon, we do certainly have a certain grip on their linguistic properties. Syntactically, conditionals have traditionally been considered to be a class of sentences which combine two constitutive sentences or clauses in a particular way. In the literature, the two constitutive sentences have been thoroughly distinguished from one another—as opposed to, say, the constituents of conjunctions

[1] For excellent and somewhat more extensive introductions to the semantics of natural language conditionals, see Edgington (1995), Bennett (2003) and von Fintel (ms.).

and disjunctions—and have usually been called *antecedent* (or *protasis*) and *consequent* (or *apodosis*) respectively. In most natural languages, conditionals are usually marked by a certain word—like 'if' in English, 'si' in French, Spanish and Latin, 'se' in Italian and Portuguese, 'hvis' in Danish and Norwegian, 'om' in Swedish, 'ef' in Icelandic, 'wenn' in German, 'als' in Dutch and so on and on—which attaches, as it were, to the antecedent and moreover indicates the conditionality of the sentence. Similarly, the consequent is sometimes marked by a particular word—like 'then' in English, ... and so on and on—although, as we shall see in due course, such consequence markers are far more dispensable than antecedent markers.[2] Together, those markers combine and provide a canonical conditional structure along the following lines in, say, English: if ..., then ....[3]

More concretely, the following sentence is a paradigmatic example of a conditional in English:

(1) If Shakespeare did not write *Hamlet*, then someone else did.

This sentence contains the crucial words 'if' and 'then' and it seems moreover to combine two constitutive sentences in a particular way. On the surface, it seems that this conditional is indeed composed of two sentences: an antecedent, which is the following sentence:

(2) Shakespeare did not write *Hamlet*.

And a consequent, which is the following sentence:

(3) Someone else wrote *Hamlet*.

So much for the rudimentary syntactic properties of conditionals. To our frustration, once we pay more attention to the conditionals, we soon realise that their surface syntax can be much more varied than (1) might ever give us a reason to

[2] On the syntax and semantics of 'then', see Iatridou (1993). On the indispensability of 'then', see Davis (1983) and Geis (1985).

[3] Interestingly though, some languages do not have such a conditional structure and express conditionals by pragmatic means only. An alleged example is the language Guugu Yimithirr, see Levinson (2000, p. 125).

expect. Arguably, all of the following sentences express the same conditional as (1) in many contexts:[4]

(4) a) Someone else wrote *Hamlet* if Shakespeare did not.
b) Did Shakespeare not write *Hamlet*, someone else did.
c) Either Shakespeare wrote *Hamlet* or someone else did.
d) Someone else wrote *Hamlet* provided that Shakespeare did not.
e) Assuming that Shakespeare did not write *Hamlet*, someone else did.

If we agree that (4a)–(4e) do in fact express the same conditional as (1), we are in a peculiar situation: demarcating conditionals by their syntactic features does not seem to get us very far afield. In fact, we might even question whether conditionals have any sufficient or necessary syntactic conditions.[5] True enough, we could designate a class of sentences according to certain syntactic features and call them 'conditionals'. Say, all sentences which have the same surface form as (4a) and related subject-auxiliary inversions and topic and focus phrases such as (1) and (4b). However, that way, we are inevitably bound to miss some sentences which intuitively express conditionals.[6] In essence, it seems that conditionals are not a syntactic category at all.

Rather, we might suspect, conditionals comprise a semantic category. Indeed, we are willing to accept that (1) and (4a)–(4e) are conditionals only because those sentences express something of the same kind. So, we could now ask, what do conditionals express? Or more precisely, what are the semantic properties of conditionals? As somewhat competent language users, we all know roughly what someone means when they utter a sentence such as (1). Furthermore, we do quite often have clear intuitions about their truth values. And moreover, we also know quite well which

[4]In particular, (4c) can only be said to expresses the same conditional as (1) in contexts where we are certain that either the antecedent or the consequent obtains but we do not know which; see Stalnaker (1975/1999).

[5]In particular, if there are languages wherein conditionals have no syntactic markers; see again footnote 3.

[6]Even if we only restrict ourselves to English, some conditionals can be both expressed as conjunctions and disjunctions, which comprise a different syntactic category altogether, and by means of numerous circumlocutions such as (4e) and (4e).

sentences express conditionals and which do not. Intuitively, conditionals report situations of some description which are actualised on the condition that some other situation obtains. Conversely, conditionals express situations of some description and tell us what other situations do also obtain. The situations in question need not be actual and therein lies the importance of conditionals: conditionals allow us to express something about counterfactual situations which may never even obtain. In fact, this very feature reflects an essential aspect of human language and thought which has been called 'displacement' in certain circles.[7] And although the oft expressed sentiment that conditionals are an essential and basic part of our mental make-up is all but obvious, we can only emphasise it once again.[8]

Despite all that, when it comes to spelling out what exactly we mean by sentences such as (1), we soon feel humbled and unquestionably out of our depth. Sure, we may come up with a number of different ways in which we can express whatever we do express by (1), but if we try to give a systematic account of what we mean by such sentences in general, we soon become bewildered. If conditionals had no serious relevance to our lives in general, that would all be fine and well. However, since the concept of conditionality is arguably quite central to an understanding of our thought, language and actions, we cannot easily ignore it. Moreover, since conditionals often play pivotal roles in our arguments, a correct account of their meaning is of considerable significance from both philosophical and logical points of view. An appropriate semantic and meta-semantic understanding of conditionals is therefore of significance for subjects as diverse as, say, philosophy of language, philosophy of logic, philosophical and mathematical logic, semantics, pragmatics, cognitive science, cognitive and developmental psychology, artificial intelligence, automated reasoning, decision theory, game theory and operation analysis. Quite unsurprisingly then, there has been much ado made about conditionals and their semantics through the years.

[7] See Hockett (1960), Hockett and Altmann (1968) and von Fintel and Heim (2007, §1.1).
[8] For a particularly articulate and eloquent expression, see Edgington (1995, p. 235).

1.2 Giving Meaning to Conditionals

We have concerned ourselves with conditionals for a long time. In fact, conditionals are arguably one of the oldest subject of semantics: almost two and a half millennia ago, the poet Callimachus allegedly remarked that 'even the crows on the rooftops are cawing about which conditionals are true'.[9] Somewhat later, Cicero in his *Academica* remarks on the bewildering number of diverse accounts of conditionals and complainingly cites Diodorus Siculus, Philo of Alexandria and Chrysippus of Soli.[10] As one would predict, after all those years, there is a staggering number of vastly different theories of conditional semantics in the literature. In many cases, of course, the difference between these semantic accounts is quite soft and subtle. However, when we consider the proposed accounts more carefully, we soon notice that we are actually up against several clusters of drastically different theories which are internally quite similar one another.

In order to gain a better grasp of the subject of this thesis, we will now take a closer look at two quite distinct strands of semantic accounts of conditionals which may be found in the literature. Since we will repeatedly encounter those accounts in one guise or another in due course, it will be helpful to have them spelled out now in some detail.[11] However, before we turn to these accounts, a brief remark is in place on the grim fact that natural language conditionals do actually appear to be of two distinct semantic categories rather than just one.

In light of this apparent distinction, the challenge of giving an appropriate semantic account of conditionals becomes twice as hard: in addition to giving an account of conditionals of the category of (1), we are also up against a new category

[9]See Mates (1965) (according to Adams (2005, p. 1)) and Sextus Empiricus' *Adversus Grammaticos* 309, reporting Callimachus' *Epigrammatum Fragmenta* 393 (according to both Young (1989, p. 29) and von Fintel (ms., p. 2)).

[10]According to von Fintel (ms., p. 2).

[11]Other accounts, some upon which we will also touch later, include: no-truth-value accounts (see Adams (1965, 1975), Gibbard (1981) and Edgington (1985/1991, 1995)), modal-restrictor accounts (see Lewis (1975) and Kratzer (1986, forthcoming)), definite-description accounts (see Schein (2003), Schlenker (2004) and Bhatt and Pancheva (2006)), dynamic strict-conditional accounts (see von Fintel (2001) and Gillies (2007)) and contextually restricted strict-conditional accounts (see Gillies (2009, 2010)).

altogether. Of course, the two categories might be related in some aspect which would allow for a unified account. Nonetheless, even if that were the case, it will be considerably harder to conjure up such a universal account. So, enough already, let us turn to this distinction now.

On the one hand, let us recall our paradigm conditional from before:

(1) If Shakespeare did not write *Hamlet*, then someone else did.

Intuitively, this conditional is true: *Hamlet* exists and since things like that do not write themselves, someone else must have written it if Shakespeare did not.

On the other hand, if we muck around with the tenses and aspect of (1), we get a peculiar result. Indeed, consider the following conditional:

(5) If Shakespeare had not written *Hamlet*, then someone else would have.[12]

Intuitively, this conditional is false: *Hamlet* is a work of considerable genius which arguably few apart from Shakespeare could have mustered. Perhaps more importantly, even if history had yielded other authors sufficiently gifted, the sheer possibility of composing a play exactly like *Hamlet* is too far-fetched. And for that reason, most of us agree that no one would ever have written *Hamlet* had Shakespeare not.

While conditionals like (1) have traditionally been called 'indicative conditionals', conditionals like (5) are called 'subjunctive conditionals'. Although we cannot easily do without the indicative/subjunctive distinction, there is no general consensus about its exact nature or its boundaries. In due course, we shall take a closer look at the distinction but for now, it will suffice for us to remain aware of its existence. In particular, the distinction is important for the two accounts we shall now consider.

[12] (1) and (5) are of course only a variant of the classic Oswald-Kennendy examples from Adams (1970).

1.2.1 Material Implication Accounts

Allegedly, material implication accounts date back at least to the Stoics.[13] A material implication, which we shall denote by '$\supset$' hereafter, is a two place truth function (or logical connective if you will) which is defined to be true if and only if its antecedent is false or its consequent is true. Conversely, we may also (and equivalently) define material implication with the following truth table:

φ	χ	$\varphi \supset \chi$
1	1	1
1	0	0
0	1	1
0	0	1

According to an undiluted material implication account, natural language conditionals, such as (1) and (5), are true if and only if the corresponding material implication is true. In other words, a natural language conditional of the form $\ulcorner$if φ, then $\chi\urcorner$ is true if and only if the corresponding material implication $\ulcorner\varphi \supset \chi\urcorner$ is true. Understandably, we might now ask, why should we ever go for this particular distribution of truth values? Indeed, anyone who has ever sat through an introductory logic class has probably entertained this question in bewilderment. The most honest answer is that out of the sixteen possible distributions of truth values available for two place truth functions, this particular distribution offers the closest fit to our intuitions. So, roughly, on the assumption that natural language conditionals are extensionally truth functional, this is as good as it ever gets.[14]

Although an undiluted material implication account seems to get the truth value of (1) correctly, (5) already runs counter to the proposal: since Shakespeare and no one else wrote *Hamlet*, both the antecedent and consequent are false, in which case the corresponding material implication is true. However, since we already claimed that (5) is intuitively false, the account seems to disagree with our data.

[13] For instance, the aforementioned Stoic Chrysippus of Soli held a material implication view of conditionals; see Sharples (1996, p. 25).

[14] See for instance Edgington (1995, §2.2).

This is merely a symptom of a more serious problem: under the material implication analysis, far more arguments are validated than the corresponding natural language conditionals seem to tolerate. The so-called positive and negative paradoxes of material implication are probably the most notorious examples: the positive paradox exploits the fact that φ implies $\ulcorner\chi \supset \varphi\urcorner$ classically. On the assumption of the material implication analysis then, any natural language conditional with a true consequent is true. Conversely, the negative paradox exploits the fact that φ implies $\ulcorner\neg\varphi \supset \chi\urcorner$ classically. On the assumption of the material implication analysis then, any natural language conditional with a false antecedent is true. Although (5) is an example of this, we can without a doubt conjure up far more outlandish conditionals which will be true according to the material implication account but still strike us as intuitively false.[15]

For those reasons, no one seriously supports an undiluted material implication account nowadays. Nevertheless, one may find serious accounts in the literature which give a pragmatically enriched material implication semantics to a certain class of conditionals. Of those accounts, the most elaborate is undoubtably Jackson's account.[16] On Jackson's account, indicative conditionals agree with material implication in terms of truth conditions, but disagree in terms of their use conditions. Let us now briefly consider the rough details of Jackson's thesis.

As way of a prolog, let us first mention that Adams proposed an intuitive thesis according to which the so-called assertibility of a conditional $\ulcorner\varphi \rightarrow \chi\urcorner$ is the conditional probability of its consequent χ given its antecedent φ, $Pr(\chi|\varphi)$.[17] Quite often, the assertibility of sentences does, all things considered, seem to go by their subjective probability: the more likely we find the truth of some sentence

[15]Other classically valid inferences which also seem dubious for natural language conditionals include $\varphi \supset \neg\chi \vdash \chi \supset \neg\varphi$ (contraposition), $\varphi \supset \chi, \chi \supset \psi \vdash \varphi \supset \psi$ (transitivity), $\varphi \supset \chi \vdash (\varphi \wedge \psi) \supset \chi$ (antecedent strengthening), $(\varphi \wedge \chi) \supset \psi \vdash ((\varphi \wedge \neg\chi) \supset \psi) \vee ((\neg\varphi \wedge \chi) \supset \psi)$ and $\neg(\varphi \wedge \chi) \wedge (\varphi \supset \psi) \wedge (\psi \supset \sigma) \vdash (\varphi \supset \sigma) \vee (\psi \supset \chi)$. For concrete examples and further discussion, see for instance Priest (2008, §1), Priest (2009, §2.5) and Bennett (2003, §§2–3).

[16]See in particular Jackson (1979/1991, 1987). For other recent defences of a material implication analysis, see Smith (1983), Smith and Smith (1988), Grice (1989a), Rieger (2006) and Allott and Uchida (2009a, 2009b).

[17]See Adams (1965, 1966) and to some extent Adams (1975).

φ, the more appropriate it becomes for us to assert φ. For that very reason, we might suspect that the assertibility of conditional sentences does also go by their subjective probability. Once upon a time, at any rate, Stalnaker took that view quite seriously.[18] According to Stalnaker's thesis, the probability of a conditional $\ulcorner\varphi \rightarrow \chi\urcorner$ is merely the conditional probability of its consequent given its antecedent: $Pr(\varphi \rightarrow \chi) = Pr(\chi|\varphi)$. To considerable surprise, however, Lewis proved that on the supposition of Stalnaker' thesis, any language which has a universal probability conditional will be a trivial language.[19] Importantly, Lewis' results tell us that the truth conditions of conditionals cannot reasonably be spelled out in any terms akin to Stalnaker's thesis.

Despite this failure of Stalnaker's proposal, Jackson refuses to jettison Adams' thesis. After all, he claims, the intuitiveness of the thesis suggests that Adams might have been onto something important although it could not have been along the particular lines Stalnaker proposed. Jackson therefore conjures up an elaborate account of the assertibility of indicative conditionals, which is consonant with Adams' thesis yet independent from Stalnaker's proposal.

In order to understand Jackson's account, let us first consider the following pair of sentences:

(6) Hamlet is determined to avenge his father's death and balks upon finding King Claudius in prayer.

(7) Hamlet is determined to avenge his father's death but balks upon finding King Claudius in prayer.

While the two sentences intuitively agree in truth-conditions—they are true only if both conjuncts are true—there is still a stark difference in their meaning: while the former tells us that Hamlet is ready to avenge his father's death and that he finds Claudius in prayer, the latter also expresses something more. Namely, (7) expresses

[18] See Stalnaker (1970); see also Jeffrey (1964).

[19] Lewis (1976/1991). See also Lewis (1986/1991), Hájek (1989, 1994) and Hájek and Hall (1994).

a contrast between the two conjuncts which (6) does not: in spite of young Hamlet's raging intentions, he nonetheless hesitates upon finding his father's murderer praying.

We cannot possibly grasp the difference between (6) and (7) in terms of truth conditions alone. Rather, we must also understand when it is permissible to assert conjunctions with 'but' instead of 'and' and when it is not.[20] According to a widespread view, the substantive difference between (6) and (7) is that (7) implies something which (6) does not: namely, there is something quite extraordinary and improbable about the second conjunct given the first. More abstractly, (7) carries an implicature which (6) does not—or more precisely, 'but' carries a conventional implicature which (7) does not.[21]

According to Jackson, we are up against something quite similar in the case of indicative conditionals: indicative conditionals agree with material implication in their truth conditions but disagree in their assertibility conditions. So, what are the assertibility conditions of indicative conditionals? As we said before, Jackson suggests that Adams' thesis provides the answer to that question: the assertibility of an indicative conditional $\ulcorner\varphi \rightarrow \chi\urcorner$ is merely the conditional probability of its consequent χ given its antecedent φ. However, in order to account for this equivalence, Jackson introduces the notion of robustness.

So, what is robustness then? Given two sentences, α and β, which are similarly assertible, there may be some new information expressed by the sentence γ whose impact upon α can differ markedly from its impact upon β in terms of subjective probability. The introduction of α may, for instance, decrease $Pr(\alpha)$ while either increasing $Pr(\beta)$ or leaving it as it were. In such cases, we say that β is robust with respect to γ while α is not. For instance, consider and contrast the following two sentences:

(8) Hamlet is determined to avenge his father's death

(9) Hamlet balks at killing King Claudius in prayer.

[20] See Dummett (1973/1981, pp. 85–86).
[21] See Grice (1975/1989) and Sperber and Wilson (1986).

Let us assume that we assign a similar subjective probability to those sentences. Moreover, however, suppose we were to learn that:

(10) Hamlet believes that if he were to kill King Claudius in prayer, that would ease his soul's passage to heaven.

Normally, our subjective probability of (8) would then decrease considerably while our subjective probability of (9) would either remain the same or increase. In our earlier terms, (9) is robust with respect to (10) while (8) is not. And since we are already dealing with probabilities, we may state this more generally: the robustness of a given sentence α with respect to some other sentence β is the conditional probability of α given β or, if you will, $Pr(\alpha|\beta)$.

This brings us back to indicative conditionals. On Jackson's account, an indicative conditional carries the conventional implicature that the corresponding material implication is robust with respect to its antecedent. Therefore, the more robust that a material implication becomes with respect to its antecedent, the greater the assertibility of the corresponding indicative conditional will be. In other words, the assertability of an indicative conditional $\ulcorner\varphi \to \chi\urcorner$ is measured by the robustness of its corresponding material implication with respect to its antecedent, which again, as we said before, is simply $Pr(\varphi \supset \chi|\varphi)$. Moreover, since $Pr(\varphi \supset \chi|\varphi)$ may be simplified to $Pr(\chi|\varphi)$, the assertability of an indicative conditional $\ulcorner\varphi \to \chi\urcorner$ is simply $Pr(\chi|\varphi)$. And thus, all things considered, the closer $Pr(\chi|\varphi)$ gets to 1, the more appropriate it becomes to assert $\ulcorner\varphi \to \chi\urcorner$.

Finally, with this account of assertability in place, Jackson can maintain that inferences such as, say, the paradoxes of material implication are in fact valid: any indicative conditional with a false antecedent or true consequent is true although it might lack in assertability. And moreover, the squeamishness we feel when we are faced by sufficiently absurd conditionals with, say, false antecedents has nothing to do with their truth, but rather their lack of assertability. Importantly, Jackson can therefore maintain that indicative conditionals do have the truth conditions of a material implication despite alleged counterexamples.

In due course, we will return to Jackson's account and offer something to say against it. However, let us now turn to a different class of accounts altogether.

1.2.2 Possible World Accounts

Although Jackson holds a material implication account of indicative conditionals, he believes that a possible world account of some description is appropriate for subjunctive conditionals. The two most influential possible world semantic accounts for conditionals were offered by Stalnaker and Lewis.[22] Since there are many similarities between the two accounts, let us first spell out the most important details of Stalnaker's account and then turn to some of the more interesting differences between his and Lewis' accounts.

Stalnaker's account is motivated by the apparent failure of undiluted material implication to account for natural languages conditionals. Stalnaker starts out by emphasising Ramsey's insight as to how we evaluate conditionals: namely, that we add their antecedent temporarily to our stock of knowledge and then consider whether the consequent thereby becomes true or not.[23] To accommodate Ramsey's insight, Stalnaker proposes to use possible worlds as representatives of our stock of knowledge. On Stalnaker's account then, we evaluate conditionals by considering the possible world in which the antecedent is true but differs otherwise minimally from the actual world. And if the consequent is then true in that world, we say that the conditional is true but otherwise false.

For his purposes, Stalnaker extends Kripke's possible world framework. First, Stalnaker restricts the accessibility relation within his modal frames to reflexivity, symmetry and transitivity (which yields the system S5). In addition, however, Stalnaker also introduces a so-called selection function which he defines along the following lines:

$$f(\varphi, w) = \text{the world } w' \text{ most similar to } w \text{ in which } \varphi \text{ is true.}$$

[22] See in particular Stalnaker (1968) and Lewis (1973).

[23] Ramsey (1931, p. 247). We shall return to the issue of the so-called Ramsey Test at far greater length in later chapters.

We shall say more about similarity in a short while, but let us first notice two important details of this selection function. First, in the case where φ is true in w, $f(\varphi, w)$ is merely w. In other words, if φ is true in w, w is the most similar or closest φ-world to itself. Second, if there are no possible worlds in which φ is true, $f(\varphi, w)$ is λ. According to Stalnaker, λ is the so-called absurd world in which all formulae are true.

Having established his basic framework, Stalnaker then defines the truth conditions of conditionals as follows:

$$w \models \varphi > \chi \text{ iff } f(\varphi, w) \models \chi.$$

In other words, $\ulcorner \varphi > \chi \urcorner$ is true in world w if and only if χ is true in w's most similar φ-world.

A brief comment on the importance of the absurd world λ is in place at this point. Although Stalnaker does not explicitly say so, λ is a piece of semantic machinery posited as means for several different ends: in particular, to allow for the validation of vacuously true conditionals (whose antecedent is impossible) and to allow for a definition of alethic possibility and necessity in terms of conditionals:

$$\models \Box\varphi \text{ iff } \models \neg\varphi > \varphi.$$
$$\models \Diamond\varphi \text{ iff } \models \neg(\varphi > \neg\varphi).$$

Finally, before turning to Lewis' account, let us make a brief remark on the notion of similarity. According to Stalnaker, similarity is determined by the context of utterance. In other words, w's most similar φ-world $f(\varphi, w)$ is determined by certain elements of the context in which the conditional $\ulcorner \varphi > \chi \urcorner$ is uttered. Clearly then, $f(\varphi, w)$ can change from context to context, even such that in some appropriate contexts, the selection function yields values which suffice to provide truth conditions for indicative conditionals and in other contexts, truth conditions for the corresponding subjunctive conditionals.

Now, let us turn Lewis' account. Let us first note that while Stalnaker takes his semantics to be adequate for both indicative and subjunctive conditionals, Lewis only ever intended his semantics as an account for subjunctive conditionals; for indicative conditionals, Lewis did adhere to a material implication analysis along the lines of Jackson's account. Although the accounts differ on quite few points, we will restrict ourselves to two points which carry a special weight.

First, the accounts diverge on a crucial structural assumption: while Stalnaker assumes that there is always a unique most similar world, Lewis rejects that assumption. Nevertheless, Stalnaker and Lewis both agree that if w is a φ-world, then w's most similar φ world is w alone. However, if w itself is not a φ-world, there can be a number of φ-worlds which are all most and equally similar to w according to Lewis, while according to Stalnaker, there is only ever one. In other words, Stalnaker takes the similarity ordering of possible worlds to be a total ordering with a minimal element (which is the world of evaluation) and a maximal element λ, while Lewis takes the ordering to be partial ordering with so-called similarity spheres of equal similarity, but also with a minimal element and a maximal element λ.

Second, there is another crucial structural difference between Stalnaker's and Lewis' systems. While Stalnaker builds his system upon a so-called limit assumption, Lewis rejects that assumption. Quite roughly, the limit assumption states that there will always be a most similar world. According to the limit assumption, the similarity ordering of worlds is discrete. Once that assumption is suspended, however, the similarity ordering is potentially continuous. In other words, on Lewis' account, there might not be any most similar φ-world to w because for any given similar φ-world w', there will always be another more similar φ-world w''. Lewis' motivation for rejection of the limit assumption is rather intuitive. Suppose we were interested in the similarity ordering induced by the proposition 'Shakespeare was born sooner (than he actually was)' and that time was in fact continuous: although we might come up with a quite similar world w' in which Shakespeare was born an instant earlier that he was in the actual world w, there will always be another even closer world w'' in which he was born later than in w' but still sooner than in w' (assuming a sufficient precisification of the predicate 'was born').

Needless to say, these structural differences yield different logics. Most famously, since there will always be a unique closest φ-world on Stalnaker's account, $\ulcorner \varphi > \chi \urcorner$ will be either true or false at any w, as χ either obtains at $f(\varphi, w)$ or not. Stalnaker's semantics therefore validate the so-called law of conditional excluded middle (CEM):[24]

$$\models (\varphi > \chi) \vee (\varphi > \neg\chi).$$

From CEM we can infer that if $\ulcorner \varphi > \chi \urcorner$ is false, $\ulcorner \varphi > \neg\chi \urcorner$ is true, and conversely. In Lewis' case, CEM does not hold universally for there might well be, for some given φ and w, more than one most similar φ-worlds, some in which χ is true and some in which χ is false.

So, why would Lewis lessen Stalnaker's total order constraint and thereby reject CEM? Lewis argues that CEM is an implausible principle because of conditionals such as the following:[25]

(11) If Hamlet and Don Quixote had been characters in the same work of fiction, then they would have been characters in Shakespeare's *Hamlet*.

Intuitively, this conditional is false: there is nothing that suggests that Hamlet and Don Quixote must have been characters of Shakespeare' *Hamlet* had they been characters of the same work of fiction. However, if (11) is false, CEM tells us that the following conditionals must be true:

(12) If Hamlet and Don Quixote had been characters in the same work of fiction, then they would not have been characters in Shakespeare's *Hamlet*.

However, intuitively, this conditional strikes us as false as (11): there is nothing that suggests that Hamlet and Don Quixote could not have been characters in Shakespeare' *Hamlet* had they been characters of the same work of fiction. In fact, we have a good reason to suspect that there some most similar worlds in which Hamlet and Don Quixote are characters in the same work fiction in which they are characters of

[24]However, according to Stalnaker, there might be several equally appropriate selection functions available in any given context. According to some admissible selections functions, the closest φ-world might be a χ-world, while according to others, the closest φ-world might be a $\neg\chi$-world. In those cases, the truth-value of $\ulcorner \varphi > \chi \urcorner$ in the given context would be a product of a super-evaluation of all the admissible selection functions. For further information, see Stalnaker (1981).

[25]Lewis (1973, pp. 79–81).

Shakespeare's *Hamlet* and also, say, in which they are characters of Cervantes' *Don Quixote*.

Although much more can be said about other differences between the two systems, let us rest our case here and move on to several outstanding semantic issues of natural language conditionals.

1.3 Semantic Issues of Natural Language Conditionals

As we said at the onset, this thesis deals with several important semantic issues of natural language conditionals. We will now briefly introduce each of the issues which we shall concern ourselves with in the following four chapters.

1.3.1 Conditionals & Truth Values

An important semantic issue of natural language conditionals concerns whether they have truth conditions or not. In particular, there are suasive arguments in the literature to the effect that indicative conditionals cannot have truth values.

Since that conclusion is somewhat bewildering, we shall examine the argument closer in a chapter of its own. We will consider several ways in which we can respond to the argument and eventually present a contextually sensitive semantic framework which allows us to escape the argument and hold onto truth conditions for indicative conditionals.

1.3.2 The Indicative/Subjunctive Distinction

The indicative/subjunctive distinction is very widespread in the literature. Nonetheless, there seems to be no general consensus over its details. In particular, although nearly everyone accepts the distinction, there is no real agreement about where to draw the indicative/subjunctive line. An adequate answer to that question has significant importance to the semantics of natural language conditionals since an understanding of the nature of the indicative/subjunctive distinction will doubtlessly tell us something about what lies on either side of the line.

We will therefore devote an entire chapter to giving an answer to the question of where to draw the line. We will go through several proposals which may be found in the literature and argue that they are all inadequate on different accounts. We will then offer our own proposal according to which the distinction has to do with the sort of suppositions conditionals are uttered to express.

1.3.3 Semantics for Conditionals

Based on the distinction we proposed in the previous chapter, we will offer fully developed semantics in a chapter of its own. We will start off by an examination of two different sort of suppositions and then show how they each correspond to different sorts of conditionals. We will then offer semantics for both sorts of conditionals based on the sort of suppositions which they are uttered to express. Consequently, we shall offer an analysis of the syntax of conditionals in English which we shall then use as an input into generative grammar semantics. Finally, we shall provide a fully compositional semantics for conditionals in generative grammar based on the suppositional analysis we gave before.

1.3.4 Inference Rules for Conditionals

Since conditionals often play an important role in our reasoning, the logic of conditionals is of considerable importance from philosophical and logical points of view. Arguably, inference rules do confer some degree of meaning to logical connectives. And if we agree that natural language conditionals are some sort of logical connectives, the relevant inference rules are of semantic importance. *Modus (Ponendo) Ponens* (MPP) tells us that a conditional and its antecedent jointly imply its consequent. Quite intuitively, MPP seems like a reasonable elimination rule for natural language conditionals. Nevertheless, there are very convincing counterexamples to MPP which suggest that this apparent intuitiveness is spurious.

Since that strikes us as somewhat incredible, we will devote an entire chapter to those counterexamples and attempt to save the honour of MPP. We will first consider several solutions which have hitherto been offered to the counterexamples and argue that they are all inadequate. We will then offer our own solution which entails that the semantics of embedded natural language conditionals is more sophisticated than their surface syntax indicates.

2 And if not True or False?

So-called Gibbard Phenomenon cases have been used to argue that indicative conditionals construed in terms of the Ramsey Test cannot have truth values. Since that conclusion is somewhat incredible, several alternative options are explored. First, the assumption that indicative conditionals require semantics in terms of the Ramsey Test is suspended and material implication semantics offered in its place. Although a proposal of that sort offers a way out, it is argued to be wanting on different grounds. Second, one of the premises of the Gibbard Phenomenon argument is questioned and temporally suspended. Although that move turns out to be viable in principle, it has some rather questionable consequences on account of which a more context sensitive solution seems to be called for. Third, another attempt to escape the Ramsey Test is made by suggesting a relation between indicative conditionals and epistemic modals. However, the epistemic modal analysis is argued to come short on account of an over-generation. Finally, a contextualised revision of the Ramsey Test is offered which sails successfully past the threats of the Gibbard Phenomenon. Consequently, several technical details of the solution are addressed in appendixes.

2.1 Preamble: The Gibbard Phenomenon

Rumour has it that certain natural language conditionals are altogether devoid of truth values. Nay, contrary to expectations, the conditionals in question are neither expressed in imperative nor interrogative moods. As it happens, those peculiar conditionals are not even cast in the somewhat mysterious subjunctive mood. No, in fact, these conditionals are supposed to find their expression in the only mood in which we ever consistently give expressions to matters of fact: the indicative mood.

To avoid confusion, let us emphasise that there is quite more to the rumour than that some indicative conditional are neither true nor false, while others might well be either. That, arguably, would not be an entirely unacceptable position. Rather, the claim that we are up against is that indicative conditionals are never either true or false. Truth and falsity, as it were, are not properties to be had by indicative conditionals. And so, since indicative conditionals do not possess truth values, an issue of truth conditions does not even arise.

Understandably, this rumour might strike us as somewhat incredible.[1] In fact, beside the nagging intuition, we have several immediate and naïve reasons to balk at any such claim. One reason is that in general, perhaps with the odd exception of moral or aesthetic value judgements, we take sentences whose verbs are in the indicative mood to possess truth values of some sort. Therefore, supposing we already have a sentence which possesses a truth value, it would be mysterious that an affixation of a mere adverbial phrase would deprive the sentence of truth values altogether. Another reason is that indicative conditionals seem to behave in reasoning much like other sentences: we may use them as our premises, we may reach them as our conclusion and we may even question the validity and soundness of our arguments on the basis of them. And finally, we would inevitably find ourselves compelled to wonder: if neither truth nor falsity becomes indicative conditionals, then what does?

We might therefore reasonably ask ourselves, is there any ground for this extraordinary rumour? To our astonishment, yes, there is arguably a quite good ground to it. As a matter of fact, the best argument for the claim that indicative conditionals lack truth value involve the so-called Gibbard Phenomenon. Let us begin by rehearsing a case which instantiates this phenomenon.[2]

[1] See for instance Lycan (2001) and Bennett (2003).

[2] Cases of this kind ware first identified by Gibbard (1981, pp. 226–232). More convincing cases may be found in Warmbrod (1981, 1983). The case that follows is an adaptation of a more

Suppose that Hamlet and Horatio have slyly engaged themselves in espionage to uncover Claudius' malicious subterfuge. From a nook of Elsinore Castle, Hamlet spies Claudius conspiring with Laertes, Rosencrantz and Guildenstern. Although the scene is only partially visible to young Hamlet from his hiding place, he clearly sees Laertes leaving the room and then overhears Claudius instructing someone to assassinate him. Hamlet does, of course, not know whom Claudius commanded to commit the deed but he knows, without any serious doubt, that it must have been either Rosencrantz or Guildenstern. It seems, therefore, that Hamlet is justified both in believing and even asserting that:

(1) If Rosencrantz was not instructed to assassinate Hamlet, Guildenstern was.

Meanwhile, hidden in another cranny of Elsinore Castle, Horatio witnesses the same scene from a different, yet equally limited perspective. Contrary to Hamlet, Horatio observes Guildenstern leaving the room and then overhears in turn Claudius' instruction to someone for Hamlet's assassination. And so, much like in Hamlet's case, it seems that Horatio is justified both in believing and asserting that:

(2) If Rosencrantz was not instructed to assassinate Hamlet, Laertes was.

(Since we will be concerned with the same example awhile, let us reserve the propositional letters g, l, and r to denote the following propositions: g for 'Guildenstern was instructed to assassinate Hamlet', l for 'Laertes was instructed to assassinate Hamlet' and r for 'Rosencrantz was instructed to assassinate Hamlet'.)

But now we seem to be in a peculiar bind. Namely, Hamlet and Hortio both seem to be right in their beliefs: they did both correctly observe the scene from their different—albeit limited—view points. However, how can (1) and (2) ever be simultaneously true? Indeed, while (1) appears to be of the form $\ulcorner \neg r \rightarrow g \urcorner$, (2) appears to be of the form $\ulcorner \neg r \rightarrow l \urcorner$. Moreover, since l (non-vacuously) entails the negation of g in this particular case, $\ulcorner \neg r \rightarrow l \urcorner$ entails $\ulcorner \neg r \rightarrow \neg g \urcorner$. Furthermore, given our most intuitive understanding of so-called indicative conditionals, $\ulcorner \neg r \rightarrow$

recent version from Edgington (1997, pp. 106–107).

$g^\urcorner$ and $^\ulcorner\neg r \rightarrow \neg g^\urcorner$ cannot possibly be true together: $^\ulcorner\neg r \rightarrow g^\urcorner$ and $^\ulcorner\neg r \rightarrow \neg g^\urcorner$ are contraries. And so, since $^\ulcorner\neg r \rightarrow g^\urcorner$ and $^\ulcorner\neg r \rightarrow \neg g^\urcorner$ are contraries, (1) and (2) are contraries. This has the look and feel of a real predicament. Yes, in fact, this is an instance of the notorious Gibbard Phenomenon.

2.2 Coming to Terms with the Gibbard Phenomenon

What are we supposed to infer from Gibbard Phenomenon cases? Some have argued that cases of that sort show us that conditionals such as (1) and (2) must lack truth values altogether under pain of a contradiction.[3] The argument may be roughly summarised along the following lines:

> First, if two statements are compatible, it can be correct to accept both simultaneously. For consistent A, and any B, no one accepts both "If A, B" and "If A, $\neg B$" simultaneously (except perhaps by oversight): rather, to accept "If A, B" is to reject "If A, $\neg B$". Therefore, "If A, B" and "If A, $\neg B$", cannot both be true. But second, we can find cases like this: one person, X, accepts "If A, B", for completely adequate reasons, while another, Y, accepts "If A, $\neg B$" for completely adequate reasons. In a good Gibbard case, there is perfect symmetry between X's reasons and Y's: no case can be made for saying one is right and the other wrong. Neither makes any mistake: no case can be made for saying both their judgements are false. So: their judgements can't both be true, and can't both be false, nor can it be that just one of them is false. Truth and falsity are not suitable terms of assessment, in such cases.[4]

Although Edgington's passage gives us a clear picture of the argument, one of its assumptions is worth a special emphasis. According to the argument, for any

[3] In particular Edgington (1985/1991, 1995, 1997). Similar claim regarding subjunctive conditionals is made in Edgington (2008). See also Adams (1975), Bennett (2003) and Gibbard and Harper (1981).

[4] Edgington (1997, p. 107).

consistent φ, $\ulcorner\varphi \rightarrow \chi\urcorner$ and $\ulcorner\varphi \rightarrow \neg\chi\urcorner$ constitute a contradiction.[5] That claim is made because indicative conditionals are assumed to deserve semantics roughly in terms of what has become to be known as the Ramsey Test. The Ramsey Test is inspired by the following, oft-quoted passage:

> If two people are arguing 'If p, will q?' and are both in doubt as to p, they are adding p hypothetically to their stock of knowledge and arguing on that basis that q; so that in a sense 'If p, q' and 'If p, $\sim q$' are contradictories.[6]

Although Ramsey's words do not offer us detailed instructions, they describe a procedure—commonly known as the Ramsey Test—for evaluating $\ulcorner\varphi \rightarrow \chi\urcorner$ somewhere along the following lines: First, add φ hypothetically to our 'stock of knowledge', then adjust any other beliefs we hold accordingly to maintain consistency, and then finally assess the truth of χ in the light thereof. In other words, the Ramsey Test predicts that the truth conditions of an indicative conditional are roughly as follows:

> **Indicative Conditional (Ramsey Test Analysis)**
> $\ulcorner\varphi \rightarrow \chi\urcorner$ is true iff χ comes out as true after adding φ hypothetically to a stock of knowledge and adjusting for consistence accordingly.

Notice that much more could and probably should be said about the nature of so-called stocks of knowledge and the mechanics of adjustments but we will let that pass for the time being.[7] Furthermore, notice too that although 'stock of knowledge' is a helpful metaphor, we should be careful not to get carried away. Indeed, whether a stock of knowledge is supposed to consist of knowledge alone or whether it may also contain beliefs or something even weaker is subject to serious discussion. In the literature, one sometimes encounters other helpful metaphors—web of beliefs, epistemic, doxastic or information states and knowledge or belief bodies, bases and

[5] Hereafter we will use lowercase Greek letters (φ, χ, ψ, …) as meta-variables which range over (well formed) formulae. In contrast, lowercase Roman letters (p, q, r, …, g and l) are used for either propositional constants or variables unless specified otherwise.

[6] Ramsey (1931, p. 247).

[7] The issue will be revisited in §2.6 and Appendix A.

boxes—which are often supposed to have a function akin to stocks of knowledge. However, to allow us to start with a clean slate, free of the connotations associated with any of those terms, let us hereafter use the neutral term 'information network' for our purposes. Needless to say, that term is no less of a metaphor than any of the other. Nonetheless, our metaphor suggest that the information in question, be it knowledge, beliefs or whatnot, has some sort of structure and coherence to it, both of which we assume as fundamental features of our information networks.

Perhaps even more importantly, it is also worth emphasising three important and closely related facts which pertain to the Ramsey Test. First, unless χ is already in our information network and the introduction φ has no effect thereupon, there must be some sort of a relation—which we allegedly unravel through a process of consistency maintenance—between φ and χ in order for us to evaluate $\ulcorner\varphi \rightarrow \chi\urcorner$ positively. Second, if φ already constitutes our information network, our judgement of $\ulcorner\varphi \rightarrow \chi\urcorner$ depends entirely on whether χ already does so too. Finally, if χ is already part of our information network and the addition of φ has no effect on χ's standing with our information network, $\ulcorner\varphi \rightarrow \chi\urcorner$ will be positively evaluated, as it were, vacuously.

Intuitively, the Ramsey Test has certain plausibility. In fact, given but a minute thought about indicative conditionals, we soon come to the conclusion that there is a certain doxastic, if not epistemic, flavour to them. In particular, it is that very flavour which the test is supposed to capture. In fact, that claim is probably too weak: when we encounter an indicative conditional, we evaluate its plausibility precisely by hypothetically adding its antecedent to our information network and arguing thereupon whether the consequent obtains or not. In other words, the Ramsey Test seems to be integral to the meaning of indicative conditionals.

Now, if we were to agree that the Ramsey Test is essential to the semantics of indicative conditionals, we would have to address the following conundrum: how can (1) and (2) ever be true together? Indeed, if the Ramsey Test is right, (1) and (2) cannot possibly be true together! Moreover, for similar reasons, (1) and (2) cannot both be false either. In fact, towards the same conclusion, a further argument might be made: since neither Hamlet nor Horatio commit any fallacy in their reasoning, we cannot claim that (1) and (2) are false. Finally, since Hamlet and Horatio arrive at their conclusions by entirely equivalent means, it would be completely arbitrary and devoid of any justification to take one be true and the other to be false. Therefore, the argument intermediately concludes, (1) and (2) are neither true nor false. And moreover, perhaps either because any indicative conditional can be made subject to the Gibbard Phenomenon or simply because excluding a particular class of indicative conditionals from truth values while not another would be somewhat whimsical, indicative conditionals in general can have no truth values. Alas, this is the argument from the Gibbard Phenomenon.

We might of course balk and claim that to reject truth values for indicative conditionals might seem somewhat rash response to the Gibbard Phenomenon. Surely, some other options must be available. For instance, one viable option seems to be to accept that (1) and (2) are in fact true despite appearances to the contrary. Another option would be to suggest different sort of semantics for indicative conditionals. Indeed, although the Ramsey Test might have an intuitive plausibility, perhaps the Gibbard Phenomenon merely shows us that any such semantics cannot be maintained. And yet another strategy would be to contextualise the truth conditions of indicative conditionals such that (1) and (2) would both be true although only within their respective contexts.[8] Before considering those possibilities in turn, let us digress awhile and consider a somewhat maverick yet quite respectable semantic account of indicative conditionals which seems to promise an easy way out of our bind.

2.3 Interlude: Material Implication

An apparent way out of our bind would be to claim that natural language indicative conditionals have truth conditions akin to the material implication:

[8] See, for instance, Gibbard (1981), Jackson (1990) and Stalnaker (1984).

Indicative Conditional (Material Implication Analysis)
$\ulcorner\varphi \rightarrow \chi\urcorner$ is true iff $\ulcorner\varphi \supset \chi\urcorner$ is true.

Indeed, if we take (1) and (2) to be of the forms $\ulcorner\varphi \supset \chi\urcorner$ and $\ulcorner\varphi \supset \psi\urcorner$ respectively, the paradox dissolves. As long as φ is false, $\ulcorner\varphi \supset \chi\urcorner$ and $\ulcorner\varphi \supset \neg\chi\urcorner$ are both true. In fact, that prediction is well in tune with our expectations: while Hamlet witnessed Laertes leaving the scene, Horatio saw Guildenstern abstract himself, leaving Rosencrantz alone to receive Claudius' malicious instructions: $\ulcorner\neg r\urcorner$ must be false if $\ulcorner\neg r \supset g\urcorner$ and $\ulcorner\neg r \supset l\urcorner$ are true.

Moreover, upon this construal of natural language indicative conditionals, (1) and (2) would agree in their truth conditions with $\ulcorner r \vee g\urcorner$ and $\ulcorner r \vee l\urcorner$ respectively. On the supposition that the truth conditions of natural language disjunctions coincide in some cases with classical extensional disjunction, that seems quite in harmony with our natural understanding of (1) and (2): Hamlet and Horatio could as well have expressed their respective thoughts as 'either Rosencrantz or Guildenstern were instructed to assassinate Hamlet' and 'either Rosencrantz or Laertes were instructed to assassinate Hamlet'. For this reason, we might be further tempted to claim that indicative conditionals deserve semantics in terms of the material implication.

That would be too rash. For various reason, the material implication alone cannot reasonably account for indicative conditionals. For instance, the two so-called paradoxes of material implication provide us with an ample argument.[9] The class of the so-called negative paradoxes of material implication exploit that φ classically implies $\ulcorner\neg\varphi \supset \chi\urcorner$. And since the meta-variable χ may be substituted with any well-formed formula, there is literally no end to uncomfortable conditionals we might generate. For instance, suppose that Claudius did in (fictional) fact instruct Rosencrantz to assassinate Hamlet. According to the material implication analysis, we would then be entitled to infer the following two jointly contradictory conditionals:

(3) If Rosencrantz was not instructed to assassinate Hamlet, someone else was.

[9] For several other arguments, see for instance Priest (2001, §1) and Priest (2009, §2.5).

(4) If Rosencrantz was not instructed to assassinate Hamlet, no one else was.

Worse yet, we are entitled to infer any conditional whatsoever which has the same antecedent as (3) and (4), no matter how absurd or far-fetched its consequent may seem, whether in isolation or in the context of the antecedent.

Conversely, the class of the so-called positive paradoxes of material implication exploit that φ also classically implies $\ulcorner \chi \supset \varphi \urcorner$. Again, since the meta-variable χ may be substituted with any well-formed formula, we may infer, say, the following conditional:

(5) If no one was instructed to assassinate Hamlet, Rosencrantz was instructed to assassinate Hamlet.

Worse yet, again, we are in fact entitled to infer an infinite number of conditionals that share their consequent with (5), no matter how ridiculous or preposterous their antecedent may otherwise seem.

Intuitively, however, that is quite incredible: (3) and (4) contradict one another and (5) strikes us as equally absurd because it contradicts itself. Indeed, our natural reaction to those conditionals is quite contrary to that which the material implication account suggests: our intuition is that that those conditionals are false or neither true nor false at best. So, despite its success with the Gibbard Phenomenon, the material implication account seems to make grossly inappropriate predictions in other cases.

But as we well know, we would be fools to dismiss the material implication account without a further consideration. Serious attempts to preserve the view from the paradoxes of material implication and various other counterexamples that have been made. According to the most elaborate attempt, indicative natural language conditionals accord with the material implication in their semantic aspect yet differ in pragmatic qualities.[10] Thus, in fashion akin to the behaviour of 'and' and 'but' in colloquial English, the indicative conditional and the material implication are supposed to agree in truth conditions but disagree in use conditions.

[10] See Grice (1975/1989, 1989a) and Jackson (1979/1991, 1987).

According to the account, the so-called assertibility of a non-conditional sentence φ is determined by its probability $Pr(\varphi)$. However, in the case of an indicative conditional $\ulcorner\varphi \rightarrow \chi\urcorner$, the assertibility is determined by the probability of its consequent given its antecedent, $Pr(\chi|\varphi)$, such that the closer $Pr(\chi|\varphi)$ is to 1, the more appropriate it would be to assert $\ulcorner\varphi \rightarrow \chi\urcorner$ all other things considered.[11] A further condition for assertion, which moreover excludes awkward cases involving necessary true antecedents and consequents, would be that $Pr(\chi|\varphi)$ must be strictly greater than $Pr(\chi)$. And so, since the mixed conditionals above are arguably bereft of assertibility, they strike us as false although merely inappropriate yet true. In other words, according to this account, (3), (4) and (5) are in fact true but they give us the contrary impression because of their lack of assertibility.

That sort of move would be desirable if only viable. Even if we agree, for the sake of the argument, that (3), (4) and (5) want in assertibility, we may well come up with intuitively false natural language indicative conditionals which are true according to the material implication account yet suffer no deficiency of assertibility as earlier contrued. We all know that $\ulcorner\varphi \supset \chi\urcorner$ is true iff φ is false or χ is true. In particular, as we saw from the negative paradox of material implication, whenever φ is false, $\ulcorner\varphi \supset \chi\urcorner$ is true. $\ulcorner\varphi \supset \chi\urcorner$ would thus be true even in cases where φ and χ are substituted for some contingently false propositions. In particular, $\ulcorner\varphi \supset \chi\urcorner$ would be true even when φ and χ are false and $Pr(\chi|\varphi)$ is both greater than $Pr(\chi)$ and sufficiently close to 1. Needless to say, our crux is to find a false indicative conditional satisfying those criteria.

Following is a counterexample of the appropriate sort which has gone unnoticed in the literature until now. Suppose that Hamlet and Horatio have gotten together for a game of dice. Hamlet has just cast a (fair six-sided) die which subsequently landed with the number three facing up. According to the material implication account, the following conditional is true since its antecedent and consequent are both false:

[11] See in particular Jackson (1979/1991, 1987). To avoid misunderstanding, it is worth to point out that there is no probability analysis of this sort in Grice (1989a) although a material implication account is espoused.

(6) If Hamlet rolled an even number, he rolled either two or four.

Furthermore, since the probability of the consequent given the antecedent is $\frac{2}{3}$—and moreover, the probability that Hamlet rolled two or four is strictly less than the probability of that given that Hamlet rolled an even number—we may suspect that the conditional is quite assertible. However, our natural language intuition tells us that the conditional is false because Hamlet might very well have rolled the number six if he rolled an even number. In other words, we have an intuitively false indicative conditional which the material implication account claims to be true and which suffers no deficit of assertibility as construed by Jackson. Bad news?

No, the proponent of the material implication account might well respond that a conditional probability of $\frac{2}{3}$ is not sufficient for assertion and that that is the actual reason for our squeamishness. In that case, we may simply suppose that Hamlet and Horatio are playing with a fair n-sided die (where n is some even number greater than 2). Still, according to the material implication account, the following conditional would be true since both its constituents are false:

(7) If Hamlet rolled an even number, he rolled either two or ... or n-2.

Hamlet, recall, rolled three, which is neither an even number nor in particular among the numbers two, ..., and n-2. However, the probability that Hamlet rolled two or ... or n-2 given that he rolled an even number is $\frac{n-2}{n}$. In that case, the conditional probability gets ever closer to 1 as n grows toward ∞. Yet, no matter how large n may become, we still have a sinking feeling about (7) because even if Hamlet rolled an even number, there is always ever so slight possibility that he rolled the number n. In other words, our intuitions and the semantic predictions of the material implication account seem to come apart in the case of (7). This time, however, our intuitions about truth value cannot be explained by limited assertibility.

This result is open to at least two different interpretations. On the one hand, we could infer that the counterexample shows that probability and assertibility are not as closely knit as the account proposes. In that case, the account fails to offer an explanation as to why certain conditionals like (7) lack assertibility. On the other hand, we could claim that probability does in fact coincide with assertibility and infer that conditionals such as (7) do actually show that the truth conditions of indicative conditionals and material implications do actually come apart. And so, the material implication account of conditionals is not suited for a semantic theory of indicative conditionals. Either way, the account seems to be in a bind.

Perhaps, a reply open to the proponent of the account is to claim that although high probability is not sufficient for assertibility, low probability is sufficient for unassertibility. However, without adding further epicycles to the account, we must conclude that the semantics of indicative conditionals will not be accounted for in terms of the material implication. In other words, the way out promised by the material implication account has turned out to be spurious.

However, if we were now to revert to semantics which involve the Ramsey Test, we are again haunted by the Gibbard Phenomenon. The following should therefore be clear: if we want to hold on to the Ramsey Test, something else has to give. An unhappy resort would be to rid indicative conditionals of truth values altogether.[12] Another option would be to argue that (1) and (2) are not true despite appearances to the contrary. Let us consider that possibility next.

2.4 Opposing the Obvious

Although no one has made serious attempts to that effect before, we might argue that sentence pairs such as (1) and (2) are not true in spite of appearances to the contrary. Although we said earlier that (1) and (2) are contraries, they do not strike us intuitively as subcontraries: indeed, given our intuitive understanding of natural language indicative conditionals, (1) and (2) may logically be false together. To see why, simply assume that Horatio held (2) and Hamlet (1): our immediate reaction is that they are both mistaken. However, before giving any argument to the effect that (1) and (2) are false, we must first offer an explanation as to why those condi-

[12] Again, see in particular Edgington (1985/1991, 1995, 1997).

tionals do strike us as blatantly true. One such error theory might be constituted by the fact that the information networks involved are incomplete with regard to the relevant facts. In particular, in any genuine Gibbard Phenomenon case, the two conditionals may seem reasonable, assertable, true and whatnot to the agents involved. However, to anyone in possession of a relevantly complete information network, the conditionals in question would appear as they really are.

Turning back to Hamlet and Horatio. From their respective points of view, given the information they have gathered from their nook and cranny of Elsinore Castle, their beliefs and assertions of (1) and (2) certainly seem justified and warranted. However, if they had had all the relevant information at hand—in particular, that both Guildenstern and Laertes left the room before Claudius gave expression to his malevolent command—we would expect them to revise their beliefs and even retract their assertions.

Importantly, anyone who would have witnessed the scene from a more omniscient point of view would have seen Guildenstern leaving through one door and Laertes through another before Claudius instructed Rosencrantz to assassinate young Hamlet. However, since Hamlet and Horatio were neither in view of all of the relevant events, they are both, as it were, epistemically impoverished. Interestingly enough, despite their impoverishment, they are both in position to justifiably believe (1) and (2) respectively. For that reason, we are probably inclined to accept (1) and (2) as true. However, as we well know, rational agents may well hold justified yet false beliefs.

Let us consider what is likely to conspire when Hamlet and Hortatio reunite. In all likelihood, poor terrified Horatio would forewarn Hamlet of his imminent assassination, advise him to remain wary of Rosencrantz and Laertes and then add something along the lines of (2). As we know, the rumour of his looming death is no news to Hamlet. However, since Hamlet, from his nook, himself witnessed Laertes leaving the scene, he would be somewhat perplexed by Horatio's advise: Laertes could not possibly have been instructed to assassinate Hamlet. Were Hamlet to explain that to Horatio, the fact would eventually dawn upon these lads that Claudius could only have instructed Rosencrantz to assassinate Hamlet. At the point, two things are likely to have transpired. First, Hamlet and Horatio would have suspended their beliefs of (1) and (2) respectively. Second, Hamlet's and Horatio's information networks would encompass the fact that Claudius gave the instruction to Rosencrantz and not to Guildenstern or Laertes.

Therefore, once Hamlet and Horatio have gathered all the information relevant to the case at hand, it seems that they would suspend their earlier beliefs of (1) and (2). And so, we could conclude: (1) and (2) were never true to begin with, they only gave the wrong impression that they were because they could be correctly reasoned from incomplete information networks.

However, there is a minor wrinkle: if (1) and (2) are not true, what are they then? False? If the Ramsey Test, as construed earlier, suffices to ground semantics for indicative conditionals, how could (1) and (2) ever be false together? Upon adding a conditional's antecedent to a relevantly complete information network, the consequent will turn out to be true, false or neither. Indeed, according to the Ramsey Test, when we consider a conditional $\ulcorner\varphi \rightarrow \chi\urcorner$, we add φ to our information network and adjust to maintain consistency. If such operation entails a change of χ, the value of $\ulcorner\varphi \rightarrow \chi\urcorner$ would reflect that. Otherwise, if the operation does not reach all the way to χ, $\ulcorner\varphi \rightarrow \chi\urcorner$ would take whichever value χ had already: true if χ was in the information network, false if $\ulcorner\neg\chi\urcorner$ was there and neither if there was no information about χ beforehand. Importantly, there is no possible consistent information network against which $\ulcorner\varphi \rightarrow \chi\urcorner$ and $\ulcorner\varphi \rightarrow \neg\chi\urcorner$ would be either both true or both false. At best, if the introduction of φ forces χ to be neither true nor false, or if χ was not in the information network to begin with and the introduction of φ had no effect thereupon, then $\ulcorner\varphi \rightarrow \chi\urcorner$ and $\ulcorner\varphi \rightarrow \neg\chi\urcorner$ would arguably both be neither true nor false.

