

Iffiness*

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1 An iffy thesis

One thing language is good for is imparting plain and simple information: *there is an extra chair at our table* or *we are all out of beer*. But — happily — we do not only exchange plain information about tables, chairs, and beer mugs. We also exchange conditional information thereof: *if we are all out of beer, it is time for you to buy another round*. That is very useful indeed.

Conditional information is information about what might or must be, if such-and-such is or turns out to be the case. My target here has to do with how such conditional information manages to get expressed by sentences in natural language — sentences often dubbed “indicative conditionals”, not because anyone thinks that’s a great name but because no one can do any better.

Some ordinary examples:

- (1) a. If the goat is behind door #1, then the new car is behind door #2
- b. If Eto’o regains his form, then Barça might advance
- c. If Carl is at the party, then Lenny must also be at the party

Each of these is an ordinary indicative conditional sentence, two of them have epistemic modals in the conditional clause, and all of them express a bit of

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ordinary conditional information.¹ What I am interested in is how well the indicatives play with the epistemic modals.

What these examples say is plain. Take (1b). This says that — within the set of possibilities compatible with the information at hand — among those in which Eto'o regains his form, some are possibilities in which Barça advance. Or take (1c). It says something about the occurrence of Lenny-is-at-the-party possibilities within the set of Carl-is-at-the-party possibilities — that, given the information at hand, every possibility of the latter stripe is also of the former stripe.

What sentences like these say is plain, how they say it isn't. That's my target here: How is it that the *if*'s in our examples manage to express conditional information and do so in a way compatible with how they play with epistemic modals?

The simplest story about how the *if*'s in our examples manages to express conditional information is that each of them expresses the information of a conditional. Which is to say: what these conditional *sentences* mean can be read-off the fact that *if* is a conditional *operator*. Which is to say: *if* is an operator, an iffy operator, and the same iffy operator in each of the sentences in (1). That is the gist of iffiness. But it is a hard line to maintain in the face of the data at hand: how conditional sentences play with modals seems to mean that *if* can't be iffy.

Iffiness is an old school story about indicatives, and I want to defend one way of telling it. But not just any telling of it will do. So I want to show how our simple examples cause what looks like insurmountable trouble for old school views that take *if* to be iffy. Then, to make the point stick, I'll sketch just how easy things would be — how easily the trouble could be surmounted — if we went new school and embraced Kratzer's thesis that *if* is no operator at all, *a fortiori* not an iffy operator, and *a fortiori* not the same iffy operator in each of our example sentences it figures in. Instead, says the restrictor analysis, *if* simply restricts other operators.² But the success of the restrictor analysis is no argument against Chuck Taylors and skyhooks *tout court*.

The old school story I favor is really a throwback. I say that *if* expresses a strict conditional operator over possibilities compatible with the context, and

¹We ought to be careful to distinguish between conditional sentences and conditional operators. The former are bits of natural language, the latter bits of some regimented language that may serve to represent the logical forms of the bits of natural language. But the point of carefully distinguishing is precisely so we can ignore the difference when it does not matter.

²See, e.g., Kratzer (1981, 1986).

that it can do all the restricting that needs doing. But before saying how we can do this, I want to make it look for all the world like it can't be done.

2 Ground rules

Let's simplify. Assume that meanings get associated with sentences by getting associated with formulas in an intermediate language that represents the relevant logical forms (LFS) of them. Thus a story, old school or otherwise, has to first say what the relevant LFS are and then assign those LFS semantic values.

Suppose that conditional sentences do their information carrying by sporting conditional operators in their LFS. So let L be the relevant intermediate language, generated from a stock of atomic sentence letters, negation (\neg), and conjunction (\wedge) in the usual way. But L also has the connective (*if* \cdot)(\cdot), and the modals *must* and *might*. What I have to be say can be said about an intermediate language that allows that the modals mix freely with the formulas of the non-modal fragment of L but restricts (*if* \cdot)(\cdot) so that it takes only non-modal sentences in its first argument and does not itself occur in the scope of negation. So assume that L is such an intermediate language. When these restrictions outlive their utility, we can exchange them for others.³

Iffiness requires that the *if* of English expresses something properly iff. That leaves open just which conditional operator we say that the *if* of English means. But our choices here are not completely free, and some ground rules will impose some order on what we may say. These will constrain our choice by saying what must be true for a conditional operator to be rightfully so called. But before getting to that, I'll start with what I will assume about contexts.

First, a general constraint: assume that truth-values — for our *if*-constructions and the modals (when we come to that), as well as for the boolean fragment of L — are assigned at an *index* (world) i with respect to a *context*. I will assume that W , the space of possible worlds, is finite. Nothing important turns on this, and it simplifies things.

For the boolean bits, contexts are idle. It will be the job of the modals to quantify over possibilities compatible with the context and the job of context

³Conventions: p, q, r, \dots range over sentences of L (subject to our constraints on L); i, j, k, \dots range over worlds; and P, Q, R, \dots range over sets of worlds. If p 's denotation is invariant across contexts - if $\llbracket p \rrbracket^c = \llbracket p \rrbracket^{c'}$ no matter the choice for c and c' - let's agree to conserve a bit of ink and sometimes omit the superscript: so, e.g., the *ifs* I am focusing on here have non-modal antecedents, and so those antecedents will be context-invariant. And let's not fuss over whether what is at stake is the '*if*' of English or the '*if*' of L ; context will disambiguate.

to select the domains over which the modals do their job. What I want to say can be said in a way that is agnostic about just what kinds of things contexts are: all I insist is that, given a world, they determine a set of possibilities that modals at that world quantify over.⁴ The functions doing the determining need to be well-behaved.

Where c is a context — replete with whatever things contexts are replete with — an epistemic modal base C determined by it is just what we need:

Definition 1 (Modal Bases). Given a c , C is a modal base (for c) only if:

$$C = \lambda i. \{j : j \text{ is compatible with the } c\text{-relevant information at } i\}$$

Since the only context dependence at stake will be dependence on such bases, we can get by just as well by taking them to go proxy for *bona fide* contexts, granting them the honorific “contexts”, and relativizing the assignment of truth-values to index-modal base pairs directly. No harm comes from that, and it makes for a prettier view.

But not just any function from indices to sets of indices will do as a (proxy) context. So we constrain C 's accordingly, requiring that they are well-behaved — that is, reflexive and euclidean:

Definition 2 (Well-behavedness). C is well-behaved iff:

1. $i \in C_i$ (Reflexiveness)
2. if $j \in C_i$ then $C_i \subseteq C_j$ (Euclideaness)

C represents a (proper) context only if it is well-behaved.

Observation 1. If C is well-behaved then C_i is *closed* — well-behavedness implies that if $j \in C_i$, then $C_j = C_i$.

Proof. Suppose $j \in C_i$. Consider any $k \in C_j$. Since C is euclidean and $j \in C_i$, $C_i \subseteq C_j$. Since C is reflexive, $i \in C_i$ and thus $i \in C_j$. Appeal to euclideaness again: since $i \in C_j$, $C_j \subseteq C_k$ and hence $i \in C_k$. And once more: since $i \in C_k$, $C_k \subseteq C_i$. And now reflexiveness: $k \in C_k$ and so $k \in C_i$. (The inclusion in the other direction just is euclideaness.) \square

⁴The problems and prospects for iffiness are independent of just whose information in a context — speaker, speaker plus hearer, just the hearer, just the hearer's picture of what the speaker intends, and so on — counts for selecting the domains for the modals to do their job, and whether or not that information is information-at-a-context at all. So let's keep things simple here. If you'd rather be reading a paper which has these (and other) complexities at the forefront, see von Fintel and Gillies (2007, 2008a,b) and the references therein.

Gloss C_i as the set of live possibilities at i in C . That C_i is closed means that the live possibilities in C do not vary across worlds compatible with C .

3 Conditional operators

By saying something about what must be true of an operator for it to be a conditional operator properly so called we thereby say something about what must be true for a story to be iffy. Iffiness begins with a simple thought: conditional sentences say what might or must be if such-and-such is or turns out to be the case by expressing a conditional operator. We can get all we need out of just that little slogan. It requires two things for iffiness.

It requires, in the cases we'll care about, that *ifs* don't take a stand on whether such-and-such is the case and so they are typically happiest being uttered in circumstances in which such-and-such is compatible with the context as it stands when the conditional is issued. I will take it as a definedness condition on the semantics for conditionals that they are happily issued.⁵

Definition 3 (Definedness).

1. $(if\ p)(q)$ is appropriate (at i , in C) only if p is compatible with C_i
2. $\llbracket (if\ p)(q) \rrbracket^{C,i}$ is defined only if $(if\ p)(q)$ is appropriate (at i , in C)

This is still slippery — I have said nothing about what counts as compatibility, and haven't said what happens when an inappropriate *if* is issued — but it will do.