If we insist on maintaining that (1) and (2) are false, a way around that problem would be to pay a closer heed to Ramsey's directions: 'If two people are arguing "If p, will q?" and *are both in doubt as to p*, they are adding p hypothetically to their stock of knowledge and arguing on that basis that q'.[13] If both agents are in

[13] Ramsey (1931, p. 247, my emphasis).

doubt as to φ when considering $\ulcorner\varphi \rightarrow \chi\urcorner$, the Ramsey Test applies. What then if there is no doubt as to φ? Here is a suggestion: if φ is already in our information network, let $\ulcorner\varphi \rightarrow \chi\urcorner$ receive whichever truth value χ has; otherwise, if $\ulcorner\neg\varphi\urcorner$ is in our information network, let $\ulcorner\varphi \rightarrow \chi\urcorner$ be false. In particular, once Hamlet and Horatio had realised that Claudius instructed Rosencrantz to assassinate Hamlet, (1) and (2) would come out as false.

Whether this proposal squares well with linguistic data is a moot point. Nonetheless, the proposal has a certain intuitive plausibility as indicative conditionals whose antecedent we already take to be false strike some of us as inappropriate.[14] However, whether that intuition is prevalent is a matter of dispute because we seem to be well disposed to evaluate indicative conditionals whose antecedents are either believed or even known to be false. The class of so-called Dutchman conditionals might arguably provide an example. Another class of potential examples might be indicative conditionals which are uttered to express (assumed) laws of one sort or another, say, logical, mathematical, metaphysical, physical and whatnot: for instance, even to the opponent of intuitionistic logic, it would be true that if intuitionistic logic is correct, the law of excluded middle fails, and false that if intuitionistic logic is correct, the law of excluded middle holds. A third class of examples might be argued to consist of indicative conditionals which we take to be true despite false antecedents and apply for the sake of persuasion by proofs by contradiction: say, I might know that φ is true and wish to persuade you of that fact; in that case, an option for me might be to argue for $\ulcorner\neg\varphi \rightarrow \chi\urcorner$ and $\ulcorner\neg\chi\urcorner$ and thus convince you that $\ulcorner\neg\varphi\urcorner$ leads to contradiction and that φ must be true. Cases of those sorts seems to suggest that we cannot reasonably maintain that indicatives whose antecedents are false in our information networks are themselves false.

Furthermore, we cannot either maintain that indicative conditionals whose antecedent we know to be false are themselves neither true nor false. Indeed, intuitively, some such conditionals are quite simply true. It seems, therefore, that the proposed revision of the Ramsey Test is not going to help us at all, whether we

[14] See for instance Gillies (2009, 2010).

claim that $\ulcorner\varphi \rightarrow \chi\urcorner$ is false or neither true nor false against an information network which contains $\ulcorner\neg\varphi\urcorner$.

So, it therefore seems that we cannot reasonably maintain that (1) and (2) are both false. A more promising proposal could be to claim that (1) and (2) are neither true nor false together. As a matter of fact, that sits quite well with our initial understanding of the Ramsey Test whereby we evaluate indicative conditionals by inserting their antecedents into our information networks irrespective of whether the antecedent or its negation are there already.

Let us illustrate. For our present purposes, it will suffice to represent information networks as a set of propositions which might and which might not be closed under some basic logical operations. Thus, once Hamlet and Horatio have conferred, their relevantly complete information network may be represented by the set $\{\neg g, \neg l, r, \ldots\}$ (where g, l and r denote the same propositions as before). Moreover, we may also reasonably suspect that their information network contains something to the effect that Claudius did instruct exactly one of the three scoundrels to assassinate Hamlet, say, something along the lines of $\ulcorner(g \veebar l \veebar r) \wedge \neg(g \wedge l \wedge r)\urcorner$ or equivalent.[15] In order to represent that unwieldy formula more articulately, let us reserve the propositional letter u to express the uniqueness claim.

When Hamlet and Horatio then come to evaluate the conditional $\ulcorner\neg r \rightarrow g\urcorner$, the following will probably transpire. First, they add $\ulcorner\neg r\urcorner$ to their information network, which in turns becomes $\{\neg g, \neg l, \neg r, u, \ldots\}$. Second, since $\ulcorner\neg g\urcorner$, $\ulcorner\neg l\urcorner$ and $\ulcorner\neg r\urcorner$ together with the belief that Claudius instructed at least one of the three rascals to assassinate Hamlet constitute an inconsistency, some adjustment must be made to restore an equilibrium. Three options are available: reject $\ulcorner\neg g\urcorner$, reject $\ulcorner\neg l\urcorner$ or reject the belief that Claudious indeed instructed someone. Since we may assume that they are less willing to suspend the belief that Claudius gave the instructions for Hamlet's assassination, they are left to choose between meddling with $\ulcorner\neg g\urcorner$ or $\ulcorner\neg l\urcorner$. However, since those two pieces of information are on par, as it were, it would be irresponsible to temper with one and hold on to the other.

[15] Where '$\veebar$' denotes the exclusive disjunction: $\varphi \veebar \chi \Leftrightarrow \neg(\varphi \equiv \chi) \Leftrightarrow (\varphi \vee \chi) \wedge \neg(\varphi \wedge \chi)$.

Moreover, since negating both $\ulcorner\neg g\urcorner$ and $\ulcorner\neg l\urcorner$ would be inconsistent with their belief that Claudius did instruct at most one of the three rouges to assassinate Hamlet, only one option remains: $\ulcorner\neg g\urcorner$ and $\ulcorner\neg l\urcorner$ must be purged together from their information network which would then become $\{\neg r, u, \ldots\}$. And so, since neither g nor its negation are in their information network, (1) is neither true nor false, and since neither l nor its negation there either, (2) is neither true nor false too.

Therefore, it seems we can after all get around the Gibbard Phenomenon by claiming that (1) and (2) were never true to begin with. The conditionals merely gave the impression that they were true because of incomplete information networks. However, we might now claim, they were neither true nor false in the first place. And more importantly, we now seem to be in a position to claim that indicative conditionals have truth values after all.

Although this account seems viable in principle, it strikes us as somewhat counterintuitive once we give it more thought: if we were to find ourselves with either Hamlet or Horatio in their nook or cranny, we would be utterly unable too to refrain from (1) and (2) respectively. Moreover, was anyone to persuade us otherwise without introducing some new information, we would only be able to respond with a traditional shrug of shoulders and a customary incredulous stare. Indeed, if we were hidden with Hamlet in his nook and someone were to tell us that (1) was neither true nor false, we could only respond that she was wrong because (1) was obviously true: we had just seen Laertes leave the room with our own two eyes, leaving only Rosencrantz and Guildenstern suspect. And we might in fact go on, claiming that for all that we know, Claudius might have instructed Rosencrantz and Claudius might have instructed Guildenstern: indeed, we might claim, had he not instructed one, he must have instructed the other.

Moreover, consider what would happen if our interlocutor were to tell us that Guildenstern had left the room too. Insofar as we are rational, we would immediately concede that Claudius must then have instructed Rosencrantz to assassinate Hamlet. However, if we were then asked why we had then claimed (1) earlier, we could only respond that we did so because (1) was compatible with everything we took to be true at the time. Knowing what we know now, of course, we would be reluctant to assert (1) but that does not undermine the appropriateness of our earlier claim at the time we made it. In fact, if we were asked whether we had been wrong before, we would probably claim that we were not: pressed further, we would probably emphasise that we had not said that Claudius had instructed Guildenstern to assassinate Hamlet but merely that if he did not instruct Rosencrantz to assassinate Hamlet, he must have instructed Guildenstern.

Taken together, those facts might be understood as suggesting that there is more in the context than meets the eye.[16] In particular, (1) seems to be true in the context of Hamlet in his nook, (2) in the context of Horatio in his cranny and (1) and (2) seem neither true nor false in the context when the two have united. There seems therefore as if there has been an obvious shift in context from when Hamlet and Horatio came to believe (1) and (2) to when they have conferred and concluded that Claudius must have instructed Rosencrantz to assassinate Hamlet. In other words, it does seem as if (1) and (2) are sensitive to their contexts in some important aspect. In fact, a certain affinity between indicative conditionals and so-called epistemic modals seems to be emerging.

2.5 Indicative Conditionals & Epistemic Modals

Epistemic modals, in English, are either subject raising verbs such as 'might' and 'must' or modal adverbs such as 'possibly' and 'necessarily' which we use to express what we take to be either possible or necessary relative to what is known, believed, supposed, imagined or whatnot in a context. For the sake of simplicity, we will only focus on modal verbs here and leave the modal adverbs aside. Nonetheless, we should remain aware that everything we say about modal verbs carries over to their adverbial counterparts.

Now, what is known, believed, supposed, imagined or whatnot in a context is, of course, nothing above or beyond the aforementioned information networks.

[16] See, again, Gibbard (1981), Jackson (1990) and Stalnaker (1984).

Although we will restrict our discussion to knowledge from now on, everything we say will equally apply to different types of information. For our purposes, we may now think of an information network as the set of possible worlds which are compatible with what we know. An epistemic modal would then be taken to range over those possible worlds much as first order quantifiers range over individuals. No one would seriously deny that there non-epistemic uses of 'might', 'must' and the alike. We will therefore reserve 'might$_e$' and 'must$_e$' to denote epistemic uses of modal verbs. That should certainly not be taken to imply that there are separate lexical items for different flavours of modality: according to a widespread and widely accepted theory of modals, modal verbs and adverbs merely carry a modal force and the context is left to determine over which sorts of possibilities the modals range over.[17]

Back to Hamlet. From his nook of Elsinore Castle, Hamlet seems well warranted to claim that:

(8) Rosencrantz might$_e$ have been instructed to assassinate Hamlet.
(Rosencrantz$_i$ might$_e$ $[t_i$ have been instructed to assassinate Hamlet$]$.)

We are inclined to understand Hamlet as claiming that for all that he knows, Claudius might have instructed Rosencrantz to assassinate Hamlet. Moreover, we are probably well disposed to regard (8) as true because for all that Hamlet knows, Claudius might indeed have given the instruction to Rosencrantz. In our current terminology, although there are some worlds compatible with Hamlet's knowledge in which Claudius did not give the instruction to Rosencrantz, there are certain worlds in which he did.

In order to facilitate our formalisation of epistemic modals, let us introduce the following notation:

$\Diamond_e\varphi$:= might$_e$ φ

$\Box_e\varphi$:= must$_e$ φ

[17]See Kratzer (1977, 1981, 1991).

We may, for instance, thereby express (8) as $\ulcorner \Diamond_e r \urcorner$. Now, we need not take a firm stand on which logic is appropriate for those epistemic modal operators. The nature of the information involved will certainly be of utmost importance in that respect. Since we want provide maximum flexibility by allowing for different sorts of information in different contexts, the accessibility relation required need neither be reflexive, symmetric, transitive nor extendable which implies that the logic of $\Box_e$ and $\Diamond_e$ cannot be any stronger than K. However, we may certainly assume standard duality of the modal operators: $\Diamond_e \varphi \equiv \neg\Box_e\neg\varphi$ and $\Box_e\varphi \equiv \neg\Diamond_e\neg\varphi$.

We said before that epistemic modals are context sensitive. In particular, we said that epistemic modals were sensitive to information networks of some sort or another. Whether the information network in question in a particular context is that of an utterer, assessor or someone else is subject to debate.[18] For our purposes, that issue does not make a fundamental difference as long as we agree that the truth conditions of epistemic modals are sensitive to some information network.

For all practical purposes, we may think of contexts as n-tuples of contextual parameters. It does not matter what we take the other parameters of the context to represent but we require that one parameter represent the relevant information network. Let a context C therefore be represented by an n-tuple $\langle \ldots, K\rangle$ where K is the set of possible worlds compatible with what is known in the context and thus represents the information network of that context.

Having laid the groundwork, we may now give the following truth conditions for the epistemic modals $\ulcorner \Diamond_e \varphi \urcorner$ and $\ulcorner \Box_e \varphi \urcorner$:

Epistemic Modals

Let C be a context constituted by an information network K. The truth conditions the epistemic modals $\ulcorner \Diamond_e \varphi \urcorner$ and $\ulcorner \Box_e \varphi \urcorner$ in C are as follows:[19]

$C \models \Diamond_e \varphi$ iff $\exists w \in K$, φ is true in w.

$C \models \Box_e \varphi$ iff $\forall w \in K$, φ is true in w.

[18] See, for instance, Egan, Hawthorne, and Weatherson (2005), von Fintel and Gillies (2007, 2008), MacFarlane (2009) and Yalcin (2007).

[19] Where $\ulcorner C \models \varphi \urcorner$ represents that φ is true in context C.

In other words, $\ulcorner \Diamond_e \varphi \urcorner$ is only true in a context where some worlds in the associated information network—which are the worlds that are compatible with what is known—are such that φ is true in them. And similarly, $\ulcorner \Box_e \varphi \urcorner$ is true in a context where all worlds in the associated information network are such that φ is true in them.

Let us consider what this tells us about our Gibbard Phenomenon case. Let C_1 represent the context in which Hamlet comes to believe (1), let C_2 represent the context in which Horatio comes to believe (2) and let C_3 represent the context which is induced after by their exchange of information once reunited. Moreover, let K_1, K_2 and K_3 represent the corresponding information networks. We would expect those contexts and information networks to let themselves to representation somewhere along the following lines:

$$C_1 = \langle \ldots, K_1 \rangle$$
$$C_2 = \langle \ldots, K_2 \rangle$$
$$C_3 = \langle \ldots, K_3 \rangle = \langle \ldots, K_1 \cap K_2 \rangle$$

$$K_1 = \{w \mid \neg l, u, \ldots \text{ are true in } w\}$$
$$K_2 = \{w \mid \neg g, u, \ldots \text{ are true in } w\}$$
$$K_3 = K_1 \cap K_2 = \{w \mid \neg g, \neg l, u, \ldots \text{ are true in } w\}$$

Given our analysis of epistemic modals, we have the following fairly obvious results. In C_1, $\ulcorner \Diamond_e g \urcorner$ and $\ulcorner \Diamond_e r \urcorner$ are true while $\ulcorner \Diamond_e l \urcorner$ is false: let us express those results as $C_1 \models \Diamond_e g$, $C_1 \models \Diamond_e r$ and $C_1 \models \neg\Diamond_e l$ respectively. In C_2, $\ulcorner \Diamond_e r \urcorner$ and $\ulcorner \Diamond_e l \urcorner$ are true while $\ulcorner \Diamond_e g \urcorner$ is false: $C_2 \models \Diamond_e l$, $C_2 \models \Diamond_e r$ and $C_2 \models \neg\Diamond_e g$. And finally, in C_3, $\ulcorner \Diamond_e r \urcorner$ is true and $\ulcorner \Diamond_e g \urcorner$ and $\ulcorner \Diamond_e l \urcorner$ are false: $C_3 \models \Diamond_e r$, $C_3 \models \neg\Diamond_e g$ and $C_3 \models \neg\Diamond_e l$. Furthermore, since for all three contexts $\ulcorner \Box_e u \urcorner$ is true, $\ulcorner \Box_e (g \vee r) \urcorner$ is true in C_1, $\ulcorner \Box_e (l \vee r) \urcorner$ is true in C_2 and $\ulcorner \Box_e r \urcorner$ is true in C_3: $C_1 \models \Box_e (g \vee r)$, $C_2 \models \Box_e (l \vee r)$ and $C_3 \models \Box_e r$. Given but a brief reflection on the case, we realise that those results are well in tune with our expectations.

Moreover, if we focus our attention on C_1 and C_2, we soon realise that if we were to restrict the information networks in some fashion or another, we would have further interesting results. In particular, if we concentrate on those worlds in K_1 where $\ulcorner\neg r\urcorner$ is true and discard the rest, we discover that g is true in all those worlds. And similarly, if we consider the worlds in K_2 where $\ulcorner\neg r\urcorner$ is true and ignore the rest, we discover that l is true in all those worlds. In other words, $\ulcorner\Box_e(\neg r \supset g)\urcorner$ is true in C_1 and $\ulcorner\Box_e(\neg r \supset l)\urcorner$ is true in C_2: $C_1 \models \Box_e(\neg r \supset g)$ and $C_2 \models \Box_e(\neg r \supset l)$. And conversely, $\ulcorner\Box_e(\neg r \supset l)\urcorner$ is false in C_1 and $\ulcorner\Box_e(\neg r \supset g)\urcorner$ is false in C_2: $C_1 \models \neg\Box_e(\neg r \supset l)$ and $C_2 \models \neg\Box_e(\neg r \supset g)$.

This is where the plot thickens. According to a widespread view of conditionals among linguists, inspired by David Lewis and championed by Angelika Kratzer, a conditional clause (antecedent or protasis) is nothing more than mere restrictor of modals and adverbs of quantification.[20] Depending on the nature of the modal in question, the conditional clause restricts quantification over some set of possible worlds. More carefully put, conditional sentences are in fact restricted modal sentences. And in those cases where the context determines epistemic modality, conditional sentences express restricted epistemic modals.

Now, if an indicative conditional $\ulcorner\varphi \rightarrow \chi\urcorner$ expresses nothing more than a mere necessity of χ on the restriction of φ, we must discern a pattern emerging: if $\ulcorner\varphi \rightarrow \chi\urcorner$ expresses $\ulcorner\Box_e\chi\urcorner$ once we have restricted the relevant information network to only epistemically possible worlds in which φ is true, the truth conditions of $\ulcorner\varphi \rightarrow \chi\urcorner$ coincide with those of $\ulcorner\Box_e(\varphi \supset \chi)\urcorner$:

Indicative Conditional (Epistemic Modal Analysis)
$C \models \varphi \rightarrow \chi$ iff $C \models \Box_e(\varphi \supset \chi)$.

And that must be good because we claimed, recall, that $\ulcorner\Box_e(r \supset g)\urcorner$ was true and that $\ulcorner\Box_e(r \supset l)\urcorner$ was false in C_1, and because we claimed that $\ulcorner\Box_e(r \supset g)\urcorner$ was false and that $\ulcorner\Box_e(r \supset l)\urcorner$ was true in C_2. According to the epistemic modal analysis, we would therefore have that $C_1 \models r \rightarrow g$, $C_1 \models \neg(r \rightarrow l)$, $C_2 \models r \rightarrow l$ and $C_2 \models \neg(r \rightarrow g)$. Reasonably, we might therefore ask ourselves now whether we have escaped the Gibbard Phenomenon.

[20] See, in particular, Lewis (1975) and Kratzer (1986, forthcoming). See also, for instance, von Fintel (1998a) and, for a nice overview, von Fintel and Heim (2007, §3–5).

No, we should not congratulate ourselves just yet. Sadly, the epistemic modal analysis falls afoul of our intuitions in C_3. In particular, the analysis predicts (1) and (2) to be true contrary to our intuitions. To make the point more clearly, let us consider this issue in more detail. Recall that we claimed that K_3 is the set $\{w \mid \neg g, \neg l, u, \ldots$ are true in $w\}$ and thus that $C_3 \models \Box_e r$. Now, since r will be true in all worlds in K_3, restricting K_3 to the worlds in where r is false will yield the empty set. That is a serious problem because any indicative conditional with $\ulcorner \neg r \urcorner$ as an antecedent will come out as vacuously true. In particular, (1) and (2) will come out as vacuously true. In other words, any context C which satisfies $\ulcorner \Box_e r \urcorner$, will be a context which satisfies $\ulcorner \Box_e(\neg r \supset \varphi) \urcorner$ for any φ and thus in particular for g and l. Thus, as the epistemic modal analysis equates $\ulcorner \Box_e(\varphi \supset \chi) \urcorner$ and $\ulcorner \varphi \rightarrow \chi \urcorner$, (1) and (2) are true in C_3. This is a serious issue for the epistemic modal analysis.[21]

Worse yet, we also have a mirror issue: since r will be true in all worlds in K_3, we may restrict K_3 in any manner we may see fit and r will still be true in every world in that subset of K_3. In particular, conditionals such as (5), 'if no one was instructed to assassinate Hamlet, Rosencrantz was instructed to assassinate Hamlet', will come out as true. In other words, if a context satisfies $\ulcorner \Box_e \chi \urcorner$, then $\ulcorner \Box_e(\varphi \supset \chi) \urcorner$ and thereby $\ulcorner \varphi \rightarrow \chi \urcorner$ will be true for any φ. As many such conditionals strike us as extremely counterintuitive, the epistemic modal analysis seems further troubled.

It goes without saying that those issues are somewhat reminiscent of the paradoxes of material implication. In fact, it does appear as if we have a sort of revenge problem upon us.[22] And thus, unless we are willing to add some well chosen epicycles to the epistemic modal analysis, we must conclude that the analysis should be abandoned.

[21] However, see Gillies (2009, 2010).

[22] Adding insult to injury, there is a further yet somewhat related issue identified by Zvolenszky (2002). Roughly, the problem is that for any φ and C, $C \models \Box_e(\varphi \supset \varphi)$ and so $C \models \varphi \rightarrow \varphi$. Therefore, since the account claims that conditionals are covert epistemic modals, we have that an context makes $\ulcorner$if φ, then *must*$_e$ $\varphi \urcorner$. Arguably, in the cases of epistemic modals this is not quite as embarrassing as in cases of other modals. Note however that Gillies (2009, 2010) does not see this as a serious problem.

Merely to emphasise, the most serious problem with the epistemic modal analysis of indicative conditionals is that unwanted results ensue from antecedents that are known to be false. A way out would be to claim that such conditionals are in fact not epistemic but rather metaphysical or whatnot. In other words, any conditional that has an antecedent which not compatible to the information network of the context in question is not to be understood as ranging over epistemically possible worlds but rather, say, metaphysically possible worlds.

That move seems faced by two obvious problems. First, there is a vast plethora of conditionals which feel indicative enough which yet have an antecedent known to be false. For instance, suppose we know which day of the week it actually is and utter, truthfully it seems, the following seven conditionals: 'if today is Monday, tomorrow is Tuesday', ..., and 'if today is Sunday, tomorrow is Monday'. Given the similarity of the seven thoughts expressed, It would seem odd that only one of the conditionals in question was indicative while the rest was not. Odder yet, which conditional happens to be the privileged indicative conditional would depend on the day of the week—a fair arrangement, to be sure, but hardly cogent.

Second, if conditionals with antecedents known to be false are to be taken to be, say, metaphysical, what are we to say about conditionals with metaphysically impossible antecedents? Well, if they require similar semantics as indicative conditionals, two options seem open: either claim that they are vacuously true or repeat our previous move and claim that they are not metaphysical and thus that they require yet another modal base to operate upon. Both options seem equally unattractive. The former option is untenable for the simple reason that we take some conditionals with metaphysically impossible antecedents to be false. For instance, we take it to be false that 'if π is a rational number, the circle cannot be squared' while true that 'if π is a rational number, the circle can be squared'. The latter option is untenable because we cannot indefinitely find ourselves new modal bases to which we may escape.

Those reflections do in fact suggest a more profound problem relating to all modal analysis of conditionals. That is not to imply that we cannot get past those issues by more complex modal machinery.[23] However, those issues might be taken to suggest that the modal turn was misguided from the beginning and that we should never have strayed away from the Ramsey Test. Let us therefore consider now whether what we have gathered so far about context sensitivity may not help us offer an appropriate revision of the Ramsey Test.

2.6 The Ramsey Test in Context

We have seen that indicative conditionals are context sensitive in an important aspect. In a similar sense as paradigm context sensitive expressions such as 'I', 'here' and 'now' differ in their denotation in correlation with their utterer, location of utterance and time of utterance, indicative conditionals seem to be tied to the information networks of their context. In particular, while (1) and (2) may be true according to some information networks, they may well be false or neither true nor false according to other. So, if we care to hold on to the Ramsey Test, we must now ask ourselves, how can we make the test sufficiently sensitive to the context in question?

As before, we may think of contexts as n-tuples of contextual parameters whereof one represents the contextually relevant information network K.[24] To make things easier for ourselves later on, let K now be the set of propositions which are known in a particular context. Of course, that sort of model is in no sense a radical departure from our earlier representation of an information network as sets of possible worlds; we may define either representation uninterestingly in terms of the other: $K_p := \bigcap K_w$ and $K_w := \{w \mid K_p \subseteq w\}$ (on the obvious assumption we take possible worlds to be sets of propositions).

According to that construal, the relevant contexts and information networks are somewhere along the following familiar lines:

[23] See, for instance, Mares (2004) and Priest (2009).

[24] Again, see footnote 18.

$$C_1 = \langle \ldots, K_1 \rangle$$
$$C_2 = \langle \ldots, K_2 \rangle$$
$$C_3 = \langle \ldots, K_3 \rangle = \langle \ldots, K_1 \cup K_2 \rangle$$

$$K_1 = \{\neg l, g \vee r, u, \ldots\}$$
$$K_2 = \{\neg g, l \vee r, u, \ldots\}$$
$$K_3 = K_1 \cup K_2 = \{\neg g, \neg l, g \vee r, l \vee r, u, \ldots\}$$

Moreover, let $\ulcorner x \oplus y \urcorner$ denote the function which adds a proposition y to an information network x, adjusts to maintain consistency and then returns the resulting information network. In other words, the value of $\ulcorner K \oplus \varphi \urcorner$ is a new information network K' which results from updating K with φ. Intuitively, we may think of this function as a form of learning. To illustrate, recall that once Hamlet and Horatio have reunited and conferred, the contextually relevant information network may be represented as $\{\neg g, \neg l, r, u, \ldots\}$. If we were to update that particular information network with $\ulcorner \neg r \urcorner$, say because we were interested in evaluating $\ulcorner \neg r \rightarrow g \urcorner$, we would expect the result to be $\{\neg g, \neg l, r, u \ldots\} \oplus \neg r = \{\neg r, u, \ldots\}$ for the reasons we stated before.[25] For the time being, we may let the exact details of this function remain undefined and treat it as primitive although we will return to the issue later.[26]

With these elements in their place, we now seem to be equipped to propose a naïve contextualised revision of the Ramsey Test.[27] In tune with our earlier discussion, it would seem reasonable to assume that an indicative conditional $\ulcorner \varphi \rightarrow \chi \urcorner$ may have (exactly) one of three possible truth values: *true*, *false* or *neither true nor false*. Under that assumption, we may therefore spell out the Ramsey Test as follows:

Indicative Conditional (Naïve Contextualised Ramsey Test)

Let C be a context constituted by an information network K. The truth conditions of an indicative conditional $\ulcorner \varphi \rightarrow \chi \urcorner$ in C are as follows:

[25] See §2.4.
[26] See Appendix A.
[27] For an alternative approach, see Appendix B.

$$C \models \varphi \rightarrow \chi \text{ iff } \chi \in (K \oplus \varphi),$$
$$C \models \neg(\varphi \rightarrow \chi) \text{ iff } \neg\chi \in (K \oplus \varphi),$$
$$C \not\models \varphi \rightarrow \chi \text{ and } C \not\models \neg\, (\varphi \rightarrow \chi) \text{ iff } \chi, \neg\chi \notin (K \oplus \varphi).$$

(In other words, the first clause says that $\ulcorner\varphi \rightarrow \chi\urcorner$ is true in C if $\chi \in (K \oplus \varphi)$, the second clause says that $\ulcorner\varphi \rightarrow \chi\urcorner$ is false in C if $\neg\chi \in (K \oplus \varphi)$, and the final clause says that $\ulcorner\varphi \rightarrow \chi\urcorner$ is neither true nor false in C otherwise.) If the third truth value strikes anyone as excessive, we may simply get away with the following clause: $C \models \varphi \rightarrow \chi$ if $\chi \in (K \oplus \varphi)$, and $C \models \neg(\varphi \rightarrow \chi)$ otherwise.

The issue of how indicative conditionals which have the third truth value are supposed to combine truth functionally with other parts of language, we shall leave unresolved here. Several obvious options are available such as trivalent logics like K_3, $Ł_3$, LP and RM_3. However, which one, if any, of those logics is appropriate is a moot point and not particularly interesting to us at present. We should certainly be aware of the issue but we will not address it in further detail here.

Now, given a certain superficial similarity, it is worth emphasising the crucial difference between the contextualised Ramsey Test and the epistemic modal analysis: only the Ramsey Test analysis seems equipped to deal with conditionals whose antecedents are false in the context in question. In other words, there does not seem to be any sense in which one account could be reduced to the other. In particular, the success of one account is certainly not a vindication of the other and, conversely, the failure of one is not any kind of vilification of the other.

Let us consider how the Naïve Contextualised Ramsey Test fares with our data. We may presumably still agree that (1) is true and (2) is false in C_1, that (1) is false and (2) is true in C_2 and that (1) and (2) are neither true nor false in C_3. Our question is thus whether our current version of Ramsey Test does predict those intuitions. To answer that question, let us now hold (1) and (2) up against our contexts one by one.

In context C_1, which is constituted of $K_1 = \{\neg l, g \vee r, u, \ldots\}$, (1) is predicted to be true: $\ulcorner\neg r \rightarrow g\urcorner$ is true in C_1 because $g \in (K_1 \oplus \neg r)$. We expect the update of K_1 with $\ulcorner\neg r\urcorner$ to result in $\{g, \neg l, \neg r, u, \ldots\}$ because Claudius did instruct someone to assassinate Hamlet and thus if not Rosencrantz or Laertes, then clearly Guildenstern. Conversely, our Ramsey Test predicts that (2) is false in C_1: $\ulcorner \neg r \rightarrow l \urcorner$ is false in C_1 as $\neg l \in (K_1 \oplus \neg r)$ for the same reasons as before.

Next, when it comes to context C_2, which is constituted of $K_2 = \{\neg g, l \vee r, u, \ldots\}$, our prediction is that (1) is false: $\ulcorner \neg r \rightarrow g \urcorner$ is false in C_2 because $\neg g \in (K_2 \oplus \neg r)$. As before, we expect the update of K_2 with $\ulcorner \neg r \urcorner$ to result in $\{\neg g, l, u, \neg r, \ldots\}$ because Claudius did instruct someone to assassinate Hamlet and thus if not Rosencrantz or Guildenstern, then obviously Laertes. And conversely, we predict that (2) is true in C_2: $\ulcorner \neg r \rightarrow l \urcorner$ is true as $l \in (K_2 \oplus \neg r)$ for the same reasons.

Finally, when it comes to C_3, which is constituted of $K_3 = K_1 \cup K_2 = \{\neg g, \neg l, u, \ldots\}$, we predict (1) to be neither true nor false: $\ulcorner \neg r \rightarrow g \urcorner$ is neither true nor false in C_3 because $g \notin (K_3 \oplus \neg r)$ and $\neg g \notin (K_3 \oplus \neg r)$. This time, indeed, for the reasons we gave earlier, we expect the update of K_3 with $\ulcorner \neg r \urcorner$ to result in $\{\neg r, u, \ldots\}$.[28] And again conversely, we predict (2) to be neither true nor false in C_3: $l \notin (K_3 \oplus \neg r)$ and $\neg l \notin (K_3 \oplus \neg r)$ for similar reasons.

The predictions of our revised Ramsey Test therefore seem to fit our intuitions quite well. But not perfectly. Perhaps unsurprisingly, as we foreshadowed earlier, the Ramsey Test is haunted with its own analogue of the paradoxes of material implication that its naïve contextualised counterpart inherits.[29] On the one hand, if φ is already in our information network, $\ulcorner \varphi \rightarrow \chi \urcorner$ will be true in the context as long as χ is there too. And on the other hand, if χ is in our information network and the addition of φ has no effect upon χ's standing, $\ulcorner \varphi \rightarrow \chi \urcorner$ will be true, quite vacuously, in that particular context. To say the least, those results are somewhat counterintuitive.

On the one hand, for instance, $\ulcorner r \rightarrow \varphi \urcorner$ is true in C_3 for any φ already in K_3: supposing that Hamlet and Horatio both know that one and one do make two, we will predict the following conditional to be true in the context:

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[28] See §2.4.
[29] See §2.2.

(9) If Rosencrantz was instructed to assassinate Hamlet, one and one make two.

Surely, that cannot be right: as it happens, our immediate reaction is that this conditional is neither true nor false. The reason, presumably, is that the antecedent and the consequent are altogether irrelevant to one another. Indeed, we expect there to be some sort of connection between the two, otherwise we begin to feel squeamish about the conditional to some extent. And the same goes for similar conditionals whose consequent is false and irrelevant to a true antecedent: our gut reaction would be that they are not false but rather neither true nor false.

On the other hand, for instance, $\ulcorner\varphi \rightarrow r\urcorner$ is true in C_3 for any φ which has no effect on r in K_3: a conditional such as as the following would thereby be true in C_3:

(10) If one and one do not make two, Rosencrantz was instructed to assassinate Hamlet.

Again, that cannot be right: our immediate reaction is that (10) is neither true nor false. The reason for our squeamishness about (10) in C_3 is probably the same as before: for truth or falsity, we expect there to be some sort of connection or relevance between the antecedent and the consequent.

Now, of course, although we cannot generate as embarrassing cases as we could with the bare paradoxes of material implication, we can nonetheless come up with a great number of conditionals in virtually any context which the Naïve Contextualised Ramsey Test predicts to be true or false although we feel intuitively uneasy about them. Considering the two sorts of unhappy cases we can generate under the analysis, the following pattern emerges: the truth of an indicative conditional is somehow correlated to the relevance of its constitutive parts. In other words, we tend to lose nerve against conditionals whose antecedent and consequent have no connection of any sort. Arguably, this condition seems diminished in cases of conditionals which either have words like 'still' in their consequents and 'even' in their antecedent—say, something along the lines of $\ulcorner$if φ, then still $\chi\urcorner$ or $\ulcorner$even if φ, then $\chi\urcorner$—or contextually imply something of similar kind. However, in cases of plain conditionals, truth or falsity in the absence of such relevance seems suspect.

How are we to cope with that fact? Are we supposed to reject the Ramsey Test altogether on those ground? Well, no, we can save the Ramsey Test by at least two distinct means: on the one hand, we might attempt to give a pragmatic account which would explain the uneasiness involved with those irrelevant conditionals and then claim that the truth conditions are in fact those which the Ramsey Test predicts, and, on the other hand, we might revise the Ramsey Test further to accommodate our intuitions better. Arguably, we should perhaps leave the rest up to pragmatics: we are, normally, willing to do the same for conjunctions and disjunctions, why not for conditionals too? If we were to agree to leave the rest up to pragmatics, our Naïve Contextualised Ramsey Test would be the end of our semantic story. However, if only for the sake of curiosity, instead of considering the pragmatic option, let us now explore the prospect of revising the Ramsey Test further.

Our guiding principle would be that for a conditional to be true, there must be some sort of connection of relevance between its antecedent and consequent. How do we propose to achieve that? Well, roughly, it seems that when we consider a conditional, $\ulcorner\varphi \rightarrow \chi\urcorner$, we may simple forget all we knew about its consequent and then add its antecedent to our information network, adjust to maintain consistency and then consider whether the consequent or its negation has re-emerged. If the consequent or its negation were to re-emerge, we would take the conditional as either true or false respectively, otherwise neither true nor false. In other words, if the consequence or its negation were not to reappear upon the adding the antecedent to the information network, the conditional is irrelevant, as it were, and therefore neither true nor false.

To implement this idea, we need a complement to our learning function. Let $\ulcorner x \oslash y\urcorner$ denote the function which subtracts a proposition y or its negation from a information network x and then returns the resulting information network. In other words, the value of $\ulcorner K \oslash \varphi\urcorner$ is a new consistent information network K' which results from subtracting φ or its negation from K. Intuitively, we may think of this function as a form of forgetting. Now, for instance, suppose we were to subtract g from K_3, say because we were interested in evaluating $\ulcorner \neg r \rightarrow g \urcorner$, the result of the subtraction would simply be $\{\neg g, \neg l, u \ldots\} \oslash g = \{\neg l, u, \ldots\}$. Again, we may let the exact details of this function remain undefined and treat it as primitive although we will return to the issue in a while.[30]

Where does that leave us? Fortunately, thus construed, forgetting seems to work small wonders for us: in the cases of (9) and (10), putting the consequents out of our minds before learning the antecedents, figuratively speaking, rules out the embarrassing cases of vacuous truth and falsity. Indeed, in most contexts, there seems no way to reach the consequents of (9) and (10) on the mere supposition of their antecedents. In other words, for conditionals such as (9) and (10) to come out as true or false, the contexts in question must be such that their information networks provide relevance of some sort between the antecedent and the consequent.

Let us therefore propose the following revision of the Ramsey Test:

> **Indicative Conditional (Contextualised Ramsey Test Analysis)**
> Let C be a context constituted by an information network K. The truth conditions of an indicative conditional $\ulcorner \varphi \rightarrow \chi \urcorner$ in C are as follows:
>
> $C \models \varphi \rightarrow \chi$ iff $\chi \in ((K \oslash \chi) \oplus \varphi)$,
> $C \models \neg(\varphi \rightarrow \chi)$ iff $\neg\chi \in ((K \oslash \chi) \oplus \varphi)$,
> $C \not\models \varphi \rightarrow \chi$ and $C \not\models \neg\, (\varphi \rightarrow \chi)$ iff $\chi, \neg\chi \notin ((K \oslash \chi) \oplus \varphi)$.

(In other words, the first clause says that $\ulcorner \varphi \rightarrow \chi \urcorner$ is true in C if $\chi \in ((K \oslash \chi) \oplus \varphi)$, the second clause says that $\ulcorner \varphi \rightarrow \chi \urcorner$ is false in C if $\neg\chi \in ((K \oslash \chi) \oplus \varphi)$, and the final clause says that $\ulcorner \varphi \rightarrow \chi \urcorner$ is neither true nor false in C otherwise.) Again, if the third truth value strikes anyone as excessive, we may simply get away with the following clause: $C \models \varphi \rightarrow \chi$ if $\chi \in ((K \oslash \chi) \oplus \varphi)$, and $C \models \neg(\varphi \rightarrow \chi)$ otherwise.

Moreover, as we hinted at already, with a proposal of this ilk, we are also equipped to give an account of conditionals which either have words like 'still' in

[30] See Appendix A.

their consequents and 'even' in their antecedent or contextually imply something of similar kind: we simply leave out forgetting the consequents and revert to our naïve truth conditions in those cases.

Let us now finally consider how the our Contextualised Ramsey Test fares with our data. Again, let us therefore move through the contexts one by one and assess the truth values our theory predicts for (1) and (2).

In context C_1, which, recall, is constituted of $K_1 = \{\neg l, g \vee r, u, \ldots\}$, (1) is still predicted to be true: $\ulcorner \neg r \rightarrow g \urcorner$ is true in C_1 because $g \in ((K_1 \oslash g) \oplus \neg r)$. We expect the subtraction of g from K_1 to result in $\{\neg l, g \vee r, u, \ldots\}$, whose update again with $\ulcorner \neg r \urcorner$ results in $\{g, \neg l, \neg r, g \vee r, u, \ldots\}$. Conversely, we predict that (2) is false in C_1: $\ulcorner \neg r \rightarrow l \urcorner$ is false in C_1 as $\neg l \in ((K_1 \oslash g) \oplus \neg r)$. That fact might be less obvious: although we expect $K_1 \oslash l$ to be devoid of $\ulcorner \neg l \urcorner$, $\ulcorner g \vee r \urcorner$ is still in K_1 and the forgetting of $\ulcorner \neg l \urcorner$ would certainly not touch upon that. In that case, when subsequently updating with $\ulcorner \neg r \urcorner$, we may again infer g from $\ulcorner g \vee r \urcorner$ and $\ulcorner \neg r \urcorner$, from which in turn we may infer $\ulcorner \neg l \urcorner$ together with u.

When it comes to context C_2, our prediction is that (1) is false and (2) is true. Since the reason for that prediction are analogous to those for which we predicted (1) to be true and (2) to be false in C_1, we will not bother to repeat ourselves.

Finally, when it comes to C_3, which is constituted of $K_3 = K_1 \cup K_2 = \{\neg g, \neg l, g \vee r, l \vee r, u, \ldots\}$, our Contextualised Ramsey Test predicts (1) to be neither true nor false: $\ulcorner \neg r \rightarrow g \urcorner$ is neither true nor false in C_3 because $g \notin ((K_3 \oslash g) \oplus \neg r)$ and $\neg g \notin ((K_3 \oslash g) \oplus \neg r)$. In this case, the subtraction of $\ulcorner g \urcorner$ from K_3 will result in $\{\neg l, r, g \vee r, l \vee r, u, \ldots\}$. Moreover, for similar reason as before, the update of $\ulcorner \neg r \urcorner$ to $\{\neg l, r, g \vee r, l \vee r, u, \ldots\}$ will result in $\{\neg r, u, \ldots\}$.[31] And again conversely, we predict (2) to be neither true nor false in C_3: $l \notin ((K_3 \oslash l) \oplus \neg r)$ and $\neg l \notin ((K_3 \oslash l) \oplus \neg r)$.

It does therefore seem as if our contextualised counterpart of the Ramsey Test allows us to escape the Gibbard Phenomenon. That must certainly come as a comfort to us: contrary to the rumour, indicative conditionals may well possess truth

[31] See §2.4.

values. We have, it does certainly seem, solved the problem which we set ourselves up against.

2.7 Conclusion: Ramsey Test & Truth Values

We began our excursion by considering so-called Gibbard Phenomenon cases. In particular, we asked ourselves whether such cases impel us to infer that indicative conditional cannot have truth values on pain of contradiction. We considered several possibilities and finally argued ourselves into a position where we may well hold on to a contextualised counterpart of the Ramsey Test and still sail successfully past the terrors of the Gibbard Phenomenon.

Our lingering question throughout this chapter has been this: if indicative conditionals cannot be true or false, what are they then? Our inability to give an answer has been our motivation for offering account by which we can hold on to our prevalent intuitions about indicative conditionals and, on the one hand, truth and falsity, and, on the other hand, the Ramsey Test. If the truth value opponent still wishes to persist, an answer must first be given to our burning question: if not true or false?

Appendix A: Maintaining Information Networks

So far, several claims have been made about information networks and their inner workings.[32] In order to get the semantics of indicative conditionals right, we have assumed two main operations through which we may manipulate information networks: learning and forgetting. So far, we only have given vague sketches but we shall describe them in more detail now.

[32] See, in particular, §2.6.

Information Networks

Let us begin by clarifying to a certain extent what we mean when we talk about information networks. Very roughly speaking, an information network is a mere collection of propositions. The propositions involved need not be atomic propositions as we may reasonably hold for some p, say, $\ulcorner p \vee \neg p \urcorner$ without holding either disjunct. Moreover, we may assume that information networks are consistent—for any p, if p is in a particular information network, p's negation is not—although information networks need not be complete—there might well be some p such that neither p nor its negation are in a particular information network. Finally, we may take information networks to impose some sort of order on its elements which reflect, say, our credence in cases of beliefs or our degrees of certainty or defeatability in cases of knowledge. In that sense, we may say that some propositions are closer to the centre of the network than others and thus more resilient to revision.

We leave the issue of information networks' content intentionally ambiguous. This is merely to allow for maximum plasticity of the account. In particular, in certain cases, networks might be required to consist of only knowledge, while in others, networks may need to consist of beliefs and in yet other cases, no constraint might be laid upon the information. In other words, an information network, we take it, is only a generic data structure which may serve a number of different applications, which may or may not impose their own restrictions on the nature of the information involved. Now, in the case of indicative conditionals, a strong case might be made for the claim that the information involved must be knowledge: in particular, a strong argument might be made from the observation that if the information involved is not factive, *Modus Ponens* will fail for the conditional given by the Contextualised Ramsey Test. Thus, arguably, the information networks in which we are currently interested are all knowledge networks although everything we will say about information networks, applies to networks of information weaker than knowledge too.

There is a further issue of closure of information networks which we shall not touch upon in any depth here.[33] Clearly, a complete closure would cause problems as, say, forgetting becomes very hard in many cases: closure would ensure that certain propositions could never be forgotten in isolation as they would emerge as soon again on account of closure. Moreover, a complete lack of closure would get us into trouble too, say, as learning new information would be far too feeble: when we add a proposition to an information network, we would like to get at least some of its entailments for free. A possible strategy would be to close any and only changes made by consistency maintenance under a set of some logical operations. We will however leave the details of this issue unresolved at present and focus instead on the operations under discussion.

Whether this characterisation of information networks is psychologically realistic is subject to a debate. For instance, the claim of consistency might well be contested since it does sometimes seem as if we hold contrary beliefs. Obviously, in the case of knowledge (and other networks of factive information), this issue does not carry any weight. For another instance, the issue of restricted closure might strike one as dubious as we may well, say, believe some fairly simple propositions without believing all their consequences. Perhaps, realistically, information networks are thus only fit to model ideal agents of some sort or another. We will however not address those issues any further now but merely accept our characterisation as adequate for our present purposes.

Forgetting: Subtracting Information

Forgetting is unsurprisingly easy. In fact, we must simply rid our information network of whatever we want to forget and leave it at that. Since the removal of a proposition from a consistent information network will not induce inconsistency, some sort of consistency maintenance upon forgetting would be absolutely redundant. We may therefore simply define the procedure of forgetting in the following terms:

Forgetting

[33] See Appendix B.

> Let $x \oslash y$ be a function which takes two arguments, an information network x and a proposition y, and returns an information network. The value of $x \oslash y$ is as follows:
>
> $x \oslash y$:= the information network which results by removing y or its negation from x.

As we shall see quite soon, the nature of the function $\ulcorner x \oslash y \urcorner$ depends upon the exact nature of information networks. If we merely take information networks to be sets of propositions, the value of $\ulcorner x \oslash y \urcorner$ is simply $x \backslash \{y, \neg y\}$. Conversely, if we take an information network to be an n-tuple of propositions, the value of $\ulcorner x \oslash y \urcorner$ is the (either n or n-1) tuple which results from removing y or its negation from x. As a matter of fact, as we go on, we will realise that we need more complex data structure to model information networks properly. However, for the models we shall offer for information networks, the operation of forgetting should be fairly obvious and will therefore not be left as subject to a further discussion.

Learning: Inserting & Updating Information

We defined $\ulcorner x \oplus y \urcorner$ as the function which adds a proposition y to an information network x, adjusts to maintain consistency and then returns the resulting information network. Obviously, the middle part of this operation—the consistence maintenance—is its real crux.

Clearly, to add a proposition φ to an information network K and then merely maintain for consistency is is not going to get us very far off the ground: the minimal adjustment required to restore an equilibrium would simply be to throw φ out of K again. Instead, we need somehow to ensure that φ remains immune to revision. The whole information network must, as it were, be adjusted around φ.

A way in which we might implement the maintenance operation would thus be the following: let the consistency maintenance be a function which takes an information network and a proposition as its arguments and returns an appropriately updated information network. More formally, let $\ulcorner x \otimes y \urcorner$ therefore denote the function which rebuilds an information network x around a proposition y and then returns the resulting information network. If we define the consistency maintenance function in this way, we actually only ever need to perform maintenance to update any given information network: since the maintenance of x around y, as it were, will both leave y in the new network and throw out its negation, if at all in x, we have in fact updated while maintaining consistency.

For that reason, we may say that $\ulcorner x \oplus y \urcorner$ is nothing more than $\ulcorner x \otimes y \urcorner$. We may thus trivially spell out the so-called learning function in the following terms:

> **Learning**
> Let $x \oplus y$ be a function which takes two arguments, an information network x and a proposition y, and returns an information network. The value of $x \oplus y$ is as follows:
>
> $$x \oplus y := x \otimes y$$

Clearly, our real challenge involves specifying the consistency maintenance operation. Let us therefore gather our courage and turn our attention to the details of consistency maintenance functions.

The Crux: Maintaining for Consistency

Partly for the sake of clarity and partly for the sake of our own limitations, we shall proceed as follows: we will begin by defining a naïve consistency maintenance function and then work our way gradually through several iterations to more and more sophisticated functions.

Our first function works under the assumption that we may simply run through our information network and knock out any proposition which contradicts whichever proposition we take to be sacrosanct. We may define our first function in the following terms:

> **Consistency Maintenance (Naïve Toy Theory)**
> Let $x \otimes y$ be a function which takes two arguments, a set of propositions x and a proposition y, and returns a set of propositions. Let z

denote an arbitrary member of x. The value of $x \otimes y$ is as follows:

$$x \otimes y := \begin{cases} \{y\} & \text{if } x = \varnothing \\ ((x \backslash \{z\}) \otimes y) \cup \{z\} & \text{if } y \text{ and } z \text{ are consistent} \\ ((x \backslash \{z\}) \otimes y) \cup \{\neg z\} & \text{otherwise} \end{cases}$$

Intuitively, the function decomposes a given information network and then reconstructs a new network with the existing pieces or their negation, whichever agrees with the proposition that we hold immune to revision. To gain a better intuitive grasp of the operation, we may perhaps think of it as analogous to when we take a fairly complex object apart and then reassemble it in reverse order in accordance with its parts agreement to some designated part. For a helpful concrete analogy, we may think of items of clothing: we may, say, shed our entire attire and then put the individual articles of clothing back on if they agree in some sense with some chosen garment.

Throughout, we should remain aware that it is open to discussion whether we replace any proposition which happens to be inconsistent with our sacrosanct proposition with its negation or else leave it out all together. From a psychological perspective, it might perhaps strike us as more realistic to replace such propositions with their negations. For that reason, we choose to implement our functions so that they replace inconstancies with their negations. In case that strikes someone as contentious, the functions may be changed in a fairly straightforward manner such that any contradicting propositions are left out altogether. We will not take a further stand on this issue here and merely consider it as flagged.

Our current function is, without any surprise, far too naïve: there is no guarantee that the resulting information network will be consistent. Although all its elements are individually consistent with our sacrosanct proposition, the information network might be inconsistent as a whole. For instance, $\ulcorner \neg\varphi \vee \chi \urcorner$ and $\ulcorner \neg\chi \urcorner$ may both be individually consistent with φ although mutually inconsistent. In other words, as long as our information network contains elements of these form—and countless other—our Naïve Toy Theory will yield an inconsistent network. Clearly, any consistency maintainer which fails to maintain consistency is not quite made for its purpose. So, we must try a little bit harder.

Obviously, we must be on the guard against mutual inconsistencies. How? Well, we could proceed as before but instead of comparing every element of the information network to our designated proposition, we may compare every element to our intermediate information network. To achieve means to that end, we may define our function in the following terms:

Consistency Maintenance (Simple Toy Theory)
Let $x \otimes y$ be a function which takes two arguments, a set of propositions x and a proposition y, and returns a set of propositions. Let z denote an arbitrary member of x. The value of $x \otimes y$ is as follows:

$$x \otimes y := \begin{cases} \{y\} & \text{if } x{=}\varnothing \\ ((x\backslash\{z\}) \otimes y) \cup \{z\} & \text{if } (x\backslash\{z\}) \otimes y \text{ and } z \\ & \quad \text{are consistent} \\ ((x\backslash\{z\}) \otimes y) \cup \{\neg z\} & \text{if } (x\backslash\{z\}) \otimes y \text{ and } \neg z \\ & \quad \text{are consistent} \\ (x\backslash\{z\}) \otimes y & \text{otherwise} \end{cases}$$

Intuitively, this function decomposes a given information network and then reconstructs a new network with the existing pieces, their negation or neither, whichever agrees with the information network we have built up so far in our process. Again, to gain a better intuitive grasp of this operation, we may perhaps think of it as analogous to when we take a fairly complex object apart and then reassemble it in accordance to its part's fit with the amalgam at that point. We may, say, shed our attire and then put the individual articles of clothing back on if they agree in some sense with what have put on so far.

This function is bound to give us a consistent information network as we do not add anything to it at any stage which disagrees with its current content. In other words, this function avoids the most obvious shortcoming of the first function. So, if we are after consistency alone, we could stop our quest here.

Insofar as we are after something more, however, we must go on as our current function has drawbacks of its own: there seems to be far more structure to information networks than we have supposed so far. Indeed, there are certain propositions which we seem more inclined to revise than others as if they carry more weight. In other words, it does appear that information networks have some internal ordering among their elements. For instance, within a given information network, we may hold $\ulcorner \neg\chi \urcorner$ quite dear but $\ulcorner \varphi \vee \neg\chi \urcorner$ substantially more so, say, because we take the latter to be a law of some sort while we only assume the former by hearsay or whatnot. Were we to maintain the consistency of our information network around $\ulcorner \neg\varphi \urcorner$, we would have two options: replace either $\ulcorner \varphi \vee \neg\chi \urcorner$ or $\ulcorner \neg\chi \urcorner$ with their negations. Clearly, replacing $\ulcorner \varphi \vee \neg\chi \urcorner$ for $\ulcorner \neg\varphi \wedge \chi \urcorner$ would be irresponsible, while replacing $\ulcorner \neg\varphi \urcorner$ for its negation seems to be the reasonable move. However, since our last function makes no distinction between the elements of a given information network, the incorrect move is as probable as the correct move. So, despite the fact that it ensures consistency, our last function is not fit for the task. We still need to do better.

To get around our current issues, we must reshuffle our cards. We need a new model of information networks which allows us to mirror the order of their elements. How can we achieve that effect? For all intents and purposes, we may model an information network as a so-called stack. A stack is a data structure whose elements are ordered and whose operations all target the front-most element. Let us call the front-most and back-most elements of a stack its 'top' and 'bottom' respectively. On the supposition that an information network imposes a preorder on its elements by their weight, we may order these elements internally into a totally ordered equivalence classes of weight. We may thus think of an information network as a stack, where the propositions gradually become heavier from top to bottom such that any proposition is either of equal or less weight than the proposition immediately under it. To implement our stack, we may simply use an n-tuple whose first element we designate as the top and the n-th element as the bottom. We will also need a notion of an empty stack, which contains no elements, which we shall implement with the empty tuple. Let $\langle\rangle$ denote the empty tuple.

To operate on our stack, we may define its functions as follows. Let $\textsc{push}(x, y)$ denote the function which adds an element y to a stack x and returns the stack whose top is y and whose remaining elements are x's elements in preserved order: $\textsc{push}(\langle x_1, \ldots \rangle, y) = \langle y, x_1, \ldots \rangle$. Let $\textsc{pop}(x)$ denote the function which removes the top from a stack x and returns the stack whose elements are x's remaining elements in preserved order unless x is empty: $\textsc{pop}(\langle x_1, x_2, \ldots \rangle) = \langle x_2, \ldots \rangle$. Let $\textsc{peek}(x)$ denote the function which returns the top from a stack x unless x is empty: $\textsc{peek}(\langle x_1, \ldots \rangle) = x_1$. Although we need not worry about the empty stack case here, we may simply let $\textsc{pop}(x)$ and $\textsc{peek}(x)$ remain undefined when x is an empty stack. Finally, let $\textsc{empty}(x)$ denote the function which tells us if a stack x is empty by returning *true* but *false* otherwise: $\textsc{empty}(x)$ = *true* iff x is $\langle \rangle$.

With our stack in place, we may now define the consistency maintenance function as follows:

Consistency Maintenance (Sophisticated Toy Theory)

Let $x \otimes y$ be a function which takes two arguments, a stack of propositions x and a proposition y, and returns a stack of propositions. The value of $x \otimes y$ is as follows:

$$x \otimes y := \begin{cases} \textsc{push}(x, y) & \text{if } \textsc{empty}(x) \\ \textsc{push}(\textsc{pop}(x) \otimes y, \textsc{peek}(x)) & \text{if } \textsc{pop}(x) \otimes y \\ & \quad \text{and } \textsc{peek}(x) \\ & \quad \text{are consistent} \\ \textsc{push}(\textsc{pop}(x) \otimes y, \neg\textsc{peek}(x)) & \text{if } \textsc{pop}(x) \otimes y \\ & \quad \text{and } \neg\textsc{peek}(x) \\ & \quad \text{are consistent} \\ \textsc{pop}(x) \otimes y & \text{otherwise} \end{cases}$$

Intuitively, the function decomposes a given information network in order of the weight of its elements and then reconstructs a new network with the existing pieces, their negation or neither, whichever agrees with the information network we have built up so far in our process. Again, to gain a better intuitive grasp of this operation, we may perhaps think of it as analogous to when we take a fairly complex and layered object apart and then reassemble it in reverse order in accordance to its parts fit to the amalgam at that point. We may, say, shed our attire according to our preference and then put the individual articles of clothing back on if they agree in some sense with what have put on so far.

Although this implementation gets around the previous shortcomings by its sensitivity to the weight of the networks elements, there are further issues. In particular, what will happen when two elements are of equal weight? Well, in the fashion we modelled information networks just now, the order in which we run through elements of equal weight is arbitrary. Sadly, that will not do: since our current function will treat elements lower in the stack as if they were of more weight, we will sooner or later get unwanted results. For instance, suppose that $\ulcorner\varphi \vee \chi \vee \psi\urcorner$, $\ulcorner\neg\chi\urcorner$ and $\ulcorner\neg\psi\urcorner$ constitute an information network where the first proposition has more weight than the other two, which we shall suppose to be of the same weight. To make the example slightly more concrete, this is what would happen in our Hamlet case in context C_3. Intuitively, were we to maintain consistency around $\ulcorner\neg\varphi\urcorner$, the result would be an information network without χ and ψ as neither has weight over the other. However, our latest procedure gets that wrong. When we cast the information network in question into a stack, two equally legitimate options are available: $\langle \ldots, \neg\chi, \neg\psi, \ldots, \varphi \vee \chi \vee \psi, \ldots\rangle$ and $\langle \ldots, \neg\psi, \neg\chi, \ldots, \varphi\vee\chi\vee\psi, \ldots\rangle$. Suppose we arbitrarily choose the first and then maintain its consistency around $\ulcorner\neg\varphi\urcorner$ with our present function, the result would be $\langle \ldots, \chi, \neg\psi, \ldots, \varphi \vee \chi \vee \psi, \ldots \neg\varphi\rangle$. Likewise, if we take the second option, we would end up with $\langle \ldots, \psi, \neg\chi, \ldots, \varphi \vee \chi \vee \psi, \ldots \neg\varphi\rangle$. Sadly, both options are wrong. Although we must make distinctions when it comes to the weight of elements, we ought not make distinctions without differences. We must therefore do still better.

What can we do? We are in some luck now: we can combine elements of our earlier strategies to get around this problem. Instead of working with a stack of propositions, we can work with a stack of sets of propositions of equal weight. Let this therefore be our next and final proposal:

Consistency Maintenance

Let $x \otimes y$ be a function which takes two arguments, a stack of sets of propositions x and a proposition y, and returns a stack of sets of propositions. The value of $x \otimes y$ is as follows:

$$x \otimes y := \begin{cases} \textsc{push}(x, y) & \text{if } \textsc{empty}(x) \\ \textsc{push}(\textsc{pop}(x) \otimes y, (\textsc{pop}(x) \otimes y) \odot \textsc{peek}(x)) & \text{otherwise} \end{cases}$$

Moreover, let $x \odot y$ be a function which takes two arguments, a stack of sets of propositions x and a set of n proposition y, and returns a set of propositions. Let $y^p_1, \dots, y^p_{n!}$ be the stacks of every permutation of the elements of y. The value of $x \odot y$ is as follows:

$$x \odot y := \bigcap_{i=1}^{n!} (x \ominus y^p_i)$$

Finally, let $x \ominus y$ be a function which takes two arguments, a stack of sets of propositions x and a stack of propositions y, and returns a set of propositions. The value of $x \ominus y$ is as follows:

$$x \ominus y := \begin{cases} \varnothing & \text{if } \textsc{empty}(y) \\ (x \ominus \textsc{pop}(y)) \cup \textsc{peek}(y) & \text{if } x \ominus \textsc{pop}(y), \textsc{peek}(y) \\ & \quad \text{and } x \text{ are consistent} \\ (x \ominus \textsc{pop}(y)) \cup \neg\textsc{peek}(y) & \text{if } x \ominus \textsc{pop}(y), \neg\textsc{peek}(y) \\ & \quad \text{and } x \text{ are consistent} \\ x \ominus \textsc{pop}(y) & \text{otherwise} \end{cases}$$

Intuitively, the function decomposes a given information network layer by layer in the order of the weight of its elements and then reconstructs a new network in layers with the existing pieces, their negation or neither, whichever agrees with the information network we have built up so far in our process. Again, to gain a better grasp of this operation, we may perhaps think of it as analogous to when we take a fairly complex and layered object apart and then reassemble it in accordance to its parts fit to the amalgam whereby we try every possible composition of each layer and rid the layer of those items which are not stable across permutations. Our clothing analogy is wearing quite thin now: we may, say, shed our entire attire from the outside in certain groups of items and then put parts of each group on as long as they agree under different permutations with whatever we have put on so far.

As the reader might be inclined to verify, this operation gets past the drawbacks of our earlier proposals. Nonetheless, our latest implementation of consistency maintenance is computationally too complex. In that respect, the function is arguably psychologically unrealistic and might be taken as an indication that we must do better. We shall, however, come to rest now and only hint at direction for further improvements.

Our implementations of consistency maintenance so far have all had in common that an entire information network is under consideration. It seems more reasonable and realistic to consider only those elements of the network which are related in some sense to the proposition around which we maintain consistency. To get a proposal of that ilk off the ground, we need more complex models of information networks than we have used so far. Earlier, we realised that sets were completely unsuited for the purpose, so we introduced stacks as models of information networks. However, the computational cost induced by our stack implementations likewise seems to indicate that we need an even more complex data structure.

The name we have chosen for the subject of our enquiry has probably betrayed our demand: for our purposes, we need a net whose vertices represent propositions and whose edges represent their internal relations. Our target of consistency maintenance would then only be the propositions on particular paths within the net. Although somewhat more complex in implementation, such model of information networks will presumably turn out to be substantially less computationally demanding in maintenance. Having hinted at a probable solution to our issues, let those be our last words on the subject.

Appendix B: Argument Centred Semantics

Our present proposal has several shortcomings. In particular, the issue of closure remains open. Moreover, there is the further issue of embedded conditionals and degrees of credence.[34]

On the one hand, conditionals which embed further conditionals in their antecedents fare badly with respect to semantics we have outlined. So far, we have not said anything about how one would add an indicative conditional to an information network. In particular, we have taken indicative conditionals to be derivative of information networks but not its constituents. One might certainly claim that there are no natural language conditionals which sensibly embed further conditionals in their antecedents but that issue seems open to serious discussion. Indeed, when, for instance, we explain *Modus Ponens* to someone in natural language, we do arguably express an embedded natural language conditional: 'if φ and if φ, then χ, we may infer χ'.[35]

On the other hand, our account seems ill-equipped to account for the fact that we may find certain conditionals more credible than others. According to our semantics, an indicative conditional is either true or false or neither; there are no further shades between true or false available. Arguably, an account of credence in conditionals is something which semantics cannot reasonably be expected to explain. Similarly, although we might expect our semantics to give us truth conditions for belief ascriptions without providing us with any information about how credible a given belief is to the agent in question. Whether the same might be said for indicative conditionals we will leave as a subject for later discussion.

Both of those issues might potentially be resolved but let us instead briefly consider an alternative implementation of the Ramsey Test. Let us begin by revisiting Ramsey's passage:

> If two people are arguing 'If p, will q?' and are both in doubt as to p, they are adding p hypothetically to their stock of knowledge and

[34] See Gärdenfors (1986).

[35] For further examples, see §4.5.5.

> *arguing* on that basis that q ...[36]

Upon a closer scrutiny, we might realise that there are in fact two ways in which we might understand Ramsey's directions. On the one hand, as we have already interpreted the test, we might add the antecedent to our information network, maintain for consistency and then look for the consequent or its negation in the resulting information network. On the other hand, we might take the antecedent as a premiss together with the content of our information network and then try to argue on that basis for the consequent or its negation.

Roughly speaking, then, we may conceive of the Ramsey Test as an attempt to argue from the antecedent in question and our information network to either the consequent or its negation. If we succeed in the former, we would take the conditional to be true; if we succeed the latter, we would take the conditional to be false; and if we were to succeed neither, we would take the conditional in question to be neither true nor false. In other words, if we let $k_1, \ldots, k_n$ be the elements of our information network K, $\ulcorner \varphi \rightarrow \chi \urcorner$ is true if we have an argument somewhere along the following lines:

$$\cfrac{\cfrac{\cfrac{\cfrac{\varphi \quad k_i}{\vdots} \quad k_j}{\vdots} \quad \cdots}{\vdots} \quad k_k}{\chi}$$

Conversely, if we can derive $\ulcorner \neg\chi \urcorner$ from the set of premises, $\ulcorner \varphi \rightarrow \chi \urcorner$ is false. And finally, if there is no valid argument to either χ or its negation, $\ulcorner \varphi \rightarrow \chi \urcorner$ is neither true nor false.

Now, clearly, there are several details which are worth to point out. First of all, the logic in question would have to be appropriately paraconsistent. Any logic which would validate EFQ would not get us particularly far: if $\ulcorner \neg\varphi \urcorner \in K$, we would have both $K, \varphi \vdash \chi$ and $K, \varphi \vdash \neg\chi$ in any sufficiently explosive logic. In

[36] Ramsey (1931, p. 247, my emphasis).

other words, whenever we derive a contradiction on our way towards the consequent or its negation, we should never be entitled to infer anything except the negation of one of the premises on which the contradiction rests.

Second, in some relevant sense, the conclusion must rest upon the premise of the antecedent: importantly, the argument must be from φ to χ; φ must thus be more than an idle cog in the derivation. If we can argue our way from φ and K to either χ or its negation, we expect φ to play some necessary role in the argument. Roughly speaking, if $\ulcorner \varphi \rightarrow \chi \urcorner$ is to be true, the role of φ in the argument must be such that $K, \varphi \vdash \chi$ and yet $K \nvdash \chi$. And again, in cases of 'even' and 'still' conditionals, that condition is arguably mitigated.[37]

On the supposition that some appropriate logic may be found for the project, we might therefore spell out the truth conditions of indicative conditionals along the following lines:

Indicative Conditional (Argument Analysis)

Let C be a context constituted by an information network K. The truth conditions of an indicative conditional $\ulcorner \varphi \rightarrow \chi \urcorner$ in C are as follows:

$C \models \varphi \rightarrow \chi$ if $K, \varphi \vdash \chi$,

$C \models \neg(\varphi \rightarrow \chi)$ if $K, \varphi \vdash \neg\chi$,

$C \not\models \varphi \rightarrow \chi$ and $C \not\models \neg(\varphi \rightarrow \chi)$ if $K, \varphi \nvdash \chi$ and $K, \varphi \nvdash \neg\chi$.

Although this approach leaves a number of issues open in terms of the appropriate logic, it does seem to get pass the problem of closure quite elegantly. In fact, we might even use elements of this approach to supplement our main account: we could forget all about closure and simply look for an argument from the updated information network to either the consequent in question or its negation. We shall leave further details unspecified until later.

[37] See §2.6.

3 Where to Draw the Line

Natural language conditionals are commonly believed to be of two semantically distinct types: indicative and subjunctive. Although this distinction is central to many semantic analyses of natural language conditionals, there seems to be no consensus on the details of its nature. While trying to uncover the grounds for the distinction, we will argue our way through several plausible proposals found in the literature. First, we shall consider whether the grammatical and syntactic features of English conditionals do illuminate the distinction somehow. Second, we shall examine whether the semantic features of the conditional constituent sentences do reveal anything about the distinction. And finally, we shall examine whether some sort of epistemic/metaphysical distinction underlies the indicative/subjunctive distinction. Upon discovering that none of those proposals seem entirely suitable, we shall next attempt to do away with the distinction. In the wake of the failure of any such reduction, we shall next reconsider our position and make several helpful observations regarding the nature of conditional sentences. And finally, in light of our observations, we shall propose and argue for plausible grounds for the indicative/subjunctive distinction.

3.1 Preamble: The Indicative/Subjunctive Distinction

According to a widespread creed, conditionals in natural languages are of two fundamentally distinct types. While conditionals of the first sort have commonly become known as 'indicative', conditionals of the other sort are normally called 'subjunctive'. In many respects, indicative and subjunctive conditionals are said to be akin. Nevertheless, a certain and obvious difference emerges once we consider the truth conditions of certain pairs of conditionals.

On the one hand, for instance, the following conditional is traditionally claimed to be an indicative conditional:

(1) If Shakespeare did not write *Hamlet*, then someone else did.

We normally take this conditional to be true. We know very well that the play *Hamlet* exists—some of us are even fortunate enough to have seen or else read it—and since things of this kind do not write themselves, we know that there must have been an author. For that very reason we take (1) to be true: *Hamlet* exists, so someone must have written it, and if not William Shakespeare, then someone else must have.

On the other hand, the following conditional is traditionally said to be a subjunctive conditional:

(2) If Shakespeare had not written *Hamlet*, then someone else would have.[1]

We normally take this conditional to be false. Indeed, unless we hold some sort of Michelangelian conception of artistic creation, *Hamlet* was not merely floating around in the ether waiting to be written. Quite the contrary, it took an author of certain genius, living at a particular place and time in history to write the play. In fact, we might even be tempted to claim that no one apart from Shakespeare could have written *Hamlet*. Be that as it may, for even weaker reasons we are inclined to say that (2) is false: if Shakespeare had not written *Hamlet*, then no one else would have.

Of course, none of this is to say that (1) contradicts (2) in any way. After all, their truth values may very well coincide in certain situations. Rather, the important difference between (1) and (2) lies in their truth conditions. We take (1) to be true

[1] (1) and (2) are, of course, mere recasts of Adams' famous Oswald-Kennedy pair, Adams (1970, p. 90): 'if Oswald did not kill Kennedy, then someone else did' and 'if Oswald had not killed Kennedy, then someone else would have'.

only on the condition that *Hamlet* was in fact written, while we take (2) to be true only on the condition that someone else would have written the play in the event that Shakespeare had not. And insofar as we take meaning as somehow tied with truth conditions, (1) and (2) differ in meaning. In other words, the difference between indicative and subjunctive conditionals therefore seems to be a semantic difference.

Conditional pairs such as (1) and (2) reveal that two natural language conditionals that seemingly share an antecedent (or a protasis or a conditional clause) and a consequent (or an apodosis or a main clause) may differ in their meaning. Needless to say, this poses a particular challenge to anyone interested in accounting for the semantics of natural language conditionals: namely, we are not only in need of a single account of conditionals, rather it seems as if we need two accounts of conditionals. And in fact, even before attempting to address the issue of the semantics of conditionals, one must feel compelled to understand where to draw the line between indicative and subjunctive conditionals: indeed, the line might reveal a good deal about the semantics on either side of it.

This is therefore how we shall proceed. While trying to uncover the grounds for the indicative/subjunctive distinction, we will argue our way through several plausible proposals found in the literature. Upon discovering that none of those proposal available seem entirely suitable, we shall next attempt to do away with the distinction. In the wake of the failure of such reductions, we will next reconsider our position and make several helpful observations regarding the nature of conditional sentences. And finally, in light of our observations, we shall propose and argue for plausible grounds for the distinction.

3.2 Discerning the Distinction

The indicative/subjunctive distinction for natural language conditionals is widespread, in fact, so widespread that almost all mainstream semantic theories for conditionals respect it in one way or another.[2] In this section, we shall attempt to uncover the grounds of the indicative/subjunctive distinction. Dialectically, we will move though a series of intuitive proposals and argue that they all lack in some aspect or another. Let us begin our enquiry at the most obvious place.

3.2.1 First Proposal: Grammatical Mood

Traditionally, the words 'indicative' and 'subjunctive' name verb moods in languages of sufficient conjugations. Perhaps then, the natural first step for anyone interested in understanding the so-called indicative/subjunctive distinction of natural language conditionals is to turn her sights toward the moods of any verbs involved. According to any such proposal, the syntax of conditional sentences would then determine their semantics.

Presumably, were verb moods to turn out to be responsible for the distinction—common sense suggests—it would be somehow along the lines that indicative natural language conditionals are constituted of verbs in the indicative mood, while their subjunctive counterparts consist of verbs in the subjunctive mood.

Of course, unless involving an ellipsis of some sort, every conditional must at the very least consist of two verbs: one in its antecedent and one in its consequent. Whether one or more verbs of a given conditional must be in the subjunctive mood for it to count as a subjunctive conditional is a moot point at present. However, let us assume that one verb in its subjunctive form is enough for a conditional to count as subjunctive. Let this therefore be our first proposal:

> **The Grammatical Mood Proposal**
> A natural language conditional is subjunctive only if at least one of its verbs is in the subjunctive mood, otherwise the conditional is indicative.

Before we can consider the merits of this proposal, me must understand what we mean by 'mood' and spell out briefly the roles of verb moods in natural languages.

[2] Just to name a few, Adams (1975), Bennett (2003), Edgington (1995), Jackson (1987), Lewis (1973) and Stalnaker (1975/1999).

Grammatical mood refers to forms of verbs in sufficiently inflected languages. The mood of a verb usually indicates whether the sentence containing it is believed by its utterer to express, say, a fact in the case of the indicative mood or a certain uncertainty, hypotheticality or even conditionality in the case of the subjunctive mood.[3] Generally, then, the indicative and subjunctive moods serve as a means to express the attitude of the utterer to the sentence uttered.

We know, of course, that most natural languages possess more moods than merely the indicative and the subjunctive. There are, for instance, the imperative mood, the interrogative mood and optative mood. However, insofar as we are interested in declarative sentences—and, in particular, conditional sentences—which allegedly have truth conditions, any conditionals consisting of verbs in either the imperative, interrogative or optative mood are of no interest presently. Indeed, such conditionals would express nothing more than a conditional command, conditional question or conditional expression of wish respectively. Arguably, any theory of conditionals should illuminate the semantics and pragmatics of such expressions, but nothing can be said about their truth conditions since, arguably, such conditionals have no truth conditions.

With those pieces in place, we may now ask ourselves, how good is our grammatical mood proposal? Let us consider our paradigms of indicative and subjunctive conditionals again. On the one hand, our indicative conditional (1) seems quite fine: since all verbs involved are clearly in the indicative mood, the conditional is an indicative conditional according to our proposal. On the other hand, our subjunctive conditional (2) seems somewhat problematic for our proposal.

In the first place, the antecedent verb phrase 'had not written *Hamlet*' does not obviously contain any verbs in the subjunctive mood: the verb phrase consists of the preterite form of an auxiliary verb, 'had', and the past participle form of a verb, 'written', which together yield the indicative pluperfect (or past perfect) tense of the verb 'to write'.

In the second place, the consequent consists of a verb phrase of the familiar

[3] For an extensive overview and analysis of grammatical moods, see Palmer (2001).

modal verb 'would' and a further embedded verb phrase 'have'. Let us note first that there is nothing that syntactically indicates 'would' is in the subjunctive mood, as we may effortlessly construct indicative sentences which involve 'would' as a modal verb. Recall that 'would' is the magical word used in epic storytelling to give our listeners a strategic glimpse into our story's unravelled future: 'little did he suspect that one day they would meet again'. Furthermore, the embedded verb phrase consists of the auxiliary verb 'have' which is in fact an ellipsis for 'have written *Hamlet*'. Together, 'have' and the past participle 'written' merely yield the indicative present perfect tense of the verb 'to write'.

So far the difference between (1) and (2) merely seems determined by tenses and modal verbs alone, there is nothing which obviously indicates the subjunctive mood at play. Therefore, according to the proposal, we cannot really claim that (2) is a subjunctive conditional. That must be bad news for our grammatical mood proposal.

Worse yet, the subjunctive mood is embarrassingly poor in English.[4] Not only is the subjunctive mood notoriously uncommon in the English language, it also seems to be growing ever more so every day. In fact, syntactically, the subjunctive mood is only distinguishable from the indicative in the third person singular present tense form of regular verbs, where the indicative '-s' inflection is absent, and for the verb 'to be', where its present tense subjunctive form, irrespective of person or number, is 'be' and its preterite tense subjunctive form, again irrespective of person or number, is 'were' (which is indistinguishable from its indicative preterite plural form). However, those forms are rare in colloquial English. Although still around, their use tends at best to convey a formal tone which might even strike one as somewhat pretentious. Nowadays, we usually only encounter them in fixed expressions such as 'be that as it may', 'as it were', 'God help you' and the like, and in certain conditionals involving either third person singular subjects or appropriate number and person inflections of the verb 'to be'.

Needless to say, despite all this, nothing is lost in expressive power: English is

[4] On the subjunctive in English, see Palmer (2001, pp. 200–201).

just as expressive as other languages rich with the subjunctive mood. What those languages achieve with the subjunctive mood, English does with an intricate system of modal verbs. Importantly, however, the fact remains: there is not very much of the subjunctive mood—as mood is traditionally understood—in English. In other words, although English has traces of a subjunctive mood, it seems to be by far too uncommon to ground a semantic distinction for conditionals as pervasive as the indicative/subjunctive distinction. Our grammatical mood proposal is therefore not very useful to us in understanding the indicative/subjunctive distinction.

Yet, although we might agree that the subjunctive mood of English is poor, we may still persist in our position. Indeed, we might claim that although we cannot distinguish between indicative mood and subjunctive mood forms of English verbs, the subjunctive mood is still there, as it were, hidden from our sights. So, even though verb forms of English do not determine which mood is at play, we can discern their mood once we consider the contexts in which they occur. Furthermore, we might claim, once we translate English sentences into a language which is sufficiently rich in verb mood distinctions, the actual moods of the verbs will appear. Presumably then, indicative conditionals might turn out to be indicative and subjunctive conditionals as subjunctive. Let this therefore be our next proposal:

> **The Fortified Grammatical Mood Proposal**
> A natural language conditional is subjunctive only if at least one of its verbs is in the subjunctive mood when translated into a language rich enough in verb mood distinctions, otherwise the conditional is indicative.

There are a number of languages which have sufficiently elaborate grammatical mood distinctions. While Ancient Greek and Latin are classic examples, Arabic, Hungarian, Italian, German and Icelandic are examples of modern languages with well established and widely used subjunctive mood. To test out our present proposal, let us see where the translation of (2) into Icelandic leads us:[5]

[5]On the syntax of Icelandic, see Thráinsson (2007).

(3) *Ef Shakespeare hefði ekki skrifað Hamlet, þá hefði einhver annar gert það.*[6]

(Admittedly, we may also translate the conditional into Icelandic by placing the modal verb '*myndi*' in the consequent, much like we do with 'would' in its English counterpart.[7] However, since the subjunctive mood is commonly used in the Icelandic language, such a conditional would look slightly contrived and stilted although perfectly understandable.) Importantly, the auxiliary verb '*hefði*' in the antecedent and consequent of (3) is the preterite subjunctive form of the verb '*að hafa*' ('*að*' is the infinitive marker in Icelandic) which plays a role in Icelandic akin to the verb 'to have' in English. Thus, according to the fortified proposal, (2) does seem to be a subjunctive conditional after all. That must be good news for our fortified grammatical mood proposal.

However, let us not forget the fact that grammar is an empirical science: when we are still bewildered by the grammar of one language, why introduce a whole set of empirical problems presented by another language? Not to mention all the imponderables relating to a faithful translation from the one language into another. In fact, this whole approach, which sometimes has been know as the 'Latin Prose Theory', has been objected to by grammarians for centuries: we simply cannot impose a grammatical doctrine of one language upon our grammatical speculations about another language without making some fairly substantial assumptions.[8] So, although we may find languages into which conditionals such as (2) translate as conditionals involving verbs in their subjunctive mood form, that is too dubious a ground for distinction of conditionals in another language. For that reason, we must reject the fortified grammatical mood proposal too.[9]

Although both of our grammatical mood proposals turned out badly, there still

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[6]

Ef	*Shakespeare*	*hefði*	*ekki*	*skrifað*	Hamlet,
If	Shakespeare	have-3SG+PST+SUBJ	not	write-PP	*Hamlet*,

þá	*hefði*	*einhver*	*annar*	*gert*	*það.*
then	have-3SG+PST+SUBJ	someone	else	do-PP	it.

'If Shakespeare had not written *Hamlet*, then someone else would have.'

[7] '*Ef Shakespeare hefði ekki skrifað Hamlet, þá myndi einhver annar hafa gert það.*'

[8] See in particular Dudman (1988, p. 119).

[9] The rejection of our so-called grammatical mood proposal was pressed extensively by Dudman (1988, 1989, 1990, 1991a, 1994a, 1994b); see also Lycan (2001, §7) and Priest (2009).

remains wiggle room for anyone inclined to maintain that the indicative/subjunctive distinction is grammatically determined. Recall that we said before that English uses modal verbs such as 'would' to achieve what other languages do with the subjunctive mood. In particular, certain modal constructions in English are widely recognised as so-called conditional mood constructions (despite being more than mere verbal inflection) which express a consequent of a hypothetical situation or event. For that reason, we might argue that the subjunctive mood is more than a mere matter of appropriate verb conjugations in English. The subjunctive mood, arguably, is also a matter of certain complex verb constructions involving the appropriate auxiliary modal verbs. If so, we could claim that conditionals which contain 'would' are subjunctive:

> **The Extended Mood Proposal**
> A English natural language conditional is subjunctive only if it has the word 'would' in its consequent, otherwise the conditional is indicative.

According to this proposal, (2) is clearly a subjunctive conditional, while (1) is an indicative conditional. So far, so good.

Is that enough? No, unfortunately not. As most non-native English speakers come to know painfully, 'would' is indeed a tricky little word. The word is an extremely delicate modal verb of various roles: 'would' may, for instance, appear as the preterite of the modal 'will', it may be used in the aforementioned conditional mood sense and it may be used in the present tense to express a desire or inclination, to express a polite request or to express conjecture, opinion or hope. Furthermore, 'would' may also appear as a transitive verb which takes a complementiser phrase (CP) as its object and expresses a wish or regret. Needless to say, we may, easily enough, come up with conditionals in which 'would' appears as a transitive (non-modal) verb. For instance, Victorians, who were all a little bit mad about Shakespeare's persona and work, might reasonably have asserted the following conditional which shares the syntactic features of our paradigm indicative yet contains 'would' in its consequent:

(4) If Shakespeare did not write *Hamlet*, would that someone else had.

Intuitively, this conditional seems to express a wish that someone had written *Hamlet* even if Shakespeare did not.

Now, if anything, this is cheating. We can make the extended mood proposal invulnerable to alleged counterexamples of this sort merely by restricting the proposal to modal verb uses of 'would':

> **The First Fortified Extended Mood Proposal**
> A English natural language conditional is subjunctive only if it has the word 'would' as a modal verb in in its consequent, otherwise the conditional is indicative.

However, that alone will not suffice for the simple reason that there are far more modal verbs in English than 'would' alone. What about, say, 'will', 'must', 'shall', 'should', 'may', 'might', 'can' and 'could'? What are we to say about conditionals having any of these modal verbs in its antecedent? For instance, consider the following conditional:

(5) If Shakespeare had not written *Hamlet*, then someone else could have.

Interestingly enough, although this conditional bears family resemblance to our paradigm subjunctive conditional, the truth conditions of this conditional do obviously neither agree with those of (1) nor (2).

This might be obvious but recall that (1) is true only on the condition that *Hamlet* was indeed written. However, (5) may be true even in the case that *Hamlet* was never written, just as long as there was someone apart from Shakespeare who could have written it. Again, a vast plethora of stories will provide the case needed but here is one: suppose that Shakespeare died briefly after only outlining no more than vague sketches of *Hamlet* and although no one ever attempted to write the play from Shakespeare's vague sketches, John Fletcher could easily have done so—he had enough information about Shakespeare's intentions with the play, he had the skill, he had the right social and historical background and whatnot—if only he could have been bothered. Anyway, in that case, (1) is false while (5) true. Therefore, as we knew from the very beginning, (1) and (5) disagree in truth conditions.

Neither do (2) and (5) agree in truth conditions. Recall that (2) is true only on the condition that *Hamlet* must—for some reason or other—have been written, and if not by Shakespeare, then by someone else. Still staying within the same scenario: although Fletcher alone could have written *Hamlet* instead of Shakespeare, Fletcher's authorship was far from inevitable. Thus, while (2) is false, (5) is true. Therefore, as we knew too, (2) and (5) disagree in truth conditions.

Were we thus to pursue our fortified extended mood, we would be in a peculiar bind: the indicative/subjunctive dichotomy that we started out with seems oddly inadequate. Indeed, now there seems to be a matter of trichotomy between conditionals such as (1), (2) and (5). Moreover, we will most definitely muddle things further merely by considering the other modal verbs. For that reason, we might want to conclude that the extended mood approach to the indicative/subjunctive distinction is doomed to failure.

Nonetheless, we might persist and claim that not only 'would' but also 'could' and perhaps 'should' and 'might' are subjunctive markers in English. In fact, we might argue somewhere along the lines that 'would' is the subjunctive form of 'will', 'could' of 'can', 'should' of 'shall' and 'might' of 'may'. Our proposal would then be roughly as follows:

> **The Second Fortified Extended Mood Proposal**
> A English natural language conditional is subjunctive only if it has the word 'would', 'could', 'should' or 'might' as a modal verb in in its consequent, otherwise the conditional is indicative.

Against that claim, we could point out that 'would', 'could', 'should' and 'might' are still also the preterite forms of the modal verbs 'will', 'can', 'shall' and 'may'. Thus, for instance, we can imagine that the writing of *Hamlet* was commissioned by some mysterious and secret brotherhood. Ignoring fundamental issues regarding the identity of works of art, let us assume that the members of our mysterious brotherhood argue over whom to hire for the job: several members believe that Shakespeare is the only man fit for the job, while others believe that Francis Beaumont might be equally able enough. Thus, we may imagine that while certain members of the secret brotherhood would object, the rest would claim that:

(6) If Shakespeare does not write *Hamlet*, someone else can.

We must admit that there is nothing intuitively subjunctive about this conditional. Moreover, we could in fact point out that there seems to be at least two distinct readings of (6): first, it is epistemically possible that if Shakespeare does not write *Hamlet*, someone else will, and second, it is metaphysically possible that if Shakespeare does not write *Hamlet*, someone else will. Interestingly, the two readings demand different truth conditions for (6) since epistemic and metaphysical modalities need not coincide. Some metaphysically impossible propositions may be true for all we know and some metaphysically possible propositions are incompatible with all we know. Even more interestingly, we seem to have found semantic distinction which is not reflected in surface syntax. We might therefore suspect that any attempt to understand the indicative/subjunctive distinction based on grammatical features is doomed.

But let us not get ahead of ourselves for we still have not entirely done away with the extended mood proposal. Suppose we take the first reading of (6) to be indicative and suppose that the members of our secret brotherhood were in fact disputing about epistemic possibility rather than metaphysical. In that case, it seems plausible that some brotherhood member, while compiling his memoirs decades later, might recall a particular dispute whose subject was whether or not:

(7) If Shakespeare did not write *Hamlet*, then someone else could have.

If we agree that this conditional is indicative, the extended mood proposal seems refuted. If we do not agree, we must explain how a mere tense shift of an indicative conditional may result in a subjunctive conditional. And if we never agreed in the first place that our reading of (6) was particularly indicative, we are again left with two semantically distinct subjunctive readings—one somewhat epistemic, the other somewhat metaphysical—of (6) which still require an account.

On those grounds, we should also abandon our extended mood proposals. We must conclude that semantic distinction we are after is not grounded in the grammatical indicative/subjunctive distinction. That is not to deny that the distinction is somehow grounded in syntax, only that the moods are not solely responsible. However, let us for the time being turn our back on the syntactic features of conditionals and look for grounds in the semantic features of their constituents.

3.2.2 Second Proposal: Counterfactuality

All of our grammatical mood proposals have turned out to be unsuitable. Of course, that does not undermine the indicative/subjunctive distinction, it merely shows us that the labels 'indicative' and 'subjunctive' were ill-chosen.[10] Moving on, where do we go next? In the conditionals literature, it often seems as if the terms 'subjunctive conditional' and 'counterfactual' are used synonymously. Let us therefore make this our next proposal:[11]

> **The Strong Counterfactual Proposal**
> A natural language conditional is subjunctive only if it is counterfactual, otherwise the conditional is indicative.

So, what is a counterfactual conditional? We will take a counterfactual conditional to be a conditional whose antecedent is false.[12] A true counterfactual conditional is therefore one which expresses a real conditional relationship of some sort between the antecedent and consequent, such that if the antecedent were to be true, the consequent would also be true for some reason or another. More carefully put, what all counterfactuals allegedly have in common is that they express a conditional relationship of some sort between two propositions, φ and χ, in a particular order, where φ is false for one reason or another, and if the counterfactual is true, χ would be true on the condition that φ is true.

[10] For similar sentiments, see also Chisholm (1946), Ayers (1965), Bennett (1988, 2003) and Edgington (1995, §1).

[11] See, for instance, Lakoff (1970), Stalnaker (1975/1999) and von Wright (1957).

[12] See, for instance, Stalnaker (1975/1999, p. 68).

As we might imagine there are numerous different ways in which antecedents can be false. In some cases, φ may be false by necessity of some sort or another: φ may express a violation of a natural law or even a metaphysical law and φ may be a mathematical impossibility or even a logical contradiction. In other cases, φ might simply be a contingent statement yet false. Among counterfactuals we may therefore distinguish between, for instance, counterlegal, counterpossible, countermathematical, counterlogical and everyday counterfactual conditionals.[13]

Upon this construal of counterfactuals, our strong counterfactual proposal seems quite absurd: the class of counterfactual conditionals must extend the class of subjunctive conditionals. Recall our paradigm example of an indicative conditional: assuming that Shakespeare did in fact write *Hamlet*, our apparently true indicative conditional does have a false antecedent. The strong counterfactual proposal, that subjunctive conditionals are co-extensional with counterfactuals, seems therefore to be an absolute non-starter.

However, as proponents of the strong counter factual proposal, we might of course bite the bullet and claim that (1) is in fact a subjunctive conditional. That, however, is not very helpful for our purposes because the riddle of why (1) and (2) differ in truth conditions will still linger. Recall, the indicative/subjunctive distinction was drawn in order to give us a handle on the semantic difference between (1) and (2) and to claim that both conditional are on the subjunctive side of the line merely leaves one anew in need of a distinction.

Faced by the failure of the strong counterfactual proposal, we might make a weaker proposal somewhere along the following lines:

> **The Weak Counterfactual Proposal**
> A natural language conditional is subjunctive only if it is counterfactual.

Our strong counterfactual proposal claimed that subjunctive conditionals, all and alone, are counterfactual conditionals. Our present proposal, however, merely claims

[13] See, for instances, Mares (2004, §8).

that subjunctive conditionals, although not necessarily only, are counterfactual conditionals. Our first proposal was therefore a claim of co-extensionality while our present proposal is a mere claim of inclusion.

First of all, we should notice that our weaker proposal does not promise to offer a definition of subjunctive conditionals; if correct, it merely specifies a necessary condition for subjunctive conditionals. So, although we might agree with the weak counterfactual proposal, something more still needs to be said in order to fully explicate the indicative/subjunctive distinction. However, with that proviso in place, let us consider the merits of our weak counterfactual proposal.

Our present proposal certainly seems more reasonable than the strong counterfactual proposal. For one thing, our paradigm example of a subjunctive conditional supports the claim. However, we would be far too hasty to induce the validity of our weak proposal from that alone.

In order to reject the weak proposal, it seems at first blush that we must merely find a subjunctive conditional whose antecedent is true. Well, that seems to be fairly easy: on the supposition that Francis Bacon actually wrote *Hamlet*, (2) would either be a subjunctive conditional with a true antecedent or else mysteriously metamorphose into an indicative conditional. Since the second option merely leaves us anew in need of semantic distinction, we might conclude that we have discovered a counterexample to our weak counterfactual proposal. Clearly, however, there has to be more to the proposal than that—the proponent of the weak counterfactual proposal must have something more subtle in mind. Something, say, along the lines that were one to maintain a subjunctive conditional and also its antecedent, one would contradict oneself. Or perhaps, if one does not contradict oneself, then, at least, one does something otherwise inappropriate by asserting such a conditional while believing its antecedent. In other words, insofar as we were either rational or adhering to some relevant pragmatic maxims, we would never express subjunctive conditionals whose antecedents we believe to be true, in which case, presumably, all felicitously uttered subjunctive conditionals would be counterfactual.

Along those lines, we may thus distinguish between two strands of the weaker counterfactual proposal. First, that $\ulcorner \varphi \mathrel{\Box\!\!\rightarrow} \chi \urcorner$ entails the truth of $\ulcorner \neg\varphi \urcorner$ and thus to maintain ⌜$\varphi \mathrel{\Box\!\!\rightarrow} \chi$⌝ and φ would be to contradict oneself. Let us call this the *semantic proposal*. Second, that ⌜$\varphi \mathrel{\Box\!\!\rightarrow} \chi$⌝ implies a belief in ⌜$\neg\varphi$⌝ and thus to assert ⌜$\varphi \mathrel{\Box\!\!\rightarrow} \chi$⌝ without believing that ⌜$\neg\varphi$⌝ would be improper and misleading. Let us call this the *pragmatic proposal*.

On the one hand, in order to reject the semantic proposal, we need a true subjunctive conditional whose antecedent is true. On the other hand, in order to reject the pragmatic proposal, we need a situation in which we might assert a subjunctive conditional felicitously without a belief in the antecedent's negation. Let us begin by considering the semantic strand of the weak counterfactual proposal.

Although the view that subjunctive conditionals must have a false antecedent is widespread, there have been good counterexamples around for a long time.[14] Here is one. Suppose that, in the late sixteenth century, we run into a young son of a glover and alderman by the name William Shakespeare who tells us about his grand aspirations to establish a career as a playwright. Being a gentleman given to talk, he also tells us of a couple of his ideas for plays and of several lines that he has been working on recently. In particular, he tells us proudly about the following sentence: 'There is nothing either good or bad, but thinking makes it so.' Being somewhat bourgeois, only decades later do we come to learn that this young lad did in fact succeed in making a career for himself as a playwright and that one of his most famous pieces at the time is a tragedy called *Macbeth*. (In other words, our relevant (true) beliefs are that 'Shakespeare wrote a number of plays', 'Shakespeare wrote *Macbeth*' and 'Shakespeare incorporated "There is nothing either good or bad, but thinking makes it so." into one of his plays'.) Remembering well what transpired years before, we are completely justified in claiming the following true subjunctive conditional:

(8) If Shakespeare had not incorporated 'There is nothing either good or bad, but thinking makes it so' into *Macbeth*, he would have done so elsewhere.

[14] Anderson (1951); see also discussion in Chisholm (1946) and Ayers (1965). Notice however that there are certain subjunctive conditionals which are, as it were, automatically counterfactual: so-called 'mismatched past counterfactuals' and 'verb-first counterfactuals' are arguably subjunctive and invariably counterfactual; see Iatridou and Embick (1993) and Ippolito (2003).

We might even be bothered to discover that Shakespeare did not, in fact, use the line in *Macbeth*, in which case we will happily detach the consequent and admit that he must have found another place for it. Needless to say, countless examples of this sort can be generated easily if there is merely an appropriate amount of ignorance involved. The semantic strand of our current proposal thus seems refuted: $\ulcorner \varphi \mathrel{\Box\!\!\rightarrow} \chi \urcorner$ and φ need not contradict each other.

Furthermore, (8) also seems to falsify the pragmatic strand of the weak counterfactual proposal. By uttering (8), a subjunctive conditional whose antecedent we do not believe, we have certainly not done anything inappropriate. We have only exposed our blatant ignorance, not said anything improper. Indeed, as far as we neither have a belief in the antecedent nor its negation, we seem to be in a position to assert conditionals such as (8) quite felicitously.

In fact, expressions of uncertainty are one of the roles of the subjunctive mood in languages of sufficient mood distinctions. Using the only verb of the properly subjunctive mood form English has to offer, 'to be', we may actually see traces of this. Say, we might be ignorant about the extent of our library and wonder whether a copy of *Hamlet were* somewhere to be found. Being given to order, we could even claim that 'if there were a copy of *Hamlet* in our collection, it would be placed between our copies of *Cymbeline* and *Henry IV*'. Were we then to go and have a look, we might discover that we did in fact have a copy, in which case we would certainly not be inclined to retract our earlier claim.

It seems therefore that neither strand of the weaker counterfactual proposal passes closer scrutiny. However, as proponents of this proposal, we might strike back and claim that (8) is not a subjunctive conditional at all but merely a cleverly disguised indicative conditional. Apart from being somewhat ad hoc, a reply of that ilk faces two problems.

First, we may cast (8) in indicative terms akin to (1), 'if Shakespeare did not incorporate "There is nothing either good or bad, but thinking makes it so" into *Macbeth*, he did so elsewhere', whose truth conditions will be different from those of (8): we may correctly recall reading 'There is nothing either good or bad, but thinking makes it so' in some Shakespearean play without it being necessary that

Shakespeare wrote the line, in which case (8) is false. Yet 'if Shakespeare did not incorporate "There is nothing either good or bad, but thinking makes it so" into *Macbeth*, he did so elsewhere' is true. Thus, were we to claim that (8) is indicative, we merely end up with two sorts of indicative conditionals whose semantic difference we must explain all over again.

Second, we must explain why two conditionals of the same grammatical properties, such as (2) and (8), fall within different semantic categories. Insofar as semantic properties are supposed to supervene on syntactic or grammatical properties, claiming that (8) is indicative seems inappropriate.

Admittedly, the second objection is not an impossible bullet to bite. However, the first objection seems quite devastating. We must therefore conclude that the counterfactual proposals will not help us to understand the indicative/subjunctive distinction. The time has come again to look elsewhere.

3.2.3 Third Proposal: Epistemic & Metaphysical Necessities

Upon a brief reflection on (1) and (2), we might soon come to the conclusion that that while (1) has an epistemic flavour of a certain sort, (2) has more of a metaphysical nature. Indeed, the truth value of (1) intuitively seems to depend on its antecedent together with what we know. Conversely, the truth value of (2) intuitively seems to depend on its antecedent together with certain facts about the world. It need not therefore surprise us that the indicative/subjunctive distinction has sometimes been taken to be closely related to an epistemic/metaphysical distinction of some sort or another.[15] According to that story, the indicative/subjunctive distinction is supposed to parallel the one of epistemic and metaphysical necessity in some interesting sense. Let us therefore make this our next proposal:

The Epistemic and Metaphysical Necessity Proposal

A natural language conditional is subjunctive only if it makes claims

[15] See, for instance, Chalmers (1998), von Fintel (1998a), Lowe (1991), Kratzer (1986), Nolan (2003), Stalnaker (1975/1999) and Weatherson (2001); see also Adams (1975) and Edgington (1995, 1995) Gibbard (1981).

> of metaphysical necessity, and indicative only if it makes claims of epistemic necessity.

According to this proposal, an indicative conditional is a claim of epistemic necessity in the following sense: were we to add the conditional's antecedent to our present stock of knowledge and then maintain consistency appropriately, the consequent would turn out to be true. This understanding of indicative conditionals, which has become known as the Ramsey Test, is traditionally traced back to the following oft quoted passage:

> If two people are arguing 'If p, will q?' and are both in doubt as to p, they are adding p hypothetically to their stock of knowledge and arguing on that basis that q ...[16]

Along those lines, an indicative conditional would be true only if its consequent were to turn out as true once we have added its antecedent to our stock of knowledge and and presumably false only if its consequent were to turn out as false. For instance, were we to add 'Shakespeare did not write *Hamlet*' hypothetically to our stock of knowledge and adjust appropriately to maintain consistency, 'someone else wrote *Hamlet*' would turn out to be—depending on the content of our current stock of knowledge—either true, false or neither true nor false. If 'someone else wrote *Hamlet*' is true in a particular stock of knowledge upon adding 'Shakespeare did not write *Hamlet*', (1) would be true; if 'someone else wrote *Hamlet*' is true in a particular stock of knowledge upon adding 'Shakespeare did not write *Hamlet*', (1) would be false; and, arguably, if 'someone else wrote *Hamlet*' is not in a particular stock of knowledge upon adding 'Shakespeare did not write *Hamlet*', (1) would be neither true nor false.

However, nothing of this sort is supposed to hold for subjunctive conditionals. According to the proposal, subjunctive conditionals are said to make broadly metaphysical claims. Subjunctive conditionals are supposed to be claims about the world: claims about what obtains on the condition that something else does. They

[16] Ramsey (1931, p. 247).

are not claims about what follows from adding some proposition to a stock of knowledge.

According to this story, the truth conditions of subjunctive conditionals are supposed to be such that we must consider a consistent situation as metaphysically similar—according to some standard or other—as possible to our actual situation—either past, present or future—where the antecedent is true, and then we must ask ourselves whether the consequent is true in that situation as well. Should the consequent thus turn out as true, the conditional is true, otherwise the conditional is false or possibly neither true nor false, if we are to allow more than one most similar situations.

Although they need not do so necessarily, semantics for subjunctive conditionals are normally spelled out in terms of possible worlds which may be ordered according to a similarity metric of some sort.[17] For instance, were we to inspect the closest world or worlds in which Shakespeare did not write *Hamlet*, it might be true or false that someone else wrote *Hamlet* in the world or worlds in question. Semantics for subjunctive conditionals such as (2) might then, for instance, be spelled out in the following terms: if someone else wrote *Hamlet* in all the closest worlds in which Shakespeare did not, (2) is true; if no one else wrote *Hamlet* in all the closest worlds in which Shakespeare did not write *Hamlet*, (2) is false; and if someone else wrote *Hamlet* in some of the closest worlds in which Shakespeare did not write *Hamlet* but no one did in some of the closest worlds, (2) is neither true nor false.

Taken together, an interesting picture emerges. On the one hand, indicative conditionals are conditional expressions of epistemic necessity: given what we know in conjunction with the antecedent of an indicative conditional, the consequent will be true or not after an appropriate consistency maintenance. On the other hand, subjunctive conditionals are conditional expressions of metaphysical necessity: given the way the world actually is in conjunction with the antecedent of a subjunctive conditional, the consequent will be true or not in the worlds deemed to be closest according to some appropriate metric. And for those reasons, the nature of

[17] See, for instance, Lewis (1973), Stalnaker (1968/1991) and Weatherson (2001).

these two sorts of conditionals should roughly parallel epistemic and metaphysical necessity.

We must admit, this proposal is extremely charming. Not only does this proposal draw a neat distinction among our natural language conditionals. More importantly, this proposal draws the line in terms which are philosophically fundamental. However, before we get ahead of ourselves, we must ask whether there is any reason for us to suspect that our natural languages respect a distinction as conceptually elemental. To be sure, that would certainly not be impossible but nonetheless quite remarkable. Although natural languages do often reflect crucial insights, they often seem quite arbitrary and erratic in their conceptual framework. Verb tenses in natural languages, for instance, reflect a rather naïve conception of time and noun genders often miss the mark altogether of their biological counterparts. So, why should conditionals in natural languages do any better at carving reality at its joints?

Indeed, at first blush, there seems to be certain conditional sentences which falsify the claim outright. Merely consider the following conditional:[18]

(9) If Shakespeare did not write *Hamlet*, we will never know about it.

Come up with whichever story you like and as long as there is an element of sufficient deceit involved, the conditional will be intuitively true. So, we might ask, is (9) an indicative conditional? Well, (9) shares its syntactical properties with (1), our paradigm indicative conditional.[19] However, if we treat (9) as an indicative conditional subject to the Ramsey Test, it seems as if it will inevitably come out as false: adding the proposition 'Shakespeare did not write *Hamlet*' hypothetically to our stock of knowledge will certainly make the consequent false. Indeed, just having added the proposition to our stock of knowledge, how could we possibly not know?

[18]Conditionals of this sort are commonly attributed to Richmond Thomason, see van Fraassen (1980).

[19]Well, that is not entirely true, the antecedent and consequent of (1) agree in tenses as both are in the preterite. We may as well recast (9) as 'If Hamlet is not by Shakespeare, we do not know about it' to maintain that agreement. Whether conditionals such as (9) are indicative has—of course—been debated, see Bennett (1988, 1995), Dudman (1985a, 1991b, 1992, 2000), Gibbard (1981), Jackson (1990, 1991) and Lowe (1991).

We might of course object to (9) and claim that indicative conditionals claiming our ignorance of their antecedents in their consequence are dubious. However, a claim like that is no less dubious: we understand very well what someone means by uttering a conditional such as (9). We even have an intuitive grasp of the truth conditions of such conditionals.

A more promising strategy, however, would be to argue that when we add 'Shakespeare did not write *Hamlet*' hypothetically to our stock of knowledge, we are wrong to consider merely whether or not we end up with that proposition in our stock of knowledge. Rather, we should consider whether or not the consequent is in our updated stock of knowledge: only if the proposition 'we will never know that Shakespeare did not write *Hamlet*' were in our updated stock of knowledge, would (9) be true. Slightly more carefully put, when we evaluate a conditional of the form $\ulcorner\varphi \rightarrow \neg K_s\varphi\urcorner$, we must ask ourselves whether $\neg K_s\varphi$ is in our updated stock of knowledge; we must ask whether we would then know $\neg K_s\varphi$ and not merely φ. And insofar as φ and $\neg K_s\varphi$ could consistently constitute the stock of knowledge in question—which intuitively seems to be the case—the conditional would be true.

Another strategy would be to claim that (9) is in fact a subjunctive conditional. According to our present proposal, (9) would then be an expression of metaphysical necessity of a certain sort and thus true as far as there is some such necessity at play. The closest possible worlds in which Shakespeare did not write *Hamlet*, might be such that there has been a widespread, hitherto and eternally successful conspiracy on behalf of Danish authorities to attribute the play of their tragic prince to England's greatest playwright. In those worlds, our ignorance of that fact may very well be inevitable and in which case (9) would be true. Conversely, there might have been no such conspiracy in the closest worlds, in which case (9) would be false. And finally, only some closest worlds might be such that our ignorance is inevitable, in which case (9) would be neither true nor false. All of this does seem to fit well with our intuitions about (9).

Notice that our present proposal makes no assumption to the effect that semantic features of natural language conditionals must supervene in some way upon their syntactic properties. So, although (9) seems syntactically more similar to (1) than

(2), we may still claim that (9) is subjunctive since that conditional seems to make a metaphysical claim rather than an epistemic one. We cannot therefore object to our current proposal on the grounds that (9) 'looks' indicative while really being subjunctive. According to the proposal, although there may be some correlation, the syntactic features of conditionals do not determine their semantic features.

Either way, whether we treat (9) as an indicative or subjunctive conditional, our epistemic and metaphysical necessity proposal seems unharmed. How then, if at all, are we supposed to reject the proposal? On the assumption that the indicative/subjunctive distinction is supposed to be mutually exclusive and jointly exhaustive, there seems to be room for objection. Insofar as we may find conditionals which seem to make both epistemic and metaphysical claims or neither, we might be onto something.

On the one hand, the following and vaguely familiar conditional does seem to allow for both epistemic and metaphysical reading:

(10) If Shakespeare and Cervantes were compatriots, they would both have been English.

On the epistemic reading, this conditional would be understood as a claim to the effect that were we to add its antecedent to our stock of knowledge, its consequent would be true. Supposing that our stock of knowledge is such that we know that Shakespeare was English, while having no information whatsoever on Cervantes' nationality, (10) would come out as true. On the metaphysical reading, however, (10) would be understood as a claim to the effect that were we to examine all closest worlds in which Shakespeare and Cervantes were compatriots, we would discover that Shakespeare and Cervantes are English in those worlds. Supposing that there was some metaphysical necessity such that this was the case, the conditional would be true. However, of course, it seems more reasonable that only in some but not all the nearest worlds Shakespeare and Cervantes were English, in which case the conditional would be neither true nor false.[20] Importantly, since (10) seems to support

[20]See Lewis (1973, p. 80).

both epistemic and metaphysical readings, (10) is both indicative and subjunctive according to our current proposal.

On the other hand, the following conditional seems to allow for a reading which is neither epistemic nor metaphysical:

(11) If Shakespeare did not write *Hamlet*, the real author should be rightfully acknowledged.

On the most natural reading of this conditional, we are making a deontic claim of some sort: whoever wrote *Hamlet* ought to be rightfully acknowledged. It would be a mistake to understand (11) as an epistemic or metaphysical claim. We are certainly not claiming that were we to add 'Shakespeare did not write *Hamlet*' to our stock of knowledge, '*Hamlet's* real author should be rightfully acknowledged' would appear after some appropriate consistency maintenance. Moreover, we are not claiming that in all the closest worlds in which Shakespeare did not write *Hamlet*, *Hamlet's* author should be rightfully acknowledged; for all we know, the closest worlds might be such that no one wrote *Hamlet*. Importantly, since (11) seems to support neither epistemic nor metaphysical readings, (11) is neither indicative nor subjunctive according to our current proposal.

In other words, if we were to accept our current proposal, the indicative/subjunctive distinction would be neither mutually exclusive nor jointly exhaustive. That is certainly not to say that there are not classes of natural language conditionals which deserve epistemic and metaphysical semantics respectively. In fact, we seem to have ample evidence already to support that claim. However, if we were to pursue our current proposal, we would be in a peculiar bind: the indicative/subjunctive distinction seems to inadequate for our subject matter. If we want to give an appropriate account of natural language conditionals, the categories of 'indicative' and 'subjunctive' as understood in terms of epistemic and metaphysical necessity are simply not sufficient.

Sheepishly, we might have to admit now that we have all but run out of ideas as to where to draw the indicative/subjunctive line. At any rate, we have considered numerous variations of the most commonplace proposals and found them all inadequate on different accounts. In order to understand the distinction, we might therefore conclude that we are in need of a new account altogether. However, before we venture on such a project, we should take some time to understand why it is not an option to discard the distinction.

3.3 Interlude: Discarding the Distinction

Although we have assumed so far that there is a distinction to be drawn between different classes of natural language conditionals, we might of course attempt to abandon that assumption.[21] Needless to say, that will leave us in dire need of an explanation that does away with the semantic difference between conditional pairs such as (1) and (2). However, having failed so far to find the grounds for the indicative/subjunctive distinction, such project might seem like the most viable option. Let us therefore make this our next proposal:

> **The No-Distinction Proposal**
> All natural language conditionals are of the same semantic kind.