It also requires that a conditional expresses a relation between antecedent and consequent. That is: *if* expresses a relation between the set of antecedent possibilities and the set of consequent possibilities. Take an arbitrary conditional like $(if\ p)(q)$ at i , in C . And let P and Q be the sets of antecedent and consequent possibilities so related by the *if*. For this to be a conditional operator properly so called, what this expresses must be a relation R between P , perhaps plus some domain D_i , and Q .

D_i is the set of possibilities relevant for the *if* at i . Although I have put that as a function of i , depending on your favorite theory D_i may be a function of i , of C , of p , of q , or of your kitchen sink. We will return to that shortly. No matter your favorite theory, we can still *ex ante* agree to this much: i is *always*

⁵The requirement isn't novel. See, e.g., Stalnaker (1975); von Stechow (1998); Gillies (2004).

among the possibilities relevant for an *if* at *i*, and *only* possibilities compatible with the context are relevant for an *if* at *i*. That is: $i \in D_i$ and $D_i \subseteq C_i$. The first is a platitude, the second means that an *if* at *i* is supposed to say something about the possibilities compatible with *C*.

Even before taking a stand on what sort of relation between antecedent possibilities and consequent possibilities that a conditional properly so called expresses, we know that it must still express such a relation. So let's insist that we can put things that way.

Definition 4 (Relationality). (*if* \cdot)(\cdot) expresses a conditional only if it's truth conditions can be put this way:

$$\text{if defined, } \llbracket (\text{if } p)(q) \rrbracket^{C,i} = 1 \text{ iff } R(D_i \cap P, Q)$$

for some set of possibilities D_i and relation R , where $i \in D_i$ and $D_i \subseteq C_i$.

But not just any relation between $D_i \cap P$ and Q counts as a relation that a conditional properly so called could express. I insist on three minimal constraints: (i) that $D_i \cap P$ imposes some order on the set of Q 's so related; (ii) that Q matters to whether the relation holds; (iii) and that — plus or minus just a bit — only the relationship between the possibilities in $D_i \cap P$ and the possibilities in Q matter to whether the relation holds. These are not controversial, but do bear some unpacking.

First, the order imposed by the antecedent:

Definition 5 (Order). R is orderly iff:

1. $R(D_i \cap P, P)$
2. $R(D_i \cap P, Q)$ and $Q \subseteq S$ imply $R(D_i \cap P, S)$
3. $R(D_i \cap P, Q)$ and $R(D_i \cap P, S)$ imply $R(D_i \cap P, Q \cap S)$

R is something (*if* \cdot)(\cdot) at *i* could mean only if it is orderly.

Such R 's are precisely those for which the set of Q 's a $D_i \cap P$ bears it to form an ideal that contains P . That is an aesthetic reason for so constraining R . Such R 's also jointly characterize the basic conditional logic.⁶ The relational properties correspond to reflexivity, right upward monotonicity, and conjunction. That is another — only partly aesthetic — reason for so constraining them.

⁶See [Veltman \(1985\)](#) for a proof.

Second, R must care about consequents. (When put as a property of quantifiers, this is usually called *activity*.)

Definition 6 (Activity). R is active iff:

if $D_i \cap P \neq \emptyset$ then there is a Q and Q' such that: $R(D_i \cap P, Q)$ but not $R(D_i \cap P, Q')$

R is something (*if* \cdot)(\cdot) at i could mean only if it is active.

This means that R cares about how $D_i \cap P$ relates to Q . So long as there are some relevant possibilities, there have to be some Q 's for which the relation holds and some for which it doesn't.

And finally: R is a relation between the sets of possibilities. Thus if R holds at all between D_i -plus-the-antecedent-determined- P and the consequent-possibilities Q , R will hold between any two sets of things that play the right possibility role. The idea is simple, the execution harder. That is because to say this properly, we have to know more about what goes in to determining D_i , and that will vary depending on your favorite story about *if*.

Three examples: (1) Suppose your favorite story takes *if* to be a variably strict conditional (Stalnaker, 1968; Lewis, 1973). For every world i , let \preceq_i be an ordering of worlds, a relation of comparative similarity (at least) weakly centered on i . Given a conditional (*if* p)(q) at i in C , you will want to identify D_i with the set of possibilities no more dissimilar than the most similar p -world to i , restricted by C_i . (2) Perhaps your favorite Lewis-inspired story comes not from D.K. but from C.I. You thus take *if* to be strict implication. Then you will want to identify D_i instead with the set W of all possibilities, restricted by C_i . But that, too, can be put in terms of orderings: your ordering \preceq_i is universal, treating all worlds the same. Whence it follows that—since the nearest p -world is the same distance from i as is every world—taking D_i to be the set of possibilities no further from i as the nearest p -world amounts to taking D_i to be the set of all worlds W , restricted by C_i . (3) Suppose you are smitten by truth-tables, and your favorite story about indicatives is the material conditional story. You will then want to take D_i to be $\{i\}$. Equivalently: you will have a maximally discerning ordering—every world, like no man, is an island—and take D_i to be the set of closest worlds to i *simpliciter*.