Before we consider this proposal, a word of caution is in place: we must be careful not to forget that (1) and (2) do quite clearly differ in their truth conditions. That said, let us now reconsider our paradigms of indicative and subjunctive conditionals again and discover that a good deal more is going on at the grammatical level in those conditionals than we first assumed.

Until now, we have taken our paradigm indicative and subjunctive conditionals, (1) and (2), as nothing more than two sentences made up of the same two constituent sentences flanking two different connectives. Indeed, we have assumed that there are two constituent sentences, p and q, roughly 'Shakespeare did not write *Hamlet*' and 'someone else (than Shakespeare) wrote *Hamlet*', merely connected by two different logical connectives of some sort or another: namely an

[21] See in particular Priest (2009) and Schaffer (ms.a); see also Jackson (2009).

indicative conditional connective, that is traditionally represented by '$\rightarrow$', and a subjunctive conditional connective, that is traditionally represented by '$\Box\!\!\rightarrow$'. Most importantly, we have taken (1) and (2) as involving the *same* two sentences and therefore assumed that the difference in meaning between them must lie in their connectives. In other words, since $\ulcorner p \rightarrow q \urcorner$ and $\ulcorner p \Box\!\!\rightarrow q \urcorner$ differ in meaning, the difference must somehow be accounted for in terms of their connectives.

Are things really so simple? Well, considering their grammatical differences, there seems to be a reason to suspect that (1) and (2) do not share antecedents and consequents. In particular, the differences in verb tenses and modal verbs might be taken as an evidence. Interestingly, if (1) and (2) do not share their constituents, we might be able to claim that the semantic difference is a mere product of the different constituents and not their connectives. Let us therefore have a closer look at our paradigms in turn.

What we take to be a paradigm of indicative conditional (1) is a conditional sentence whose antecedent is a subject-predicate-object subordinate clause having the auxiliary verb 'to do' in its preterite tense, 'did', followed by a negation and a verb in the infinitive, 'write'. The auxiliary verb in the antecedent is merely there to support the negation; if we would drop the negation, the sentence would simply become 'Shakespeare wrote *Hamlet*'. On the other hand, the sentence's consequence is a subject-predicate clause whose predicate is merely an auxiliary verb in the preterite tense, 'did', which is an elliptical verb phrase for the infinitive verb and the object of the subordinate clause: 'someone else did write *Hamlet*'. Notice that in this case we can, of course, do without the auxiliary verb as long as we shift the tense of 'write' to its preterite form, 'wrote': 'someone else wrote *Hamlet*'.

There is nothing very complex at play at the grammatical level of this conditional. The mood of the verbs in both clauses is the indicative. The tense of the auxiliary verbs in both clauses is the preterite, which is the most primitive past tense English has on offer, yielding a preterite tense of both predicates. Moreover, there are no modal verbs involved which might otherwise muddle things. Perhaps interestingly, both clauses can stand on their own: 'Shakespeare did not write *Hamlet*' and 'someone else did write *Hamlet*' are both grammatical sentences in isolation.

On the other hand, our paradigm of subjunctive conditional is more complex. The antecedent is again a subject-predicate-object subordinate clause containing the past participle form of its main verb, 'written', which together with its familiar auxiliary 'had' yields the pluperfect (or past perfect) tense. In this sentence, notice that the auxiliary verb does far more than support the negation: the auxiliary verb helps to make up the tense of the predicate. On the other hand, the consequent is again a subject-predicate clause whose predicate consists of the familiar modal verb 'would' followed by the auxiliary verb 'have' which is an elliptical verb phrase for the past participle form of a verb, 'written', yielding the present perfect tense, and the object of the subordinate clause: 'someone else would have written *Hamlet*'.

There is clearly something more complex at play at the grammatical level of this conditional. As we remarked on earlier, there is nothing that suggests anything other than the indicative mood of the verbs involved although we might claim, as we proposed before, that the modal verb does contribute some sort of subjunctivity to the clauses. Furthermore, the tenses of both clauses are complex, the subordinate clause is in the pluperfect tense, while the main clause involves a present perfect construction embedded within the scope of the modal verb 'would'. Arguably, although not very importantly, such a construction gives us the complex future-in-past tense. Again, perhaps interestingly, both clauses seem somewhat strange on their own: 'Shakespeare had not written *Hamlet*' and 'someone else would have written *Hamlet*' strike us as a little bit funny in isolation.[22]

For all those reasons, it is very tempting to suspect that (1) and (2) have different antecedents and consequents altogether. As obviously as, say, 'Shakespeare wrote *Hamlet* in 1599', whose tense is the preterite, and 'Shakespeare had written *Hamlet* in 1599', whose tense is the pluperfect, disagree obviously in meaning, we might claim that so do too the clauses of (1) and (2). If that is the case, the semantic difference between (1) and (2) does not necessarily spring from their different connectives. Indeed, the connectives need not be different at all, their difference in meaning might be the product of their different constituent sentences.

[22] See Priest (2009, §2.1).

There are a number of issues here we need to address. First, it is hardly the case that the sentences 'Shakespeare had not written *Hamlet*' and 'someone else would have written *Hamlet*' are ungrammatical or senseless in isolation outside conditional sentences.[23]

Once we consider the grammatical properties of the antecedent and consequent, it is fairly easy to embed those sentences in a context where their place is natural. The first one has its predicate in the pluperfect tense, which we commonly use to refer to the past of an already implied past. Thus, when speaking about some time t_1 prior to the time of utterance t_0, we may use the pluperfect tense to reach further back to some time t_2, such that $t_2 < t_1 < t_0$, a past-in-past, as it were. Therefore, supposing I were to relate to you the history of European literature in the early sixteenth century, I might begin along the following lines: 'In the early sixteenth century, the landscape of European literature was quite barren. True, some time ago, Dante had written his *Divine Comedy* and Chaucer had written his *Canterbury Tales*. However, Cervantes had not yet written the story of *Don Quixote*, Shakespeare had not written *Hamlet*, and Pope had not written his *Dunciad* ...'.

The same goes for the consequent whose predicate is a curious matrimony of the modal verb 'would' and a verb phrase in the present perfect tense. Although we seldom find ourselves in situations where such expressions are called for, we may use this structure to refer to the past of a future of an already implied past. Thus, when speaking about some time t_1 prior to the time of utterance t_0, we may use this structure to reach back to the future t_2 and its past t_3, such that $t_1 < t_0$, $t_1 < t_2$ and $t_3 < t_2$, a future-in-past, as it were. Therefore, suppose that the events *Hamlet* relate actually took place. In his prime, Christopher Marlowe came across the tragic anecdote about the prince of Denmark. Although the story moved him, he decided that the tale was not fit for the stage and not worthy of further pursuit. If I were now to relate those facts to you, I would probably cast my narrative in the past tense. Yet, after having recounted those facts, I might conclude my little chronicle along those lines: 'Never did Marlowe suspect that someday someone else

[23] See, again, Priest (2009, §2.1).

would have written *Hamlet*. In fact, never in doubt of his own talent, he could not imagine that someone else would have written *Hamlet* to a great repute some years later'.[24]

What about properly subjunctive sentences? Say, if our antecedent had been 'Shakespeare were not the author of *Hamlet*' or 'Shakespeare were Marlowe'? Are those sentences ungrammatical outside the refuge of conditional structures. Well, they may look odd but we must submit that this only stems from the fact that the subjunctive case is as good as lost from English. It is for that very reason that expressions like 'God bless you', 'be that as it may' and 'come what may', although well entrenched into the vernacular, strike us as odd once we give them a thought. Yet, once we recall the alleged roles of the subjunctive mood, the cases seem abundant. Recall that we use the subjunctive mood primarily to express our attitude to the truth of the sentence uttered. Therefore, suppose that I have in high stakes devoted my lifework in some way or another around Shakespeare's authorship of *Hamlet* in which I hold a sturdy belief. Were someone to ask me of my greatest fear, it seems only natural for me to reply: 'That Shakespeare were not the author of *Hamlet*.' Or about some conspiracy theorist: 'Often times he wondered whether Shakespeare were Marlowe.'

We must therefore conclude that whatever else might be said about the difference between (1) and (2), their antecedents and consequents may well appear outside conditional constructions. The disparity is therefore no more than apparent. Despite that, we are still not forced to abandon the no-distinction proposal: the fact that the constituents of (2) can appear grammatically outside conditional constructions does not compromise the claim that (1) and (2) do not share antecedents and consequents. However, let us now return to a more serious objection.

The most serious objection to the no-distinction proposal comes from the way in which natural language conditionals behave in reasoning.[25] In particular, let us consider how (1) and (2) behave in reasoning with inference rules such as *Modus*

[24]We must of course assume too, contrary to numerous conspiracy theories, that Marlow was not Shakespeare. For more cases, see for instance Schaffer (ms.a)

[25]I am in debt to Frank Jackson for this suggestion.

(Ponendo) Ponens (MPP) and *Modus (Tollendo) Tollens* (MTT).

Recall that MPP is the inference rule that tells us that from a conditional and its antecedent we may infer its consequent. Furthermore, supposing that MPP is valid for natural language conditionals, we may infer χ from $\ulcorner$if φ, then $\chi\urcorner$ and φ.[26] On the other hand, MTT is the inference rule that tells us that from a conditional and the negation of its consequent we may infer the negation of its antecedent. Moreover, supposing that MTT is valid for natural language conditionals, we may infer $\ulcorner$not $\varphi\urcorner$ from $\ulcorner$if φ, then $\chi\urcorner$ and $\ulcorner$not $\chi\urcorner$.[27]

Keeping that in mind, let us now consider how (1) and (2) behave in reasoning. Starting with MPP, it appears that we do in fact use the same minor premise to get things off the ground in both cases. Namely, the sentence 'Shakespeare did not write *Hamlet*' is all we need to apply MPP and detach 'Someone else wrote *Hamlet*'. Indeed, for (1) we get:

If Shakespeare did not write *Hamlet*, then someone else did.
Shakespeare did not write *Hamlet*.

Someone else wrote *Hamlet*.

And similarly so for (2), we have:

If Shakespeare had not written *Hamlet*, then someone else would have.
Shakespeare did not write *Hamlet*.

Someone else wrote *Hamlet*.

On the other hand, now with MTT, we need again the same minor premise to set our inference in motion. Namely, in either case, the sentence 'No one else wrote *Hamlet*' is all we need to apply MTT and infer 'Shakespeare wrote *Hamlet*'. So, for (1) we get:

[26] On the validity of MPP for natural language conditionals, see §5.

[27] Although it remains in general agreement that contraposition fails for subjunctive conditionals, MTT is generally taken to be valid. See Lewis (1973, pp. 35–36) and Adams (1988)

If Shakespeare did not write *Hamlet*, then someone else did.
No one else wrote *Hamlet*.
———
Shakespeare wrote *Hamlet*.

And so in the same manner for (2), we have:

If Shakespeare had not written *Hamlet*, then someone else would have.
No one else wrote *Hamlet*.
———
Shakespeare wrote *Hamlet*.

What are we to make of this? Well, the obvious conclusion to draw from this is that (1) and (2) do after all—despite appearances otherwise—share the same antecedent and consequent. In other words, the semantic difference between (1) and (2) does not stem from their constituent sentences because they are the same in both cases. The difference must therefore lie elsewhere.

We have thus now seen that we cannot easily explain away the indicative/subjunctive distinction: the semantic difference between (1) and (2) cannot be blamed entirely on their constituent clauses. We should therefore continue our search for an adequate account of the distinction. However, before we do that, let us make several valuable observations which will help us to formulate our ultimate account.

3.4 Several Observations

3.4.1 First Observation: Grammar of Natural Language Conditionals

Those whose youth was fortunately graced with studies of English grammar might, albeit vaguely, recall a distinction between so-called first, second, third and zero conditionals.[28] This distinction has been recognised for a long time and has been observed across different natural languages to some extent. As those things go, this is one of the classical grammarian account of conditionals. We should nonetheless remain aware that there is another equally classical distinction for certain languages,

[28] See for instance Swan (2005, §256–§265).

for instance Latin, between simple conditionals, so-called more and less vivid future conditionals and contrary-to-fact conditionals. However, since our primary interest here is with conditionals in English, we will not get too bogged down with this distinction. Moreover, there is also the classical distinction between so-called realis and irrealis conditionals to consider. However, since the realis/irrealis distinction aligns with the first/second/third/zero distinction, with zero and first conditionals on the realis side and second and third conditionals on the irrealis side, we will not consider the realis/irrealis distinction any further.

Before moving on, a brief remark on the nature of grammar is probably in place. Grammar, in the sense used here, is an empirical science. Although prescriptive grammar instructs us on how to speak and write grammatically, its data is the result of the work of the descriptive grammarian. Indeed, although prescriptive grammar is normative, its norms spring from the 'best' of our language use. The grammatical rules of English are not arbitrary chosen in a darkly lit back room. Quite the contrary, the rules of grammar are an empirical hypotheses intended to describe and explain the way we use our language in the best of times.

Of course, no one seriously denies that people do often speak and write ungrammatically. Part of the grammarian's predicament is to demarcate whether a particular sentence which falls outside the prevalent theory of grammar is a case of bad language or a counterexample to the current theory of grammar. As pressing as that issue may be, however, we do not need to address that here. All we must keep in mind is that any grammatical story—including the story about conditional sentences which we are about to relate—is nothing more that a hypothesis as to how people ideally use English and how we thus ought to speak or write. What we must therefore keep in mind is that the rules of grammar are no more than well observed regularities of our language which are as open to empirical refutation as any other empirical theory.

A certain analogy with logic is perhaps emerging: insofar as logic is to model the best of our reasoning, so are the rules of grammar to capture our ideal language use. In this sense, both logic and grammar may be mistaken: the models they provide may very well turn out to be inadequate for the data. A certain dissimilarity has presumably also emerged: although our logic and grammar might be mistaken, correct reasoning seems more eternal than the good uses of natural language. The logician's target is therefore, so to speak, more static than the grammarian's: a valid argument remains valid (although our logic of choice may deem it as invalid), an ungrammatical sentence, on the other hand, may well become grammatical as the language evolves. Having said all this, let us now familiarise ourselves with the zero/first/second/third conditionals account.

3.4.1.1 First Conditional

In addition to being an expression of conditional relation of some sort, the so-called first conditional expresses, as it were, a real (subjective) possibility of its antecedent. In other words, the utterer of first conditionals usually takes its antecedent to be quite probable. According to the story, we normally use first conditionals to talk about actual future conditions. For a first conditional, the antecedent is a clause in the (simple) present tense and the consequent consists of a determiner phrase, a particular modal verb and a verb phrase whose verb is of its infinitive form. We may give the following schema of first conditionals:

$$\textbf{(First Conditional)}\quad \text{If } [\mathrm{DP}_1]\ [\text{present tense } \mathrm{VP}_1],$$
$$\text{then } [\mathrm{DP}_2] \left\{ \begin{array}{l} \text{will} \\ \text{shall} \\ \text{can} \\ \text{may} \\ \text{must} \\ \text{should}_1 \\ \text{ought (to)} \\ \ldots \end{array} \right\} [\text{infinitive } \mathrm{VP}_2].$$

An example of a first-conditional sentence is the following conditional:

(12) If you read Shakespeare's *Hamlet*, then you may learn something important about human nature.

According to the story, this conditional tells us two things. First, the conditional says that on the fulfilment of the condition expressed by its antecedent, that you read *Hamlet*, then the consequent obtains, that you may learn something important about human nature. Second, by casting my conditional expression in those terms, I convey that I believe there is a real possibility that you will read *Hamlet*. Needless to say, much depends on our choice of a modal verb when it comes to the meaning of the conditional. In our example, 'may' indicated a possibility on the condition of the antecedent, while, say, 'will' expresses necessity. However, whichever modal verb we choose, the important fact remains, this sort of conditional expresses a belief of real possibility of its antecedent by its utterer. Interestingly, conditionals of this ilk are expressed in the indicative mood in some languages that are rich enough of verb moods inflections.[29]

3.4.1.2 Second Conditional

The so-called second conditional is also an expression of conditional relation which furthermore expresses, so to speak, an unreal (subjective) possibility although not quite impossibility of its antecedent. In other words, the utterer of second conditional usually takes its antecedent to be quite improbable although not impossible. According to the story, we use these conditionals often to talk about improbable future conditions. For a second conditional, the antecedent is a clause in the preterite tense and the consequent consists of a determiner phrase, a particular modal verb and a verb phrase whose verb is of its infinitive form. We may give the following schema of second conditionals:

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[29] For instance, again, in Icelandic:

Ef	*þú*	*lest*	Hamlet	*Shakespeares*,
If	you	read-2SG+PRS+IND	*Hamlet*	Shakespeare+GEN,

þá	*getur*	*þú*	*lært*	…
then	may-2SG+PRS+IND	you	learn-PP	…

'If you read Shakespeare's *Hamlet*, then you may learn something important about human nature.'

(**Second Conditional**) If [DP_1] [preterite VP_1],

$$\text{then } [DP_2] \left\{ \begin{array}{l} \text{would} \\ \text{should}_2 \\ \text{could} \\ \text{might} \end{array} \right\} [\text{infinitive } VP_2].$$

An example of a second-conditional sentence is the following conditional:

(13) If I staged *Hamlet*, then I would appreciate the play better.

According to the story, this conditional tells us two things. First, the conditional says that on the fulfilment of the condition expressed by its antecedent, that I stage *Hamlet*, then the consequent obtains, that I would appreciate the play better. Second, by casting my conditional expression in those terms, I convey that I believe there is no real possibility, although not quite impossibility, that I will stage *Hamlet*. As before, much depends on our choice of a modal verb when it comes to the meaning of the conditional. However, whichever modal we choose, the important fact remains, this sort of conditional expresses a belief of unreal possibility of its antecedent by its utterer. Again interestingly, conditionals of this sort are expressed in the subjunctive mood in some languages rich enough of verb moods.[30]

3.4.1.3 Third Conditional

The so-called third conditional is one which expresses a conditional relation of some sort in addition with the (subjective) impossibility of its antecedent. In other words, the utterer of third conditional usually takes its antecedent to be impossible for some reason or another. Furthermore, according to the story, we use conditionals of this sort frequently to talk about the counterfactual past situations. For a third conditional, the antecedent is a clause in the pluperfect tense and the consequent consists

[30] Again, in Icelandic:

Ef	*ég*	*sviðsetti*	Hamlet,
If	I	stage-1SG+PST+SUBJ	*Hamlet*,

þá	*mæti*	*ég*	*leikritið*	*betur*.
then	appreciate+1SG+PST+SUBJ	I	play-DEF+DET	better.

'If I staged *Hamlet*, then I would appreciate the play better.'

of a determiner phrase, a particular modal verb and a verb phrase whose verb is of present perfect form. We may give the following schema of third conditionals:

(**Third Conditional**) If [DP_1] [pluperfect VP_1],

$$\text{then } [\mathrm{DP}_2] \left\{ \begin{array}{l} \text{would} \\ \text{should}_2 \\ \text{could} \\ \text{might} \end{array} \right\} [\text{present perfect } \mathrm{VP}_2].$$

An example of a third-conditional sentence is our (2), 'if Shakespeare had not written *Hamlet*, then someone else would have (written *Hamlet*)'. According to the third-conditional story, this conditional too tells us two things. First, the conditional says is that on the impossible fulfilment of the condition expressed in the antecedent, that Shakespeare did not write *Hamlet*, then the consequent would obtain, that someone else wrote *Hamlet*. Second, by casting my conditional expression in those terms, I convey that I believe there is a no possibility whatsoever that Shakespeare did not write *Hamlet* because, say, I know in fact that he did. As before, much depends on our choice of a modal verb when it comes to the meaning of the conditional. However, whichever modal we choose, the important fact remains, this sort of conditional expresses a belief of the impossibility of its antecedent by its utterer. And finally, unlike first conditionals but like second conditionals, conditionals of this ilk are expressed in the subjunctive mood in languages rich enough of verb moods.[31]

Apart from differences in tenses, modalities and moods in some languages, the only significant difference between first, second and third conditionals seems to be their utterer's attitude towards their antecedent.[32] One might therefore suspect that the distinction is one of interest for the pragmatics of conditionals but of no important relevance to an account of their semantics. That, however, would be too rash

[31] Review our gloss from §1.1.

[32] Also, although irrelevant to our project, recall that the realis/irrealis distinction cuts across this categorisation with zero and first conditionals on the realis side and second and third on the irrealis side; on more of the realis/irrealis distinction, see Palmer (2001, §6).

as different sorts of conditionals might carry different presuppositions which might in turn both determine the utterer's attitude and their truth conditions. However, even if we fix the sort of conditional and the modal verb in question, we may come up with, say, first conditionals which seem to call for different sorts of truth conditions: while 'if he doesn't have his umbrella, he must be soaking' calls for epistemic reading, 'if you want to enter, you must pay the admittance fee' demands a deontic reading of some sort. We might therefore conclude that semantic categories of conditionals are orthogonal to the first/second/third distinction which in turn merely provides pragmatic distinction.

Another issue of interest to note is that there is a certain back-shift in tenses in cases of second and third conditionals.[33] Although second conditionals may be about the present or the future, their tenses are shifted backwards: both their antecedent verb-phrase and their consequent modal verb are cast in the preterite tense. Likewise, although third conditionals may allegedly be about the past, the present and even the future, both their antecedent verb-phrase and their consequent modal verb are shifted, as it were, once tense further back: the antecedent verb-phrase is cast in the pluperfect tense and the consequent under its modal scope is cast in the present perfect tense. This phenomenon is even more drastic when we cast conditional sentences whose context already calls for the pluperfect tense: the antecedent is pushed even further back into the so-called plupluperfect tense, a tense which does not otherwise occur in English.[34] In general, it seems that the more unlikely an utterer takes an antecedent to be true (the higher the degree of the conditional's hypotheticality), the observed back-shift is more likely to occur.

3.4.1.4 Zero Conditional

That said, let us now turn to the so-called zero conditional. Apart from being a conditional expression, conditionals of that ilk convey, according to the story, certainty of the consequent on the condition of the antecedent to their utterer. Those are the conditionals the utterer takes to express a fact of some sort or another that relates

[33] See Comrie (1986, §6), Dudman (1983, 1985b, ibid.) and Tynan and Lavín (1997).
[34] See Comrie (ibid.).

antecedent and consequent. Needless to say, there may be different reasons for the zero conditional utterer to believe in the said certainty. For instance, in some cases, there might be something like a logical necessity of sorts involved and, in other cases, the utterer might simply have a firm belief in the habits or dispositions of the sentence subject. Note however, that in the case of zero conditional, its utterer may very well be unsure whether the conditional's antecedent obtains or not and whether it will or has indeed ever obtain. In this manner, the nature of the message conveyed is quite different from that of first, second and third conditionals. For a zero conditional, according to the story, the antecedent and the consequent are clauses in the present tense. We may therefore give the following schema of zero conditionals:

(**Zero Conditional**) If [DP_1] [present tense VP_1],
then [DP_2] [present tense VP_2].

An example of a zero conditional is the following conditional:

(14) If Shakespeare is still alive, he is quite old.

According to the zero-conditional story, this conditional merely tells us that on the fulfilment of the condition expressed in the antecedent, that Shakespeare is still alive, then the consequent obtains, that he is quite old. Arguably, this conditional does not provide us with any information about its utterer's attitude towards the antecedent. For all we know, its utterer might not even have any opinion whatsoever about the antecedent's truth value. Conversely, we might claim that the utterer must at least believe that there is a possibility that the zero conditional antecedent is true. Whatever the case is, it is helpful to contrast zero conditionals with since-sentences which do definitely convey something about their utterer's attitude to their subordinate clause: anyone who were to utter 'since Shakespeare is still alive, he is quite old' felicitously, implies a belief in Shakespeare still being alive.

Another important feature to notice about zero conditionals is that they often coincide in meaning with respective when- or whenever-sentences.[35] However,

[35]Notice that there is a subtle difference between when- and whenever-sentences: 'when Shake-

we may see that this is not always the case since recasting our zero conditional example from above in these terms, 'when/whenever Shakespeare is still alive ...', clearly yields an odd result. Apart from cases like this, when a zero conditional antecedent describes events of some sort or another, it can in many cases be recast as a when/whenever-sentence. However, notice that this does not obviously obtain as freely in the other direction since 'when' may, for instance, act as a relative adverb as in 'when Shakespeare wrote *Hamlet*, he had encountered Saxo Grammaticus' *Vita Amlethi*'.

3.4.1.5 Limitations of the Classical Account

We must admit that all of this is pretty neat and tidy. However, it is time to burst the bubble: this picture of conditionals in English is far from complete. For instance, we have seen that third conditionals, such as (8), may well be felicitously asserted without any belief in the falsity of their antecedent. Likewise, we have seen that natural language conditionals come in more tenses than the first, second, third and zero conditionals schemata seem to allow for. Importantly, where do conditionals such as, for instance, (1) fit into this picture?

The classical account seems too simple mostly for the reason that there are far more conditional constructions in natural languages than the account allows for. To begin with, we can shift the tenses of the zero conditional back and forth, yielding a great number of different zero conditionals. Although we use the present tense zero conditional to expresses some conditional relation we believe to obtain at present, we may do so for any tense we like. We may, for instance, express a conditional relation which we do believe obtained in the past with a preterite tense zero conditional. By stretching our language, we might be willing to submit that we can in fact express zero conditionals of all the following tenses in English: pluperfect, imperfect, preterite, past continuous, present perfect, present, present continuous,

speare was born, ...' and 'whenever Shakespeare was born, ...' ('whenever' in the sense 'every time', not 'at whatever time'). It seems we cannot combine clauses describing unique events together with complimentisers such as 'whenever'.

future perfect, future and future continuous.[36] Moreover, nothing seems to be in our way of expressing zero conditionals whose antecedent and consequent disagree in tenses: we may have an unshakeable faith in a conditional relationship, say, between something in the past and the future—'if Shakespeare died in 1616, then we will not find him alive anywhere'—or even, say, between something in the present and the past—'if Shakespeare is still alive, then he did not die at Stratford-upon-Avon'. We may therefore propose a revised schema for zero conditionals along the following lines:[37]

$$\text{(}\textbf{Zero Conditional}\text{)}\qquad \text{If } [\mathrm{DP}_1]\ [\left\{\begin{array}{l}\text{pluperfect } \mathrm{VP}_1\\ \text{imperfect } \mathrm{VP}_1\\ \dots\end{array}\right\}],$$

$$\text{then } [\mathrm{DP}_2]\ [\left\{\begin{array}{l}\text{pluperfect } \mathrm{VP}_2\\ \text{imperfect } \mathrm{VP}_2\\ \dots\end{array}\right\}].$$

Interestingly, upon that construal of third conditionals, (1) now falls squarely within the category of zero conditionals.

Another thing to remark on, although not of fundamental importance, is that the classical account assumes that all conditionals in English are of the form 'if ..., then ...'. However, as we should know, that is not the case. In fact, we can get away with expressing conditionals without both 'if' and 'then'.[38] Considering (2),

[36]To remind ourselves, here the tenses of the verb 'to go' in the first person: 'went' (preterit),'had gone' (pluperfect), 'used to go' (imperfect), 'was going' (past continuous), 'go' (present), 'have gone' (present perfect), 'am going' (present continuous), 'will go' (future), 'will have gone' (future perfect), and 'will be going' (future continuous). (Whether some of those tenses are proper tenses or mere pseudo tenses brought about by an interplay of tenses and aspect—in particular by the perfect and progressive aspects in English—is a moot but irrelevant point.) For an extensive overview and analysis of grammatical tense, see for instance Comrie (1985).

[37]Notice that conditionals with simple, perfect or continuous future tense antecedents are delicate structures which are only felicitously uttered in contexts in which the antecedent has already been been asserted, see Tynan and Lavín (1997). Conditionals whose antecedent echos something which has already been presented in the discourse have sometimes been called 'factual conditionals' or 'premise conditionals'; see Iatridou (1991) and Haegeman (2003)

[38]On worries regarding the absence of 'then', see Davis (1983) and Geis (1985). On 'then', see also Iatridou (1993)

for instance, there seems to be no harm done by omitting 'then': 'if Shakespeare had not written *Hamlet*, someone else would have'. Furthermore, we may also do without the word 'if' through a subject-predicate inversion of the antecedent: 'had Shakespeare not written *Hamlet*, someone else would have'. In other words, neither of the words 'if' nor 'then' are a necessary condition for a sentence to express a conditional proposition.

Conversely, the word 'if' is certainly not unique to conditionals. Indeed, in the cases where 'if' is substitutable with 'whether', there is normally nothing conditional at play. For instance, 'I wonder if Shakespeare actually wrote *Hamlet*' is in no sense expressing a conditional of any sort. Rather, the 'if' here serves as a complementiser which introduces an indirect question.[39] Of course, that is not to say that the word 'if' does not always have the syntactic role of complementiser—because, arguably, it does—but rather that the word is not a sufficient condition for a sentence to express a conditional proposition.

Also, according to the classical account, the antecedent is invariably expressed prior to the consequent. With some exceptions, most natural languages allow for the reverse.[40] Again, we may just as well express (2) as 'someone else would have written *Hamlet* if Shakespeare had not'. Interestingly, perhaps, such a movement of the consequent yields a loss of the word 'then'. Furthermore, we may lose the 'if' again by subject-predicate inversion: 'someone else would have written *Hamlet*, had Shakespeare not'.

Moreover, it seems that although we express certain thoughts with conditional sentences, we might as well cast them in different terms. We already remarked upon the way in which we may just as well cast many zero conditionals in terms of when- and whenever-sentences. Furthermore, there is nothing to stop us using a great number of other linguistic constructions to get our points across. We may, for instance, use locutions of the following sorts to transmit certain conditional thoughts across:

[39] See Harman (1979) and Bhatt and Pancheva (2006).

[40] For more on those exceptions, see Comrie (1986).

$$\left\{\begin{array}{l}\text{On the assumption}\\ \text{Supposing}\\ \text{In the event}\\ \text{Given}\\ \ldots\end{array}\right\}\ [\mathrm{CP}_1]\text{, it follows } [\mathrm{CP}_2].$$

Clearly, not every conditional lends itself to expression in those terms. Nonetheless, we should remain aware that we may quite generally cast our conditionals in such terms.

Furthermore, certain conditional sentences, generally with a future referring antecedent and an authoritative tone achieved with the imperative mood, may find expression either as disjunctions or conjunctions. For instance, I might utter 'read *Hamlet* and you will not regret it' or 'read *Hamlet* or you will regret it' roughly to express the conditional 'if you read *Hamlet*, then you will not regret it' although on a natural reading the first carries a tone of recommendation and the second of threat. Notice, however, that the disjunction 'read *Hamlet* or you will regret it' also implies, on its natural reading, that 'only if you read *Hamlet*, then you will not regret it', while the conjunction does not to the same extent.

3.4.1.6 The Moral of the Story

What have we learned from this observation? Most importantly, we have seen that syntactic and grammatical features of conditionals in English do not determine in any obvious sense what sort of truth conditions a particular conditionals demands. Rather, the grammatical features convey information about the attitude of their utterer either towards their antecedent, in the case of first, second and third conditionals, or the conditional relation, in the case of zero conditionals. Now, of course, that is not to say that the attitude of the utterer to the conditional expressed does not provide some evidence about how we are supposed to understand the conditional in question.

In an interesting sense, different conditionals may express different thoughts which ultimately do determine the appropriate truth conditions. However, the attitude of their utterers may provide important indications about which sort of thought they express. Together with the context in which conditionals are expressed, the utterer's attitude may in many cases suffice to guide correctly towards interpretation. Having now touched on the idea that tokens of conditional sentences express conditional thoughts of some sort, let us now turn to that issue.

3.4.2 Second Observation: What We Mean *&* What We Say

It is an uncontroversial platitude that we sometimes express our thoughts by our utterances. Indeed, our words—be they spoken, written or otherwise manifested—do generally express our minds. And astoundingly often we do manage to get our intentions across to our audience who correctly interpret our utterances. Needless to say, the fact that we do manage to pull off successful communication is no small wonder. However, for our present purposes, we need only realise that conditional sentences, like any other meaningful sentences, are expressions of propositional thoughts of some sort or another. Conditional sentences do certainly express thoughts quite distinct from more simple sentences. However, there is no sensible way in which we can deny the fact that conditional sentences do express thoughts of some sort or another.

All this is important for us because we seem to use the *same* natural language conditional sentences to express different sorts of thoughts.[41] Already with a conditional such as (10), we discovered that certain conditionals allow themselves to at least two distinct readings. In the terms we have just adopted, that is merely to say that different sorts of thoughts do seem to find the same sort of conditional expression.

Let us spell this out more carefully and clearly. We may express our thoughts by our utterances. However, when we give expression to our thoughts, by some process of encoding or another, our utterances do not uniquely determine our thoughts. More often than not, however, our utterances may be correctly interpreted, by some process of decoding or another, as expressing our thoughts. By sufficient sensitivity

[41] This observation is, of course, inspired by Dudman (1984a, 1984b, 1986, 1988, 1989, 1990, 1991a, 1994a, 1994b).

to various contextual parameters, on the assumption that conversational participants respect a certain set of pragmatic maxims, and with the aid of our vast 'world knowledge', we do quite reliably stumble upon correct interpretation. However, in certain cases, we do admittedly make mistakes: we might overlook some contextual information, the utterer might not adhere to our maxims, or we might simply not get something on account of our ignorance. In those cases, our thoughts—which were already underdetermined by their utterances—will be misconstrued.[42]

For an illustration, I might for some reason wish to convey to you my belief that everyone loves someone although, of course, the one or ones loved by someone need not be the same for everyone. My thought has a particular logical form—which we may express unambiguously in, say, first order logic as $\ulcorner \forall x \exists y Lxy \urcorner$—which does presumably determine its meaning to a certain extent. However, when I express my thought, I might perhaps, somewhat misleadingly, utter the sentence 'everyone loves someone'. My utterance has a particular phonetic form, which you might interpret either incorrectly as expressing a thought of the logical form $\ulcorner \exists y \forall x Lxy \urcorner$ or correctly as expressing a thought of the logical form $\ulcorner \forall x \exists y Lxy \urcorner$. Insofar as I was in fact interested in getting my thought across to you, I ought to have expressed myself more clearly unless, of course, I thought that there was already enough information available in the context or some pragmatic principles to guide your interpretation correctly or that I assumed that you possessed some relevant world knowledge required. And insofar as you are sensitive to the features of the context which I intended as your guidance, my thought will most likely get across to you.

Our claim is that natural language conditional sentences share the same symptoms. In the terminology we have adopted, that is merely to say that different sorts of thoughts may all be encoded as conditional utterances of the same sort. And as such, certain conditional sentences may be interpreted as expressing different thoughts. Again, provided that everything runs smoothly in communication, the thought an utterance was intended to express may be correctly decoded. However,

[42] All of this seems quite compatible with the story of Chomsky's generative grammar; see, for instance, the classic Chomsky (1957/2002, 1965, 2006) and, for more recent developments, Chomsky (1995, 2000); see also Sperber and Wilson (1986)

again, a misunderstanding may easily arise when we either overlook some contextual information, flout certain pragmatic maxims, or fail to get something on account of our ignorance.

So, we might ask, what sort of thoughts do we actually express by conditional sentences? We have already distinguished between roughly metaphysical, epistemic and deontic readings of conditionals. Arguably, each of those readings might correspond to distinct sorts of thoughts.[43] Moreover, we also noticed that we may use conditionals sentences (as well as when- or whenever sentences sometimes) to express what we usually express in terms of generalisations, habituals or generics.[44] Finally, we do commonly use conditional sentences for the sole sake of decorum and politeness or rhetorical effect. Along those lines, we may then distinguish between at least four broad categories of thoughts which lend themselves to expression as conditional sentences.

First, there are thoughts of a roughly metaphysical nature: thoughts to the effect that should something be the case, something else would be the case by some sort of metaphysical necessity broadly construed. Although those thoughts may, of course, refer to past present and future actual and counterfactual situations, they are all of a similar nature in an important sense: they are claims of metaphysical relationships. Interestingly, on the most natural interpretation of (2), the sentence expresses a thought of that very ilk: had Shakespeare not written *Hamlet*, things would have turned out such that someone else had.

Second, there are thoughts of a nature more akin to deductive arguments. However, when we express those thoughts—perhaps for the sake of economy—we express them as conditional sentences whose antecedent is in some sense the crucial premise or premises of the argument and whose consequent is the conclusion, and hope that the remaining premises which we take for granted are somehow obvious to our audience. Those conditional sentences are therefore arguably akin to enthymemes in nature. In other words, conditionals of this sort resemble condensed arguments of which we only express some premises and the conclusion and hope

[43] See §3.2.3.
[44] See §3.4.1.4.

that the implicit premises are shared by our audience. Interestingly, on the most natural interpretation of (1), the sentence expresses a thought of that very strain: Shakespeare did not write *Hamlet*, therefore—since *Hamlet* does exist and things of that sort must be written by someone, someone clearly must have written *Hamlet*—someone other than Shakespeare wrote *Hamlet*.

Third, there are thoughts of a nature alike to generalisations, generics or habituals expressing that whenever something is the case, something else is also the case. It seems that thoughts of this sort may just as well be encoded with when- or whenever-sentences instead of conditionals. On its most natural interpretation, the following conditional sentence expresses a thought this kind:

(15) If Shakespeare felt dejected, then he wrote another sonnet.

Now, since generalisations, generics and habituals are presumably distinct sorts of claims, we may well expect that there is a certain variability in truth conditions for conditionals expressing thoughts of this sort. In other words, conditionals which express generalisations require semantics suited for generalisations, and so forth.

Finally, we do commonly use conditional sentences for the sake of decorum and politeness or rhetorical effect. Arguably, those conditionals do not really convey anything beyond what their consequents do express although their tone is somewhat different. The following conditionals are examples of the sort:

(16) a) If you want my honest opinion, I think you should read *Hamlet*.
b) If you don't mind me saying so, you remind me of Ophelia sometimes.
c) If I may say so, you would be better off without those *Hamlet* examples.
d) If you are interested, I have a copy of *Hamlet* that you may read.[45]
e) . . . or, if you will, Hamlet had a bit of the so-called oedipal complex.
f) If one were so inclined, one might say that Hamlet was a moral relativist.
g) If truth be told, I have never seen or read *Hamlet*.

[45] Conditionals of this sort have sometimes been called 'biscuit conditionals'. See, for instance Austin (1956), DeRose and Grandy (1999), Siegel (2006) and Predelli (2009).

Arguably, only thoughts of the first two sorts are properly conditional. In much the same manner as we claimed that certain disjunctions and conjunctions are actually conditional expressions, we might likewise claim that conditionals like (15) are actually expressions of generalisations, generics or habituals. And we might therefore claim that a theory of conditionals should not account for conditionals of this sort any more than, say, a theory of conjunctions should account for conjunctions which express conditionals. Rather, we should defer conditionals of this sort to whichever semantic account of generalisations, generics and habituals to which we might adhere. In a similar fashion, we may also claim that conditionals such as (16a)–(16g) are merely glorified expressions of their consequent and thereby not really expressions of conditional thoughts. We should nonetheless remain aware that conditionals such as (15) seem both subject to modus ponens and modus tollens and that conditionals such as (16a)–(16g) seem at least subject to modus ponens. In other words, although the thoughts we express by those conditionals sentences are not strictly conditional in nature, those expressions do share certain behaviour with proper conditionals—which is perhaps precisely why we cast those thoughts in such terms.

Finally, we might also point out that those who are fortunate enough to traffic in logics often use natural language conditional sentences to express thoughts of a different nature: when expressing, say, material or strict implication, logicians frequently utter natural language conditional sentences. Although that is true, that is not really relevant for our purposes. Insofar as our objective is to analyse natural language conditionals, we are interested in the conditional sentences that natural language speakers use in normal discourses. However, since the semantics of the logician's artificial conditionals are, nearly always, well defined, we need not worry too much about those issues here.[46]

However, the important issue remains: our problem is that different sorts of

[46] Finally, it is probably worth it to mention that conditionals which have been called 'speech-act conditionals' in certain circles do not fall into any of our categories. An example of a speech-act conditional is 'if someone asks, I am not here'. Arguably, that needs not worry us much because such conditionals are not conditional sentences but rather conditional commands: the conditional 'if someone asks, I am not here' is in fact an ellipsis of 'if someone asks, *tell them that* I am not here'.

thoughts are encoded as conditional sentences. To gain a better grasp of the thoughts involved, let us now turn our sights to suppositions.

3.4.3 Third Observation: On Ways of Supposing

We may agree that most conditionals express a suppositional thought of some sort or another: namely, whoever asserts a conditional seems to be asserting that on the supposition of its antecedent, its consequent is true. Interestingly, however, there are at least two distinct ways in which we can make suppositions.[47] On the one hand, we may consider how our world would have panned out had our supposition actually been the case. On the other hand, we may consider what we know about the world at the instant of our act of supposition and assess how the world must be in order for it to conform to our supposition.

On the one hand, by our first way of supposing, we must look at our world at the time of our supposition and we must ask ourselves how it would have panned out had the supposition been true. How do we do that? Well, we know that were our supposition the case, it could not have occurred in isolation: some events must have been its cause and some events must be its effect and in turn, each of those may have further causes and effects and so on. More metaphorically, we throw our supposition into our world and observe its ripple spread through time and space.

However, this is somewhat more delicate than we have made things out to be: we may well make suppositions of this sort on top, as it were, of other suppositions. For instance, we may very well make this sort of supposition against fictional settings: we may suppose against the world portrayed by Shakespeare's *Hamlet* that Polonius did in fact survive Hamlet's stab. Under such a supposition, we are concerned about the metaphysical or nomological entailments of Polonius' survival in the world of *Hamlet* but not in the actual world in which, for all we know, there never was anything as Shakespeare made things out to be in the tragedy. In order to capture this, we must therefore relativise our suppositions to some world or another.

[47] I am in debt to Frank Jackson for this observation. See also Jackson (2009, §3) and Lance and White (2007).

Let us call this way of supposing 'modal' and characterise its procedure as follows:

> **Modal Supposition**
> A modal supposition of φ against a world w is made by a revision of the facts in w which nomologically necessitate or are necessitated by φ.

How does this relate to conditionals? Well, interestingly, when faced by a conditional we may suppose its antecedent in this very manner. If the antecedent is false, we must figure out how the world would have had to be so that the antecedent was true. If the consequent turns out to be true under such a supposition we are inclined to regard the conditional as true and otherwise false. Interestingly, this is exactly what we do when we think about (2): we ask ourselves what would be different if Shakespeare had not written *Hamlet*. Well, there are many things we must consider—and it is indeed remarkable that we can do that—but having considered everything, we are very tempted to conclude that in all likelihood, no one would have written *Hamlet* had Shakespeare not. And for that very reason we are inclined to take (2) as false. Of course we might be wrong, simply because we have not considered all the relevant facts, but still, in cases where we have, this is precisely how we seem to get to the truth value of (2).

On the other hand, by our second way of supposing, we go about it quite differently. In this case, we consider what we know and ask ourselves what, if anything, must be different were our supposition to be true. If our supposition is actually consistent with what we know, that is the end of that: our knowledge would just be as it were before our supposition. However, when our supposition does run counter to something which we know, we must revise our knowledge accordingly in order to maintain consistency. However, insofar as particular knowledge does not contradict our supposition we must leave it as it is, even although it might be immensely improbable given our supposition. More metaphorically, we throw our supposition into our web of knowledge to corrode away anything which contradicts it but leave all other things as they stand.

We may also make suppositions of this sort on top of other suppositions. We may, again, very well make a supposition of this sort about, say, fictional settings: we may suppose against the background of Shakespeare's *Hamlet* that, say, Polonius did in fact survive Hamlet's stab. Under this sort of supposition, we are merely concerned about revising what we know about *Hamlet* that contradicts our supposition, not of things we know about the actual world in which, for all we know, there never was anything as Shakespeare made things out to be in *Hamlet*.

Let us call this way of supposing 'amodal' and characterise its procedure as follows:

> **Amodal Supposition**
> An amodal supposition of φ against a set of propositions K is made by the minimal revision of K required to consistently accommodate φ.

When facing a conditional, we may too suppose its antecedent in this manner. If the antecedent runs counter to something that we know, we must revise our knowledge accordingly to accommodate our supposition and see where that takes us. This, of course, is very reminiscent of the Ramsey Test. If the consequent then either turns out to be true or otherwise follows from our revised knowledge, we are inclined to regard the conditional as true and otherwise false. Interestingly, this is precisely what we do when we think about (1): we ask ourselves what would be different if we had been wrong about Shakespeare's authorship of *Hamlet*. Unless our epistemic state is sufficiently impoverished, most of our knowledge will be consistent with the supposition that Shakespeare did not write *Hamlet*. However, there will almost certainly be something that we know which does contradict our supposition and therefore needs revision. Interestingly, the supposition does not contradict the fact that there is a play called *Hamlet* and that *Hamlet* was written. Now, since our knowledge of those facts is compatible with our supposition, we must infer that someone other than Shakespeare wrote *Hamlet*. And for that very reason we are inclined to take (1) as true.

This distinction, we must submit, seems quite fundamental. In particular considering that it explains why we are wont to regard (1) as true and (2) as false. As our chosen labels suggest, there is nothing particularly modal about our first means of supposition. Indeed, our amodal suppositions are more akin to deductive arguments than modal reasoning: given a set of propositions, we make our supposition and infer some conclusions on these grounds. When supposing in this fashion, we are not in any obvious sense considering any ways in which a world might have been. Rather, we are considering a world as it is and merely assuming that we were mistaken in our beliefs about it. On the other hand, when we make a modal supposition, what we are doing has a strong flavour of modal reasoning: given a world, we make our supposition and consider how that world would have had to pan out and then draw our conclusions on those grounds.

Another important difference to notice between those two modes of supposition is the element of supposition time. While amodal supposition simply involves considering what we know at the time of supposition, here and now, the modal supposition drags us to whichever time the supposition specifies. On the one hand, when we amodally suppose that Shakespeare did not write *Hamlet*, we merely think of the world of here and now—a world in which *Hamlet* does exist—and suppose on top, as it were, that we were wrong about Shakespeare's authorship. On the other hand, when we modally suppose that Shakespeare did not write *Hamlet*, we must first trace our way back to when Shakespeare allegedly wrote *Hamlet*, suppose that he did not and consider the way the world would have unfolded differently. The world of which we conceive by this mode of thought may be dramatically different from the world from where we started. In the case of the supposition, made in the actual world, that Shakespeare did not write *Hamlet*, there will be stark differences: most likely, there will be no *Hamlet* and, for instance, Fielding's *Tom Jones*, Melville's *Pierre* and Joyce's *Ulysses* will all be, if at all, quite different works of literature.

This observation gives us a neat explanation of two apparently unrelated phenomena. First, this observation explains why it seems absurd to amodally suppose that things would be different from the way they actually are; since we are considering a world as it actually is and merely supposing that we are, as it were, wrong about something, inferring that something will be different from the way it actually is seems quite senseless. Since we never even take off from actuality, as it were, nothing could ever be different from actuality in the first place: we are merely considering no more than what is actual.[48] Again, let us consider (1): when we suppose amodally that Shakespeare did not write *Hamlet*, we are merely supposing that we had been wrong about that particular fact in the actual world and as a consequence reject any other true sentences contradicting our supposition. All along, however, we keep our sights fixed on the actual world.

Our observation also explains why possible-world accounts get certain things wrong when we are dealing with amodal suppositions: namely, that we may be fairly confident that if φ were the case, χ would be even when we are sure that not all real and relevant φ-worlds are χ-worlds.[49] Indeed, a vast number of things in the actual world are very unlikely but real nonetheless. From a certain deterministic point of view, the fact that Shakespeare wrote *Hamlet* might have been inevitable. But still, that he did, that he chose the very words that he did, when he did and where he did, was all extremely unlikely from any less of a deterministic point of view. But even so, it was even more unlikely that someone else should have. Keeping all of that in mind, of the set of nearby possible worlds in which Shakespeare did not write *Hamlet*, there will presumably be next to no world where someone else did due to the very high improbability that someone would write *Hamlet*. Although this all seems fine under our second mode of supposition, our first mode eludes possible-world accounts for this reason.[50]

[48]This relates to Jackson's so-called 'actually' argument, see Jackson (1987).

[49]I am in debt to Dorothy Edgington for this observation. See also Edgington (2008). However, see also Nolan (2003)

[50]Interestingly, this seems to explain why Fine's counterexample to Lewis' *Counterfactuals* misses its target; see, Fine (2005). Interestingly, Fine's counterexample makes sense—albeit harmlessly—by amodal supposition.

3.5 Connecting the Dots: Towards a Theory of Semantics

It is high time to put together the pieces we have gathered from our observations.

We ought to agree that natural language conditionals call for different interpretation based on the thought they were intended to express. However, since the surface form of natural language conditionals need not determine the thought which they express, we are destined for misinterpretation in certain cases. Nonetheless, when we are sufficiently sensitive to contextual parameters and pragmatic particulars, we are quite successful in understanding each other's intentions.

From our observation of the so-called first, second, third and zero conditionals, we noticed that different types of conditional sentences convey information about their utterer's attitude towards either the probability of the antecedent or the nature of the conditional relationship involved. Arguably, since we are more wont to make modal suppositions than amodal suppositions about something we take to be improbable or impossible, second and third conditionals are usually used to express modal suppositions. Likewise, since we are arguably more inclined to make amodal suppositions than modal suppositions about things for which we have no beliefs, first and zero conditionals are usually used to express amodal suppositions.

Nonetheless, things are not quite as simple as that. We seem to be well endowed cognitively to make amodal suppositions about things we know to be false and, conversely, to make modal suppositions about something we do not believe to be false. We may therefore, it certainly seems, express amodal suppositions with second and third conditionals and modal suppositions with first and zero conditionals. In fact, we might even suspect that any conditional might express either modal or amodal supposition in some appropriate context. Nonetheless, that is not to say that second and third conditionals do not generally express modal suppositions while first and zero conditionals generally express amodal suppositions.

Moreover, we might suspect that all this in turn relates to the sort of thoughts which conditionals are uttered to express, namely, that second and third conditionals do generally encode thoughts of the first kind—the ones we said to be of metaphysical nature—while first and zero conditionals normally express thoughts of the second genre—the ones we said are akin to deductive arguments. Again, we might claim that this is because the thoughts of the first kind seem to be nothing more than modal suppositions, while the thoughts of the second kind are simply amodal suppositions.

The time is ripe for us to jettison the labels 'indicative' and 'subjunctive'. Although those labels have technical and relatively well defined meaning within the study of grammar, we have seen that they do not capture anything of interest in our quest for semantic theories of conditionals. Of course, for the sake of tradition, we might hang on to those but to avoid further misunderstanding I propose we start afresh and adopt the labels 'modal' and 'amodal' to refer to the two sorts of conditionals we have identified. Let us call conditionals which demand an interpretation in terms of our modal way of supposition 'modal conditionals':

> **Modal Conditional**
> A modal conditional is a conditional that expresses a modal supposition.

Conversely, let us call conditionals which demand an interpretation in terms of our amodal way of supposition 'amodal conditionals':

> **Amodal Conditional**
> An amodal conditional is a conditional that expresses an amodal supposition.

We now have everything in place that we need in order to give an outline for the semantics of natural language conditionals. First, to avoid connotations of yore, let us also reserve fresh pair of symbols to represent modal and amodal conditionals formally:

$\varphi \gg \chi$:= under the modal supposition of φ, χ obtains.
$\varphi > \chi$:= under the amodal supposition of φ, χ obtains.

Since modal conditionals involve modal supposition, their truth conditions should be spelled in those terms:

$\ulcorner \varphi \gg \chi \urcorner$ is true iff χ is true under the modal supposition of φ.

Conversely, since amodal conditionals involve amodal supposition, their truth conditions should be spelled out in those terms:

$\ulcorner \varphi > \chi \urcorner$ is true iff χ is true under the amodal supposition of φ.

3.6 Conclusion: Modal & Amodal Conditionals

We set off in search of a ground for the indicative/subjunctive distinction. We began by going through a series of intuitive proposals—several grammatical mood proposals, counterfactual proposals and epistemic and metaphysical necessity proposals—which we eventually found wanting on different accounts. We next considered the prospect of doing without the distinction but consequently discovered projects of that ilk to be futile. We then made several helpful observations relating to our subject matter: we considered the way conditionals are frequently used in English and other languages; we considered what sort of thoughts we express with conditional sentences; and finally, we considered suppositions and their relation to conditionals. Based on our observations, we finally proposed that a line be drawn between indicative and subjunctive conditionals and hinted at the semantics suited for natural language conditionals.

Instead of the widespread labels 'indicative' and 'subjunctive', we suggested that talk of 'modal' and 'amodal' conditionals would be more appropriate: while modal conditionals express modal suppositions, amodal conditionals express amodal supposition. The modal/amodal distinction, we submit, is a fundamental distinction of natural language conditionals and one which any semantics should respect. We must conclude that we have finally found a satisfying answer to our question as to where to draw the line.

In the next chapter, we shall work out the semantics for modal and amodal conditionals more carefully.

4 Suppositional Semantics

This chapter offers semantics for natural language conditionals. We shall begin by exploring the nature of suppositions and subsequently draw a distinction between modal and amodal suppositions. In light of our analysis of suppositions, a corresponding distinction is then drawn between modal and amodal conditionals and their character further examined. Consequently, we shall uncover the syntax of conditionals in English for the purpose of providing input for our semantics. And finally, we will offer compositional semantics in generative grammar for modal and amodal conditionals.

4.1 Preamble: Modal & Amodal Conditionals

Earlier, we came to the conclusion that natural language conditionals are of two fundamentally distinct types.[1] We decided to call the first sort 'modal conditionals' and claimed that such conditionals express modal suppositions. Conversely, we called conditionals of the second sort 'amodal conditionals' and claimed that such conditionals express, yes, amodal suppositions.

Modal suppositions, we claimed, are suppositions that are made against a world or situation of some description.[2] Normally, the world in question is the world

[1] See §3.4.3.

[2] Henceforth, we shall assume that suppositions and thus conditionals are sensitive to situations

of utterance, although suppositions of this sort may as well be made against some other contextually salient world, say, one of hypothesis or fiction. When we modally suppose φ against a world w, we consider how w would have had to pan out for φ to have been the case in w.

When we make suppositions of this sort, we assume that certain laws still obtain in the world in question. In most cases, the occurrence of φ could thereby not have occurred in isolation: rather, there must be a chain of causes and effects, as it were, leading up to and trailing from φ. Our task, as modal supposers, is therefore, metaphorically speaking, to straighten out the bump in our carpet so that we end up with a world in which φ is the case and which is only different from w in the ways which φ requires. Now, although in some cases there might be a unique way in which the world in question would have had to turn out, there will presumably be other cases in which there are number of different ways the world could contain our supposition. And in those cases we end up with a number of different worlds compatible with our world of departure and our supposition. The resulting world or set of worlds is then, so to speak, the product of our modal supposition.

A modal conditional is a conditional which expresses the truth of its consequent on the modal supposition of its antecedent against some contextually relevant world. In most contexts, for instance, the following conditional would be uttered to express the truth of its consequent on the modal supposition of its antecedent:

(1) If Shakespeare had not written *Hamlet*, then someone else would have.

Upon the modal reading of this conditional, its utterer claims that on the modal supposition that Shakespeare did not write *Hamlet* against, say, the actual world of utterance, it is true that someone else wrote *Hamlet*. If the actual world of utterance is such that had Shakespeare not written *Hamlet*, someone else would have, then (1) is true and otherwise false. Or else, if we were perhaps so inclined, neither true

rather than only worlds. Whenever we mention worlds hereafter, what we say should be understood as pertaining to situations alike. For further information about situations semantics, see Barwise (1981) and Barwise and Perry (1983) and subsequent literature.

nor false in case the product of our supposition constitutes certain worlds in which someone else wrote *Hamlet* and other worlds where no one did.

Conversely, we claimed that amodal suppositions are suppositions which are made against some set of propositions. Normally, the set of propositions in question represents our knowledge, although, we said, suppositions of this sort might well be made against a background of, say, our beliefs or some other contextually salient set of propositions, for instance, of hypothesis or fiction. When we amodally suppose φ against a set of propositions K, we add φ to K and then restore equilibrium by some sort of consistency maintenance procedure. Now, as for modal suppositions, there may well be several equally valid ways in which consistency may be maintained. And in those cases we end up with a number of different sets of propositions compatible with our original set and supposition. The resulting set of propositions or set of sets of propositions is then the product of our amodal supposition.

An amodal conditional is one which expresses the truth of its consequent on the amodal supposition of its antecedent against some contextually relevant set of propositions. In most contexts, for instance, the following conditional would be uttered to express the truth of its consequent on the amodal supposition of its antecedent:

(2) If Shakespeare did not write *Hamlet*, then someone else did.

Upon the amodal reading of this conditional, its utterer claims that on the amodal supposition that Shakespeare did not write *Hamlet* against, say, the utterer's knowledge, it is true that someone else wrote *Hamlet*. Much like before, if the utterer's knowledge is such that were we to add to it 'Shakespeare did not write *Hamlet*', maintain for consistency and then get out 'someone else wrote *Hamlet*', then (2) is true and otherwise false. Or else, if we are so inclined, neither true nor false in case the product of our supposition constitutes certain sets of propositions which contain 'someone else wrote *Hamlet*' and others which do not.

This chapter will offer semantics for modal and amodal conditionals. First, we shall explore the nature of modal and amodal suppositions in detail. Subsequently, we shall investigate the details of the corresponding conditionals. Once we have understood the essential features of modal and amodal conditionals, we will turn to the syntax of English conditionals to provide us with some input for our semantics. And finally, once we have given an appropriate account of syntax, we will offer semantics for modal and amodal conditionals in generative grammar.

4.2 On Suppositions

When we began our investigation of suppositions, we soon noticed that there are at least two distinct ways in which we may suppose. On the one hand, we may consider how our world would have had to pan out for our supposition to be true. And on the other hand, we may reflect on what we know and then assess whether we must have been wrong about something were our supposition true. Due to the modal flavour of the former, we decided to call that sort of suppositions 'modal suppositions' while we called the later 'amodal suppositions'.

We soon realised that in the case of modal suppositions, the world against which we suppose need not be our actual world. In fact, we may make modal suppositions against any world whatsoever. Normally, we keep the actual world as background to our suppositions but we may as well suppose against, say, a hypothetical or fictional world. We thus arrived at the following preliminary characterisation of modal suppositions:

> **Modal Supposition (Naïve Analysis)**
> A modal supposition of φ against a world w is made by a revision of the facts in w which nomologically necessitate or are necessitated by φ.

Conversely, in the case of amodal suppositions, the set of propositions against which we suppose need not be our own knowledge. In fact, we may make amodal supposition against any set of propositions whatsoever. Normally, however, we do keep our own knowledge as background to our suppositions but we may well suppose against, say, someone else's knowledge, mere beliefs, hypothesis, pretence or fiction. We thereby arrived at the following preliminary characterisation of amodal suppositions:

> **Amodal Supposition (Naïve Analysis)**
> An amodal supposition of φ against a set of propositions K is made by the minimal revision of K required to consistently accommodate φ.

With this preliminary grasp of the modal/amodal supposition distinction, let us now explore those two kinds of suppositions in greater detail.

4.2.1 Modal Suppositions

Modal suppositions are modal in the following sense: when we modally suppose φ against a world w, we are concerned with how w would have to have panned out for φ to have been the case. We have already said a good deal about modal suppositions but enough still remains to be said. Let us begin with the issue of the context sensitivity of modal suppositions.

Somewhat contrary to what we said before, modal suppositions actually seem to be context sensitive in two distinct senses. On the one hand, as we already claimed, a modal supposition is sensitive to a situation or world of some description. This is the world against which the supposition in question is made. Often, we already said, the world in question is merely the world of the context, although, we also said, we may suppose against any world whatsoever. Importantly, then, the world of the context and the world against which we suppose in the context need not be the same world. On the other hand, a modal supposition is sensitive to the laws which we assume obtain in the world of supposition. We do not need to have any firm position on the nature of laws in our present context but may simply assume that they may be represented by a collection of generalisations or other lawlike statements of some ilk or another. Often, the laws in question are the laws actually at play in the world against which we suppose, although, any set of laws might be in the background of our suppositions.

In order to emphasise this dual context sensitivity, let us return to our original example. While modally supposing, there seem to be numerous ways in which we can make the following supposition:

(3) Shakespeare did not write *Hamlet*.

On the one hand, we might be in a context where the world against which we suppose is the actual world: we suppose that (3) were the case in our actual world. Now, if the context in which we suppose (3) is such that we assume some sort of everyday commonsensical (or folk) physical laws to obtain, we have good reason to suspect that the world, or worlds, which result from our supposition are all such that no one wrote *Hamlet*. However, if a set of laws of quantum probabilistic nature—according to which just about anything, so to speak, can happen—were to be raised to contextual salience, we would have equally good reason to suspect that some worlds, which result from our supposition, are such that someone (other than Shakespeare) wrote *Hamlet*.

On the other hand, we might be in a context where the world against which we suppose is not the actual world but some other contextually salient world. For instance, the world could be one in which Shakespeare did in fact write *Hamlet* but in which Francis Beaumont was all but bound to do it had Shakespeare failed. Again, if the context in which we suppose (3) is such that we assume some sort of everyday commonsensical laws to obtain, we have good reason to suspect that the world, or worlds, which result from our supposition are all such that someone (other than Shakespeare) wrote *Hamlet*, namely Beaumont. Again, however, if a set of laws of quantum probabilistic nature were to be raised to contextual salience, we have reason to suspect that some worlds, which result from our supposition, are such that no one wrote *Hamlet*.

Now, it is worth pointing out that instead of this twofold context sensitivity, we can equally well get by with introducing a thicker notion of possible worlds whereby every world comes equipped with its own set of laws. Our present approach has the only benefit that we may say that one and the same world can act with different sets of laws in different contexts. Thus, once a different set of laws is raised to salience, we may still suppose against the same world as we began with. For instance, this might be beneficial if we tried to account for disagreement in suppositions between, say, a folk physicist and a quantum physicist who presumably agree over some particular thing, namely the world of supposition, but disagree as to which kind of laws obtain. However, we shall leave unsettled at present whether that is actually a benefit or not.

An issue of some sort of objectivity is important here. On the assumption that there are such things as laws, a certain (possibly empty) set of laws will obtain at a particular world. Of course, if we are dealing with, say, the actual world, we might not know the full extent of the laws in question but that is not really relevant here. More importantly, since we may assume any set of laws when against our supposition, we could easily suppose something which need not coincide with the laws obtaining at the world in question. Clearly, then, a supposition made against a world whose actual laws do not coincide with the set of laws assumed in the context might not be, as it were, objectively correct. For instance, assuming that the actual world is in fact as predicted by the laws of quantum mechanics, any supposition made against the actual world and a set of some more commonsensical laws would be incorrect in the above sense. Indeed, given the laws which do obtain in the actual world, the world would have panned out differently had the content of our supposition been the case. This is perhaps even more vivid when we make suppositions about the future of the actual world. We might suppose that φ will be the case in the actual world in, say, a few minutes and furthermore assume a set laws where, say, the law of gravity is absent. We do not need to take the supposition far to realise that its product will be a peculiar world where everyday concrete things, for instance, get lost astoundingly often. In particular, if the actual world then turns out to be such that φ became the case several minutes later, precisely as we had assumed, we will soon notice that the actual world and the product of our supposition do not coincide at all. In other words, the supposition in question was not objectively correct. And moreover, assuming that the aim of supposition is some sort of objective correctness, our supposition would be, so to speak, defective.

However, that is not at all to say that an objectively incorrect supposition could not be correct in the context in which it is made. For instance, we might well be in a context where, say, the laws in question are merely our commonsensical laws of physics and the salient world is the actual world. In that particular context, we would be correct in our modal supposition that Shakespeare did not write *Hamlet* only if all worlds which result from our supposition are such that no one did and incorrect otherwise. In other words, suppositions are contextually correct if their result is appropriately sensitive to the relevant elements of the context. In a certain sense, then, suppositions are quite similar to other contextually sensitive phenomena such as epistemic modals: although φ is the case, the relevant stock of knowledge in the context in question might be such that 'might not φ' is true in that context. In much the same way, a supposition might be correct in the context in which it is made, although it is objectively incorrect.

It is worth emphasising, if the fact is not already apparent to us, that our ability to suppose against any set of laws, gives us a great leeway in our suppositions. For instance, the laws need not be only physical or metaphysical in nature. We may, for instance, be in a context where deontic laws are salient. Or we may be in a context where juridical laws are salient. We may thus suppose, say, on the assumption that the world is fair and moral, or on the assumption that everybody abides by the laws, or on the assumption that every crime is complemented by its appropriate punishment. In fact, we do often make suppositions of that sort: for instance, when reasoning about counterfactual situations in moral, political or legal philosophy, we work with such assumptions. And moreover, we do, it seems, quite frequently, in our everyday practical reasoning, make suppositions assuming laws of all sorts: rules of games, house rules, traffic regulations, ... and whatnot.

Having said all that, we seem finally to be in a position to give an adequate definition of modal suppositions:

> **Modal Supposition.**
> A modal supposition of φ against a world w is made by a revision of the facts in w which nomologically necessitate or are necessitated by

φ and a set of laws l.

For later purposes, we will need to introduce a convenient formalism for modal suppositions. First, we can represent contexts as n-tuples of contextual parameters. It matters not, currently, what we take the other parameters of contexts to represent but we do require that one parameter represent the relevant world against which we suppose and another the laws assumed to obtain in the world in question. Let a context C therefore be represented by an n-tuple constituted by S_w and S_L, where S_w is the world against which we make our supposition in C and S_L is the set of laws assumed to obtain in S_w in C.

Second, it will be helpful to represent a modal supposition as a function from the content of the supposition, the world against which the supposition is made and the set of laws assumed to obtain in that world, to a set of worlds which results from the supposition. Let $M(x, y, z)$ therefore be a function which has three arguments, a proposition x, a world y and a set of laws z, and returns a set of worlds.

With those pieces all in place, we can now formalise our definition of modal suppositions as follows:

> **Modal Supposition (Formal Representation)**
> Let C be a context constituted by a world S_w and a set of laws S_L. The result of modally supposing φ in C is the set of worlds $M(\varphi, S_w, S_L)$.

4.2.2 Amodal Suppositions

Amodal suppositions are not modal in the sense which modal suppositions are: when we amodally suppose φ, we are concerned with how some set of propositions or another must be to in order to accommodate φ rather than how some world would have had to pan out for φ to be the case. Needless to say, the propositions in question may well be taken to represent a world of some description.

Like modal suppositions, amodal suppositions are also sensitive to their context in two distinct senses. On the one hand, an amodal supposition is sensitive to the set of propositions against which it is made. Usually, we already said, the set in question is our knowledge, although, we may equally well suppose against, say, our beliefs or any other set for that matter. On the other hand, amodal suppositions are sensitive to whichever logic that is assumed to hold for the set in question. Again, we do not need to have any firm position about the nature of logic in our present context but we may simply assume that logics may be represented by a collection of introduction and elimination rules of some sort or another. Whichever logic we assume to obtain for the set of propositions in the context will determine both what constitutes a contradiction and therefore what sort of revisions are required to maintain consistency upon supposition.

In order to emphasise this dual context sensitivity, let us yet again return to our original example. While amodally supposing, there are various ways in which we can make the following supposition:

(3) Shakespeare did not write *Hamlet*.

On the one hand, we might be in a context where we suppose against our knowledge: assuming that we know that Shakespeare wrote *Hamlet*, we can suppose the contrary. Now, if our context is such that the consistency of our stock of knowledge is dictated by a logic which, say, validates $\Gamma \vdash \varphi \vee \chi$ iff it validates either $\Gamma \vdash \varphi$ or $\Gamma \vdash \chi$, we might end up making different sort of revision than if consistency is dictated by a logic that does not. For instance, assuming that the knowledge in the context is such that beside Shakespeare, whom we know wrote *Hamlet*, Francis Beaumont and John Fletcher are the only obvious candidates for the tragedy's authorship: in the context where the first logic dictates consistency, a revision will presumably yield two equally valid sets of propositions, one which contains 'Beaumont wrote *Hamlet*' and another which contains 'Fletcher wrote *Hamlet*'; in the context where the second logic dictates consistency, a revision will yield a set in which contains neither propositions nor their negations—which is to say that we would be agnostic about who wrote *Hamlet* on the supposition that Shakespeare did not—although the proposition 'either Beaumont or Fletcher wrote *Hamlet*' would be in the revised set.

On the other hand, we might be in a context where we amodally suppose against some contextually salient set of propositions which is not our knowledge but, say, a fiction whereby tragedies such as *Hamlet* are either written by authors or else come mysteriously into being out of thin air. Were we to suppose (3) in such context, assuming some fairly uncontroversial logic, revision would yield a set of propositions which constitutes 'no one wrote *Hamlet*'.

Again, the issue of objectivity looms large but in a slightly different way than before. This time, a supposition made against a set of propositions whose actual logic does not coincide with the contextually salient logic is not objectively correct. Were we to assume, for instance, that some deviant logic dictated the consistency of our knowledge in a particular context, the result of our supposition would be objectively incorrect. However, like before, we can still claim that a supposition may be correct in the context which it is made despite being objectively incorrect.

That all said, we are now finally in a position to give a definition of amodal suppositions:

> **Amodal Supposition**
> An amodal supposition of φ upon a set of propositions K is made by a minimal revision of K required to consistently accommodate φ according to the logic l.

For our later purposes, we shall also need a convenient formalism for amodal suppositions. Like before, we may represent contexts as n-tuples of contextual parameters. For our purposes, again, it does not matter what we take the parameters of the context to represent as long as one represents a set of propositions against which we suppose and another the logic assumed in the context in question to dictate the consistency of our set of propositions. Let a context C therefore be represented by an n-tuple of constituted by S_K and S_l, where S_K is the set of propositions against which we make our supposition and S_l is the logic assumed to dictate the consistency of S_K.

As for modal suppositions, we may think of amodal suppositions as a function from the content of the supposition, the set of propositions against which the supposition is made and the logic assumed to dictate the consistency of that set, to a set of sets of propositions which results from the supposition. Let $N(x, y, z)$ therefore be a function which three arguments, a proposition x, a set of propositions y and a logic z, and returns a set of sets of propositions.

That said, we may now formalise our definition of amodal suppositions as follows:

> **Amodal Supposition (Formal Representation)**
> Let C be a context constituted by a set of propositions S_K and a logic S_l. The result of amodally supposing φ in C is the set of sets of propositions $N(\varphi, S_K, S_l)$.

4.2.3 Prospect for Unification

Unsurprisingly, we might now wonder whether there is any prospect of unifying the two accounts such that we would actually only be up against one sort of supposition rather than two. To answer that question, let us consider the ways in which modal and amodal suppositions are alike and unlike.

In the first place, the time of supposition seems to be of importance. On the modal supposition of (3), on the one hand, we must locate the time of Shakespeare and then trace the chains of causes and effects wherever they may take us. On the other hand, however, on the amodal supposition of (3), we must consider what we know in the context in question and then simply work from there. In fact, for that very reason, our suppositions yield quite different products: upon a modal supposition, no one wrote *Hamlet*, while upon an amodal supposition, someone other than Shakespeare did. Since *Hamlet* took an author of considerable genius, living at a particular place and time in history, it seems all but necessary that no one else could have written the tragedy had Shakespeare not. However, since *Hamlet* does exist and such tragedies do not just come into being without an author, there must have been an author even if Shakespeare did not write *Hamlet*.

However, the plot thickens somewhat in cases where the content of the supposition in question does not denote a synchronic fact. For example, we may either modally or amodally suppose the proposition expressed by the following sentence:

(4) No one has read *Hamlet*.

When we modally suppose (4), our task is no longer that of locating a single fact in the world against which we suppose, but rather numerous facts of particular description. Of course, the fact that we can do such a thing is no small cognitive achievement but nonetheless one which we do generally master. In any commonplace context, the modal supposition of (4) will result in a set of worlds in which no one has ever staged *Hamlet* since, quite obviously, no one has ever read the play. However, the amodal supposition of (4), will result in sets of propositions where *Hamlet* has been staged numerous times although, oddly enough, no one involved has ever read the play. Importantly, the fundamental difference remains: modal suppositions require us to locate the time of the content of our supposition while amodal suppositions do not.

In the second place, the modal and amodal aspects of modal and amodal suppositions is of considerable importance. While the products of modal suppositions are closely related to ways in which the worlds in question could be, the products of amodal suppositions need not even represent possible worlds of any contextually interesting modality. For instance, the result of amodally supposing (3) in some everyday context will, we must agree, result in a set of propositions which contains propositions along the lines of '*Hamlet* exists', 'someone wrote *Hamlet*' and 'Shakespeare did not write *Hamlet*'. Were we so inclined, we may let the set represent a set of possible worlds in which the propositions in question are true. Importantly, the worlds determined by our set of propositions may all well be metaphysically possible yet physically impossible: given the make-up the actual world and assuming some sort of common sense physical laws, it seems impossible that *Hamlet* would exist had Shakespeare not been its author.

One might, of course, retort that amodal suppositions do relate to modality of some sort, to wit, epistemic or doxastic modality. Yes, indeed, in the cases where we amodally suppose against our knowledge or beliefs, we are indeed concerned with epistemic or doxastic possibilities: given what we know or believe, the product of our amodal supposition is epistemically or doxastically necessary. That, however, misses the point that modal suppositions have to do with the ways in which worlds could have been while their amodal counterparts do not. In other words, the modal flavour of modal suppositions does not seem to characterise their amodal counterparts.

In the third place, the fact that modal and amodal suppositions are sensitive to different elements of their contexts seems to reveal a fundamental difference in their nature. While modal suppositions are sensitive to a world or situation of some description and the set of laws assumed to obtain there, amodal suppositions are sensitive to a set of propositions and the logic assumed to dictate the consistency of the set in questions.

However, as we should know, the ties between propositions and worlds have traditionally been assumed close-knit: depending on one's purposes, a world may be represented by the set of propositions which are true in the world or, conversely, a proposition may be represented by the set of worlds in which it is true. Perhaps, then, there lurks a prospect for a translation between the world parameter of modal suppositions and the set-of-propositions parameter of amodal suppositions, and vice versa. Apart from the usual problems involved treating worlds as sets of propositions or vice versa, there are, to be sure, certain further issues involved: sets of propositions which represent, say, our knowledge and beliefs do rarely determine a single possible world; in fact, the number of worlds grows exponentially with our ignorance. However, we may, of course, well claim that suppositions are sensitive either to sets of worlds or sets of propositions, which then are interchangeable.

Moreover, we might offer a translation between the set-of-laws parameter of modal suppositions and the logic parameter of amodal suppositions. Naturally, this will depend on what one takes laws, on the one hand, and logic, on the other hand, to involve. Were we, for instance, to take both laws and rules of logic to be schematically represented by generalisations and introduction and elimination rules respectively, we might argue that the difference between laws and rules of logic is merely one of matter but not kind. Indeed, we do not have to venture too far into the quagmires of metaphysics for the boundary between logical and metaphysical laws begins to blur. On reflection, we might soon ask ourselves, say, whether the law of non-contradiction is one of metaphysics or logic—or indeed neither.

Are all our suppositions perhaps of the same kind? Say, are all all our suppositions merely some sort of universal revision process, which is sensitive to a contextually salient set of propositions and a contextually salient set of laws of various sorts? Although the details remain to be spelled out, we might certainly argue for that claim. We will however not pursue that project further at present but merely leave the issue at that. However, for our purposes, we have decided to treat suppositions as of two distinct kinds. An immediate effect of that decision is that conditionals will also be of two sorts.

4.3 Modal & Amodal Conditionals

Conditionals, we claimed before, are expressions of their consequents upon the supposition of their antecedents. And since we have decided to treat suppositions as of two fundamentally distinct sorts, we end up with two corresponding sorts of conditionals, which we have aptly decided to call 'modal conditionals' and 'amodal conditionals'.

In this section, we will give a preliminary semantic account of modal and amodal conditionals, which we will use later to feed into our generative grammar account. However, before we do that, let us make several remarks pertaining to modal and amodal conditionals alike.

Firstly, we claimed earlier that many conditional could receive either modal or amodal readings in respectively appropriate contexts. Our claim was that there are no syntactic markers for different sorts of conditionals in English, rather only indications, most notably temporal shifts and modal verbs that betray their utterers' attitude and consequently imply the sort of conditional expressed and interpretation required.[3] Conditionals are therefore distinctly context sensitive in three respects:

[3] See §3.4.

apart from the dual context sensitivity required by their constituent suppositions, the context moreover determines whether we are up against modal or amodal conditionals. Once we finally turn to giving proper generative semantics for conditionals, we will return to this issue.

Secondly, although we have talked as if the context determines world of supposition, the laws obtaining at a world, set of propositions, the logic dictating the consistency of sets of propositions, the sort of conditionality expressed and whatnot, that is merely an idealisation. Without offering an argument, let us merely admit that we believe that the utterer's intentions determines all such things. In ideal situations, where the utterer is abiding by principles of cooperation by successfully exploiting contextual elements and pragmatic particulars to get his thoughts across, a competent interpreter may pick up on the relevant intentions through sufficient sensitivity to such factors and thus interpret accurately and understand the utterer. In those cases alone, we can actually claim that there is contextual salience of some sort or another and that the context may be used to determine the meaning of the sentences uttered in that context. We will, however, continue to talk as if the context provides us with the appropriate parameter although we should keep in mind that that is merely a convenient idealisation.

Thirdly, although suppositions require us to follow their appropriate processes of revision to the bitter end, we are often permitted to take short-cuts in cases of conditionals. For instance, when we are up against a modal supposition of (3), we do not have to follow the supposition that Shakespeare did not write *Hamlet* to the end of our contextually salient world. Instead, we do merely have to follow the ripples of causes and effects until we have reached the fact denoted by the consequent or its negation. In other words, although conditionals quite often require daunting cognitive efforts on our behalf, we often get by more lightly than their constitutive suppositions give us reason to expect: conditionals often require only partial suppositions.

And finally, although we did claim that all proper conditionals are either modal or amodal, we have certainly not claimed that there are no other conditional sentences around.[4] Rather, we said, there are certain sorts of thoughts which frequently find their expression in conditional sentences without actually being of proper conditional nature. That is to say, certain sentences may have the surface form of a conditional without having the appropriate logical form. In particular, there are thoughts of a nature akin to generalisations, generics or habituals that are often expressed as conditionals. Moreover, conditional sentences are often merely used for the sake of decorum and politeness or rhetorical effect to express their consequent. And conversely, as we also said before, conditional thoughts do not necessarily have to find their expression in conditional sentences: in appropriate contexts, conditional thoughts may be expressed as conjunctive or disjunctive sentences.

4.3.1 Modal Conditionals

According to our earlier intuitive characterisation of modal conditionals, we may tentatively define them in the following terms:

> **Modal Conditional (Naïve Analysis)**
> A modal conditional is a conditional which expresses its consequent on the modal supposition of its antecedent.

In the introduction, we already gave an example of an alleged modal conditional:

(1) If Shakespeare had not written *Hamlet*, then someone else would have.

In most common contexts, this conditional would be uttered to express the truth of its consequent on the modal supposition of its antecedent.

Upon the modal reading of (1), its utterer claims that someone else wrote *Hamlet* on the modal supposition that Shakespeare did not. As we already said before, the utterance of (1) is (ideally) made in a context which determines the world against which the supposition is made and the laws assumed to obtain in that world. And (1) is therefore true only on the condition that if on the modal supposition that

[4] See §3.4.2

Shakespeare did not write *Hamlet* against the contextually salient world of supposition and the laws assumed to obtain in that world, someone else wrote *Hamlet*.[5]

Since the product of modal suppositions need not be a single world (as the world of supposition could have panned out in different ways), the issue of bivalence requires attention. Presumably, we are willing to say that a modal conditional is true in a context if in every world of the product of the modal supposition of its antecedent in that context, the consequent is true. And conversely, presumably, we are willing to say that a modal conditional is false in a context if in every world of the product of the modal supposition of its antecedent in that context, the consequent is false. But what about cases where the consequent is true in some worlds and false in others? We have quite obvious reason to claim that such conditionals are not true. However, whether such conditionals are false or not is a more interesting question. If we were to agree that such conditionals are neither true nor false, we would have the following truth conditions for modal conditionals:

> **Modal Conditional**
> Let C be a context constituted by a world S_w and a set of laws S_L. The truth conditions of the modal conditional $\ulcorner\varphi \gg \chi\urcorner$ in C are as follows:
>
> $C \models \varphi \gg \chi$ iff $\forall w \in M(\varphi, S_w, S_L), w \in \chi$,
> $C \models \neg(\varphi \gg \chi)$ iff $\forall w \in M(\varphi, S_w, S_L), w \notin \chi$,
> $C \not\models \varphi \gg \chi$ and $C \not\models \neg\,(\varphi \gg \chi)$
> iff $\exists w, w' \in M(\varphi, S_w, S_L), w \in \chi \wedge w' \notin \chi$.

In other words, the first clause says that $\ulcorner\varphi \gg \chi\urcorner$ is true in C iff χ is true in every world produced by the modal supposition of φ against S_w and S_L, the second clause says that $\ulcorner\varphi \gg \chi\urcorner$ is false in C iff χ is false in every world produced by the modal supposition of φ against S_w and S_L, and the final clause says that $\ulcorner\varphi \gg \chi\urcorner$ is neither true nor false in C otherwise. However, if the third truth value strikes us

[5] Notice that this sort of account sits well with so-called causal theories of counterfactuals; see, in particular, Downing (1959), Jackson (1977) and their followers.

as excessive, we may simply get away with the following clause: $C \models \varphi \gg \chi$ if $\forall w \in M(\varphi, S_w, S_L), w \in \chi$, and $C \models \neg(\varphi \gg \chi)$ otherwise.

Finally, before moving on to amodal conditionals, let us consider a few examples of modal conditionals to appreciate the leeway their context sensitivity provides.

First, suppose that we are in a context where we would suppose against the actual world but where we are sympathetic to the latest trends of physics which predict probability of fantastic flukes. Indeed, were we to modally suppose that Shakespeare did not write *Hamlet* in that context, the result would be a set of worlds in which there will be worlds where no one wrote *Hamlet* but also, more importantly, worlds in which someone else, by some fabulous quantum mechanical twists and turns, did. In the context in question, the following conditional will be true:

(5) If Shakespeare had not written *Hamlet*, then someone else could have.

Second, suppose that we are in a context where we would still suppose against the actual world and where we assume that common sense physical laws obtain but moreover also that, as some sort of law, that Shakespeare was a gentleman of moral integrity. We need not assume that that deontic laws obtain in the world in question but merely that Shakespeare was unable to act out of line with respect to a certain class of actions. Again, were we to modally suppose that Shakespeare did not write *Hamlet* in that context, the result would be a set of worlds in which, of course, there will be no worlds in which someone else wrote *Hamlet* but there will also be no worlds in which Shakespeare did anything morally delinquent. In the context in question, the following conditional will be true:

(6) If Shakespeare had not written *Hamlet*, then he would not have pretended that he had.

Third, suppose we are in a context much like the one before except that we now assume that deontic laws obtain, in the sense that there are certain acts that one ought to perform and others one ought not to perform, and that Shakespeare is not quite immune to temptations. Were we, yet again, to modally suppose that Shakespeare did not write *Hamlet* in that context, the result would be a set of worlds in which, again, no one did throughout but also in which in every world it would be morally culpable for Shakespeare to pretend an authorship of a drama he did not write. In the context in question, the following conditional will be true:

(7) If Shakespeare had not written *Hamlet*, then he ought not have pretended that he had.

Fourth, suppose that we are in a context where the world we suppose against is not the actual world but rather the world (or, rather, one of the worlds) compatible with Shakespeare's *Hamlet*. Moreover, in the context in question, let us assume that queen Gertrude upheld strict house-rules in Elsinore Castle, whereby anyone, noble and common alike, had to clean the crockery after use. Were we to modally suppose that young prince Hamlet had used the crockery, the result would be a set of worlds in which in every world Hamlet had to clean up his mess. In the context in question, the following conditional will be true:

(8) If Hamlet had used the crockery, he would have had to clean it afterwards.

Finally, suppose that we are in a context much similar to the one before except that we have added the rules of chess to our set of laws. Were we to modally suppose that young prince Hamlet was playing a game of chess with his mate Horatio in which he had already moved his king, the result would be a set of worlds in which in every world Hamlet would be unable to castle. In the context in question, the following conditional will be true:

(9) If Hamlet had already moved his king, he would not be able to castle.

4.3.2 Amodal Conditionals

According to our earlier intuitive characterisation of amodal conditionals, we may tentatively define them in the following terms:

Amodal Conditional (Naïve Analysis)
An amodal conditional is a conditional which expresses its consequent on the amodal supposition of its antecedent.

In the introduction, we already gave an example of an alleged amodal conditional:

(2) If Shakespeare did not write *Hamlet*, then someone else did.

In most common contexts, this conditional would be uttered to express the truth of its consequent on the amodal supposition of its antecedent.

Upon the amodal reading of (2), its utterer claims that someone else wrote *Hamlet* on the amodal supposition that Shakespeare did not. As we already said before, the utterance of (2) is (ideally) made in a context which determines a set of propositions against which the supposition is made and a logic assumed to dictate the consistency of the set. And (2) is therefore true only on the condition that if on the amodal supposition that Shakespeare did not write *Hamlet* against the contextually salient set of propositions and the logic assumed to dictate the consistency of the set, 'someone else wrote *Hamlet*' will be in the set resulting from the supposition.

Since the product of amodal suppositions need not be a single set of propositions, the issue of bivalence begs attention again. As before, we are willing to say that an amodal conditional is true in a context if the consequent is in every set of the product of the amodal supposition of its antecedent in that context. And conversely, again, we are willing to say that an amodal conditional is false in a context if the negation of the consequent is included in every set of the product of the amodal supposition of its antecedent in that context. Again, what about the middle ground? If we are tempted to say that such amodal conditionals are neither true nor false, we may spell the truth conditionals of amodal conditionals as follows:

Amodal Conditional

Let C be a context constituted by a set of propositions S_K and a logic S_l. The truth conditions of the amodal conditional $\ulcorner \varphi > \chi \urcorner$ in C are as follows:

$C \models \varphi > \chi$ iff $\forall S \in N(\varphi, S_K, S_l), \chi \in S$,

$C \models \neg(\varphi > \chi)$ iff $\forall S \in N(\varphi, S_K, S_l), \chi \notin S$,

$$C \not\models \varphi > \chi \text{ and } C \not\models \neg(\varphi > \chi)$$
$$\text{iff } \exists S, S' \in N(\varphi, S_K, S_l), \chi \in S \wedge \chi \notin S'.$$

In other words, the first clause says that $\ulcorner \varphi > \chi \urcorner$ is true in C iff χ is in every set of propositions produced by the amodal supposition of φ against S_K and S_l, the second clause says that $\ulcorner \varphi > \chi \urcorner$ is false in C iff χ is in no set of propositions produced by the amodal supposition of φ against S_K and S_l, and the final clause says that $\ulcorner \varphi > \chi \urcorner$ is neither true nor false in C otherwise. However, if the third truth value strikes us as excessive, we may simply get away with the following clause: $C \models \varphi > \chi$ if $\forall S \in N(\varphi, S_K, S_l), \chi \in S$, and $C \models \neg(\varphi > \chi)$ otherwise.

In order to get a better grasp of the context sensitivity of amodal conditionals, let us consider an example.[6] Suppose now that we are Shakespeare's contemporaries and I know that Shakespeare is far from fit enough to swim the across the English Channel and that were he to try in his current state, he would be certain to drown. Were I to amodally suppose that Shakespeare were to swim across the Strait of Dover—which is the narrowest part of the English Channel—against my knowledge, the result would be a set of sets of propositions each containing 'Shakespeare drowns'. In the context in question, the following conditional will therefore be true:

(10) If Shakespeare attempts to swim across the Strait of Dover, he will drown.

Now, suppose furthermore, that you know something about Shakespeare that I do not: Shakespeare is sensible and cautious and would thus never attempt do anything of this sort unless being sure of his own safety. In particular, you know that Shakespeare would never attempt to swim across the strait unless he had had sufficient training and never without having someone on a boat nearby at all times in case of exhaustion. Were you to amodally suppose that Shakespeare were to swim across the Strait of Dover against your knowledge, the result would be a set of sets of propositions each containing 'Shakespeare does not drown'. In the context in question, the following conditional will therefore be true:

[6] The so-called Gibbard cases provide an excellent example of this, see §§2.1–2.

(11) If Shakespeare attempts to swim across the Strait of Dover, he will not drown.

Of course, (11) is false in my context and (10) is false in your context. That, however, does not pose any particular problems. Assuming there are no other relevant facts to be known in the case, you are objectively right while I am wrong: were Shakespeare actually to attempt the swim, he would not drown. However, I have made no error in my supposition and neither have you: we have both made correct amodal suppositions and correctly expressed the truth of different propositions upon our respective suppositions. Arguably, therefore, we have both uttered true propositions in our respective contexts. Of course, were you to let me in on the relevant facts, my context would shift and I would reasonably reject (10) and accept (11). However, the important fact remains: the truth conditions of amodal conditionals are sensitive to their context in ways which allow for great flexibility.

4.3.3 Conflation of Modal & Amodal Conditionals

In some cases, modal and amodal conditional are hard to tell apart. In fact, when we are up against certain conditionals in particular contexts, it does not matters truth-conditionally whether we interpret them modally or amodally. For instance, suppose I were to utter the following conditional:

(12) If Shakespeare had not married Anne Hathaway, he would have married someone else.

By uttering (12), I might mean one of two distinct things. On the one hand, I might assume a great deal about the laws—physical, social and whatnot—which obtained in our world in the latter half of the fifteenth century and on those grounds, I might suppose modally that had Shakespeare not married Hathaway, he would doubtlessly have married some other woman—such was the way of the world in those days. On the other hand, I might hold no beliefs about the intricate social laws of Elizabethan England but still, say, know that although Shakespeare did marry Hathaway, he also had an eye for certain fair damsel and thus also know that he was destined to marry one or the other. And on those grounds, I might amodally suppose that had Shakespeare not married Hathaway, he would have married the other woman.

Were you to successfully interpret my utterance of (12), your task would normally be to determine which of the two I had meant. However, in this particular context, it matters not in which way you choose to interpret my utterance: as long as you are only interested in the truth conditions, the result would be one and the same.

In cases of present and future tense conditionals, such conflation becomes even more harmless. For instance, suppose I were to utter the following conditional:

(13) If Gabriel García Márquez rewrote *Hamlet*, he would infuse it with magical realism.

Again, it would not matter truth conditionally whether you understood me as expressing a modal conditional or an amodal conditional. Moreover, by uttering (13), I might not even be entirely certain myself which of the two I have in mind: I might only know that Márquez would imbue any story with magical realism and whether I am assuming there to be a law of some sort or merely a constituent of my knowledge might not even be obvious to myself. Yes, if I had assumed there to be such a law obtaining in the world and modally supposed against the actual world that Márquez rewrote *Hamlet*, I would have expressed a modal conditional. And conversely, if such a proposition had only been a constituent of my knowledge and I had amodally supposed against my knowledge that Márquez rewrote *Hamlet*, I would have expressed an amodal conditional. However, perhaps because it does not really matter in such cases, I might not even have considered which sort of supposition I wanted to express. In fact, I might not even have one particular supposition in mind. Perhaps, I had intended to express both a modal conditional and an amodal conditional at once.

What we should ultimately say about such cases is a subject for further discussion. However, let it suffice to say that modal and amodal conditionals are subject to harmless conflation in many cases. Of course, we should not forget that in many cases such conflation will turn out disastrous. However, we should also keep in mind that conflation will not impede successful interpretation in many cases.

4.4 Syntax of English Conditionals

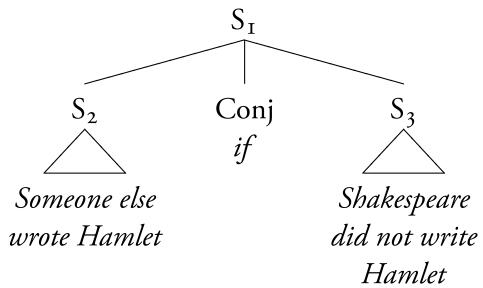
In order to offer semantics for modal and amodal conditionals, we ought to pay heed to the syntax of conditional sentences in our object language.[7] One might of course argue that the issues involving the syntax/semantics interface should be delegated to linguists, while philosophers should be left alone to philosophise about the actual semantics. If we were to agree with that view, we might stop our enquiry now as we have already provided adequate semantics for modal and amodal conditionals. However, since we do believe that a proper semantic account should appropriately align with the syntax of its subject matter, we will now offer a rough analysis of the syntax of English conditional sentences which in turn we shall use as input to our semantics in generative grammar. Throughout our discussion, we should keep in mind that we are not concerned with the syntax of the surface form, since, as we should know by now, approximately anything goes at the surface. Rather, the phrase marker trees we will deal with are to represent the deep form, if not the logical form, of conditional sentences. The form in question, therefore, is the form we assume shared by all expressions of conditionals irrespective of whether their surface form is that of conditional sentences, disjunctions, conjunctions or something else.

First, a historical observation. Hitherto, philosophers and logicians alike have usually worked under the quite natural assumption that conditional sentences in natural languages express a proposition composed of two constitutive propositions joined by a logical connective of some sort and which together determine the meaning of the conditional sentence. Moreover, since conditional pairs such as our (1) and (2) differ in meaning yet share the same constitutive propositions, the view that there are two different conditional connectives around in natural languages

[7] On the syntax of conditionals, see also Iatridou (1991) and Bhatt and Pancheva (2006).

has become all but the standard among philosophers and logicians.[8] Traditionally, conditional sentences such as (1) and (2) have thus been understood as $\ulcorner \varphi >_1 \chi \urcorner$ and $\ulcorner \varphi >_2 \chi \urcorner$ where different theories assign their own distinct semantics to $>_1$ and $>_2$ which are somehow spelled out in terms of φ and χ.

Although this picture is not harmful to the enquiry into the semantics of natural language conditionals as such, it does place unnatural constraint on the syntax of conditional sentences given the assumption that syntax must align in some important sense with semantics. The picture predicts that antecedents and consequents are syntactically on a par much like the conjuncts of conjunctions and the disjuncts of disjunctions. Clearly, that is not to say that antecedents and consequents are commutative but rather that they occupy the same level in phrase marker trees of conditional sentences. In fact, according to this picture, the syntactic structure of a natural language conditional such as (1) is therefore somewhere along the following lines:[9]



Although we must admit that this picture is quite charming, linguistic evidence gives us reason to suspect that it is oversimplified for three distinct yet related reasons. In the first place, antecedents or so-called conditional clauses behave very much like adverbial phrases in their matrix clauses.[10] In the second place, the word 'if' behaves syntactically much more like complementiser than conjunction.[11] In

[8] Although, see for instance Priest (2009) and Schaffer (ms.a).

[9] For the sake of simplification, we have switched the order of our antecedent and consequent and spelled out the elliptical verb phrase 'did' as 'wrote *Hamlet*'.

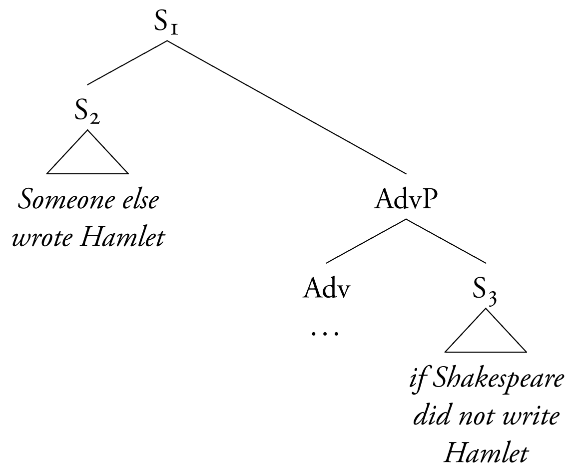
[10] See in particular Geis (1985).

[11] See Harman (1979) and Bhatt and Pancheva (2006).

the third place, according to this picture, we cannot really make any sense of conditionals involving adverbs of quantification—such as 'always', 'sometimes' and 'never'—in their consequents.[12] Arguably, it seems that the only way we can make sense of such conditionals is by maintaining that conditional clauses in fact operate as restrictors on either overt or covert adverbs of quantification.

For those three reasons, we might conclude that antecedents, or conditional clauses, are in fact constituents of adverbial phrases rather than sub-clauses on par with consequents.[13] And moreover, for that reason, any conditional where the antecedent appears to the left of the consequent—such as our (1) and (2)—are either focus or topic phrases where the antecedent has been raised in the structure for the sake of focus or topicalisation. The canonical form of natural language conditionals is one where the consequent appears left of the antecedent.

Very roughly, then, the correct picture seems to be more along the following much simplified lines:



In many cases, like our (1) and (2), where there are no explicit adverbs of quantification or modal adverbs, we arguably understand the conditional clause as restriction on some non-restricting adverb such as 'always' or 'necessarily'. (1) would thus be synonymous with the following conditionals and share its logical form:

[12] See, in particular, Lewis (1975) but also Kratzer (1986).

[13] See Geis (1985) and Bhatt and Pancheva (2006); see also von Fintel (1998b) and Kratzer (1986).

(14) If Shakespeare did not write *Hamlet*, then *necessarily* someone else did.

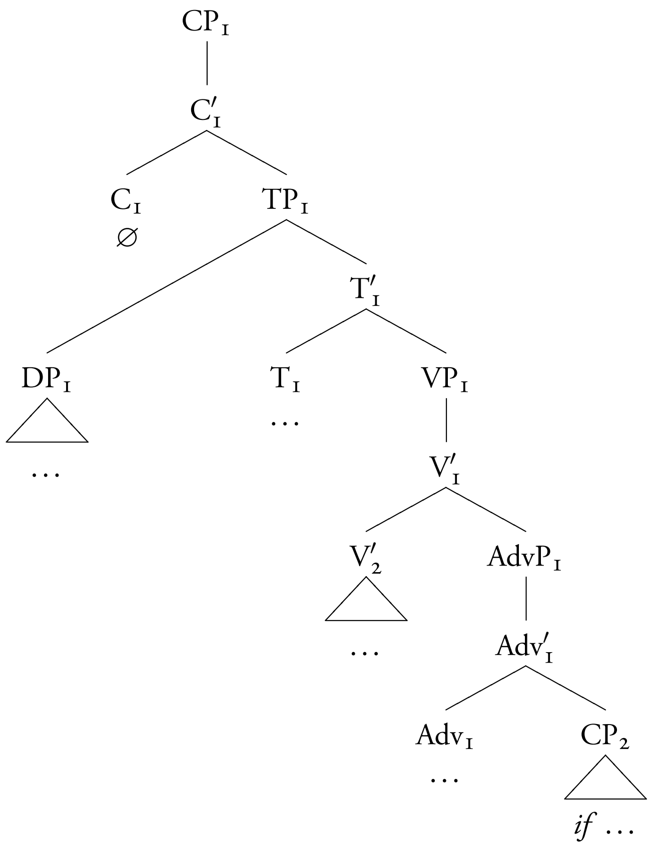
Moreover, on this sort of construal of conditional sentences, conditional clauses behave similarly syntactically to any other adverbial phrases. Therefore, sentences such as our (1) are syntactically not so different from, say, any of the following sentences:

(15) a) Someone else wrote *Hamlet* secretly.
b) Someone else wrote *Hamlet* too.
c) Someone else wrote *Hamlet* long ago.

Needless to say, there will be a vast semantic difference between (1) and (15a)-(15c) which is brought about by the obvious semantic difference of the adverbial phrases in question. However, insofar as we assume that the meaning of sentences may be read roughly off from their structure, we must go about in a similar manner when we account for conditional sentences as when we account for other sentences involving adverbial phrases.

The time has come to be somewhat more precise in our representation of the phrase markers in question. Using so-called *X-bar* notation, the phrase marker trees of conditional sentences look as follows:[14]

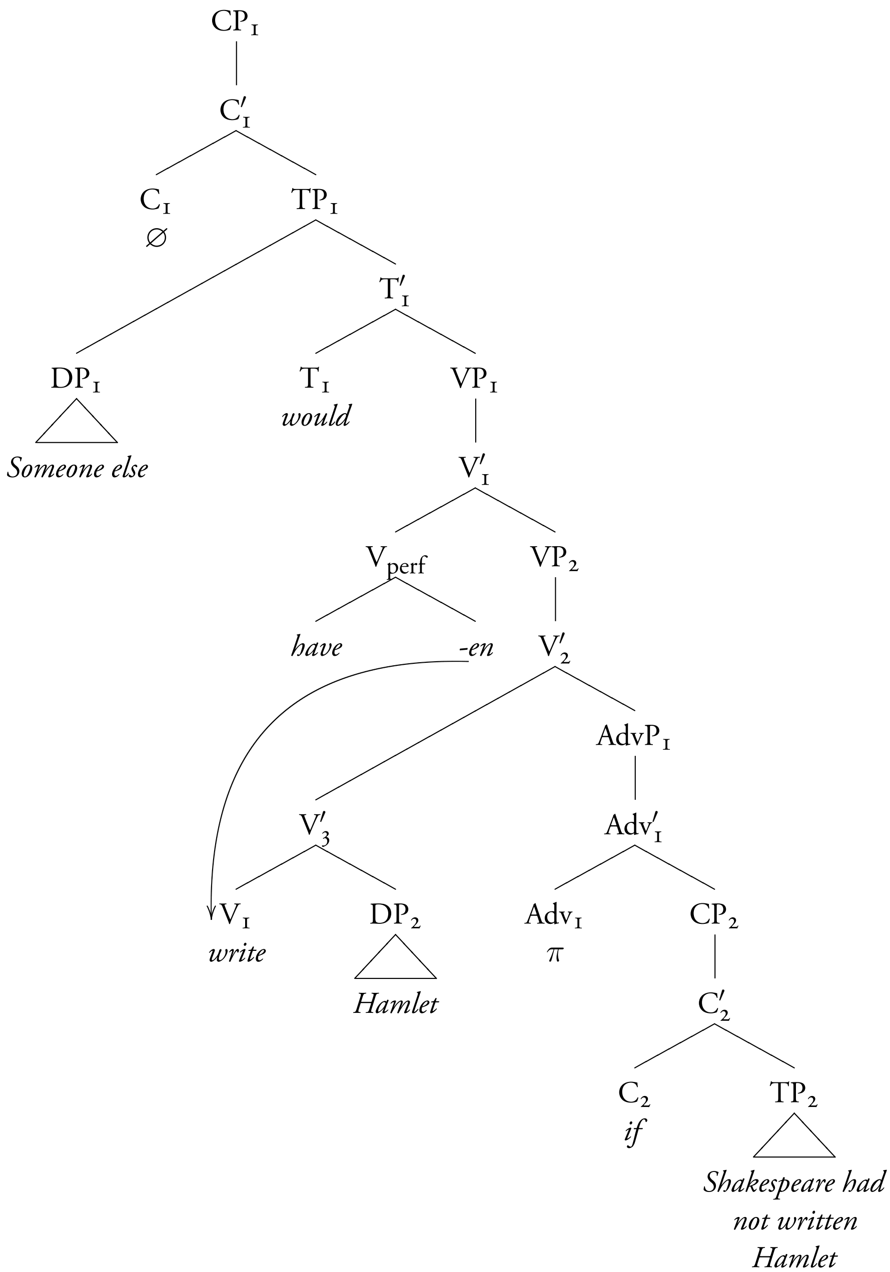
[14]For introduction to generative syntax, see, for instance, Carnie (2007) and Radford (2004).



In this schematic syntactic tree, the subject of the matrix sentence, CP_1, is DP_1, the main verb is V'_1 and the conditional clause is CP_2. In order to gain a better grasp of how actual conditional sentences fit into the structure, let us spell out the phrase structure trees for our two paradigm conditionals. On the one hand, for our (1), we get the following tree:[15]

[15]Strictly speaking, the quantifier makes this and subsequent trees slightly more complex than we make them out to be. However, since that will not matter much in the analysis of our subject matter, we will (incorrectly but innocently so) treat them as DPs hereafter.

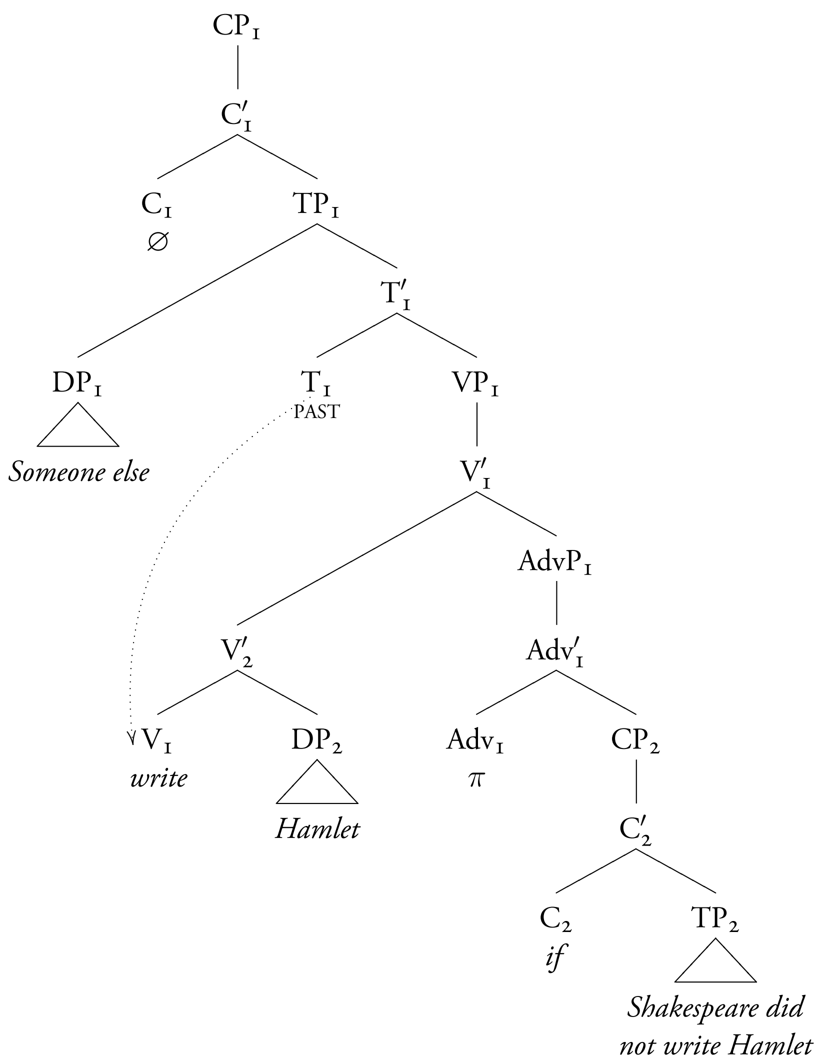
(1)



Notice that the conditional clause CP_2, 'if Shakespeare did not write *Hamlet*', is not c-commanded by any overt adverb in (1). However, since we already claimed that the syntactic role of conditional clauses is merely to restrict adverbs, we will have to treat conditionals which have no overt adverb in their surface form as having a covert non-restricting adverb, contributing a meaning similar to 'necessarily' or 'always', present in their structure. Hereafter, let us call this covert adverb π and let its meaning, which we will further specify soon, be akin to that of 'necessarily' and 'always'.

On the other hand, for our (2), we get the following phrase structure tree. Again, notice that we will have to assume the covert adverb π in the structure of our conditional.

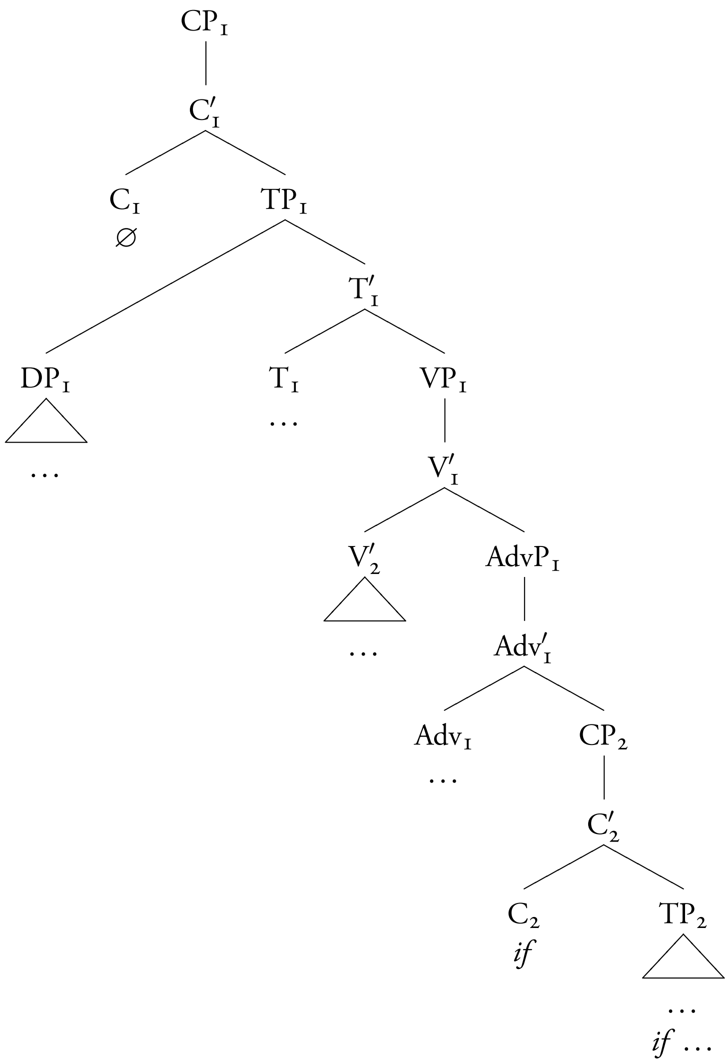
(2)



Finally, it is worth pointing out that on this construal, we get a quite attractive syntactic picture of embedded conditionals. A left-side embedded conditional is a conditional which embeds a further conditional in its antecedent. Although we rarely express conditionals of this sort, the following conditional is an example of a left-side embedded conditional:

(16) If Fletcher would have written *Hamlet* if Shakespeare had not, then Shakespeare could have spent his time doing something else.

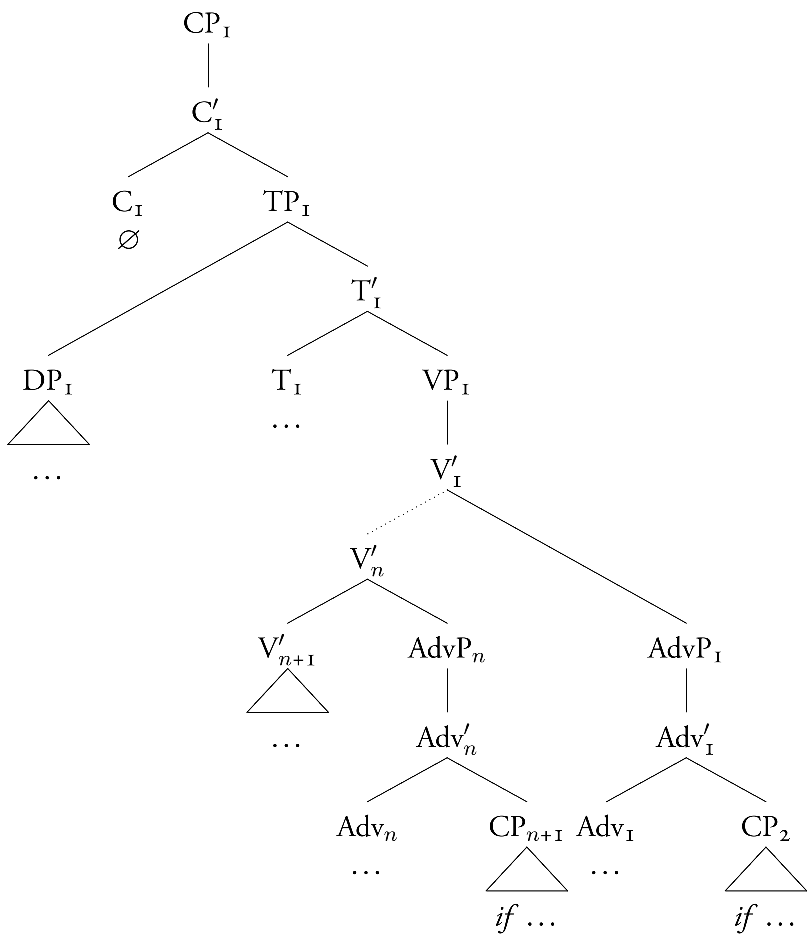
Without going into the relevant details, we may similarly account for left-side embedded conditionals: instead of stacking adjuncts, the conditional clause contains a conditional of its own. In the case of singly left-side embedded conditionals, the picture would look as follows:



Conversely, a right-side embedded conditional is one which embeds a further conditional in its consequent. Such conditionals are fairly common place in natural discourse and the following conditional provides us with an example:

(17) If Shakespeare did not write *Hamlet*, then if Fletcher did not write *Hamlet*, then someone else did.

In conditionals like this, according to the picture we have pushed so far, each conditional clause is merely a further adjunct to the matrix clause's main verb and its complement. Although this will become clearer later, that entails that the law of importation applies to natural language conditionals:[16] any conditional of the form ⌜if φ, then if χ, then ψ⌝ entails truth-conditionally a conditional of the form ⌜if φ and χ, then ψ⌝. According to our picture, we will have the following schema for the syntactic structure of right-side embedded conditionals, whereby any given number of conditional adverbial phrases, AdvP_1 through AdvP_n, may act as adjuncts to any main verb:



[16] See, for instance, McGee (1985); see, however, also §§5.7.2.

4.5 Compositional Semantics in Generative Grammar

4.5.1 Preliminaries

We must quite naturally begin with some preliminaries.[17] First, we will use the double brackets to denote the semantic values of sentences, phrases and lexical items whose mention in our metalanguage we shall represent with bold typeface hereafter in order to avoid an overabundance of quotation marks. Generally, $[\![\alpha]\!]$ therefore denotes the semantic value of α. More carefully put, $[\![x]\!]$ denotes an interpretation function from sentences, phrases and lexical items to their semantic values. For instance, the semantic value of the word **Shakespeare** would thus be the individual Shakespeare:

$[\![$**Shakespeare**$]\!]$ = Shakespeare.

Moreover, we will use so-called lambda notation to represent functions: we use '$\lambda x \in D.\, y$' as a shorthand for the minimal function from the domain D to some domain specified by the function's value y. For illustration, the function $\lambda x \in \mathbb{N}.\, x$ + 1 is then the successor function for natural numbers. With the lambda notation, we may thus represent the denotation of predicates such as, say, **wrote *Hamlet*** as functions from individuals to truth values:

$[\![$**wrote *Hamlet***$]\!]$ = $\lambda x \in D.[x$ wrote *Hamlet*$]$.

For further example, when we deal with two-place predicates, which are often expressed by transitive verbs, we assume that they are functions from individuals to functions from individuals to truth values. The denotation of, say, **wrote** is then the following function:

$[\![$**wrote**$]\!]$ = $\lambda x \in D.[\lambda y \in D.[y$ wrote $x]]$.

In order to deal with conditionals—and a range of other expressions—we will need our account to handle both context sensitivity and intensionality. In order to

[17] For further background and details, see, in particular, Heim and Kratzer (1998) and von Fintel and Heim (2007).

do so, we must extend our interpretation function such that it takes two further arguments: an assignment function g, in order to account for context-sensitivity, and a world of evaluation w, in order to account for intensionality. Let g be a partial function from the set of free variables, context sensitive terms, traces and the like to the domain of semantic values. Although this might be an unrealistic idealisation, we shall assume that the context will provide us with g.

On the one hand, the extension of α is then $[\![\alpha]\!]^{g,w}$. More precisely, $[\![\alpha]\!]^{g,w}$ denotes the semantic value of α under the assignment g and as evaluated in world w. Even more precisely, $[\![x]\!]^{g,w}$ denotes a interpretation function from terms, assignment functions and worlds to the domain of semantic values. Upon such extension of our interpretation function, we now have a means of relativisation to contexts and worlds of evaluation. Inspired by Kripke, we shall assume that names are rigid designators whose extension is fixed across worlds.[18] Quite naturally, however, we will assume that predicates, descriptions and the like vary their extension from world to world. For instance, then, the extension of the terms **Shakespeare**, ***Hamlet*** and **wrote** are as follows:

$[\![$**Shakespeare**$]\!]^{g,w}$ = Shakespeare.
$[\![$***Hamlet***$]\!]^{g,w}$ = *Hamlet*.
$[\![$**wrote**$]\!]^{g,w}$ = $\lambda x \in D.[\lambda y \in D.[y$ wrote x in $w]]$.[19]

On the other hand, the intension of α is $\lambda w.[\![\alpha]\!]^{g,w}$. Hereafter, let us use $[\![\alpha]\!]^{g}$ as a shorthand for $\lambda w.[\![\alpha]\!]^{g,w}$. In short, the extension of α is then $[\![\alpha]\!]^{g,w}$ and its intension is $[\![\alpha]\!]^{g}$. More carefully stated, $[\![\alpha]\!]^{g}$ denotes a function from a world w to the the extension of α as evaluated in that world. More generally put, $[\![x]\!]^{g}$ denotes a function from terms and worlds to the domain of intensions. For instance, the intension of the terms **Shakespeare**, ***Hamlet*** and **wrote** are as follows:

$[\![$**Shakespeare**$]\!]^{g}$ = λw. Shakespeare.

[18] See, of course, Kripke (1972).

[19] Since none of the terms in question are context-sensitive, the assignment function g is an idle parameter.

$[\![$***Hamlet***$]\!]^g = \lambda w.$ *Hamlet*.
$[\![$**wrote**$]\!]^g = \lambda w.[\lambda x \in D.[\lambda y \in D.[y \text{ wrote } x \text{ in } w]]]$.

Quite obviously, semantic values are of different types. For instance, the extension of **Shakespeare** is an individual, the extension of **wrote** is a function from individuals to a function from individuals to truth values, and the extension of the sentence **Shakespeare wrote *Hamlet*** is a truth value. Let us call the semantic type of truth values t and the semantic type of individuals e. Let $\langle i, o\rangle$ denote the type of a function from a domain whose elements are of type i to domain whose elements are of type o. We may then represent the semantic type of functions from individuals to truth values as $\langle e, t\rangle$, the semantic type of functions from individuals to functions from individuals to truth values as $\langle e, \langle e, t\rangle\rangle$ and so on. Moreover, to allow for intensions, let w represent the type of worlds. Intensions of names will then have the semantic type $\langle w, e\rangle$, the intension of intransitive verbs will have the semantic type $\langle w, \langle e, t\rangle\rangle$ and so on. More carefully stated, we may now recursively define the semantic types of our framework as follows:

Semantic Types

(i) t is a semantic type.
(ii) e is a semantic type.
(iii) If a and b are semantic types, $\langle a, b\rangle$ is a semantic type.
(iv) If a is a semantic type, $\langle w, a\rangle$ is a semantic type.
(v) Nothing else is a semantic type.

Corresponding to this definition of semantic types, we may define semantic denotation domains recursively as follows:

Semantic Denotation Domains

(i) $D_t := \{0,1\}$ (the set of truth values).
(ii) $D_e := D$ (the set of all possible individuals).
(iii) If a and b are semantic types, $D_{\langle a,b\rangle}$ is the set of all functions from D_a to D_b.

(iv) If a is a type, then $D_{\langle w,a\rangle}$ is the set of all functions from the set of worlds W to D_a.

For instance, then, a semantic value of type $\langle w, \langle e,t\rangle\rangle$ is a function in the domain $D_{\langle w,\langle e,t\rangle\rangle}$, which is the domain of functions from W to functions of type $\langle e,t\rangle$.

In order to get us off the ground, we will need two principles of composition. We will assume that we work with binary syntactic trees throughout. A binary tree is a tree whose nodes have at most two children. Following syntactic tradition, we call parent nodes 'mothers' and their children nodes their 'daughters'. In the cases where a mother has only one daughter, the value of the mother is simply the value of its daughter. In the cases where a mother has two daughters, our compositional principles dictate how to derive the value of the mother from the value of her daughters. Our two principles therefore tell us how to calculate the meaning of a branching tree node in terms of its two daughters.

The first principle is straightforward functional application: whenever one daughter node is a function whose domain contains the other daughter node, the value of the mother node is the value which results from applying the first daughter node to the second:

Functional Application
If α is a branching node and $\{\beta,\gamma\}$ the set of its daughters, then, for any world w and assignment g: if $[\![\beta]\!]^{g,w}$ is a function whose domain contains $[\![\gamma]\!]^{g,w}$, then $[\![\alpha]\!]^{g,w} = [\![\beta]\!]^{g,w}([\![\gamma]\!]^{g,w})$.

Our second principle of composition is merely an intensional counterpart of the first:

Intensional Functional Application
If α is a branching node and $\{\beta,\gamma\}$ the set of its daughters, then, for any world w and assignment g: if $[\![\beta]\!]^{g,w}$ is a function whose domain contains $\lambda w'.[\![\gamma]\!]^{g,w'}$, then $[\![\alpha]\!]^{g,w} = [\![\beta]\!]^{g,w}(\lambda w'.[\![\gamma]\!]^{g,w'})$.

Finally, we will need to tie the notion of truth to our semantic system. For that purpose, let us introduce the following principle:

Truth of an Utterance

An utterance of a sentence φ in a world w is true iff $[\![\varphi]\!]^{g,w} = 1$.

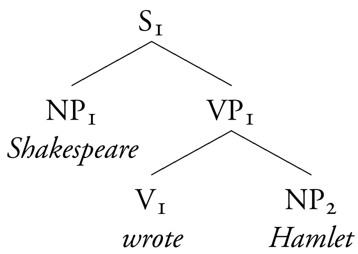
4.5.2 Putting the Pieces Together

To gain a better grasp of the framework, let us give an example to illustrate how we compute the semantic values of sentences. Let us focus on the following sentence:

(18) Shakespeare wrote *Hamlet*.

For all intents and purposes, we may assume that the structure of our sentence may be represented by the following simplified phrase marker tree:

(18)

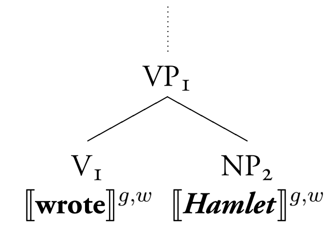


In order to compute $[\![(18)]\!]^{g,w}$, we must work our way up from the semantic values of the terminal nodes. Recall, we already said above that the extensions of **Shakespeare**, ***Hamlet*** and **wrote** were as follows:

$[\![\textbf{Shakespeare}]\!]^{g,w}$ = Shakespeare.
$[\![\textbf{\textit{Hamlet}}]\!]^{g,w}$ = *Hamlet*.
$[\![\textbf{wrote}]\!]^{g,w} = \lambda x \in D.[\lambda y \in D.[y \text{ wrote } x \text{ in } w]]$.[20]

We may substitute the terminal nodes of our tree for their respective extensions. Let us begin by computing the value of VP_1 whose daughters are V_1 and NP_2:

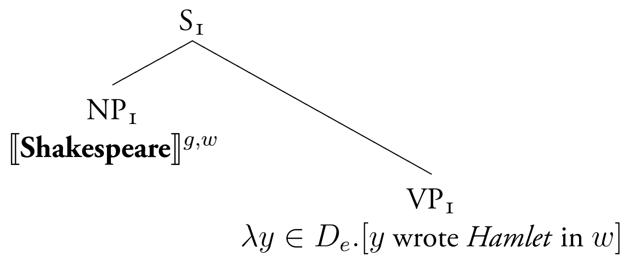
[20]Since none of the terms in question are context-sensitive, the assignment function g is an idle parameter.



The extension of **wrote** is the function $\lambda x \in D_e.[\lambda y \in D_e.[y \text{ wrote } x \text{ in } w]]$ and the extension of ***Hamlet*** is the object *Hamlet*. Since the type of the former is $\langle e, \langle e, t\rangle\rangle$ and the type of the latter is e, our principle of functional application tells us that $[\![\text{VP}_1]\!]^{g,w}$ is $[\![\textbf{wrote}]\!]^{g,w}$ applied to $[\![\textbf{\textit{Hamlet}}]\!]^{g,w}$:

$$\begin{aligned}
[\![\text{VP}_1]\!]^{g,w} &= [\![\textbf{wrote}]\!]^{g,w}([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
&= \lambda x \in D_e.[\lambda y \in D_e.[y \text{ wrote } x \text{ in } w]](\textit{Hamlet}) \\
&= \lambda y \in D_e.[y \text{ wrote } \textit{Hamlet} \text{ in } w]
\end{aligned}$$

Let us now move on to S$_1$ whose daughters are NP$_1$ and VP$_1$. Since we have already computed $[\![\text{VP}_1]\!]^{g,w}$, let us leave its value in our tree:



The extension of **Shakespeare** is the individual Shakespeare and the extension of VP$_1$, we just computed, is the function $\lambda y \in D_e.[y \text{ wrote } \textit{Hamlet} \text{ in } w]$. Since the type of the former is e and the type of the latter is $\langle e, t\rangle$, our principle of functional application again tells us that $[\![\text{S}_1]\!]^{g,w}$ is $[\![\text{VP}_1]\!]^{g,w}$ applied to $[\![\textbf{Shakespeare}]\!]^{g,w}$:

$$\begin{aligned}
[\![\text{S}_1]\!]^{g,w} &= [\![\text{VP}_1]\!]^{g,w}([\![\textbf{Shakespeare}]\!]^{g,w}) \\
&= \lambda y \in D_e.[y \text{ wrote } \textit{Hamlet} \text{ in } w](\text{Shakespeare}) \\
&= \text{Shakespeare wrote } \textit{Hamlet} \text{ in } w
\end{aligned}$$

Given our principle of truth of utterance, an utterance of (18) is then true in a world w iff Shakespeare wrote *Hamlet* in w. More importantly, the truth conditions of (18) may therefore be calculated as follows:

$$
\begin{aligned}
[\![(18)]\!]^{g,w} = 1 \quad & \text{iff} \quad [\![\textbf{wrote}]\!]^{g,w}([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{Shakespeare}]\!]^{g,w}) = 1 \\
& \text{iff} \quad \lambda x \in D_e.[\lambda y \in D_e.[y \text{ wrote } x \text{ in } w]](\textit{Hamlet}) \\
& \qquad (\text{Shakespeare}) = 1 \\
& \text{iff} \quad \lambda y \in D_e.[y \text{ wrote } \textit{Hamlet} \text{ in } w](\text{Shakespeare}) = 1 \\
& \text{iff} \quad \text{Shakespeare wrote } \textit{Hamlet} \text{ in } w.
\end{aligned}
$$

Now that we have spelt out the preliminaries of our semantic framework, let us now turn to the issue of conditionals again.

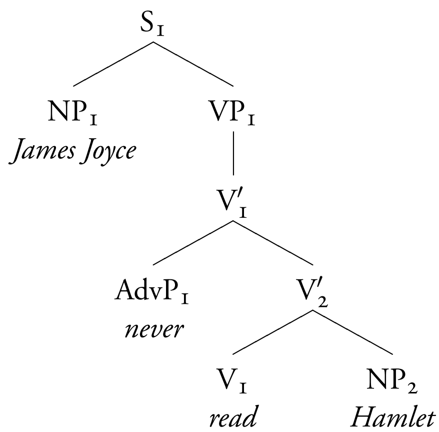
4.5.3 Adverbial Phrases

We claimed above that conditional clauses are constituents of adverbial phrases. In order to understand the semantic contribution of adverbial phrases, let us first consider sentences which contain adverbial phrases but no conditional clauses such as the following:

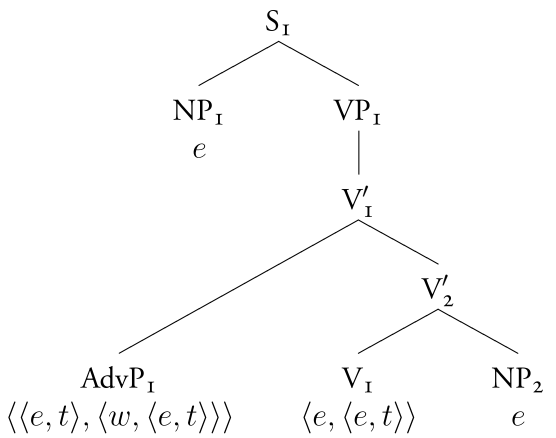
(19) James Joyce never read *Hamlet*.

For our present purposes, we may assume that the syntactic structure of our sentence may be represented by the following simplified phrase marker tree:

(19)



For more simple sentences, such as (18), we have already seen that the verb phrase of the matrix clause must be of type $\langle e, t\rangle$ in order to correspond with the subject whose type is e. More carefully put, in such simple sentences, we expect whichever function the verb and its object, if any, determine together to percolate up through the tree and eventually end up in the relevant VP node. In more complex sentences containing adverbial phrases, which are driven like a wedge between the relevant VP node and the verb and its object, if any, we would therefore expect that the adverbial phrase node in question would be a function of the type $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$ or $\langle\langle e, t\rangle, \langle w, \langle e, t\rangle\rangle\rangle$. Since the latter will make things slightly easier for us, let us assume that the adverbial phrase operates on the intension of the verb by our intensional functional application. We would then expect that the types of the terminal nodes of our previous tree would be as follows:



If we let W represent the set of worlds or situations viable in the context, the semantic value of **never** could, it seems intuitively, be spelt out as follows:[21]

$$[\![\textbf{never}]\!]^{g,w} = \lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.\ [\lambda x \in D_e.[(\{w : f(w)(x) = 1\} \cap W) = \varnothing]].^{22}$$

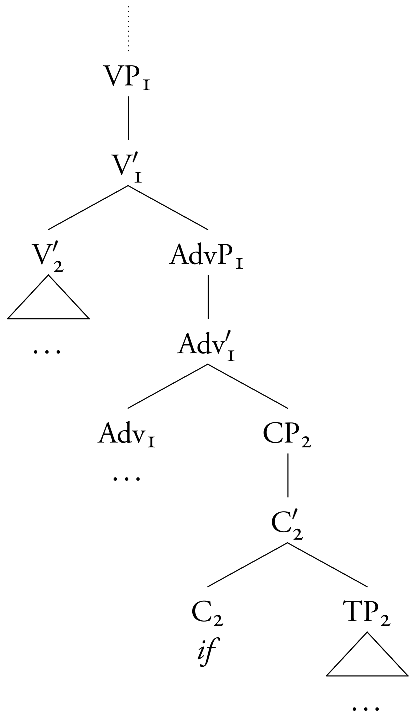
[21] In the case of **never** and some other adverbs of temporal quantification, we may assume that W will be the a set of earlier 'times' modally presented along the lines of Prior (1957) and subsequent literature. Alternatively, we may build temporal clauses into the denotation of **never**, say, along the following lines: $[\![\textbf{never}]\!]^{g,w} = \lambda f \in D_{\langle e,t\rangle}.\ [\lambda x \in D_e.[\forall t <$ time of context, $f(x) = 0$ at $t]]$.

[22] Or alternatively, yet equivalently, $[\![\textbf{never}]\!]^{g,w} = \lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.\ [\lambda x \in D_e.[\neg\exists w(w \in W \wedge f(w)(x))]]$.

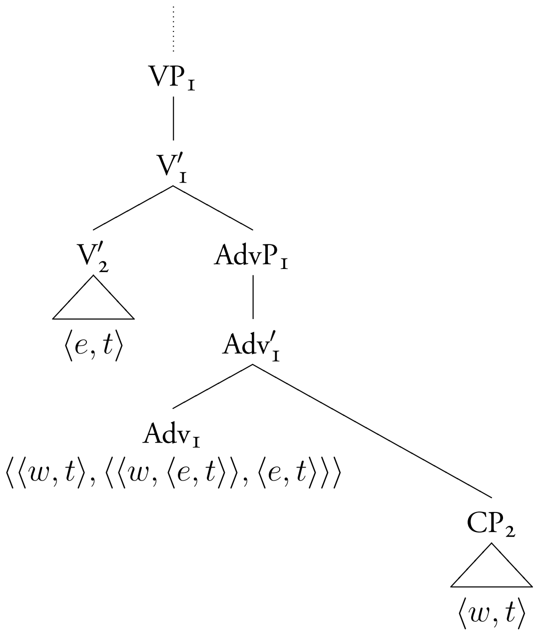
Assuming the obvious denotations of the other terms, if we were then compute the truth conditions of (19), we would then get the correct results:

$$
\begin{aligned}
[\![(19)]\!]^{g,w} = 1 \quad & \text{iff} \quad [\![\textbf{never}]\!]^{g,w}([\![\textbf{read}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
& \qquad ([\![\textbf{James Joyce}]\!]^{g,w}) = 1 \\
& \text{iff} \quad \lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\{w : f(w)(x) = 1\} \cap W = \varnothing]] \\
& \qquad (\lambda x \in D_e.[\lambda y \in D_e.[y \text{ read } x \text{ in } w]])(\textit{Hamlet}) \\
& \qquad (\text{James Joyce}) = 1 \\
& \text{iff} \quad \lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\{w : f(w)(x) = 1\} \cap W = \varnothing]] \\
& \qquad (\lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w])(\text{James Joyce}) = 1 \\
& \text{iff} \quad \lambda x \in D_e.[\{w : \lambda w'.[\lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w']](w) \\
& \qquad (x) = 1\} \cap W = \varnothing](\text{James Joyce}) = 1 \\
& \text{iff} \quad \{w : \lambda w'.[\lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w']](w) \\
& \qquad (\text{James Joyce}) = 1\} \cap W = \varnothing \\
& \text{iff} \quad \{w : \lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w](\text{James Joyce}) = 1\} \\
& \qquad \cap W = \varnothing \\
& \text{iff} \quad \{w : \text{James Joyce read } \textit{Hamlet} \text{ in } w\} \cap W = \varnothing \\
& \text{iff} \quad \neg\exists w \in W, \text{ James Joyce read } \textit{Hamlet} \text{ in } w.
\end{aligned}
$$

So much for non-conditional adverbial phrases. In cases of conditionals, however, the picture becomes substantially more complex. Recall that we said that natural language conditionals such as (1) and (2) have a syntactic structure which contains a sub-tree of the following form:



For the sake of compositionality, the verb and its object, if there is any, of the matrix clause must determine an extension of type $\langle e, t\rangle$ in the cases of conditionals just as in the case of more simple sentences such as (18) and (19). So, again, we expect both the sister of the adverbial phrase and its mother to have an extension of type $\langle e, t\rangle$. However, although we claimed earlier that the type of an adverb would have to be $\langle\langle e, t\rangle, \langle w, \langle e, t\rangle\rangle\rangle$, we now see that there must be more to them than that: otherwise, if that were the case, there would be no way to combine the adverb and its relevant complementiser phrase whose type we assume is either $\langle w, t\rangle$, if treated intensionally, or t, if treated extensionally. Since the intensional treatment of the complementiser phrase in question is more helpful for our purposes, we will let the type of adverbs be $\langle\langle w, t\rangle, \langle\langle w, \langle e, t\rangle\rangle, \langle e, t\rangle\rangle\rangle$. Without going into the details of the complementiser phrase at this point, we would expect that the types of the terminal nodes of our sub-tree would be as follows:



It therefore seems that the meaning we attributed to **never** before is too simple. Instead, the correct meaning would have to be something along the following lines:[23]

$$[\![\textbf{never}]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\ [(\{w : f(w)(x) = 1\} \cap \{w : p(w) = 1\}) = \varnothing]]].^{24}$$

Now, however, we seem to be in a peculiar predicament: namely, if we agree on the above meaning of **never**, we do not seem to be able to compute the meaning of sentences such as (18) any more. To get us out of the bind, we have at least two distinct options. First, we might maintain that **never** (and every other adverb which supports a conditional clause) is in fact ambiguous between two distinct lexical items, say **never**$_1$ and **never**$_2$, whose denotations are of types $\langle\langle e, t\rangle, \langle w, \langle e, t\rangle\rangle\rangle$ and $\langle\langle w, t\rangle, \langle\langle w, \langle e, t\rangle\rangle, \langle e, t\rangle\rangle\rangle$ respectively. Second, we might maintain that in

[23] Contrary to Heim and Kratzer (1998) and von Fintel and Heim (2007) we shall not equivocate sets and their characteristic functions. Although that will inevitably leave our formalism more complex, it will eventually be more precise and correct.

[24] Alternatively, yet equivalently, $[\![\textbf{never}]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\neg\exists w(f(w)(x) \wedge p(w))]]]$. On yet different representation, see also footnote 21.

cases where there are no conditional clauses, such as (18), the context provides the appropriate function from worlds to truth values as an argument to $[\![\textbf{never}]\!]^{g,w}$.

Since adverbs such as **never** show some obvious symptoms of context sensitivity (and ambiguity should arguably be avoided whenever possible), the second option seems far more attractive. First, in order to appreciate the context sensitivity of an adverb such as **never**, we can imagine two distinct contexts C_1 and C_2 in which the utterance of (19) is true and false respectively. On the one hand, in C_1 we might, say, only be interested what transpired during Joyce's brief first stay in Zürich. Now, were someone then to utter (19) in C_1, the proposition expressed by the utterance would be true due to the domain restriction provided by the context: Joyce never read *Hamlet* during his first brief stay in Zürich. On the other hand, in C_2 we might, say, be interested in Joyce's entire biography and were we to utter (19) in that context, the proposition expressed by the utterance would be false due to the domain restriction provided by the context: Joyce did read *Hamlet* sometime during his lifetime.

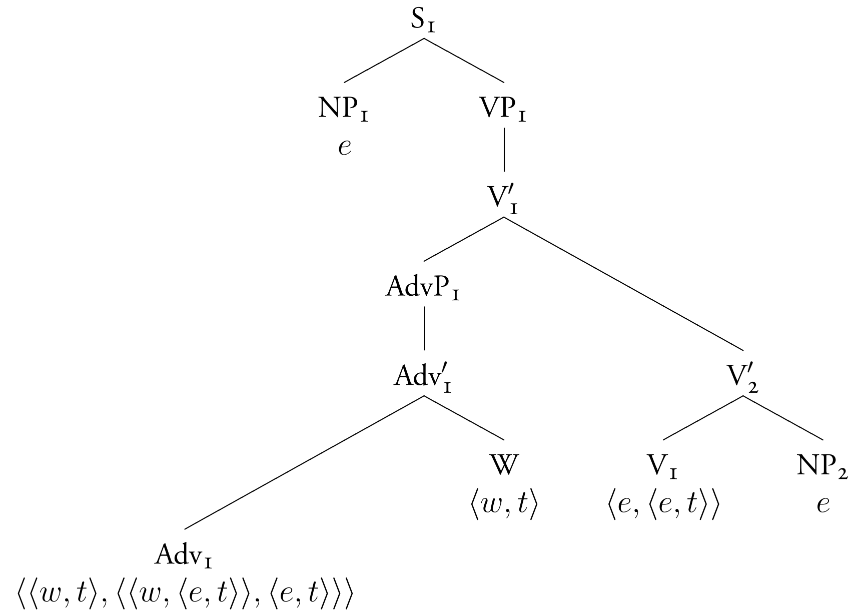
If we agree that adverbs of quantification have an element of context sensitivity, we must next decide on some means of integration into our current framework. A possible way would be to posit a constituent in our syntactic structure which represents the set of worlds or situations in question. More precisely, we would need a function of type $\langle w, t \rangle$ which would return 1 for the worlds or situations in question and 0 otherwise.[25] Let us call our overt constituent W and define its denotation as follows:

$$[\![\textbf{W}]\!]^{g,w} = g(W) = \lambda w.[w \in \{w' : w' \text{ is contextually relevant}\}].$$

In other words, we expect the assignment function g to provide us with the appropriate function from worlds to truth values, such that its value is 1 iff its argument is a world or situation which is relevant in the context that determines g. Now, were we to go for an implementation of this sort, the types of the terminal nodes in the

[25]Another viable implementation would be to posit anchors which a domain fixing function of some sort would take as an argument and return the set of relevant worlds. for details, see Schwarzschild (2009) but also Kratzer (2009).

syntactic structure of (19) would be of the following form, where our constituent is Adv_1's sister:



Were we now to compute the truth conditions of (19), we would get the correct result:

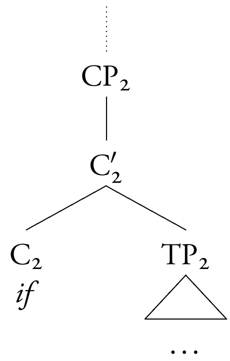
$$
\begin{aligned}
[\![(19)]\!]^{g,w} = 1 \quad & \text{iff} \quad [\![\textbf{never}]\!]^{g,w}([\![\textbf{W}]\!]^{g,w})([\![\textbf{read}]\!]^{g,w}) \\
& \qquad ([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{James Joyce}]\!]^{g,w}) = 1 \\
& \text{iff} \quad \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\
& \qquad [\{w : f(w)(x) = 1\} \cap \{w : p(w) = 1\} = \varnothing]]](g(W)) \\
& \qquad (\lambda x \in D_e.[\lambda y \in D_e.[y \text{ read } x \text{ in } w]])(\textit{Hamlet}) \\
& \qquad (\text{James Joyce}) = 1 \\
& \text{iff} \quad \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\
& \qquad [\{w : f(w)(x) = 1\} \cap \{w : p(w) = 1\} = \varnothing]]] \\
& \qquad (\lambda w.[w \in \{w' : w' \text{ is contextually relevant}\}]) \\
& \qquad (\lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w])(\text{James Joyce}) = 1 \\
& \text{iff} \quad \lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\{w : f(w)(x) = 1\} \cap \\
& \qquad \{w : \lambda w'.[w' \in \{w'' : w'' \text{ is contextually relevant}\}](w) \\
& \qquad = 1\} = \varnothing]](\lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w])
\end{aligned}
$$

$$\begin{aligned}
&\quad (\text{James Joyce}) = 1\\
\text{iff}\quad &\lambda x \in D_e.[\{w : \lambda w'.[\lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w']](w)\\
&(x) = 1\} \cap \{w : \lambda w'.[w' \in \{w'' : w'' \text{ is contextually}\\
&\text{relevant}\}](w) = 1\} = \varnothing](\text{James Joyce}) = 1\\
\text{iff}\quad &\lambda x \in D_e.[\{w : \lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w](x) = 1\}\cap\\
&\{w : w \text{ is contextually relevant}\} = 1\} = \varnothing]\\
&(\text{James Joyce}) = 1\\
\text{iff}\quad &\{w : \lambda y \in D_e.[y \text{ read } \textit{Hamlet} \text{ in } w](\text{James Joyce}) = 1\}\cap\\
&\{w : w \text{ is contextually relevant}\} = \varnothing\\
\text{iff}\quad &\{w : \text{James Joyce read } \textit{Hamlet} \text{ in } w\}\cap\\
&\{w : w \text{ is contextually relevant}\} = \varnothing\\
\text{iff}\quad &\neg\exists w \in \{w' : w' \text{ is contextually relevant}\},\\
&\text{James Joyce read } \textit{Hamlet} \text{ in } w.
\end{aligned}$$

4.5.4 Conditionals

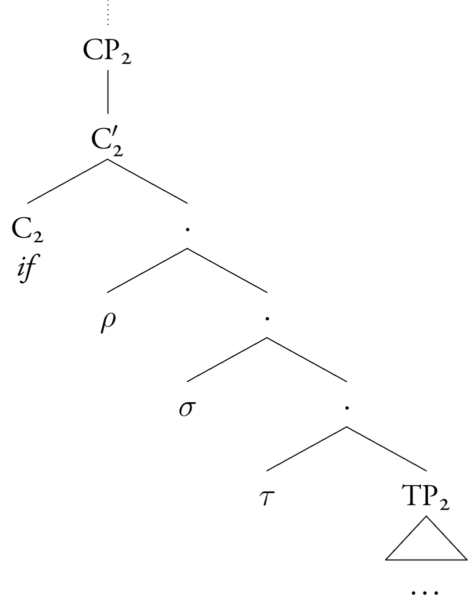
We now have almost everything we need to deal successfully with conditionals. In the cases of conditionals, we simply expect the conditional clause to pass up a function similar to $[\![\mathbf{W}]\!]^{g,w}$ above. In particular, we expect the complementiser phrase to be a function from worlds to truth values such that its value is 1 if its argument is a product of the relevant modal or amodal supposition and 0 otherwise.

Recall that we claimed that the syntactic structure of the complementiser phrases of conditionals have the following form:



Since we need the value of the complementiser phrase to be of type $\langle w, t\rangle$ in order to match its adverbial sister, either **if** or the tense phrase will have to pass up a function of that type. Since the extension of tense phrases is of type t in matrix clauses, it would be peculiar from a compositional point of view if we were to assume a different sort of meaning of tensed phrases in conditional clauses.[26] In other words, it seems that the denotation of **if** is required to be a function whose argument is a tensed phrase and whose value is a function of type $\langle w, t\rangle$. However, it would be hasty to conclude already that the extension of **if** must thereby be of type $\langle t, \langle w, t\rangle\rangle$ or $\langle\langle w, t\rangle, \langle w, t\rangle\rangle$. This is because we expect there to be further constituents in our syntactic structure: namely, based on our earlier analysis of modal and amodal conditional, the sort of supposition in question, the world or the set of propositions against which the supposition is made and the laws or the logic assumed to obtain. In other words, we propose that the syntactic structure of the conditional clause is of the following form:

[26] Unless, of course, one were to take the so-called schmentencite way; see Lewis (1980/1998) and also Schaffer (ms.b).



The constituents ρ, σ and τ need all be context sensitive in a fashion which will eventually allow us to get the appropriate elements into the truth conditions of modal and amodal conditionals.[27]

First, let ρ be a constituent such that when our contextual assignments function g is applied to it, the result is either the modal supposition function M or the amodal supposition function N, depending on which sort of suppositions is expressed in the context:

$$[\![\rho]\!]^{g,w} = g(\rho) = \begin{cases} M(x,y,z) & \text{if a modal supposition} \\ & \quad \text{is expressed in the context} \\ N(x,y,z) & \text{if an amodal supposition} \\ & \quad \text{is expressed in the context} \end{cases}$$

Second, let σ be a constituent such that when our contextual assignment function g is applied to it, the result is either the world against which a modal supposition is made S_w or the set of propositions against which an amodal supposition is

[27] See §§4.2.1–4.2.2.

made S_K, depending on the supposition expressed in the context and the world or proposition set salient:

$$[\![\sigma]\!]^{g,w} = g(\sigma) = \begin{cases} S_w & \text{if a modal supposition} \\ & \quad \text{is expressed in the context} \\ S_K & \text{if an amodal supposition} \\ & \quad \text{is expressed in the context} \end{cases}$$

Third, let τ be a constituent such that when our contextual assignment function g is applied to it, the result is either the laws assumed to apply in the world against which a modal supposition is made S_L or the logic assumed to dictate the consistency of the set of propositions against which an amodal supposition is made S_l, again depending on the supposition expressed in the context:

$$[\![\tau]\!]^{g,w} = g(\tau) = \begin{cases} S_L & \text{if a modal supposition} \\ & \quad \text{is expressed in the context} \\ S_l & \text{if an amodal supposition} \\ & \quad \text{is expressed in the context} \end{cases}$$

At last, we are now in a position to spell out the required denotation of **if**. Quite roughly, $[\![\textbf{if}]\!]^{g,w}$ needs to be a function which picks up, as it were, whatever is denoted by ρ, σ and τ, the intension of the tensed phrase, and which then returns a function of type $\langle w, t\rangle$. Without further ado, let us now present the much anticipated denotation of **if**:

$$[\![\textbf{if}]\!]^{g,w} = \lambda f.[\lambda s.[\lambda l.[\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in f(p, s, l)]]]]].$$

In order to deal with conditionals such as (1) and (2), we must furthermore spell out the denotation of the unarticulated adverb π.[28] As we already claimed, the meaning of π needs to be quite similar to $[\![\textbf{always}]\!]^{g,w}$ or $[\![\textbf{necessarily}]\!]^{g,w}$ or some equally unrestrictive adverb. In other words, we need a function of type $\langle\langle w, t\rangle, \langle\langle w, \langle e, t\rangle\rangle, \langle e, t\rangle\rangle\rangle$ similar in structure to that of $[\![\textbf{never}]\!]^{g,w}$ above yet

[28] See §4.4.

inverse in meaning. The natural candidate for the denotation of π is therefore as follows:

$$[\![\pi]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. [\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]].^{29}$$

Let us now consider how we would derive the truth conditions of (1) and (2) in our framework. To make things a little bit easier for us, let us make several fairly uncontroversial assumptions about our sentences. We shall assume here that **then** is semantically vacuous.[30] Furthermore, we shall assume that **have** and **had** do nothing more than generate a perfective aspect in their respective clauses and we shall assume that the perfective aspect, together with the modal verb, does nothing more here than provide evidence for utterer's intention of modal supposition. Moreover, we shall assume that the auxiliary **did** does no more in (2) than to support negation and inspire the past tense of **write**. Needless to say, we do expect that our best semantic theory of aspect and tense should provide us with an appropriate account of those elements to fit into a bigger picture. However, at present, we need not worry about the exact details.

Before we can derive the meaning of (1) and (2), we need to spell out the denotation of those of their constituents which we have not already spelled out above. The extension of **someone else** and **not** are fairly obvious in our contexts:

$[\![$**someone else**$]\!]^{g,w}$ = $g($**someone else**$)$ = some $x \in D_e$ which is not Shakespeare.[31]

$[\![$**not**$]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \notin \{w' : p(w') = 1\}]]$.

However, the meaning of **would** requires some imagination. First of all, let us notice that **would** seems context sensitive to the same extent as **always** and some

[29]Or alternatively, yet equivalently, $[\![\pi]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\forall w(p(w) \supset f(w)(x))]]]$.

[30]See, however, Davis (1983) and Geis (1985).

[31]Clearly, different contexts will provide different assignment functions g which in turn will yield different denotations to **someone else**.

other adverbs of quantification: when there is no conditional clause, **would** and **always** become sensitive to some contextually salient set of worlds. For instance, the truth conditions of the following sentence will depend on the context in which it is uttered:

(20) James Joyce would not have written *Ulysses*.

Again, we may well imagine two distinct contexts C_1 and C_2 in which the utterance of (20) is true and false respectively. On the one hand, in C_1 we might, say, only be interested in how Joyce's life would have turned out had he given up literature after writing his *Dubliners*. Now, were someone then to utter (20) in C_1, the proposition expressed by the utterance would be true due to the restriction provided by the context. On the other hand, in C_2 we might, say, be interested in how Joyce's life would have turned out had he left Dublin slightly sooner than he actually did in 1904. Were we to utter (20) in that context, the proposition expressed by the utterance would (presumably) be false due to the restriction provided by the context.

Above, we introduced the overt **W** in order to provide a means to the appropriate context sensitivity of adverbs of quantification. We may repeat a move of that sort here. In sentences where a modal verb is not complimented by a complementiser phrase, we can posit a constituent in the syntax which is sensitive to appropriate elements of the context. For the sake of simplicity, let us assume here that that constituent is in fact our **W**. On that assumption, we can give the following meaning to **would**:

$$[\![\textbf{would}]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. [\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]].^{32}$$

And for the sake of completeness, we can give a corresponding meaning to **could**, the dual of **would**:[33]

[32]Alternatively, $[\![\textbf{would}]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\forall w(p(w) \supset f(w)(x))]]]$.

[33]On this account, **would**, as it were, entails **could**. Although this is standardly assumed, we

$$[\![\textbf{could}]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.\ [(\{w : p(w) = 1\} \cap \{w : f(w)(x) = 1\}) \neq \varnothing]]].$$ [34]

Moreover, it seems we can assume that other modals will, as it were, follow suit in the sense that, **will**, **shall**, **should**, **must** and **ought**, on the one hand, and **may**, **might** and **can**, on the other hand, denote the same functions as **would** and **could** respectively.[35] The apparent difference between those modal verbs lies merely in the contextually determined function of the type $\langle w, t\rangle$ which they pick up.

In the cases of conditionals, the picture gets slighly more interesting: in the presence of a conditional clause, the modal verbs seem to become sensitive to their contribution instead of the contextually contributed **W**. More precisely, in those cases, it seems that **W** is in fact anaphoric (or cataphoric) on the conditional clause in question. Now, as the attentive reader will without a doubt have noticed already, our proposed denotation of **would** is the same as that of π and the adverb **always** and, similarly, the proposed denotation of **could** is the same as that of the adverb **sometimes**. For that very reason, we might actually claim that in conditionals such as our (1), π drops out as the conditional clause moves up to **W**'s place in the syntactic structure. Now, of course, we must admit the we are only engaging in speculative syntax at this point. However, in order to get things right in our framework, something along those lines will have to be assumed at present about the syntax of conditionals.

Upon those assumptions, the structure of both (1) and (2) are roughly along those lines, where the only difference could lie in the contribution of the meaning of ρ, σ and τ:[36]

(1) $[_{CP} [_{NP}$ Someone else$]$ $[_{TP}$ would $[_{CP}$ if $\rho\ \sigma\ \tau$ $[_{TP}$ not Shakespeare wrote

have reasons to suspect that that assumption is mistaken. For instance, to our annoyance, it might be true that he *would* always count on our support although it would be false that he *could* always count on our support.

[34]Alternatively, $[\![\textbf{could}]\!]^{g,w} = \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\exists w(p(w) \wedge f(w)(x))]]]$.

[35]A similar proposal is espoused by Kratzer (1977, 1981).

[36]Under our present analysis, the structure of (1) and (2) has become too complex to typeset in tree form; for a hint, see previous sub-tree and §4.4.

Hamlet]]$_i$[$_{\text{VP}}$wrote *Hamlet* [$_{\text{AdvP}}$$\pi$ t_i]]]].

(2) [$_{\text{CP}}$[$_{\text{NP}}$Someone else] [$_{\text{VP}}$wrote *Hamlet* [$_{\text{AdvP}}$$\pi$ [$_{\text{CP}}$if ρ σ τ [$_{\text{TP}}$not Shakespeare wrote *Hamlet*]]]]].

We are finally then in a position to derive the truth conditions of (1) and (2). Assuming that (1) was uttered to express its consequent on the modal supposition of its antecedent against the actual world @ and on the assumption that the some fairly commonsensical physical laws $@_l$ obtain in the actual world, the truth conditions of (1) may be derived as follows:

$$\begin{aligned}
[\![(1)]\!]^{g,w} = 1 \quad & \text{iff} \quad [\![\textbf{would}]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho]\!]^{g,w})([\![\sigma]\!]^{g,w})([\![\tau]\!]^{g,w}) \\
& ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{Shakespeare}]\!]^{g,w}) \\
& ([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{someone else}]\!]^{g,w}) = 1 \\
& \text{iff} \quad \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\
& [\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]] \\
& (\lambda f.[\lambda s.[\lambda l.[\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in \{w' : w' \in \\
& f(p,s,l)\}]]]]])(g(\rho))(g(\sigma))(g(\tau)) \\
& (\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \notin \{w' : p(w') = 1\}]]) \\
& (\lambda x \in D.[\lambda y \in D.[y \text{ wrote } x \text{ in } w]])(\textit{Hamlet}) \\
& (\text{Shakespeare})(\lambda x \in D.[\lambda y \in D.[y \text{ wrote } x \text{ in } w]]) \\
& (\textit{Hamlet})(\text{some } x \in D_e \text{ which is not Shakespeare}) = 1 \\
& \text{iff} \quad \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\
& [\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]] \\
& (\lambda f.[\lambda s.[\lambda l.[\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in f(p,s,l)]]]]]) \\
& (M(x,y,z))(@)(@_l)(\lambda p \in D_{\langle w,t\rangle}. \\
& [\lambda w.[w \notin \{w' : p(w') = 1\}]]) \\
& (\lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w])(\text{Shakespeare}) \\
& (\lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w])(\text{some } x \in D_e \ldots) = 1 \\
& \text{iff} \quad \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\
& [\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]] \\
& (\lambda s.[\lambda l.[\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in M(p,s,l)]]]])
\end{aligned}$$

$(@)(@_l)(\lambda p \in D_{\langle w,t\rangle}.[\lambda w'.[w' \notin \{w'' : p(w'') = 1\}]])$
(Shakespeare wrote *Hamlet* in w)
$(\lambda y \in D.[y$ wrote *Hamlet* in $w])($some $x \in D_e \ldots) = 1$

iff $\lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.$
$[\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]]$
$(\lambda l.[\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in M(p,@,l)]]])(@_l)$
$(\lambda w.[w \notin \{w' : \lambda w''.[$Shakespeare wrote *Hamlet* in $w'']$
$(w') = 1\}])(\lambda y \in D.[y$ wrote *Hamlet* in $w])$
$($some $x \in D_e \ldots) = 1$

iff $\lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.$
$[\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]]$
$(\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in M(p,@,@_l)]]])$
$(\lambda w.[w \notin \{w' :$ Shakespeare wrote *Hamlet* in $w'\}])$
$(\lambda y \in D.[y$ wrote *Hamlet* in $w])($some $x \in D_e \ldots) = 1$

iff $\lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.$
$[\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]]$
$(\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in M(p,@,@_l)]]])$
$(\lambda w.[w \in \{w' :$ Shakespeare did not write *Hamlet* in $w'\}])$
$(\lambda y \in D.[y$ wrote *Hamlet* in $w])($some $x \in D_e \ldots) = 1$

iff $\lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.$
$[\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]]$
$(\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in M(p,@,@_l)]]])$
$(\lambda w.[$Shakespeare did not write *Hamlet* in $w])$
$(\lambda y \in D.[y$ wrote *Hamlet* in $w])($some $x \in D_e \ldots) = 1$

iff $\lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.$
$[\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]]$
$(\lambda w.[w \in M(\lambda w'.[$Shakespeare did not write *Hamlet*
in $w'],@,@_l)]])(\lambda y \in D.[y$ wrote *Hamlet* in $w])$
$($some $x \in D_e \ldots) = 1$

iff $\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\{w : \lambda w'.[w' \in$

$$
\begin{aligned}
& M(\lambda w''.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w''],@,@_l))] \\
& (w) = 1\} \subseteq \{w : f(w)(x) = 1\}]] \\
& (\lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w]) \\
& (\text{some } x \in D_e \ldots) = 1 \\
\text{iff} \quad & \lambda x \in D_e.[M(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'], \\
& @,@_l) \subseteq \{w : \lambda w'.[\lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w']] \\
& (w)(x) = 1\}](\text{some } x \in D_e \ldots) = 1 \\
\text{iff} \quad & M(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'],@,@_l) \subseteq \\
& \{w : \lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w] \\
& (\text{some } x \in D_e \ldots) = 1\} \\
\text{iff} \quad & M(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'],@,@_l) \subseteq \\
& \{w : \text{some } x \in D_e \text{ which is not Shakespeare wrote } \textit{Hamlet} \\
& \text{in } w\}
\end{aligned}
$$

In other words, (1) is true iff every world of the product of the modal supposition that Shakespeare did not write *Hamlet*, against the actual world @ and assuming some fairly commonsensical physical laws $@_l$, is a world in which someone other than Shakespeare wrote *Hamlet*.

In the case of (2), things are unsurprisingly similar. Assuming that (2) was uttered to express its consequent on the amodal supposition of its antecedent against a set of propositions K and on the assumption that the logic of some description K_l dictates the consistency of K, the truth conditions of (2) may be derived as follows:

$$
\begin{aligned}
[\![(2)]\!]^{g,w} = 1 \quad \text{iff} \quad & [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho]\!]^{g,w})([\![\sigma]\!]^{g,w})([\![\tau]\!]^{g,w}) \\
& ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{Shakespeare}]\!]^{g,w}) \\
& ([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{someone else}]\!]^{g,w}) = 1 \\
\text{iff} \quad & \lambda p \in D_{\langle w,t\rangle}.[\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e. \\
& [\{w : p(w) = 1\} \subseteq \{w : f(w)(x) = 1\}]]] \\
& (\lambda f.[\lambda s.[\lambda l.[\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \in \{w' : w' \in \\
& f(p,s,l)\}]]]]])(g(\rho))(g(\sigma))(g(\tau)) \\
& (\lambda p \in D_{\langle w,t\rangle}.[\lambda w.[w \notin \{w' : p(w') = 1\}]]) \\
& (\lambda x \in D.[\lambda y \in D.[y \text{ wrote } x \text{ in } w]])(\textit{Hamlet})
\end{aligned}
$$

$$
\begin{aligned}
&\quad (\text{Shakespeare})(\lambda x \in D.[\lambda y \in D.[y \text{ wrote } x \text{ in } w]])\\
&\quad (\textit{Hamlet})(\text{some } x \in D_e \text{ which is not Shakespeare}) = 1\\
\text{iff}\ &\ \ldots\\
\text{iff}\ &\ \lambda x \in D_e.[N(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'],\\
&\quad K, K_l) \subseteq \{w : \lambda w'.[\lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w']]\\
&\quad (w)(x) = 1\}](\text{some } x \in D_e \text{ which is not Shakespeare}) = 1\\
\text{iff}\ &\ \ldots\\
\text{iff}\ &\ N(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'], K, K_l) \subseteq\\
&\quad \{w : \text{some } x \in D_e \text{ which is not Shakespeare wrote } \textit{Hamlet}\\
&\quad \text{in } w\}
\end{aligned}
$$

In other words, (2) is true iff every set of propositions of the product of the amodal supposition that Shakespeare did not write *Hamlet*, against the set of propositions K and assuming logic K_l to dictate the consistency of K, is a set which contains the proposition 'someone other than Shakespeare wrote *Hamlet*'. We must, of course, make the further assumption that worlds may be represented as sets of propositions but that is a fairly innocent assumption in the context of our framework.

We have thus seen that our framework allows us to derive the appropriate meaning of (1) and (2) compositionally. Although we have managed to give appropriate compositional semantics for modal and amodal conditionals, our work is not entirely over: we still have not addressed the issue of embedded conditionals.

4.5.5 Embedded Conditionals

We introduced the issue of embedded conditionals above.[37] We made an obvious distinction between left-side and right-side embedded conditionals: while left-side embedded conditionals embed a further conditional in their antecedents, right-side embedded conditionals embed a further conditional in their consequents.

To remind ourselves, the following conditional is an example of a left-side embedded conditional is the following conditional:

[37] See §4.4.

(16) If Fletcher would have written *Hamlet* if Shakespeare had not, then Shakespeare could have spent his time doing something else.

Our framework deals neatly with with left-side embedded conditionals. Above, we said that the structure of a singly left-side embedded conditional such as (16) would be as follows:[38]

(16) $[_{CP}[_{NP}$Shakespeare$_1]$ $[_{VP}$could spent his$_1$ time doing something else $[_{AdvP}\pi$ $[_{CP}$if $\rho_1\ \sigma_1\ \tau_1$ $[_{TP}$would Fletcher wrote *Hamlet* $[_{AdvP}\pi[_{CP}$if $\pi\ \rho_2\ \sigma_2$ $\tau_2[_{TP}$not Shakespeare wrote *Hamlet*]]]]]]].

Without going into excruciating details, our framework predicts the following truth conditions for (16):

$$\begin{aligned}
[\![(16)]\!]^{g,w} = 1 \quad \text{iff} \quad & [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_1]\!]^{g,w})([\![\sigma_1]\!]^{g,w})([\![\tau_1]\!]^{g,w}) \\
& [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_2]\!]^{g,w})([\![\sigma_2]\!]^{g,w})([\![\tau_2]\!]^{g,w}) \\
& ([\![\textbf{Shakespeare had not written } \textbf{\textit{Hamlet}}]\!]^{g,w}) \\
& ([\![\textbf{Fletcher would have written } \textbf{\textit{Hamlet}}]\!]^{g,w}) \\
& ([\![\textbf{could have spent his time doing something else}]\!]^{g,w}) \\
& ([\![\textbf{Shakespeare}]\!]^{g,w}) = 1 \\
\text{iff} \quad & \ldots \\
\text{iff} \quad & g(\rho_1)(\lambda w.[g(\rho_2)(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \\
& \text{in } w'], g(\sigma_2), g(\tau_2)) \subseteq \{w'' : \text{Fletcher wrote } \textit{Hamlet} \\
& \text{in } w''\}], g(\sigma_1), g(\tau_1)) \subseteq \{w : \text{Shakespeare could have} \\
& \text{spent his time doing something else in } w\}
\end{aligned}$$

Insofar as our intuitions carry any weight, those are the appropriate truth conditions for (16). The product of the $g(\rho_1)$ supposition, relative to $g(\sigma_1)$ and $g(\tau_1)$, that the product of the $g(\rho_2)$ supposition, relative to $g(\sigma_2)$ and $g(\tau_2)$, that Shakespeare did not write *Hamlet* is comparable with Fletcher having written *Hamlet*, is comparable with Shakespeare having be able to spend his time doing something else. In slightly more familiar terms, all the worlds in which the supposition that all

[38] §4.4.

the suppositional worlds of 'Shakespeare did not write *Hamlet*' are 'Fletcher wrote *Hamlet*' worlds, are themselves 'Shakespeare could have spent his time doing something else' worlds. We can therefore conclude that our account deals appropriately with left-side embedded conditionals.

Right-side embedded conditional are more interesting. Recall that we said that the following conditional is an example of a right-side embedded conditional:

(17) If Shakespeare did not write *Hamlet*, then if Fletcher did not write *Hamlet*, then someone else did.

Clearly, we can make quite good sense of this sort of conditional. And although we rarely do so, we may in principle sensibly embed indefinitely on the right-side.

Now, for our intent and purposes, we may claim that the syntactic structure of (17) is somewhere vaguely along the following lines:[39]

(17) $[_{CP}[_{NP}$someone else$]$ $[_{VP}$wrote *Hamlet* $[_{AdvP}\pi$ $[_{CP}$if ρ_1 σ_1 τ_1 $[_{TP}$not Shakespeare wrote *Hamlet*$]]][_{AdvP}\pi$ $[_{CP}$if ρ_2 σ_2 τ_2 $[_{TP}$not Fletcher wrote *Hamlet*$]]]]]$.

However, that might seem to be bad news for us: given our current semantic clauses and compositional principles, we soon run into peculiar issues in our derivation of the truth conditions of (17). The problem is certainly not as bad as a type clash but one worth a worry nonetheless. Again, without going into minute details, our framework predicts the following truth conditions:[40]

$$\begin{aligned}
[\![(17)]\!]^{g,w} = 1 \quad \text{iff} \quad & [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_1]\!]^{g,w})([\![\sigma_1]\!]^{g,w})([\![\tau_1]\!]^{g,w}) \\
& ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
& ([\![\textbf{Shakespeare}]\!]^{g,w}) \\
& [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_2]\!]^{g,w})([\![\sigma_2]\!]^{g,w})([\![\tau_2]\!]^{g,w}) \\
& ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{Fletcher}]\!]^{g,w}) \\
& ([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})([\![\textbf{someone else}]\!]^{g,w}) = 1
\end{aligned}$$

[39] See also §4.4.

[40] We shall assume, quite naturally in the context, that $[\![\textbf{someone else}]\!]^{g,w} = g(\textbf{someone else})$ = some $x \in D_e$ which is neither Shakespeare nor Fletcher.

iff $\ldots$

iff $\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.$
$[g(\rho_1)(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'],$
$g(\sigma_1), g(\tau_1)) \subseteq \{w : f(w)(x) = 1\}]](\lambda x \in D_e.$
$[g(\rho_2)(\lambda w'.[\text{Fletcher did not write } \textit{Hamlet} \text{ in } w'],$
$g(\sigma_2), g(\tau_2)) \subseteq \{w : \lambda y \in D.[y \text{ wrote } \textit{Hamlet} \text{ in } w]$
$(x) = 1\}])(\text{some } x \in D_e \ldots) = 1$

iff $\ldots$

iff $\lambda x \in D_e.[g(\rho_1)(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet}$
$\text{in } w'], g(\sigma_1), g(\tau_1)) \subseteq \{w : \lambda y \in D_e.$
$[g(\rho_2)(\lambda w'.[\text{Fletcher did not write } \textit{Hamlet} \text{ in } w'], g(\sigma_2),$
$g(\tau_2)) \subseteq \{w : \lambda z \in D.[z \text{ wrote } \textit{Hamlet} \text{ in } w](y) = 1\}]$
$(x) = 1\}](\text{some } x \in D_e \ldots) = 1$

iff $\ldots$

iff $g(\rho_1)(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'],$
$g(\sigma_1), g(\tau_1)) \subseteq \{w : g(\rho_2)(\lambda w'.[\text{Fletcher did not write}$
$\textit{Hamlet} \text{ in } w'], g(\sigma_2), g(\tau_2)) \subseteq \{w : \text{some } x \in D_e$
$\text{which is neither Shakespeare nor Fletcher wrote } \textit{Hamlet}$
$\text{in } w\}\}$

Depending on whether the product of the $g(\rho_2)$ supposition that Fletcher did not write *Hamlet*, relative to $g(\sigma_2)$ and $g(\tau_2)$, is such that someone other than Shakespeare or Fletcher wrote *Hamlet*, the set on the right will either contain every world or else be empty. In the former case, the product of the $g(\rho_1)$ supposition that Shakespeare did not write *Hamlet*, relative to $g(\sigma_1)$ and $g(\tau_1)$, will trivially be its subset and (17) will thus be true. In the latter case, trivially not so and (17) will thus be false.

Although the truth conditions are correct in this case, something seems terribly amiss: the outer supposition is, as it were, completely idle. Indeed, the truth of (17) depends entirely on the inner supposition. And surely, that cannot be correct. On brief reflection, we realise that the correctness of the truth conditions of (17) above is only a epiphenomenon of the particular case. Had we chosen a different embedded conditional, we would probably have noticed discrepancy. For an instance, the following conditional, insofar as its σ_1 and σ_2 denote the same world or proposition set, is bound to come out as false:

(21) If Shakespeare did not write *Hamlet*, then if no one else wrote *Hamlet*, then no one did.

For this conditionals, our framework predicts the following truth conditions:

$$\begin{aligned}
[\![(21)]\!]^{g,w} = 1 \quad &\text{iff} \quad [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_1]\!]^{g,w})([\![\sigma_1]\!]^{g,w})([\![\tau_1]\!]^{g,w}) \\
&\qquad ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
&\qquad ([\![\textbf{Shakespeare}]\!]^{g,w}) \\
&\qquad [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_2]\!]^{g,w})([\![\sigma_2]\!]^{g,w})([\![\tau_2]\!]^{g,w}) \\
&\qquad ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
&\qquad ([\![\textbf{someone else}]\!]^{g,w}) \\
&\qquad ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
&\qquad ([\![\textbf{someone}]\!]^{g,w}) = 1 \\
&\text{iff} \quad \ldots \\
&\text{iff} \quad g(\rho_1)(\lambda w'.[\text{Shakespeare did not write } \textit{Hamlet} \text{ in } w'], \\
&\qquad g(\sigma_1), g(\tau_1)) \subseteq \{w : g(\rho_2)(\lambda w'.[\text{no } x \in D_e \text{ which} \\
&\qquad \text{is not Shakespeare wrote } \textit{Hamlet} \text{ in } w'], g(\sigma_2), g(\tau_2)) \\
&\qquad \subseteq \{w : \text{no } x \in D_e \text{ wrote } \textit{Hamlet} \text{ in } w\}\}
\end{aligned}$$

Since the $g(\rho_2)$ supposition that no one who is not Shakespeare wrote *Hamlet* will in most context yield either worlds or sets of proposition where someone, namely Shakespeare, wrote *Hamlet*, the right-side set will be empty and (21) thus false. However, we must agree that (21) must be true in all normal contexts. And thus, we might conclude, something must be quite wrong.

So, what can we do? We have at least three options available. First, we can claim that there are no contexts in which ρ_1 and ρ_2 (and any subsequent ρs) denote the same world: rather, the value of $g(\rho_{i+1})$ is some function of the value of $g(\rho_i)$.

Second, we may devise a new compositional principle in order to deal with right-side embedded conditional clauses. And third, we may revise our current denotation of adverbial phrases in order to ensure a correct match. Although the third option does not seem desirable within our current framework due its complexity, the first two seem auspicious.

On the one hand, were we to place a restriction on the denotation of the ρs of embedded conditionals, such that for any i, $g(\rho_i)$ influences the value of $g(\rho_{i+1})$ in the syntactic structure. In particular, the worlds or proposition sets available to subsequent suppositions, must be such that the content of earlier suppositions are already there. In a sense then, we accumulate our suppositions into the inner most conditional and the value of $g(\rho_n)$ would then be a world or set of propositions where all previous suppositions have been t. Intuitively, that does make some sense: when dealing with an embedded conditional, we seem to be stacking suppositions on top of each other in some manner or another.

On the other hand, we may introduce a new compositional principle which allows us import all subsequent conditional clauses into the first conditional clause. The rule might be expressed somehow along the following lines:

> **Conditional Clause Modification**
> If α is a branching node and $\{\beta, \gamma\}$ the set of its daughters, then, for any world w and assignment g: if $[\![\beta]\!]^{g,w}$ is a function of the form $\lambda f \in D_{\langle w,\langle e,t\rangle\rangle}.[\lambda x \in D_e.[\Gamma(\varphi, f(x))]]$ and $[\![\beta]\!]^{g,w}$ a function of the form $\lambda x \in D_e.[\Gamma(\chi, \eta(x))]$, then $[\![\alpha]\!]^{g,w} = \lambda x \in D_e.[\Gamma(\varphi \wedge \chi, \eta(x))]$.

Without going into details, with a rule like that in place, we would derive the following truth conditions for (21):

$$
\begin{aligned}
[\![(21)]\!]^{g,w} = 1 \quad \text{iff} \quad & [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_1]\!]^{g,w})([\![\sigma_1]\!]^{g,w})([\![\tau_1]\!]^{g,w}) \\
& ([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w}) \\
& ([\![\textbf{Shakespeare}]\!]^{g,w}) \\
& [\![\pi]\!]^{g,w}([\![\textbf{if}]\!]^{g,w})([\![\rho_2]\!]^{g,w})([\![\sigma_2]\!]^{g,w})([\![\tau_2]\!]^{g,w})
\end{aligned}
$$

$([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})$
$([\![\textbf{someone else}]\!]^{g,w})$
$([\![\textbf{not}]\!]^{g,w})([\![\textbf{wrote}]\!]^{g,w})([\![\textbf{\textit{Hamlet}}]\!]^{g,w})$
$([\![\textbf{someone}]\!]^{g,w}) = 1$

iff $\ldots$

iff $g(\rho_1)(\lambda w'.$[Shakespeare did not write *Hamlet* in w'], $g(\sigma_1), g(\tau_1)) \cap g(\rho_2)(\lambda w'.$[no $x \in D_e$ which is not Shakespeare wrote *Hamlet* in w'], $g(\sigma_2), g(\tau_2)) \subseteq \{w :$ no $x \in D_e$ wrote *Hamlet* in $w\}$

Either way, it seems then, we can account for right-side embedded conditionals. True, both implementations require more heavy machinery. But then again, no one ever claimed that natural languages were easy.

4.6 Conclusion: Giving Meaning to Conditionals

We set off by exploring the nature of modal and amodal suppositions. Consequently, we argued that conditionals in natural languages express their consequents on the modal or amodal supposition of their antecedents. We concluded that the modal/amodal distinction is essential for understanding conditionals. Moreover, the uncertain indicative/subjunctive distinction should be substituted by our modal/amodal one as the fundamental semantic distinction for conditionals. Next, we examined the syntactic structure of conditionals in English. And finally, we offered compositional semantics for English conditionals in generative grammar.

Our final conclusion is that the modal/amodal distinction of conditionals allows us to give appropriate semantics for conditional sentences in natural languages.

5 Saving Modus Ponens

This chapter offers a solution to McGee's counterexamples to Modus Ponens. The chapter opens with a brief introduction to McGee's counterexamples and a short subchapter that emphasises their significance. In particular, a strong paradoxical flavour is attributed to the counterexamples which the semanticist of natural language conditionals must arguably address. Subsequently, solutions offered to the counterexamples hitherto are all argued to be inadequate and, moreover, McGee's own reaction to the conundrum is maintained to be of little avail. After a couple of observations on the counterexamples' nature, a solution is offered. The solution suggests that that the semantics of embedded natural language conditionals is more sophisticated than their surface syntax indicates. An important part of the solution therefore lies in a translation function from the surface form of natural language conditionals to their logical form.

5.1 Preamble: McGee's Counterexamples

To our astonishment, McGee conjured up apparent counterexamples to *Modus (Ponendo) Ponens* (MPP).[1] Of McGee's counterexamples, the following is the best known:

[1] McGee (1985) and (1989, pp. 511–512). According to Edgington (1995, p. 282) and Bennett (2003, p. 148), McGee's examples are in fact inspired by comments from Adams (1975, p. 33). For an extensive overview of McGee's counterexamples and their responses, see Djordjevic (2000).

> Opinion polls taken just before the 1980 election showed the Republican Ronald Reagan decisively ahead of the Democrat Jimmy Carter, with the other Republican in the race, John Anderson, a distant third. Those apprised of the poll results believed, with good reason:
>
> If a Republican wins the elections, then if it's not Reagan who wins it will be Anderson.
>
> A Republican will win the election.
>
> Yet they did not have reason to believe
>
> If it's not Reagan who wins, it will be Anderson.[2]

For our future reference, let us label these sentences as (1), (2) and (3) respectively. McGee's other counterexamples share the same form and likewise reveal an apparent failure of MPP for natural language conditionals: where, as above, an inference by MPP from (1) and (2) leads us to the unacceptable conclusion of (3).

5.2 Appreciating the Ado

Let us begin by gaining some understanding as to why examples of this particular kind pose a threat to MPP. As if we do not already know, MPP is the following rule of implication:[3]

> **Modus Ponendo Ponens**
> *Any* conditional, $\ulcorner$*if* φ, *then* $\chi\urcorner$, together with its antecedent, φ, implies its consequent, χ.

This is a schema for which we have distinct instantiations for different sorts of conditionals: for instance, the material implication and so-called natural language indicative and subjunctives conditionals. For those different sorts of MPP, let us reserve

[2] McGee (1985, p. 462).

[3] In what follows, we will regard MPP as a rule of implication rather that a rule of inference following Harman's distinction; see, for instance, Harman (1986).

'$\text{MPP}_{\supset}$', '$\text{MPP}_{\rightarrow}$', and '$\text{MPP}_{\Box\!\!\rightarrow}$' respectively. Furthermore, since we will be very interested in natural language conditionals in general, let us reserve '$\text{MPP}_{\rightsquigarrow}$' to denote MPP for all natural language conditionals.[4]

Above, McGee's counterexample described a situation where (1) obtains. At the propositional level, (1) is an instance of the following form:[5]

$$\varphi \rightarrow (\chi \rightarrow \psi).$$

Moreover, given McGee's example, it seems that (2) does indeed obtain. (2) is an instance of the following form:

$$\varphi.$$

From those premisses combined, it does seem legitimate for us to draw the conclusion by MPP that (3). Importantly, (3) is an instance of the following form:

$$\chi \rightarrow \psi.$$

Nevertheless, in the context of McGee's examples, the conclusion is absurd. That is to say, McGee depicts a situation in which an inference by $\text{MPP}_{\rightarrow}$ from seemingly true premises, (1) and (2), leads us to false conclusion, (3). Or in other words, the examples appear to reveal $\text{MPP}_{\rightarrow}$ as an invalid rule of implication. Moreover, since McGee's counterexamples can be phrased in terms of indicative and subjunctive conditionals alike, we have reason to suspect that $\text{MPP}_{\Box\!\!\rightarrow}$ fails too. Therefore, supposing that indicative and subjunctive conditionals are all that there is to natural language conditionals, McGee's counterexamples reveal an apparent failure of $\text{MPP}_{\rightsquigarrow}$.

McGee's counterexamples have a peculiar feature: at first sight, they do not seem so paradoxical. For that reason, some are inclined to brush them off or treat

[4]In this paper, '$\supset$' will be used to denote the material implication and '$\rightarrow$' and '$\Box\!\!\rightarrow$' to denote the so-called indicative and subjunctive conditionals respectively; furthermore, '$\rightsquigarrow$' will denote any natural language conditional structure, whether indicative, subjunctive or possibly something else.

[5]Where, obviously, 'A Republican wins the elections' substitutes φ, 'Reagan does not win the elections' χ, and 'Anderson wins the elections' ψ. For the mere sake of simplicity, χ subsumes the negation.

lightly. Indeed, to some the most intuitive response to McGee's counterexamples is to reply along those lines: since we have already assumed that a Republican will win, how can it possibly be false that if it will not be the first one, it will be the other? After all, a republican will win! Indeed, assuming both (1) and (2), it does seem obvious that (3) follows. So, at first blush, it seems easy to conclude that this is all there is to McGee's counterexamples. If only things were so simple.

In order to realise the seriousness of McGee's counterexamples, we may be forced to recast them in slightly different terms. One way to emphasise their threat is as follows.[6] If we hold fixed the details of McGee's example, it certainly seems true to say that:

(1′) If Carter does not win the election, then if Reagan does not win, Anderson will.

This, just as (1), in fact seems close to a conceptual truth, given the set-up of the elections, the number of candidates, and so on. Also, given the indication of the poll, it seems true too that:

(2′) Carter does not win the election.

Furthermore, McGee's example seems to depict a situation where it is the case that if Reagan does not win, Carter will. After all, given the predicted distribution of votes, it seems obvious that should Reagan not win, the runner-up will. And since Carter is by a wide margin the runner-up, we have that:

(*) If Reagan does not win the election, Carter will.

However, if we take the conditional in question to be something somewhat stronger than material implication—which our natural language understanding suggests to us—(*) will be incompatible with:

(3′) If Reagan does not win the election, Anderson will.

[6] I owe this suggestion to Elia Zardini.

Which, as we should know by now, MPP$_{\rightarrow}$ allows us to infer.

Some might still resist the counterexample by appealing to the fact that we do assume (2′) to be true. That, however, should not matter. Indeed, that if the most likely winner does not win, the runner-up will, does not seem to be incompatible with the thought that the winner will actually win and the runner-up will actually not. After all, we often accept claims of this sort, even when we are absolutely certain that someone will win. We may know full well that someone will win but that fact is not incompatible with the fact that if the actual winner should not win, someone else will. And for that reason, McGee's counterexamples pose a real threat to MPP$_{\rightsquigarrow}$.

Although MPP thus appears to fail for natural language conditionals, that is not to say that MPP fails in general: different instantiations may very well hold. For instance, MPP$_{\supset}$ is a valid rule of implication in classical logic. Therefore, needless to say, if we equate the natural language indicative conditional at play in (1) and (3) with material implication, the inference from $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$ and φ to $\ulcorner\chi \rightarrow \psi\urcorner$ is valid.[7] (That is to say, $\ulcorner\varphi \supset (\chi \supset \psi)\urcorner, \varphi \vdash \ulcorner\chi \supset \psi\urcorner$ holds in classical logic.)

Furthermore, according to most mainstream semantic accounts for natural language conditionals, the move from (1) and (2) to (3) is valid.[8] Notice therefore that McGee's counterexamples cannot be simply fended off by showing that some logic or other does indeed validate the implication from the premisses to the conclusion in spite of our intuitions to the contrary. Rather, McGee's very point is that MPP$_{\rightsquigarrow}$ fails, since there are cases such as his own, where an intuitively false conclusion follows from true premisses. More importantly, any semantics that deem MPP$_{\rightsquigarrow}$ as universally valid are thereby worse off.

Now, since MPP is among our most beloved and cherished rules of implication, any counterexamples to its validity are not to be taken lightly. Indeed, even the

[7]Notice that McGee's counterexamples also provide an argument against any material implication theories of natural language conditionals. McGee's counterexamples thus leave two notable material implication theories of natural language conditionals espoused by Grice (1975/1989) and Jackson (1987) in dire need of some account or another.

[8]For instance, both Stalnaker's (1968/1991) and Lewis' semantics (1973) validate the inference.

most deviant logicians among us are reluctant to give up MPP without reservations. (There are, of course, various logics in which MPP fails for *some* kind of conditionals. More on that point later.) We are therefore inclined to find solutions of some sort to McGee's counterexamples rather than to abandon MPP. It follows without saying that there has been a vast number of proposed strategies to alleviate the suffering brought on by McGee's counterexamples.[9] However, before proposing yet another solution of our own to McGee's conundrum, let us first come to appreciate that there still remains a demand for one.

5.3 Failed Rescue Attempts

There are numerous ways in which we may respond to McGee's counterexamples. Sadly, however, most of those attempts fail for one reason or another. Above we already considered an intuitive response which unbefittingly made light of McGee's counterexamples. Most other responses, however, acknowledge the seriousness of our predicament to some degree. To appreciate the seriousness of McGee's counterexamples, let us now consider some possible responses and why they each go wrong.

5.3.1 Reasonable Beliefs & Assumptions

We might emphasise the fact that McGee does frame his counterexamples in terms of what is reasonable to believe and probable rather than in terms of truth or assumptions thereof, in particular, since $\text{MPP}_{\rightsquigarrow}$ is an alleged principle of the latter rather than the former. To illustrate, McGee's election case is infused with locutions such as 'believed, with a good reason' and 'they did not have reason to believe

[9] See, for instance, Sinnott-Armstrong, Moor, and Fogelin (1986), Over (1987), Lowe (1987), Sorensen (1988, pp. 449–451), Kornblith (1994), Katz (1999), Djordjevic (2000), and Bennett (2003, pp. 148–149). The only sincere defender of McGee's counterexamples, beside McGee himself, is Lycan, see Lycan (1993, pp. 422–425), Lycan (1994, pp. 235–236), and Lycan (2001, pp. 66–69).

that'.[10] We might, for that reason, even suggest that McGee does in fact give counterexamples to a different principle altogether which has no relevance to $\textsc{mpp}_{\rightsquigarrow}$'s status.[11]

We may agree that it is unfortunate that McGee did not state his examples in such terms. However, we must refuse to acknowledge the significance of this point since McGee's examples can be expressed in terms of truth just as well as reasonable beliefs or probability.[12] Even if we assume (1), that it is the case that if a Republican wins the elections, then if it's not Reagan who wins it will be Anderson, and (2), that a Republican will win the election, it still seems plainly incorrect to infer (3), that if it's not Reagan who wins, it will be Anderson is the case because, just as before, it must be Carter.

In fact, this response is closely related to our initial response to McGee's counterexamples. In order to realise why this response fails, we must acknowledge that it can both be the case that someone will win and yet, if that someone does not win, the runner-up will. So much for this plan of action.

5.3.2 Challenging the Examples' Structure

Another stratagem would be to attack the hitherto supposed structure of the examples and claim that McGee does in fact fail to give counterexamples to $\textsc{mpp}_{\rightsquigarrow}$. One way to go about this would be to argue that (1) instantiates the form $\ulcorner\varphi \rightarrow (\chi \supset \psi)\urcorner$ rather than $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$. Were that the case, McGee's counterexamples would only invalidate the implication from $\ulcorner\varphi \rightarrow (\chi \supset \psi)\urcorner$ and φ to $\ulcorner\chi \rightarrow \psi\urcorner$. And since any such implication is clearly not an instance of $\textsc{mpp}_{\rightsquigarrow}$, the examples cease to threaten.[13] (Notice that merely saying that (3) has the form $\ulcorner\chi \supset \psi\urcorner$ would then not be enough to bring back the counterexamples since (3) would be true.) The motivation for believing that the consequent of (1) expresses

[10] McGee (1985, p. 462).

[11] This point is made, in one form or another, by Sinnott-Armstrong et al. (1986) and Over (1987).

[12] See however Djordjevic (2000, pp. 27–29) for an alternative—and presumably an over-elaborate—response to the charge made by Sinnott-Armstrong et al. (1986) and Over (1987).

[13] This proposal is pursued by Lowe (1987); for a related attempt, see also Katz (1999).

a material implication rather than an indicative conditional is the assumption that (1) expresses something equivalent to this: if a Republican wins the election, then it will be either Reagan or Anderson who wins, whose form, $\ulcorner \varphi \rightarrow (\neg\chi \vee \psi)\urcorner$, is classically equivalent to $\ulcorner \varphi \rightarrow (\chi \supset \psi)\urcorner$.

There are different ways by which we can respond to this, but I believe that the following is the most convincing.[14] Recall that we said that McGee's counterexamples seemed to apply to natural language indicative and subjunctive conditionals alike. If we recast McGee's example in terms of subjunctive conditionals rather than indicative, it becomes more obvious that we do indeed mean something different from a mere disjunction. Suppose that after learning only of the three candidates of the 1980 American presidential elections, I realise that

(4) If Carter had lost the election, then if Reagan had not won the elections, Anderson would have.

In fact, I may make this judgement independently of knowing any of the details of any polls or even the elections' result, because given the elections' arrangement and an assumption that nothing funny will happen, (4) is fairly close to a conceptual truth. You however, knowing a good deal more than me about this election, inform me that it is the case that:

(5) Carter lost the election.

Again, showing symptoms of sound mind on my better days, I might now infer by $\textsc{mpp}_{\Box\!\!\rightarrow}$ that:

(6) If Reagan had not won the election, Anderson would have.

Now, to anyone in the know, my conclusion is absurd: given the actual outcome of the elections—Reagan got 50.7% of the votes, Carter 41% and Anderson 6.7%—if Reagan had not won the elections, Carter most certainly would have. Which is merely to say that the implication from $\ulcorner \varphi \Box\!\!\rightarrow (\chi \Box\!\!\rightarrow \psi)\urcorner$ and φ to $\ulcorner \chi \Box\!\!\rightarrow \psi\urcorner$ is invalid. Note, just as in the indicative case, that even though Reagan actually

[14] For alternative response, see for instance Djordjevic (2000, pp. 15–16).

won the elections, there is nothing incoherent about wondering what would have happened had he not: indeed, if we were to engage ourselves in that sort of counterfactual thought, our conclusion would precisely be that Carter would have won if Reagan had not.

We must admit that, given McGee's words, it might be tempting to confuse the embedded indicative conditional in (1) with a disjunction—for the simple fact that indicative conditionals are usually syntactically indistinguishable from material implications when expressed in natural language—but once we recast McGee's counterexample in terms of subjunctive conditionals, that temptation is lost. But is that enough? No, not really, because, if one were so inclined, one could still persist in the position that both (1) and (4) do express a disjunction in their consequent. So, in order to persuade someone that we do express something of the form $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$, rather than $\ulcorner\varphi \rightarrow (\chi \supset \psi)\urcorner$, by (1), we will need to look closer at their difference in truth conditions.

Indeed, as we know a material implication has truth conditions altogether different from natural language conditionals: in our two-valued gap- and glutless classical logic, $\ulcorner\varphi \supset \chi\urcorner$ is true iff φ is false or χ is true. However, when it comes to natural language conditionals, it still remains a matter of heated debate whether we have discovered the sufficient and necessary conditions for truth. Nevertheless, that is not to say that we do not have an inkling: we are quite certain—in particular in the subjunctive case—that the truth conditions of natural language conditionals do not coincide with any truth-functional binary connectives such as the material implication.

Moreover, we are quite confident that the natural language conditionals unilaterally imply material implication, in the sense that $\ulcorner\varphi \rightarrow \chi\urcorner$ entails $\ulcorner\varphi \supset \chi\urcorner$. Were we also to remind ourselves that $\ulcorner\varphi \supset \chi\urcorner$ is classically equivalent to $\ulcorner\neg\varphi \vee \chi\urcorner$, we would, more importantly, realise that $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$ does entail $\ulcorner\varphi \rightarrow (\neg\chi \vee \psi)\urcorner$. In other words, on the supposition that (1) is true, it would also be true that if a Republican had won the elections, then either Reagan or Anderson would have. The truth-conditions of those two sentences can however differ when the one of the form $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$ becomes false. Indeed, suppose we discovered that Carter had joined the Republican party only minutes before the results of the elections became clear (such that the actual distribution of votes would still have been correctly predicted by the poll). In that case, (1) will turn out as false because the Republican Carter will win if Reagan does not. However, because Reagan will win, it remains true that if a Republican wins the elections, either Reagan or Anderson will win.

This finally brings us to the heart of the matter: we may reasonably distinguish between two potential logical forms lying beneath the surface structure of (1). While one is $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$, the other is $\ulcorner\varphi \rightarrow (\neg\chi \vee \psi)\urcorner$. And while the former entails the latter, the latter might be true while the former is not. That is merely to say that McGee's counterexamples are ambiguous as they could be understood as expressing either of those two forms. Importantly, while one of those forms renders the counterexamples impotent, the other does not. The crucial fact thus remains: we can hold the belief that (1), if a Republican wins the elections, then if it is not Reagan, Anderson will, which we would abandon if we were to discover that Carter had recently joined the Republican Party, and (2), that a Republican won the elections, without so much as feeling tempted to believe (3), that if it is not Reagan who wins the elections, Anderson will. So much for that approach.

5.3.3 Conditionals in Context

Another option would be to claim that McGee's examples are not really counterexamples to MPP$_{\rightsquigarrow}$'s validity because we evaluate (1) and (2) as true in an altogether different context from that in which we evaluate (3) as false.[15] We all know that context shifting cases whereby, say, one points at Carter and says 'he is a Democrat' and then concludes, now pointing at Reagan, that 'he is a Democrat', are not in any relevant sense counterexamples to the entailment from φ to φ, because the first utterance is made in a context importantly different from the second.

In such a fashion, we hope to be able to say the same about McGee's counterexamples: in order to evaluate the premises true and the conclusion false, there must

[15] This move is made by Gauker (2005, p. 86); see also Gauker (1987).

be a shift of context. Now, of course, to resort to a response of that kind we must have a rich enough conception of logical validity whereby context comes to play an important role: an argument is valid only if there is a context in which the premisses are true and the conclusion false. We might thus attempt to argue that once we fix a context for McGee's examples, they cease being counterexamples to MPP$_{\rightsquigarrow}$ because there is no context in which both (1) and (2) are true and yet (3) is false. However, instead of arguing for that, let us consider the prospect of such response.

So, is this strategy viable against McGee's counterexamples? No, it seems not. Contexts in which (1) and (2) are true while (3) is false are easy enough to come up with. In fact, upon the most natural reading, McGee's counterexample could be said to determine a set of contexts in which, among other things, the poll is very close to infallible—telling us that Reagan will win, Carter will come second and Anderson a distant third—and that Reagan, Carter and the Democrat Anderson are the only candidates. Furthermore, since there are only two Republican candidates, it seems obviously true that if some Republican will win, then if it will not be one, it will be the other. That is, (1) is true in our contexts. Also, since Reagan will win, it follows, since Reagan is a Republican, that a Republican will win. (2) is therefore likewise true in the contexts. Nonetheless, still within the bounds of our contexts, it seems true that if Reagan will not win, it will be Carter and not Anderson, since the poll so suggests. In other words, (3) will turn out as false in the said contexts. Importantly, it does not seem that there has been any shift of context in this case.

Might we not say that (1) and (3) have a context altogether different from (2)?[16] Indeed, it might be said that (1) and (3) are evaluated from a context provided by the poll while (2) is evaluated from some context of what will actually happen. In other words, can we not claim that there is a shift in context from (1) and (3), on the one hand, to (2), on the other? Perhaps we can but an important part of McGee's story is that the poll is close to infallible. Within such a context we do evaluate (2) as true, just as we evaluate (1) as true and (3) as false. We must therefore conclude that this strategy is not going help us to save MPP$_{\rightsquigarrow}$.

[16] I owe this observation to Stephen Read.

5.3.4 Conditions of Assertion

There are still other ways. One resort would be to question the *assertibility* of McGee's counterexamples.[17] Indeed, this strategy promises to do McGee's counterexamples in by deeming some of the sentences involved unassertible, irrespective of their truth values, and thus claim that the example fails to invalidate MPP.

Let us consider this plan of defence further. This sort of response requires us to take sentences as having not only truth conditions but also assertibility conditions. A standard example illustrating such a difference is the sentence 'she is poor but honest', which, although true in certain situations, may not be assertible since 'but' implies a certain contrast between the two conjuncts. The way we spell out the conditions of assertibility do vary from one theory to the next, but following Jackson, we may say that the assertibility of an indicative conditional, $\ulcorner\varphi \rightarrow \chi\urcorner$, is the conditional probability of χ given φ, $Pr(\chi|\varphi)$.

In that case, the assertibility of (1) will be extremely high, since given the details of McGee's counterexample, $Pr(\psi|\varphi\wedge\chi)$ is no less than 1. (According to Jackson, $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$ has the same conditions of assertibility as $\ulcorner(\varphi \wedge \chi) \rightarrow \psi\urcorner$.)[18] The assertibility of (3) is substantially lower, which again is only to be expected because we take (3) to be false, and not something we should normally find an urge to assert. Moreover, Jackson's theory tells us that the sentence 'if Reagan does not win the elections, Carter will', which is incompatible with (3), has a high assertibility. That again does not surprise us, because we take that sentence to be true and therefore something we would assert.

We might therefore respond to McGee's counterexamples as follows: the inference from (1) and (2) to (3) strikes us as funny simply because (3) has low assertibility although true. In other words, there is nothing wrong with the inference as an inference, the assertion of the conclusion is merely inappropriate and misleading. (Perhaps in a way similar to the inference from 'she is honest' and 'she is poor' to 'she is poor but honest'.) But that will not do: the whole problem is that (3) is not

[17]This kind of reply is inspired by Jackson's treatment of indicative conditionals as material implication with certain assertibility conditions(1979/1991, 1987); see also Grice (1989b, 1989a).

[18]Jackson (1987, pp. 129–134).

a case of a true but misleading sentence; our problem is precisely that (3) is false!

That, however, would be an unfair response and one which seems to beg the very question. The claim is that (3) is in fact true but we mistake it as false because of its low assertibility. We must therefore seriously address the issue of whether (3) is true despite its feeble assertibility. Why are we so convinced that (3) is false irrespective of its assertibility? We have certainly been through that before and our reason is simply that Carter is the runner-up by a vast margin: saying therefore that Anderson will have won had Reagan not, is somewhat absurd without any further justification.

Jackson's theory of conditionals and assertibility will therefore not be of any help to us here. Nevertheless, we may still persist and change our strategy by claiming that (2) lacks assertibility on the grounds that it is misleading. Since we know for a fact that Reagan will win the elections, it is a misleading breach of the maxim 'always assert the stronger' to claim that a Republican—that is either Reagan or Anderson—will win. We may then perhaps claim that McGee's counterexample fails because it involves, although true, a misleading and ill assertible sentence, namely (2). But that will not do the trick either for two reasons. First, once we recast McGee's elections poll counterexample as (1′), (2′) and (3′), the minor premise ceases to be misleading. Second, insofar as $\text{MPP}_{\rightsquigarrow}$ is a principle of truth, the assertibility conditions of any supposed counterexamples have no relevance to its validity. And since we are concerned with a principle of truth and not assertibility, this sort of response to McGee's counterexamples is not likely to succeed.

Without further responses to McGee's counterexamples at our disposal at present, we must acknowledge that the examples do pose a genuine threat to $\text{MPP}_{\rightsquigarrow}$. Needless to say, McGee himself recognises the significance of his own counterexamples and has several words to add on the issue. Let us now see what he has to say.

5.4 McGee's Reaction

5.4.1 Diagnosis: Clash of Two Principles

According to McGee, our problem lies in a conflict between MPP and the so-called *Law of Exportation* (LE). In classical logic, LE tells us that $\ulcorner(\varphi \wedge \chi) \supset \psi\urcorner$ entails $\ulcorner\varphi \supset (\chi \supset \psi)\urcorner$. (Its converse, $\ulcorner\varphi \supset (\chi \supset \psi)\urcorner \vdash \ulcorner(\varphi \wedge \chi) \supset \psi\urcorner$, is the so-called *Law of Importation* (LI).) If we generalise LE about all conditional structures, like we did with MPP earlier, we end up with the following principle:

> **Law of Exportation**
> *Any* conditional of the form $\ulcorner$*if* $(\varphi \wedge \chi)$, *then* $\psi\urcorner$ implies $\ulcorner$*if* φ, *then* (*if* χ, *then* ψ)$\urcorner$.

(And as we did for MPP, we may now make distinctions between LE for different sorts of conditionals: say, $\text{LE}_{\supset}$, $\text{LE}_{\rightsquigarrow}$, $\text{LE}_{\rightarrow}$ and $\text{LE}_{\Box\!\!\rightarrow}$.)

As we have already seen, McGee's counterexamples rest on an embedded conditional, $\ulcorner\varphi \rightarrow (\chi \rightarrow \psi)\urcorner$ as their major premise, which, assuming $\text{LE}_{\rightarrow}$, we ought to believe whenever we believe that $\ulcorner(\varphi \wedge \chi) \rightarrow \psi\urcorner$. Without much of an argument, McGee tells us that both $\text{LE}_{\rightsquigarrow}$ and $\text{LI}_{\rightsquigarrow}$ are, as it were, indisputable features of our natural languages.

Now, as far as these things go in philosophy, there is a near consensus that natural language conditionals are somewhere between logical consequence and the material implication, in the sense that $\varphi \vdash \chi$ implies both $\ulcorner\varphi \rightarrow \chi\urcorner$ and $\ulcorner\varphi \Box\!\!\rightarrow \chi\urcorner$, which in turn both imply $\ulcorner\varphi \supset \chi\urcorner$.[19] However, McGee proves, if both MPP and LE hold for natural language conditionals, those conditionals become equivalent to material implication.[20]

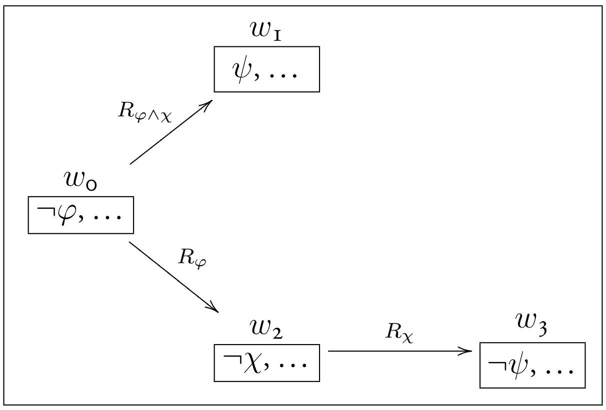
Obviously, since such an equivalence is a rather intolerable result for the conditional theorist, only two options seem available: either $\text{MPP}_{\rightsquigarrow}$ or $\text{LE}_{\rightsquigarrow}$ must go. And

[19] Unrestricted, this assumption in turn entails the so-called *Conditional Proof* (CP) for natural language conditionals and the material implication, which to we may object for a couple of reasons: suppose that $\Gamma, \varphi \vdash \chi$. Together with CP, this entails $\Gamma \vdash \ulcorner\varphi \rightsquigarrow \chi\urcorner$. Substitute $\ulcorner\varphi \supset \chi\urcorner$ for Γ and we have a reason to worry: $\ulcorner\varphi \supset \chi\urcorner \vdash \ulcorner\varphi \rightsquigarrow \chi\urcorner$! Luckily, McGee makes a weaker assumption which entails only a restricted form of CP where $\Gamma = \varnothing$.

[20] McGee (1985, pp. 465–466).

since LE is an essential feature of natural languages according to McGee, MPP$_{\rightsquigarrow}$, at the least in its unrestricted form, must yield.

But is LE$_{\rightsquigarrow}$ really as much of a feature of natural languages as McGee makes it out to be? At first blush, it certainly looks as if it is: any true instances of $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$ seem substitutable for the corresponding instance of $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$. If so, Stalnaker's semantics, in the case of both indicative and subjunctive conditionals, and Lewis' semantics, in the case of subjunctive conditionals, are severely mistaken since both invalidate the inference.[21] Conversely, if McGee is wrong about LE's importance in our natural language, the Stalnaker-Lewis semantics tell us that a counter model to the inference looks like this (where R is the accessibility relation determined by Stalnaker's selection function f, $w_i R_\varphi w_j$ iff $w_j = f(\varphi, w_i)$): $W = \{w_0, w_1, w_2, w_3\}$, $w_0 R_{\varphi\wedge\chi} w_1$, $w_0 R_\varphi w_2$, $w_2 R_\chi w_3$, and $v_{w_1}(\psi) = 1$, $v_{w_3}(\psi) = 0$. We may also present the counterexample with the following diagram (where an arrow represents an indexed accessibility relation and any formula boxed immediately underneath a world name is true at that particular world):



[21] See Stalnaker (1968/1991) and Lewis (1973).

5.4.2 Remedies

If McGee is right, which we shall assume for the time being, our most prominent theories of conditionals are mistaken in an important aspect by failing to validate LE at the cost of validating MPP. McGee proposes two strategies by which to amend our theories which both share the same fundamental feature of replacing any instances of the form $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ with $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$ in order to disarm the counterexamples.

5.4.2.1 Expelling the Form $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$

The first strategy is to fix our semantics such that for all natural language conditionals, $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ and $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$ have the same truth conditions: namely those of $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$ in Stalnaker-Lewis semantics. For the project, McGee provides us with a translation manual of sorts for propositional logic by which the truth conditions of conditionals with conditional consequent are forced to concur with those of the imported version of the conditional: any formula of the form $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ is thus to be replaced by $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$.[22]

Strictly speaking, by this strategy, MPP is no longer valid for nested natural language conditionals of the said kind although the rule applies as before to any conditionals without a conditional consequent. However, once we are through with such a translation there will be no natural language conditionals with conditional consequents and $\text{MPP}_{\rightsquigarrow}$ may be said to apply unrestrictedly. Although this strategy appears to deliver its promises, we must admit that this solution is uncomfortably *ad hoc*. In fact, in spite of its elegance, the only motivation we have for this solution is to hold on to the Stalnaker-Lewis semantics, even by quite artificial means. We must be able to do better than this.

5.4.2.2 Interpreting Our Natural Languages Otherwise

The other strategy McGee proposes, which also leaves MPP untouched, is to change our ways of translating from our natural language into the formal ones, such that

[22] McGee (1985, pp. 469–470).

occurrences of $\ulcorner$if φ, then if χ, then $\psi\urcorner$ in our natural language simply translate to $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$. In a word, this strategy serves to ostracise from our formal language the syntax $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ for any natural language conditionals. Although somewhat *ad hoc*, this proposal is by far better motivated than the first one. And not only does McGee advocate the view, Jackson, for instance, proposes the same reading for conditionals with conditionals as consequents.[23]

5.4.3 Issues: Adhocery & Deeply Embedded Conditionals

As McGee gallantly admits, the first strategy has a strong *ad hoc* flavour to it:[24] our only reason to accept the proposal is to hold onto our present conditional logics. On that ground alone, we must conclude that we may reasonably discard that proposal. Although being more insightful, the second strategy seems to have problems of its own: there appear to be cases where the second strategy fails. Which is to say, despite imposing the said restrictions on translation from natural languages to our formal languages, we will be able to fortify McGee's counterexamples such that they continue to pose a threat.

The most simple way to go about it is to embed the natural language conditional in the consequent of (1) within a more complex formula, say, merely by negating the consequent conditional. That way, McGee's second proposal is rendered impotent. Let us therefore try to construct such an example. Supposing the details depicted by McGee's counterexamples, it will seem reasonable to anyone who apprised the poll to believe that:

(7) If a Republican wins the elections, then it is not the case that if Reagan does not win, Carter will,

since, obviously, if a Republican wins and the winner is not Reagan, then our winner must be Anderson. Just as before, it likewise remains reasonable to believe that:

(8) A Republican will win the election.

[23] See, for instance, Bennett (2003, pp. 98–102) and Jackson (1987, pp. 129–134).

[24] McGee (1985, p. 471).

But yet, just as before, no one will then reasonably believe that:

(9) It is not the case that if Reagan does not win, Carter will,

because if it is not Reagan who wins, it will be Carter. In this example, the major premise for MPP$_{\rightsquigarrow}$ has the form $\ulcorner\varphi \rightsquigarrow \neg(\chi \rightsquigarrow \psi)\urcorner$, in which case neither LE nor McGee's revised rule of translation will be of any help to us. Indeed, in this case the conditional in the consequent is embedded within negation, yielding McGee's strategy impotent. (Notice that although we used negation, the same can presumably be done for the other logical constants too.)

Yet, this objection does not do the trick as we expected. As the connoisseur of conditionals will realise, negated natural language conditionals, $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$, are sometimes substitutable with the negated conditional with negated consequent, $\ulcorner\varphi \rightsquigarrow \neg\chi\urcorner$. And in the case of our example, this may indeed be done, such that our major premise simply becomes:

(10) If a Republican wins the elections, then if Reagan does not win, Carter will not win.

In this form, McGee's second strategy does work as he promised.

However, we can conjure a substantially better objection. Indeed, let us keep in mind Lewis' keen observation on the nature of the so-called *Law of Conditional Excluded Middle*:[25] although the inference $\ulcorner\varphi \rightsquigarrow \chi\urcorner \vdash \ulcorner\neg(\varphi \rightsquigarrow \neg\chi)\urcorner$ seems valid for natural language conditionals,[26] the inference from $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$ to $\ulcorner\varphi \rightsquigarrow \neg\chi\urcorner$ is invalid. (To understand why, suppose φ is irrelevant to χ, such that both $\ulcorner\varphi \rightsquigarrow \chi\urcorner$ and $\ulcorner\varphi \rightsquigarrow \neg\chi\urcorner$ may be false and both $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$ and $\ulcorner\neg(\varphi \rightsquigarrow \neg\chi)\urcorner$ are therefore true.)[27] Therefore, if we can restate our example such that the move from $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$ to $\ulcorner\varphi \rightsquigarrow \neg\chi\urcorner$ becomes blocked, we have shown that McGee's second strategy fails.

[25] Lewis (1973, pp. 79-83).

[26] This requires a reservation: insofar as indicative and subjunctive conditionals are all there is to natural language conditionals, the inference seems to hold. If, however, there are some conditional structures in natural language which behave just as the material implication, the inference does not hold.

[27] For illustration, Lewis' Bizet-Verdi example will do fine; see Lewis (1973, p. 80).

Let us try to conjure up an example of this kind. Still working from the details of McGee's original example, let us now furthermore suppose that we have reliable grounds to correctly suspect that a foul election scam orchestrated from within Watergate is about to be exposed.

Irrespectively of our suspicions, it is reasonable to believe that were an election scam to be exposed, there is no telling whether whichever candidate got the most votes will become president or not: in some cases he might and in some cases he might not, entirely depending on the nature of the exposed scam. For that reason, it does seem quite reasonable to believe that:

(11) If an election scam is exposed, then it is not the case that if Reagan wins the elections, he will become president.

If a scam is exposed, we have no reason to believe that the winner will become president or that he will not; for all we know, the winner might be involved in this foul play or he might not. Indeed, the exposed scam is perhaps only a lame one by Carter, which only managed to get him up to second place, or an extremely poor one by Anderson, or one innocent enough by Reagan for anyone to care, or ..., in which case Reagan would still become president were he to get the most votes; alternatively, should we discover that Reagan won the election by cheating, new elections would clearly be called for.

Moreover, since we have reliable grounds to correctly suspect that a Democratic election scam will be exposed, it is reasonable to believe that:

(12) An election scam will be exposed.

And yet, it will entirely be unreasonable to believe that:

(13) It is not the case that if Reagan wins the elections, he will become president.

Indeed, as far as we know, Reagan is not involved in any sort of foul play: we therefore have every reason to believe that were he to win the elections, he would become president.

The crucial feature of this example is that although the major premise has the form $\ulcorner\varphi \rightarrow \neg(\chi \rightarrow \psi)\urcorner$, we cannot infer the form $\ulcorner\varphi \rightarrow (\chi \rightarrow \neg\psi)\urcorner$, which we need to move onto $\ulcorner(\varphi \wedge \chi) \rightarrow \neg\psi\urcorner$. Remember that it is a well-documented fact that winners of presidential elections, *ceteris paribus*, become presidents. However—and for that very reason our example works—the relation between winning elections and becoming a president is severed once a scam is exposed. In other words, if a scam is exposed, Reagan might or might not become president, all depending on whose scam gets discovered. That is to say, should a scam be discovered, it is neither the case that if Reagan gets the most votes, he will become president, nor that if he gets the most votes, he will not become president.

Since McGee's second strategy seems impotent against counterexamples involving sentences of the form $\ulcorner\varphi \rightsquigarrow \neg(\chi \rightsquigarrow \psi)\urcorner$ whose consequent we cannot translate into $\ulcorner\chi \rightsquigarrow \neg\psi\urcorner$, we are faced by a new problem. Indeed, we have given a counterexample to $\text{MPP}_{\rightsquigarrow}$ which cannot be alleviated by McGee's strategy. We must, therefore, conclude that both of McGee's strategies have failed. That, however, does not imply that we should give the latter strategy up entirely. Indeed, we might be able to expand McGee's second strategy to cope better with the data.

5.5 Expanding McGee's Strategy

5.5.1 Fumbling for a Solution

Indeed, although McGee's second strategy failed for more complex formulae, we should hang on to the idea for a while longer and try to make the best of it for there is something quite attractive about McGee's proposal. There seems to be something intuitive about claiming that when we say something of the form $\ulcorner$if φ, then if χ, then $\psi\urcorner$, it seems as if our claim is equivalent to $\ulcorner$if φ and χ, then $\psi\urcorner$. And not only does McGee share that feeling with us, the intuition has been defended in different ways in different places.[28] Let us therefore dwell on the suggestion for a while in

[28] See for instance Bennett (2003, pp. 98–102) and Jackson (1987, pp. 129–134).

the hope that we can perhaps work around the problems we have just discovered.

As the observant reader might remember, with sentences such as (11), we established that there are forms other than $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ alone which haunt us. Indeed, something must be said about the form $\ulcorner\varphi \rightsquigarrow \neg(\chi \rightsquigarrow \psi)\urcorner$ too, and presumably countless others which encapsulate natural language conditionals deep inside their consequent, by which we can regenerate McGee's counterexamples. How do we intend to deal with those? Without a doubt, there remains a story to be told here but to begin with, we can claim that the logical form of (11) is in fact $\ulcorner\neg((\varphi \wedge \chi) \rightsquigarrow \psi)\urcorner$.

That alone will not do. What about, for instance, the form $\ulcorner\varphi \rightsquigarrow ((\chi \rightsquigarrow \psi) \wedge (\pi \rightsquigarrow \sigma))\urcorner$ or $\ulcorner\varphi \rightsquigarrow ((\chi \rightsquigarrow \psi) \vee (\pi \rightsquigarrow \sigma))\urcorner$? We may propose $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)) \wedge (\varphi \rightsquigarrow (\pi \rightsquigarrow \sigma))\urcorner$ and $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)) \vee (\varphi \rightsquigarrow (\pi \rightsquigarrow \sigma))\urcorner$ respectively, which again have the logical form $\ulcorner((\varphi\wedge\chi) \rightsquigarrow \psi)\wedge((\varphi\wedge\pi) \rightsquigarrow \sigma)\urcorner$ and $\ulcorner((\varphi \wedge \chi) \rightsquigarrow \psi) \vee ((\varphi \wedge \pi) \rightsquigarrow \sigma)\urcorner$. And so on ...

In fact, seeking inspiration from McGee's first strategy,[29] we may propose the following translation N from natural language into its logical form in first-order logic supplemented with a conditional, whose operation on φ we indicate by $\ulcorner\varphi^N\urcorner$, given by a definition from a base case by induction on the depth of formulae. First, for formulae whose main connective is not natural language conditional, we have the rather trivial translation:

$$
\begin{array}{rcl}
\varphi^N & := & \varphi, \text{ where } \varphi \text{ is atomic} \\
(\neg\varphi)^N & := & \neg\varphi^N \\
(\varphi \wedge \chi)^N & := & \varphi^N \wedge \chi^N \\
(\varphi \vee \chi)^N & := & \varphi^N \vee \chi^N \\
(\varphi \supset \chi)^N & := & \varphi^N \supset \chi^N \\
(\exists x(\varphi(x)))^N & := & \exists x((\varphi(x))^N) \\
(\forall x(\varphi(x)))^N & := & \forall x((\varphi(x))^N)
\end{array}
$$

[29] McGee (1985, pp. 469–470).

Second, for any formulae whose main connective is a natural language conditional, we have:

$$\begin{array}{rcl}
(\varphi \rightsquigarrow \chi)^N & := & \varphi^N \rightsquigarrow \chi^N, \text{ where } \chi \text{ is any } \rightsquigarrow\text{-free formula} \\
(\varphi \rightsquigarrow \neg\chi)^N & := & \neg(\varphi \rightsquigarrow \chi)^N \\
(\varphi \rightsquigarrow (\chi \wedge \psi))^N & := & (\varphi \rightsquigarrow \chi)^N \wedge (\varphi \rightsquigarrow \psi)^N \\
(\varphi \rightsquigarrow (\chi \vee \psi))^N & := & (\varphi \rightsquigarrow \chi)^N \vee (\varphi \rightsquigarrow \psi)^N \\
(\varphi \rightsquigarrow (\chi \supset \psi))^N & := & (\varphi \rightsquigarrow \chi)^N \supset (\varphi \rightsquigarrow \psi)^N \\
(\varphi \rightsquigarrow \exists x(\chi(x)))^N & := & \exists x(\varphi \rightsquigarrow \chi(x))^N, \text{ where } x \text{ does not occur free in } \varphi \\
(\varphi \rightsquigarrow \forall x(\chi(x)))^N & := & \forall x(\varphi \rightsquigarrow \chi(x))^N, \text{ where } x \text{ does not occur free in } \varphi \\
(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^N & := & ((\varphi \wedge \chi) \rightsquigarrow \psi)^N
\end{array}$$

(Very roughly speaking, any formula within the scope of an N, $\ulcorner\varphi^N\urcorner$, is in natural language. Once it has been translated such that nothing is left within an N, we may say it has reached its logical form.)

The first seven clauses are much as one would expect, dictating a roughly direct translation from the surface form of natural language sentences into their logical form. The remaining clauses are concerned with translations of formulae with natural language conditional as their main connective. For any natural language conditional which does not include some natural language conditionals in its consequent, we have a clause, $\ulcorner(\varphi \rightsquigarrow \chi)^N\urcorner := \ulcorner\varphi \rightsquigarrow \chi\urcorner$, telling us that the logical form of the natural conditional is simply that of the surface form of the conditional. Furthermore, for all other natural language conditionals, the proposed translation manual tells us recursively how to give their logical form. This proposal does extend McGee's second proposal in the sense that our last clause, $\ulcorner((\varphi \wedge \chi) \rightsquigarrow \psi)^N\urcorner :=$ $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^N\urcorner$, resembles McGee's proposal for translation from natural language sentences of the (surface) form $\ulcorner$if φ, then if χ, then $\psi\urcorner$, into their logical form as $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$.[30]

[30]McGee (1985, p. 470).

Following this proposal, we can now deal with (11), (12) and (13) in the following way. (11), 'if an election scam is exposed, then it is not the case that if it is Reagan who gets the most votes, he will become president', we translate into its logical form as follows:

$$\begin{array}{ll} \text{(i)} & (\varphi \rightsquigarrow \neg(\chi \rightsquigarrow \psi))^N \Rightarrow \\ \text{(ii)} & \neg(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^N \Rightarrow \\ \text{(iii)} & \neg((\varphi \wedge \chi) \rightsquigarrow \psi)^N \Rightarrow \\ \text{(iv)} & \neg((\varphi \wedge \chi)^N \rightsquigarrow \psi^N) \Rightarrow \\ \text{(v)} & \neg((\varphi^N \wedge \chi^N) \rightsquigarrow \psi) \Rightarrow \\ \text{(vi)} & \neg((\varphi \wedge \chi) \rightsquigarrow \psi) \end{array}$$

Since $\ulcorner \neg((\varphi \wedge \chi) \rightsquigarrow \psi) \urcorner$ together with φ does not warrant us to infer $\ulcorner \neg(\chi \rightsquigarrow \psi) \urcorner$, it does seem as if we have averted the threat to $\textsc{mpp}_{\rightsquigarrow}$ in this case.

For the sake of further illustration, let us try something slightly more challenging. Still working from McGee's example, replace (1) with:

(14) If a Republican wins, then if it is not Reagan who wins, then if anyone has a strong opposition to Anderson's presidency, that very person will either have to put up with Anderson for four years or else revolt.

(Whose surface form appears arguably to be $\ulcorner \varphi \rightsquigarrow (\chi \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x)))) \urcorner$.) Supposing we still have our minor premise, (2), 'a Republican will win', $\textsc{mpp}_{\rightsquigarrow}$ allows us to detach the consequent and infer:

(15) If it is not Reagan who wins, then if anyone strongly opposes Anderson's presidency, that very person will either have to put up with Anderson for four years or else revolt.

(Whose surface form appears to be $\ulcorner \chi \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x))) \urcorner$.) That seems absurd, because as before, should Reagan not win, Carter will become the president, in which case there is no putting up to be done with Anderson, let alone revolting against. In other words, yet again we seem to have a counterexample to $\textsc{mpp}_{\rightsquigarrow}$, only this time slightly more complex than before.

However, according to our proposal, the logical form of (14) is arrived at as follows:

(i) $(\varphi \rightsquigarrow (\chi \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x)))))^N \Rightarrow$

(ii) $((\varphi \wedge \chi) \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x))))^N \Rightarrow$

(iii) $\forall x((\varphi \wedge \chi) \rightsquigarrow (\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x))))^N \Rightarrow$

(iv) $\forall x((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow (\pi(x) \vee \sigma(x)))^N \Rightarrow$

(v) $\forall x(((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow \pi(x))^N \vee ((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow \sigma(x))^N) \Rightarrow$

(vi) $\forall x(((\varphi \wedge \chi \wedge \psi(x))^N \rightsquigarrow (\pi(x))^N) \vee$
$((\varphi \wedge \chi \wedge \psi(x))^N \rightsquigarrow (\sigma(x))^N)) \Rightarrow$

$\ldots \Rightarrow$

(vii) $\forall x(((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow \pi(x)) \vee ((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow \sigma(x)))$

(Where the ellipsis between the sixth and seventh line merely indicates an iterated application of the $\rightsquigarrow$-free clauses.) In the same manner, we take the logical form of (15) to be $\ulcorner \forall x(((\chi \wedge \psi(x)) \rightsquigarrow \pi(x)) \vee ((\chi \wedge \psi(x)) \rightsquigarrow \sigma(x))) \urcorner$. That move, again, is sufficient for saving $\text{MPP}_{\rightsquigarrow}$ as the move from (14), $\ulcorner \forall x(((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow \pi(x)) \vee ((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow \sigma(x))) \urcorner$, and φ to (15), $\ulcorner \forall x(((\chi \wedge \psi(x)) \rightsquigarrow \pi(x)) \vee ((\chi \wedge \psi(x)) \rightsquigarrow \sigma(x))) \urcorner$, is no longer warranted by $\text{MPP}_{\rightsquigarrow}$. In other words, supposing this sort of reading of natural language conditionals, it seems as if McGee's counterexamples cease to be such.

5.5.2 Sinking Feelings: Four Worries

We are still not home free. There are at least four reasons to doubt the proposal we have just given.

5.5.2.1 Existentially Quantified Conditionals

The first worry has to do with the clause for existentially quantified conditionals: $\ulcorner (\varphi \rightsquigarrow \exists x(\chi(x)))^N \urcorner := \ulcorner \exists x(\varphi \rightsquigarrow \chi(x))^N \urcorner$. For instance, let us assume that it is true that:

(16) If Anderson were to become president, there will be a revolution.

(Whose surface form is, arguably, $\ulcorner Pa \rightsquigarrow \exists x Rx)\urcorner$, where a denotes Anderson, P denotes the presidential property and R denotes the property of being a revolution against Anderson's presidency, or something along similar lines.) Now, our suggested translation tells us that the logical form of (16) is $\ulcorner \exists x(Pa \rightsquigarrow Rx)\urcorner$, but surely that is absurd: we do not want to say that there is some thing which exists independently of Anderson's presidency, awaiting to become a revolution should the opportunity arise. Certainly not generally, at least. Presumably, we only want to say that should Anderson become president, then a revolution will come into existence.

5.5.2.2 Disjunctive Consequents

This was not really fair to Anderson: for all we know, he might have made a wonderful president. This brings us to the second worry. That worry has to with the clause for natural language conditionals with disjunction, embedding further conditionals, in their consequent: $\ulcorner(\varphi \rightsquigarrow (\chi \vee \psi))^N\urcorner := \ulcorner(\varphi \rightsquigarrow \chi)^N \vee (\varphi \rightsquigarrow \psi)^N\urcorner$. If we want to be absolutely fair, we must admit that it is true that:

(17) If Anderson were to become president, he will either be successful or not.

(Whose surface form is $\ulcorner Pa \rightsquigarrow (Sa \vee \neg Sa)\urcorner$, where P denotes the presidential property and S denotes the property of being successful, or something along those lines.)

Again, our translation gets us into trouble, telling us that the logical form of (17) is $\ulcorner(Pa \rightsquigarrow Sa) \vee (Pa \rightsquigarrow \neg Sa)\urcorner$, which in turn is quite absurd since neither disjunct is presumably true. Indeed, although we have every reason to believe (17), we have no good reason to suspect that it is either the case that 'if Anderson were to become president, he will either be successful' or 'If Anderson were to become president, he will not be successful'.

5.5.2.3 Conditional Excluded Middle

Our third worry has loomed awhile. Recall that we said above that the inference from $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$ to $\ulcorner\varphi \rightsquigarrow \neg\chi\urcorner$ is invalid.[31] That is merely to say that there are instances of φ and χ which make the form $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$ true and $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$ false. For that reason, it does seem dubious to expect the translation clause $\ulcorner(\varphi \rightsquigarrow \neg\chi)^{N}\urcorner := \ulcorner\neg(\varphi \rightsquigarrow \chi)^{N}\urcorner$ to do the job for us. More accurately, there will inevitably be some false natural language conditionals of the surface form $\ulcorner\varphi \rightsquigarrow \neg\chi\urcorner$ whose translation into logical form, $\ulcorner\neg(\varphi \rightsquigarrow \chi)\urcorner$, will be true.

That will clearly not do. If we want to give a solution along the above lines, we must therefore revise the translation clause for natural language conditionals with negated consequent. The real problem, however, is that finding a replacement clause for $\ulcorner(\varphi \rightsquigarrow \neg\chi)^{N}\urcorner := \ulcorner\neg(\varphi \rightsquigarrow \chi)^{N}\urcorner$ is quite far from obvious. It would be too hasty to conclude that one cannot be found. Let it suffice for now to acknowledge the fact that a new clause is desperately needed, were we to aim for a solution to this problem.

5.5.2.4 Importation and Exportation

Our fourth worry—and perhaps the most serious—is that we still have not seen any serious argument for the validity of LE and LI for natural language conditionals. Of course, no one denies that these laws hold in classical logic for material implication. However, we are dealing with something different here. If those laws do not hold for natural language conditionals, we have no serious grounds on which to base our proposal.

We remarked before that intuitively it seems that whenever we say something of the form $\ulcorner$if φ, then if χ, then $\psi\urcorner$, we have not said anything above or beyond $\ulcorner$if φ and χ, then $\psi\urcorner$. Now, since, according to our translation, $\ulcorner(\chi \rightsquigarrow (\varphi \rightsquigarrow \psi))^{N}\urcorner$ and $\ulcorner((\chi \wedge \varphi) \rightsquigarrow \psi)^{N}\urcorner$ have the same truth conditions, we need something more firm than a mere intuition to justify our translation. Indeed, we need a good argument to the effect that LE and LI do indeed hold for natural language conditionals.

[31] See, again, Lewis (1973, pp. 79-83).

In light of those the previously highlighted objections, I believe we must, at least for the time being, abandon the proposal.

Where does that leave us? Without notable success we have tried halfheartedly to ignore the problem of McGee's counterexamples. To no avail, we have considered numerous ways in which to respond to the counterexamples. Moreover, we have also seen that McGee's reaction to his own counterexamples is impotent. And finally, despite the seemingly promising prospect, we have discovered that an extension to McGee's solution gets us nowhere. What remains? Of course, we might simply give up and reject the unrestricted form of MPP. However, let us digress for a minute to consider the link between MPP and natural language conditionals.

5.6 Modus Ponens & Natural Language Conditionals

We now have good reason to believe that McGee's counterexamples are a genuine threat to MPP$_{\leadsto}$. We therefore face the following problem: insofar as our logics are intended to model the best of our reasoning in natural languages, our conditional logics have failed by validating MPP$_{\leadsto}$. Furthermore, we have seen that the attempts to patch up our existing logics, as proposed and inspired by McGee, fail to deliver. What are the remaining options?

As we hinted at above in a parenthetical remark, there are various logics in which MPP fails for some conditional or another. For example, there are some non-reflexive modal logics—such as K, D, and any extensions of K which are without the so-called ρ frame restriction—where MPP fails for the strict implication: $\ulcorner \varphi \strictif \chi \urcorner, \varphi \nvDash_K \chi$; $\ulcorner \varphi \strictif \chi \urcorner, \varphi \nvDash_D \chi$; $\ldots$. Also, there is the three-valued logic LP, which invalidates MPP for what may arguably be said to be the material implication, $\ulcorner \varphi \supset \chi \urcorner, \varphi \nvDash_{LP} \chi$.[32] Furthermore, there is FDE augmented with material implication, for which MPP$_{\supset}$ fails. More generally, MPP$_{\supset}$ fails for most relevant

[32] See Priest (1979).

logics. Moreover, there are various logics with non-normal world semantics, which may invalidate anything at their non-normal worlds. And finally, there are variants of the fuzzy logic $Ł_{\aleph}$ and the fuzzy relevant logic FR.[33] Nonetheless, although all those logics invalidate MPP for some conditional or another, they do not in general invalidate MPP for whichever conditional that is assumed to be the *real* conditional. In light of our experience with McGee's counterexamples, we might propose to take the further step and reject MPP for natural language conditionals. However, do we really dare to venture on a project of that nature?

Let us admit that there persists a strong intuition and sturdy conviction that conditionals of any sort and MPP are somehow intimately related. The fact that classical logic, along with numerous other logics, including both Stalnaker's and Lewis' conditional logics, validate MPP indicates as much. And to the extent that we believe that either introduction or elimination rules confer meaning to logical connectives, the fact that MPP dictates the elimination of conditionals in various proof systems further betrays our inclinations. In fact, considering that MPP has a quite long and successful history as far as these things go,[34] it is small wonder that the principle has found a place quite close to our hearts.

The exact nature of this intuition might be hard to tease out. However, it seems that the gist of it is something along the lines that we cannot consistently claim that $\ulcorner$if φ, then $\chi\urcorner$, and yet reject that χ, without retracting $\ulcorner$if φ, then $\chi\urcorner$, when φ turns out to be the case. Should anyone do so, we would be inclined to doubt that person's language or logic competency, or assume otherwise confused, or even dismiss the person as a liar.[35] In other words, our intuition is that an assertion of a

[33] For more detail about those logics and their failure to validate mpp, see Priest (2001).

[34] For an interesting overview of MPP's early history and development in antiquity, see Bobzien (2002).

[35] Despite appearances, even so-called Dutchman Conditionals—say, 'if Anderson wins the elections, I am a Dutchman'—do seem to behave in this way: although an expression of that sort does arguably serve as a mere idiom to convey (subjective) improbability, we would expect the utterer to retract the conditional if the antecedent were to turn out true. Keeping Harman's distinction (cf. footnote 3) in mind, those absurd conditionals are still intended to *implicate* their consequents given their antecedents: that is how they get their point across. However, to *infer* the consequent upon learning the antecedent would be a mistake.

That said, however, it is worth noting that there do seem to be non-conditional uses of 'if' in conditional is a commitment to an assent of its consequent in light of its antecedent. And to the extent that we share this intuition, MPP seems all the more appropriate.

For that very reason, McGee's counterexamples disturb us horribly. However, the real issue is whether McGee's counterexamples do something more than shaking our intuition about natural language conditionals and MPP. Do McGee's counterexamples in fact reveal the intuition to be incorrect? In the history of philosophy, such things have surely transpired before. And if so, all that remains is to find some way or another to cope. As we have already noted, one option is to revise our conditional logics accordingly. But since that option seem deeply counterintuitive, a revision is only reasonable as a last resort.

Another option, which we have not yet considered, is a sort of Fifth-Columnist approach: why not just accept McGee's counterexamples and admit that MPP fails for natural languages in some rare cases and let that be the end of it? We know full well that MPP holds for the material implication in classical logic and for various other conditionals in other logics. We might even claim that our natural languages are confused and unsuited for proper reasoning, while our formal languages are rigourous enough to be appropriate for the project. Indeed, we may just as well divorce ourselves from those horrid natural languages and resort to conduct all our reasoning in their formal counterparts—in which, by the way, we know that MPP obtains and our intuition is cherished. On this sort of view, by feeling ourselves compelled to respond to McGee's counterexamples, we display nothing more than a failure of nerve.

However, as we know, logic is not only fun and games. Indeed, insofar as our logic is to model our ideal reasoning in our everyday natural languages, this sort of response to McGee's counterexamples would be a grim betrayal to our mission. But the Fifth-Columnist might very well persist: our natural languages are ill-suited for reasoning in the first place, why waste our time and efforts by modelling them? This

English: uses of 'if' as 'although' ('Reagan was a fair president, if firm'), 'like' ('Carter acted as if everything was all right'), expression of polite request ('please, consider voting Carter, if you don't mind') or offer ('Reagan has promised an economical reform, if you like'), implied reservation ('Anderson got few votes, if any') and so on. Whether MPP has any relation to those uses is a moot point. For more extensive discussion on this point, see §3.4.2

might be a valid point, but we can still claim that natural languages may contain many important structures which we should strive to incorporate into our formal languages. Conjunction and negation are obvious examples, but others include, for instance, quantifiers, and if we desire to reason about something more than mere mathematics and alike, modal and tense operators, and—last but certainly not least—conditionals.

Our natural language conditionals are linguistic structures by which we may express very complex thoughts. Indeed, it seems that conditional thought is a fundamental feature of our mental repertoire.[36] And if we cannot reason properly about something as fundamental, why bother to reason at all? In other words, the Fifth-Columnist may say what he likes about natural languages but we still have a strong need to incorporate natural language conditionals into some logic or another.

We are not free yet, our Fifth-Columnist might now vex us thus: although natural language conditionals have their place within logic, McGee's counterexamples merely reveal inappropriate use of them, not a failure of $\text{MPP}_{\rightsquigarrow}$. This is an interesting response, and not one that we considered before. This response must still be deemed as fundamentally mistaken because further analysis of McGee's counterexamples, through which we have gone above, shows us beyond reasonable doubt that (1), (2) and (3) all express clear and coherent thoughts. I believe we must therefore abandon the Fifth-Columnist approach to natural language conditionals.

Another option is to have yet another look at McGee's counterexamples in the hopes of finding some way or another to save MPP.

[36]This opinion has been expressed a vast number of times in different way by different authors. For instance, see Edgington (1995, p. 235): 'The ability to think conditional thoughts is a basic part of our mental equipment. A view of the world would be an idle, ineffectual affair without them.'

5.7 In Search of a Solution

5.7.1 Second Thoughts on the Law of Exportation

According to McGee, recall, $\text{LE}_{\rightsquigarrow}$ is an essential feature of English.[37] We did not pay much heed to McGee's claim above but let us have a closer look now. At first blush, this claim seems quite a reasonable one. After all, usually when we claim something of the form $\ulcorner(\varphi \land \chi) \rightsquigarrow \psi\urcorner$ it seems as if we may just as well make a claim of the form $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$. To appreciate that, it is sufficient for us to consider (1) once again.

However, if we were to come up with a counterexample to $\text{LE}_{\rightsquigarrow}$, we could safely reject $\text{LE}_{\rightsquigarrow}$ and hold on instead to $\text{MPP}_{\rightsquigarrow}$ without our natural language conditionals collapsing into material implication.[38] Although that does not address the counterexamples directly, that would at the least be a first step to rescue $\text{MPP}_{\rightsquigarrow}$. What we need therefore is an interpretation under which $\ulcorner(\varphi \land \chi) \rightsquigarrow \psi\urcorner$ is true and $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ false. Let us see what we can come up with.

I intuit that our best chance is to look for counterexamples where φ and ψ coincide, such that $\ulcorner(\varphi\land\chi) \rightsquigarrow \varphi\urcorner$ is true and $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \varphi)\urcorner$ is false. Working directly from McGee's examples is not going to help us: that if a Republican wins the elections and Reagan does not win, then a Republican wins the elections, $\ulcorner(\varphi \land \chi) \to \varphi\urcorner$, seems just as true as that if a Republican wins the elections, then if Reagan does not win, then a Republican wins the elections, $\ulcorner\varphi \to (\chi \to \varphi)\urcorner$.

That will clearly not do. We might instead try our luck with apparently irrelevant sentences. There are plenty to choose from, so restricting ourselves to events which took place in that eventful November 1980, it seems trivially true that if Reagan won the elections and million of TV viewers discovered who shot J.R., then Reagan would win the elections, $\ulcorner(\varphi \land \chi) \mathrel{\Box\!\!\rightarrow} \varphi\urcorner$. However, it may be false that if Reagan won the elections, then it would be the case that if millions of TV viewers discovered who shot J.R., then Reagan would win the elections,

[37] McGee (1985, p. 465).

[38] Recall that McGee proves that in any reasonably well-behaved logic which validates both MPP and LE for some conditional, that very conditional will collapse into material implication; see McGee (1985, pp. 465–466).

$\ulcorner \varphi \mathrel{\Box\!\!\rightarrow} (\chi \mathrel{\Box\!\!\rightarrow} \varphi)\urcorner$, because there is presumably no telling whether the embedded conditional is true or not, even in light of the fact that Reagan wins the elections.[39]

Will this do? Well, we seem to be torn between conflicting intuitions here: on the one hand, we are uncertain whether it is true that if millions discovered who shot J.R., then Reagan would win the elections, and on the other, it seems most obvious that if Reagan won the elections, then he would win no matter whether millions of viewers discovered who shot J.R. or not. That is, if we consider the embedded conditional in isolation, our intuition tells us that if millions discovered who shot J.R., then Reagan *could* win the elections; however, if we consider the embedded conditional together with the embedding conditional's antecedent, we feel compelled to judge that the embedding conditional must be true, quite independently of how we come to evaluate the embedded one in isolation.

Needless to say, we can make a McGee inspired move here, claiming that since we may detach the false consequent 'if millions of TV viewers discovered who shot J.R., then Reagan would win the elections', $\ulcorner(\chi \mathrel{\Box\!\!\rightarrow} \varphi)\urcorner$, given that 'Reagan won the elections', φ, the major premise, $\ulcorner \varphi \mathrel{\Box\!\!\rightarrow} (\chi \mathrel{\Box\!\!\rightarrow} \varphi)\urcorner$, must be false on pain of contradiction. That way, it appears that we have proven the major premise false by a reductio. However, since it is precisely the validity of $\textsc{mpp}_{\rightsquigarrow}$ which is up for grabs, that move would be rather dubious as we assume its very validity by detaching the consequent. Unfortunately, we must conclude that this move will not be of any help.

Let us not lose hope yet. One might conjecture that our failure to invalidate $\textsc{le}_{\rightsquigarrow}$ so far might have to do with the wrong sort of irrelevance of our atomic sentences. As we noted above, funny things emerge when atomic sentences work against each other in some ways: for instance, exposures of scams tend to affect our acceptance of elections' results.[40] Well, then, what do we want to say about the following sentence?[41]

[39] Incidentally, Kristin Shepard, Sue Ellen's sister, shot J.R.

[40] This again is closely related to the so-called failure of antecedent strengthening for natural language conditionals, the failure to infer $\ulcorner(\varphi \wedge \psi) \rightsquigarrow \chi\urcorner$ from $\ulcorner \varphi \rightsquigarrow \chi\urcorner$.

[41] Let us assume that the predicate 'is a president' does not denote a unique property.

(18) If Reagan and Carter were presidents, then Reagan would be a president.

Of course, in order for (18) to be true, our antecedent calls for a slightly peculiar state of affairs: namely, one such that there are two (or more) American presidents in office concurrently—but that must surely be well within the bounds of our imagination. Should that be the case, then clearly anyone who is one of the presidents in office is a president in office.

Nonetheless, although we assume (18) to be true, it still seems dubious that:

(19) If Reagan was a president, then it would be the case that if Carter was a president, then Reagan would be a president.

After all, if Reagan is a president, he might be *the* president, in which case the same can presumably be said about Carter, he too might be *the* president, in which case he, but not Reagan, is a president. (Even if Reagan was a president, he would normally cease to be one as soon as someone else become a president.) In other words, it seems as if the former sentence, which is of the form $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$, is true, while the latter, which is of the form $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$, is false. Which is merely to say that $\textsc{le}_{\rightsquigarrow}$ fails.[42]

Not without a good reason, our antagonist might now reply: wait a minute, if Reagan is a president *and* Carter is a president, of course Carter, but not Reagan, is a president. This kind of reply rests on the assumption that natural languages conjunctions are not usually commutative. For instance, when reasoning in natural language, it seems awkward to infer from ‘Reagan became the president and there was a revolution’ that ‘there was a revolution and Reagan became the president’, since these sentences may express two quite distinct thoughts; for instance, it is believed that ‘Fulgencio Batista was a president and there was a revolution’ and ‘there was a revolution and Osvaldo Dorticós Torrado was president’ by anyone familiar with Cuban history, while the commuted conjunctions seem incredible.[43]

[42] See also Davis (1979, p. 551).

[43] President Fulgencio Batista was overthrown in the Cuban revolution, after which, following a brief presidency of Anselmo Alliegro, Carlos Manuel Piedra and Manuel Urrutia Lleó, Osvaldo Dorticós Torrado became a president until Fidel Castro’s succession in 1976.

This is a good and valid point. Nevertheless, there is also a reading of natural language conjunctions where the order of its conjuncts has no effect. Clearly, to say that Reagan is a president and Carter is president can be said to imply that one somehow led to the other, but we may cancel any such implicature simply by adding something along the lines that we might just as well have said that Carter and Reagan are presidents, or by adding that they are in office concurrently. Either way, (18) will be true: if Reagan and Carter were presidents, Reagan would be a president. After all, it does therefore seem that LE fails for natural language conditionals.

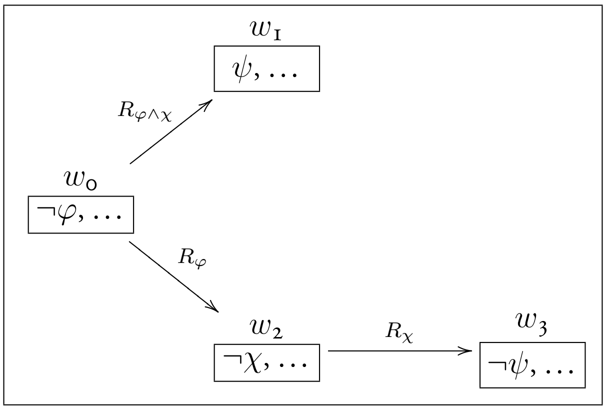
5.7.2 Against the Law of Importation

As we already mentioned, the converse of LE is the so-called *Law of Importation* (LI). Once generalised, LI is therefore the following principle:

> **Law of Importation**
> *Any* conditional of the form $\ulcorner$*if* φ, *then* (*if* χ, *then* ψ)$\urcorner$ implies $\ulcorner$*if* $(\varphi \wedge \chi)$, *then* $\psi\urcorner$.

And as before, we may distinguish different instantiations of LI for different sorts of conditionals. In classical logic, LI thus tells us validly that $\ulcorner\varphi \supset (\chi \supset \psi)\urcorner$ entails $\ulcorner(\varphi \wedge \chi) \supset \psi\urcorner$. Moreover, in the case of natural language conditionals, $\text{LI}_{\rightsquigarrow}$ tells us that from $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ we may infer $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$.

Just as for $\text{LE}_{\rightsquigarrow}$, the Stalnaker-Lewis semantics tell us that $\text{LI}_{\rightsquigarrow}$ is invalid. A counter model to the inference looks as follows (where R is the accessibility relation determined by Stalnaker's selection function f, $w_i R_\varphi w_j$ iff $w_j = f(\varphi, w_i)$): $W = \{w_0, w_1, w_2, w_3\}$, $w_0 R_{\varphi\wedge\chi} w_1$, $w_0 R_\varphi w_2$, $w_2 R_\chi w_3$, and $v_{w_1}(\psi) = 0$, $v_{w_3}(\psi) = 1$. We may also present the counterexample with the following diagram (where an arrow represents an indexed accessibility relation and any formula boxed immediately underneath a world name is true at that particular world):



Moreover, as for LE$_{\rightsquigarrow}$, McGee tells us without much of an argument that LI$_{\rightsquigarrow}$ is valid.[44] And just as for LE$_{\rightsquigarrow}$, we have reason to suspect that McGee is wrong about LI$_{\rightsquigarrow}$.

Perhaps because our counterexample to LE$_{\rightsquigarrow}$ is still fresh in our mind, finding one to LI$_{\rightsquigarrow}$ is easy. Presumably, it is true that:

(20) If Reagan was a president, then it would be the case that if Carter was a president, then it would not be the case that an amendment must have been made to the second article of the United States Constitution.

However, it is clearly false that:

(21) If Reagan and Carter were presidents, then it would not be the case that an amendment must have been made to the second article of the United States Constitution.

Indeed, in order for two (or more) presidents to be in office concurrently, there must have been some sort of amendment made to the United States Constitution. In other words, it seems as if the former sentence, which is of the form $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$, is true, while the latter, which is of the form $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$, is false. Which is merely to say that LI$_{\rightsquigarrow}$ fails.

[44] McGee (1985, p. 465).

This must be a relief to anyone adhering to any sort of Stalnaker-Lewis semantics. The failure of $\text{LE}_{\rightsquigarrow}$ and $\text{LI}_{\rightsquigarrow}$ is now not as embarrassing as McGee made them out to be. Also, having established that both $\text{LE}_{\rightsquigarrow}$ and $\text{LI}_{\rightsquigarrow}$ fail for natural language conditionals, we can conclude that any translation strategy similar to the one we considered above—where an important clause is $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^{N}\urcorner :=$ $\ulcorner((\varphi \wedge \chi) \rightsquigarrow \psi)^{N}\urcorner$—is not going to get us off the ground, because we do not want to equate the truth conditions of $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ and $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$.

Better yet, as we already remarked on above, we can reject $\text{LE}_{\rightsquigarrow}$ and hold on to $\text{MPP}_{\rightsquigarrow}$ without our natural language conditionals collapsing into material implication. With that on our side, let us now have yet another look at McGee's counterexamples. However, let us first make two important observations concerning the counterexamples.

5.7.3 Observations

5.7.3.1 First Observation: Accumulative and Non-Accumulative Conditionals

So far, we have considered various cases of embedded natural language conditionals. If not already apparent, our reading of each of these seems to fall into one of two mutually exclusive semantic categories: *accumulative* and *non-accumulative*. While our reading of (1) is an example of the first, (20) is of the second. Let us clarify those concepts in turn.

We may define an accumulative embedded conditional as follows:

> **Accumulative Conditional**
> An embedded conditional, $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$, is accumulative iff we necessarily take its consequent $\ulcorner\chi \rightsquigarrow \psi\urcorner$ to be evaluated on the supposition that φ, such that we actually, albeit implicitly, take the consequent to be of the form $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$.

This requires an example for clarification. In the case of (1), we take the conditional 'if a Republican wins the election, then if it's not Reagan who wins it will be

Anderson' as saying that 'if a Republican wins the election, then if it's not Reagan who wins *and a Republican wins*, it will be Anderson'. In other words, upon the most natural reading of (1), we understand the sentence such that the supposition of φ is still alive when we come to evaluate the conditional within the consequent, $\ulcorner\chi \rightsquigarrow \psi\urcorner$, and we in fact consider ψ upon the supposition of φ *and* χ. For that reason we can say that the suppositions of each antecedent get accumulated for any conditionals embedded within the consequent. In other words, this is what we mean by 'accumulative conditional'.

Conversely, we may define a non-accumulative embedded conditional as follows:

> **Non-Accumulative Conditional**
> An embedded conditional, $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$, is non-accumulative iff we do not necessarily take its consequent $\ulcorner\chi \rightsquigarrow \psi\urcorner$ to be evaluated on the supposition that φ. (In other words, an embedded conditional is non-accumulative iff it is not accumulative.)

For instance, in the case of (20), we take the conditional 'If Reagan was a president, then it would be the case that if Carter was a president, then it would not be the case that an amendment must have been made to the second article of the United States Constitution' as saying 'If Reagan was a president, then it would be the case that if Carter was a president *and Reagan might or might not be a president too*, then it would not be the case that an amendment must have been made to the second article of the United States Constitution'. As before, upon the most natural reading of (20), we understand the sentence as saying that the supposition of φ is not alive anymore when we come to evaluate the conditional within the consequent, $\ulcorner\chi \rightsquigarrow \psi\urcorner$, such that we in fact consider ψ upon the supposition of χ *and not necessarily* φ. In other words, this is what we mean by 'non-accumulative conditional'.

Notice that if we read (1) as non-accumulative, it turns out as false, because if Reagan does not win, and we are not forced to suppose that a Republican wins, then Carter will win. Likewise, if we read (20) as accumulative, it turns out as false, because if Carter is a president, and we are supposing that Reagan is a president (too), then obviously a change must have been made to the United States Constitution.

Notice also, there is no reason to believe that there cannot be an accumulative embedded conditional that embeds a non-accumulative conditional nor conversely. Albeit a cumbersome and clumsy conditional, 'if a Republican wins the election, then if it's not Reagan who wins, then if a Democrat wins, . . . ' seems a clear example of a non-accumulative conditional within an accumulative conditional.

What determines our reading of an embedded conditional as either accumulative or non-accumulative? That is quite hard to tell, although we may suggest that the more unlikely φ is given χ, the more we are inclined to opt for a non-accumulative reading of $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$. Obviously, however, despite that one reading may seem to come more naturallly than the other for most embedded conditionals, we can generally force our reading to its natural reading's opposite. Whether the probability of the coincidence of φ and χ alone is enough to explain the more natural reading in each case is far from clear. At best, if so, the exact probability will probably vary from one embedded conditional to the next. Likewise, if so, we have reason to suspect that there are embedded conditionals whose most natural reading will be indeterminate between accumulative and non-accumulative readings.

Moreover, insofar as we can rephrase natural language conditionals such as $\ulcorner$if φ, then $\chi\urcorner$ as $\ulcorner\chi$ if $\varphi\urcorner$, we seem to be able to disrupt accumulation in some—albeit clearly not in all—cases.[45] On the one hand, we are inclined to evaluate the conditional 'if a Republican wins, then if Reagan does not win, then a Republican wins' as true, because we accumulate the antecedents and consider the embedded consequent, that a Republican wins, on the supposition that a Republican wins and that Reagan does not win. On the other had, when it comes to 'if a Republican wins, then a Republican wins, if Reagan does not win', we are less wont to accumulate and therefore more willing to evaluate as false. In other words, we take the latter conditional to be false because although it is true that a republican will win, it is not

[45] I owe this observation to Frank Jackson.

true come what may; indeed, it might be true that a Republican wins only because it is true that Reagan wins. So, what is going on here?

Several options seem available. One is to claim that this merely shows that the move from $\ulcorner$if φ, then $\chi\urcorner$ to $\ulcorner\chi$ if $\varphi\urcorner$ is not a valid move in natural language. This might be because, say, $\ulcorner$if φ, then $\chi\urcorner$ is not always substitutable for $\ulcorner$if φ, $\chi\urcorner$, although the latter would be substitutable for the same conditional with the antecedent in a post-verbal position, $\ulcorner\chi$ if $\varphi\urcorner$.[46] That is to say that 'if Reagan does not win, then a Republican wins' is not equivalent in its truth conditions to 'a Republican wins if Reagan does not win'. However, in this particular case the discrepancy between truth conditions is very hard to spot.

Another option is to claim that although $\ulcorner$if φ, then $\chi\urcorner$ and $\ulcorner\chi$ if $\varphi\urcorner$ agree in truth conditions, something happens at the pragmatic level which disrupts the accumulation. For instance, we might say something along the lines that the post-verbal positioning of the antecedent carries a (conversational) implicature to the effect that we tend to understand $\ulcorner\chi$ if $\varphi\urcorner$ as implying $\ulcorner\chi$ *even* if $\varphi\urcorner$. In other words, when we encounter 'a Republican wins if Reagan does not win' in the consequent of an embedded conditional, we get thrown off balance and halt our accumulation. Perhaps, in such cases, we are wont to stop our accumulation, say, because we do not believe the antecedent of the embedding conditional, $\ulcorner$if φ, then φ if $\chi\urcorner$, come what may. On the other hand, when evaluating 'if a Republican wins, then if Reagan does not win, then a Republican wins' we are, perhaps for the reason that there is no such implicature, more willing to carry on with our accumulate reading.

Whatever the reason may be, there seems to be a good deal more to be said about this distinction. However, since our current interest lies in McGee's counterexamples to MPP, I suggest we leave those questions for another time.

How does all this relate to McGee's counterexamples? Interestingly enough, for each instance of McGee's counterexamples we have considered until now, the major premise is a conditional that begs for an accumulative reading. Moreover, our counterexamples to $\text{LE}_{\rightsquigarrow}$ and $\text{LI}_{\rightsquigarrow}$ both seem to require non-accumulative readings.

[46]See Davis (1983) and Geis (1985, p. 148).

Let us keep this observation in mind for now, it will come in handy later.

5.7.3.2 Second Observation: Internal Tension

We have already noticed that the constituents of conditional sentences may have funny effects on one another. Are we confronted by something of that sort in the case of McGee's counterexamples? Well, it certainly seems that something of a similar kind is the case. As we have noted before, the major premise in McGee's counterexamples has the form $\ulcorner \varphi \rightsquigarrow (\chi \rightsquigarrow \psi) \urcorner$. What we have not remarked on before now, however, is that there seems to be a certain tension between φ and χ. Namely, it appears as if our very ground to believe φ is $\ulcorner \neg\chi \urcorner$.[47]

To clarify, let us consider (1) again: we believe that a Republican will win *because* we believe that Reagan will win. After all, the poll tells us that Reagan will win, $\ulcorner \neg\chi \urcorner$, and for that reason alone we believe that a Republican will win, φ. Therefore, when we come to evaluate (1), $\ulcorner \varphi \rightarrow (\chi \rightarrow \psi) \urcorner$, we start off by entertaining the possibility of a Republican victory which we take to be probable only because we believe that Reagan will win. However, as we carry on with our evaluation of the conditional and turn to the conditional within the consequent, $\ulcorner \chi \rightarrow \psi \urcorner$, we face a peculiar predicament: our initial supposition that a Republican would win, φ, was made on the ground that Reagan would win, $\ulcorner \neg\chi \urcorner$, and yet the antecedent of the embedded conditional demands that we make the supposition that Reagan will win. Thus, by making the supposition that Reagan will not win, we have undermined our supposition that a Republican will win and that leaves us in a particular state. On our journey through the space of possibilities, we must therefore, as it were, reverse our course as we reach our first waypoint and discover ourselves to have been on the wrong track.[48] In a way, then, when we evaluate (1), we are forced off our initial track, that of supposing Reagan's victory, onto a new and altogether different one.

[47] I owe this observation to Crispin Wright.

[48] Presumably, a similar story may be told about certain narratives psychologists are wont to employ to expose our prejudices, for instance: 'Both members of the Senate and the House of Representatives accused the president of high treason. Upon those accusations, *she* pleaded innocent and ridiculed the inculpation.'

What about McGee's other counterexamples and all their variants we have considered hitherto? Unfortunately, the previously observed tension between φ and χ in $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ does not seem to be common to all the examples. At least, for instance in the case of (11), the tension seems to be absent: we do not ground our supposition of an exposure of a scam, φ, on Reagan not winning the elections, $\ulcorner\neg\chi\urcorner$. Nonetheless, within (11) there seems to be a certain tension as to the exposure of a scam, φ, is one that throws everything we take for granted about elections up in the air, in particular the link between winning the elections, χ, and becoming the president, ψ.

How important is this tension for the counterexamples? Clearly, the internal tension alone is not sufficient to bring about a counterexample. For instance, the sentence 'If a Republican wins the elections, then if it's not Reagan who wins and it's not Carter who wins, it will be Anderson', which has the exact same tension as (1), does not give rise to a counterexample to $\textsc{mpp}_{\rightsquigarrow}$. To claim that the internal tension is necessary to the counterexamples seems a more promising claim. At present, it seems a hard one to argue for, but that might not be a problem we need to concern ourselves with here. The importance of a characterisation of the counterexamples is perhaps not fundamental to our project. Indeed, it seems that the observation of this tension, whatever its exact significance to the counterexamples, is enough to guide us in an important direction.

So, what is the lesson to be learnt here? The observation of this tension seems to indicate and emphasise the distinction we made above between accumulative and non-accumulative embedded conditionals. Namely, in cases of accumulative embedded conditionals, $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$, since we read them as if φ is still a live supposition when we evaluate ψ on the supposition of χ, we must somehow mirror that in the respective logical form. In other words, whenever we face an accumulative natural language conditional, all conditionals embedded in its consequent must take any antecedents we have supposed until then as a conjunction to their own antecedents.

How are we best supposed to achieve that effect? Well, perhaps surprisingly, McGee was not all that far off target when he proposed $\textsc{le}_{\rightsquigarrow}$ for the undertaking.

(Indeed, although approached from quite a different angle, McGee makes a similar observation about the suppositional nature of conditionals.[49]) However, we have seen that McGee's proposal for a translation from natural languages into formal language fails. Let us see whether we can do any better.

5.7.4 Towards a Solution

Here is a thought: in cases of accumulative embedded conditionals, why not carry any suppositions to which we have already committed ourselves, over to the conditional within the consequent? Instead of McGee's proposal of using LE$_{\rightsquigarrow}$ as the heart of our translation, why not rather say that the logical form of a natural language conditional, $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$, has in fact the logical form $\ulcorner\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)\urcorner$? And instead of McGee's proposal of translating *all* embedded natural language conditionals in the proposed way, why not merely restrict our translation to accumulative conditionals? We can, for the time being, say that the logical form of an non-accumulative conditional is merely its surface form. That way, the failure of LE$_{\rightsquigarrow}$ and LI$_{\rightsquigarrow}$ for non-accumulative conditionals need not worry us. Likewise, the failure of the inference from $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$ to $\ulcorner\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)\urcorner$ and back, for non-accumulative conditionals, thus makes no difference to us.

5.7.4.1 Interpreting Natural Language Conditionals

In fact, we may again propose a translation N from natural language into its logical form in first order logic supplemented with a conditional, whose operation we indicate by $\ulcorner\varphi^N\urcorner$, given by a definition from a base case by induction on the depth of formulae. A natural start is to begin as before with seven trivial clauses for formulae with a main connective other than natural language conditionals. But where do we go from there? As before, it might be tempting to give a clause such as $\ulcorner(\varphi \rightsquigarrow \chi)^N\urcorner := \ulcorner\varphi^N \rightsquigarrow \chi^N\urcorner$ for any formulae whose main connective is a natural language conditional and where χ is any $\rightsquigarrow$-free formula, $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^N\urcorner :=$

[49] McGee (1985, p. 469). See also Weatherson (2007), which makes an observation to a similar effect.

$\ulcorner\varphi \rightsquigarrow ((\varphi\wedge\chi) \rightsquigarrow \psi)^{N}\urcorner$ otherwise, and somehow deal with the other connectives in a way that brings everything together.

Unfortunately, that will not do. The reason is that for every conditional within the consequent, we need to add the antecedent of the embedded conditional. Using recursive definition clauses of the sort normally used is presumably possible by using a clause of the form $\ulcorner(\varphi \rightsquigarrow (\ldots(\chi \rightsquigarrow \psi)\ldots))^{N}\urcorner := \ulcorner\varphi \rightsquigarrow (\ldots((\varphi \wedge \chi) \rightsquigarrow \psi)\ldots)^{N}\urcorner$, whereby we replace *every* occurrence of conditionals within the consequent, $\ulcorner\chi \rightsquigarrow \psi\urcorner$, for $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$ recursively. That, however, if possible, will become a rather messy affair. A more elegant way is to build some sort of bookkeeping into our translation, such that we keep track of the suppositions already at play. In other words, at every stage of our translation, we must be able to recall all antecedents we have already encountered.

To do so, we might want to run our translation as follows. (Other options are, of course, viable.) On the side, for a given translation, we keep track of all suppositions (given by the respective antecedents) we have so far encountered in our process of translation. Let us call this set of (sub) formulae our 'supposition set'.

Whenever we get to a point of translation where we have $\ulcorner(\varphi \rightsquigarrow \chi)^{N(X)}\urcorner$, we proceed as follows. First, we add the elements of the supposition set to the antecedent, φ, and make it subject for a new iteration of translation with an unchanged supposition set. Two, we add φ to the supposition set and make the consequent, χ, subject to that translation. Let us use the notation $N(X)$ to denote that the translation N has the (possibly empty) set X as its supposition set. Given this extension, our main translation clause becomes:

$$(\varphi \rightsquigarrow \chi)^{N(X)} := ((\bigwedge X)^{N(\varnothing)} \wedge \varphi^{N(X)}) \rightsquigarrow (\chi)^{N(\{\varphi\}\cup X)}$$

Of course, given this translation, we must also modify our simple clauses. Trivially, we may modify the simple clauses as follows:

$$\begin{array}{rcl}
\varphi^{N(X)} & := & \varphi, \text{ where } \varphi \text{ is atomic} \\
(\neg\varphi)^{N(X)} & := & \neg\varphi^{N(X)} \\
(\varphi \wedge \chi)^{N(X)} & := & \varphi^{N(X)} \wedge \chi^{N(X)} \\
(\varphi \vee \chi)^{N(X)} & := & \varphi^{N(X)} \vee \chi^{N(X)} \\
(\varphi \supset \chi)^{N(X)} & := & \varphi^{N(X)} \supset \chi^{N(X)} \\
(\exists x(\varphi(x)))^{N(X)} & := & \exists x((\varphi(x))^{N(X)}) \\
(\forall x(\varphi(x)))^{N(X)} & := & \forall x((\varphi(x))^{N(X)})
\end{array}$$

5.7.4.2 Applications of *N*

This sort of translation might perhaps strike one as somewhat obscure. As often, the easiest way to understand things like these is by way of example. Let us try this translation out on (1), whose surface form, recall, we said to be $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\urcorner$:

(i) $(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^{N(\varnothing)} \Rightarrow$

(ii) $((\bigwedge \varnothing)^{N(\varnothing)} \wedge \varphi^{N(\varnothing)}) \rightsquigarrow (\chi \rightsquigarrow \psi)^{N(\{\varphi\})} \Rightarrow$

(iii) $\varphi^{N(\varnothing)} \rightsquigarrow (((\bigwedge\{\varphi\})^{N(\varnothing)} \wedge \chi^{N(\{\varphi\})}) \rightsquigarrow \psi^{N(\{\varphi,\chi\})}) \Rightarrow$

(iv) $\varphi \rightsquigarrow ((\varphi^{N(\varnothing)} \wedge \chi^{N(\{\varphi\})}) \rightsquigarrow \psi)$

(v) $\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)$

Needless to say, the translation gives us our desired result, $\ulcorner\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)\urcorner$. When we take this to be the logical form of (1), together with (2) we may infer by MPP$_{\rightsquigarrow}$ $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \psi\urcorner$. That conclusion says something along the lines that 'if a Republican wins the elections and Reagan does not win, then Anderson will win', which we do take to be true in the context of the example. So far, so good.

It is time to get slightly more ambitious. The translation above was not really that impressive; we would like to see something somewhat more convoluted. Let us try our luck with (14), whose surface form we claimed to be something along the lines of $\ulcorner\varphi \rightsquigarrow (\chi \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x))))\urcorner$:

(i) $(\varphi \rightsquigarrow (\chi \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x)))))^{N(\varnothing)} \Rightarrow$

(ii) $((\bigwedge \varnothing)^{N(\varnothing)} \wedge \varphi^{N(\varnothing)}) \rightsquigarrow$
$(\chi \rightsquigarrow \forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x))))^{N(\{\varphi\})} \Rightarrow$

(iii) $\varphi^{N(\varnothing)} \rightsquigarrow (((\bigwedge\{\varphi\}^{N(\varnothing)} \wedge \chi^{N(\{\varphi\})}) \rightsquigarrow$
$(\forall x(\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x))))^{N(\{\varphi,\chi\})}) \Rightarrow$

(iv) $\varphi \rightsquigarrow ((\varphi \wedge \chi^{N(\{\varphi\})}) \rightsquigarrow \forall x((\psi(x) \rightsquigarrow (\pi(x) \vee \sigma(x)))^{N(\{\varphi,\chi\})})) \Rightarrow$

(v) $\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \forall x(((\bigwedge\{\varphi,\chi\}^{N(\varnothing)} \wedge \psi(x)^{N(\{\varphi,\chi\})}) \rightsquigarrow$
$(\pi(x) \vee \sigma(x))^{N(\{\varphi,\chi,\psi(x)\})})) \Rightarrow$

(vi) $\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \forall x(((\varphi \wedge \chi)^{N(\varnothing)} \wedge \psi(x)^{N(\{\varphi,\chi\})}) \rightsquigarrow$
$((\pi(x))^{N(\{\varphi,\chi,\psi(x)\})} \vee (\sigma(x))^{N(\{\varphi,\chi,\psi(x)\})}))) \Rightarrow$

(vii) $\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \forall x((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow (\pi(x) \vee \sigma(x))))$

That was perhaps somewhat less simple, but this translation shows, I believe, the application of N quite well: for every embedded conditional, the antecedents already encountered get added to their antecedents as we required. Moreover, taking $\ulcorner\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \forall x((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow (\pi(x) \vee \sigma(x))))\urcorner$ to be the logical form of (14), with (2) we may infer by MPP$_{\rightsquigarrow}$ $\ulcorner(\varphi \wedge \chi) \rightsquigarrow \forall x((\varphi \wedge \chi \wedge \psi(x)) \rightsquigarrow (\pi(x) \vee \sigma(x)))\urcorner$. That conclusion says something like 'if a Republican wins and Reagan does not win, then if a Republican wins and Reagan does not win and anyone has strong opposition to Anderson's presidency, then that very person must either put up with Anderson for four years or else revolt', which seems true in the context of the example.

Obviously, the logical form may become quite cumbersome in cases such as this one where antecedents get copied and recopied. That, however, is simply a price that must be paid. No one ever said that natural languages were easy.

More interestingly, in both of the above cases, McGee's paradox disappears as we take the conclusion to be true. In other words, taking our translation proposal seriously, we no more have reason to doubt the validity of MPP$_{\rightsquigarrow}$.

Before moving on, let us consider one more exercise of our translation. One might suspect the occurrence of a conditional within the antecedent of a conditional might pose problems for N.[50] Already with sentences such as (14), we are somewhat stretching what people normally claim in natural languages. Arguably so, by placing a conditional within the antecedent of a conditional, we are stretching things even further. But be that as it may, considering how our translation fares with such cases is interesting enough by itself. Without trying to come up with a concrete example, let us merely suppose that we have a natural language conditional whose surface form is $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)) \rightsquigarrow (\pi \rightsquigarrow \sigma)\urcorner$. On an accumulative reading, we expect such conditional to have the logical form $\ulcorner(\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)) \rightsquigarrow (((\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)) \wedge \pi) \rightsquigarrow \sigma)\urcorner$.

According to our translation, such a conditional would translate as follows:

(i) $((\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)) \rightsquigarrow (\pi \rightsquigarrow \sigma))^{N(\varnothing)} \Rightarrow$

(ii) $((\bigwedge \varnothing)^{N(\varnothing)} \wedge (\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^{N(\varnothing)}) \rightsquigarrow (\pi \rightsquigarrow \sigma)^{N(\{\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\})} \Rightarrow$

(iii) $(((\bigwedge \varnothing)^{N(\varnothing)} \wedge \varphi^{N(\varnothing)}) \rightsquigarrow (\chi \rightsquigarrow \psi)^{N(\{\varphi\})}) \rightsquigarrow$
$(((\bigwedge\{\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\})^{N(\varnothing)} \wedge \pi^{N(\{\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)\})}) \rightsquigarrow$
$\sigma^{N(\{\varphi \rightsquigarrow (\chi \rightsquigarrow \psi), \pi\})}) \Rightarrow$

(iv) $((\varphi \rightsquigarrow ((\bigwedge\{\varphi\}^{N(\varnothing)}) \wedge \chi^{N(\{\varphi\})}) \rightsquigarrow \psi^{N(\{\varphi, \chi\})}) \rightsquigarrow$
$(((\varphi \rightsquigarrow (\chi \rightsquigarrow \psi))^{N(\varnothing)} \wedge \pi) \rightsquigarrow \sigma) \Rightarrow$

(v) $(\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)) \rightsquigarrow$
$((((\bigwedge \varnothing)^{N(\varnothing)} \wedge \varphi^{N(\varnothing)} \rightsquigarrow (\chi \rightsquigarrow \psi)^{N(\{\varphi\})}) \wedge \pi) \rightsquigarrow \sigma) \Rightarrow$

(vi) $(\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)) \rightsquigarrow$
$(((\varphi \rightsquigarrow ((\bigwedge\{\varphi\})^{N(\varnothing)} \wedge \chi^{N(\{\varphi\})}) \rightsquigarrow \psi^{N(\{\varphi, \chi\})})) \wedge \pi) \rightsquigarrow \sigma) \Rightarrow$

(vii) $(\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)) \rightsquigarrow (((\varphi \rightsquigarrow ((\varphi \wedge \chi) \rightsquigarrow \psi)) \wedge \pi) \rightsquigarrow \sigma)$

The translation thus gives us the desired result.

Of course, this time around, we are not in the business of dissolving cases of McGee's counterexamples. However, if we were, it seems quite obvious that if a conditional of the form $\ulcorner(\varphi \rightsquigarrow (\chi \rightsquigarrow \psi)) \rightsquigarrow (\pi \rightsquigarrow \sigma)\urcorner$ could serve as a major premiss in a counterexample, the translation would get us yet again away from the awkward conclusion. In other words, by taking our translation proposal seriously, we have no reason to doubt the validity of MPP$_{\rightsquigarrow}$ anymore.

[50] I owe this observation to Greg Restall.

5.8 Conclusion: Saving Modus Ponens

Once again, we seem to be in position to claim that MPP is a valid rule of implication. As there is something extremely unpleasant about rejecting MPP, that must surely come as a comfort to us. Even though we were only to reject MPP$_{\rightsquigarrow}$, there is still something quite disturbing about that thought. Indeed, as we remarked above, there seems to be a very intimate connection between natural language conditionals and MPP: an important part of the meaning of natural language conditionals seems to be captured, as it were, by MPP$_{\rightsquigarrow}$. If we were so inclined, we might even claim that MPP is among the rules which confer meaning on natural language conditionals. Indeed, insofar as it is possible to talk about introduction and elimination rules in proof-theoretic style for natural language expressions, MPP$_{\rightsquigarrow}$ strikes us intuitively as the most appropriate elimination rule for natural language conditionals.

Our result above is therefore more than mere idle procrastination. Indeed, our results are comforting for the reason that we can hold onto MPP for natural language conditionals. After all, if we buy into the solution we have developed above, McGee's 'counterexamples' to MPP show us nothing more than that there is more to natural language than first meets the eye. Yes, if so, McGee's 'counterexamples' merely serve to tell us that the logical form of sentences such as (1) is more complex than their surface form suggests.

So, what remains to be done? The task we set ourselves seems completed: we have managed to save MPP$_{\rightsquigarrow}$ from its alleged counterexamples. Is there anything more to be done? Well, here is a bold conjecture: the backbone of our translation N may be used to deal with a host of context-dependent phenomena such as restricted quantification and definite descriptions. How so? It does seem as if some context-dependent phenomena behave a lot like accumulative conditionals. For, say, both restricted quantification and definite descriptions, the universe of discourse is determined by the very context in which those appear. Why not then take the set of sentences contained in the context, as an antecedent to whichever expressions made in that context? But we must leave that project for another day.

6 Conclusion

In this thesis' introduction, we identified several pressing semantic issues pertaining to natural language conditionals. In the preceding chapters, we have dealt with each of them in turn. In order to bring our journey to an end, let us summarise briefly our main conclusions now.

Firstly, we dealt with the issue whether a certain class of natural language conditionals were truth apt or not. In particular, our discussion was motivated by suasive arguments involving so-called Gibbard Phenomemon cases to the effect that indicative conditionals cannot have truth conditions on pain of contradiction. However, since that conclusion seems quite extraordinary from intuitive, logical and linguistic points of view, we felt compelled to investigate the subject in detail. Upon a closer look, we soon saw that the conditionals in question do in all likelihood demand semantics of some sort in terms of the so-called Ramsey Test. However, we also noticed that if we were to give indicative conditionals truth conditional semantics in terms of the Ramsey Test, Gibbard Phenomenon cases soon lead us to contradiction. Since we were reluctant to give up truth conditions for indicative conditionals, we considered several alternatives. We then finally argued ourselves into a position where we may well hold on to a contextualised counterpart of the Ramsey Test and still successfully avoid the threats of the Gibbard Phenomenon.

Secondly, we addressed a fundamental issue concerning a widely recognised semantic distinction among natural language conditionals. More precisely, we set ourselves out to uncover the grounds of the so-called indicative/subjunctive distinction. We went through a series of intuitive proposals but found them all insufficient on different accounts. We then attempted to explain the distinction away but eventually concluded that we could not do without it. After we had made several helpful observations, we finally suggested that the indicative/subjunctive line should in fact be drawn with respect to the sorts of suppositions expressed by natural language conditionals. We then drew a distinction between modal and amodal suppositions and argued that any interesting natural language conditional expresses either of the two. Corresponding to modal and amodal suppositions, we presented an outline of semantics for modal and amodal conditionals and suggested that the indicative/subjunctive distinction should be understood in terms our modal/amodal distinction.

Thirdly, we considered the issue of semantics proper and meta-semantics of natural language conditionals. In particular, we offered a fully developed semantic theory for conditionals in natural languages. We based our theory on the modal/amodal distinction we presented in the previous chapter. We began by a close examination and analysis of the so-called modal and amodal suppositions. Consequently, we turned to the corresponding conditionals and finally spelled out their truth conditions in terms of modal and amodal suppositions. In order to provide us with an input for more elaborate semantics, we then offered a rudimentary syntactic account of conditional sentences in English. Eventually, we then presented a fully compositional semantics for natural language conditionals in generative grammar.

Fourthly and finally, we explored the issue of inference rules of natural language conditionals. In particular, we questioned and eventually defended the validity of

Modus Ponens (MPP) despite McGee's compelling counterexamples to the contrary. MPP, recall, is a rule of implication which tells us that a conditional together with its antecedent imply its consequent. Intuitively, there is a very strong link between natural language conditionals and MPP: indeed, MPP strikes us an integral part of the meaning of natural language conditionals. For that reason, we claimed, some resolution of the counterexamples is all the more pressing. We began our journey by presenting the most prominent responses the counterexamples currently in the literature and we then argued that they were all inadequate in different aspects. We finally motivated and presented our own solution which allows us to hold onto MPP at the price of positing a more complex logical form of embedded conditionals than their surface structure suggest. Moreover, we also offered a translation function from their surface form to their logical form in adherence with our solution to the counterexamples.

Although this thesis has merely scratched the surface of a vast subject, I humbly and sincerely hope that it has contributed something worthwhile to the topic of natural language conditionals.

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