What is important is this: suppose your favorite story posits some additional structure to modal space to find just the right worlds which, when combined with P , gives the set of worlds relevant for evaluating Q . That means that your

favorite story cares about how P relates to Q but also about the distribution of the worlds in P compared to the distribution in Q — perhaps insisting that it is the *closest* worlds in P to i that must bear R to Q . If we systematically swap possibilities for possibilities in a way that we preserve the relevant structure, then the conditional relation ought to hold pre-swapping iff it holds post-swapping. And *mutatis mutandis* for D_i : since once the posited structure does its job determining D_i , then any systematic swapping of possibilities that leaves the domain untouched should also leave the conditional relation untouched.⁷

If π is such a mapping and P a set of worlds, let $\pi(P)$ be the set of worlds i such that $\pi(j) = i$ for some $j \in P$. Then:

Definition 7 (Quality). R is qualitative iff:

$$R(D_i \cap P, Q) \text{ implies } R(\pi(D_i \cap P), \pi(Q))$$

R is something (*if* \cdot)(\cdot) at i could mean only if it is qualitative.

This does generalize the familiar constraint on quantifiers — it allows conditional operators to care about both the relationship between P and Q , but also where the satisfying worlds are. If \preceq_i is the universal ordering then this requirement reduces to the more familiar quantitative one (restricted to C_i). And if $D_i = \{i\}$, it trivializes.

I am insisting that a story is iff only if the truth conditions for an indicative (*if* p)(q) at i in C_i can be put as a relation between R between $D_i \cap P$ and Q . And we have insisted that the relation be constrained in sensible ways — it must impose some order on sets of consequent possibilities, it must care about consequents, and it must not care about the intrinsic properties of possibilities. Still, it seems open to take the conditional to be true just in case most/many/several/some/just the right possibilities in $D_i \cap P$ are in Q . But that is not so: given our constraints, *if* must express inclusion.⁸

Observation 2. Assume R expresses a conditional relation. Then $R(D_i \cap P, Q)$ holds iff $D_i \cap P \subseteq Q$.

⁷This is, of course, a natural extension of the familiar requirement that quantifiers be *quantitative*: for Q to be a quantifier (with domain E) it must be that $Q_E(A, B)$ iff $Q_E(f(A), f(B))$ where f is an isomorphism of E . Once we have structure to our domain, this will not do. The more general constraint is then to require that Q be invariant under \mathcal{O} -automorphisms of the domain, where \mathcal{O} is the ordering that imposes the posited structure. We can get by with slightly less: namely, stability under D_i -invariant automorphisms.

⁸This was first proved by van Benthem — see, e.g., van Benthem (1986). The version I give is simpler (we're ignoring the infinite case) and a bit more general (slightly weaker assumptions); the proof is based on one in Veltman (1985), but generalizes it to cover the case of ordering semantics for conditional operators.

Proof. Assume that R is a conditional relation. I care about the left-to-right direction.

Suppose — for *reductio* — that $R(D_i \cap P, Q)$ but $D_i \cap P \not\subseteq Q$. What we'll see is: (i) $R(D_i \cap P, P \cap Q)$; (ii) the world that witnesses that $D_i \cap P \not\subseteq Q$ can be exploited (since R is qualitative) to show that no world in $P \cap Q$ plays a role in $R(D_i \cap P, P \cap Q)$ holding — from which it follows that $R(D_i \cap P, \emptyset)$; (iii) from which it follows that $D_i \cap P$ must be empty — a contradiction.

Ad (i): By hypothesis $R(D_i \cap P, Q)$. Since R is orderly (Definition 5), $R(D_i \cap P, P)$. Hence, $R(D_i \cap P, P \cap Q)$.

Ad (ii): Let j be a witness to $D_i \cap P \not\subseteq Q$. So $j \in D_i \cap P$ but $j \notin Q$. Now pick any confirming instance k — that is, any $k \in (D_i \cap P) \cap Q$ — and let π be the mapping that swaps k and j and leaves all else untouched:

- $\pi(j) = k$
- $\pi(k) = j$
- $\pi(i) = i$ for every $i \notin \{j, k\}$

By (i) $R(D_i \cap P, P \cap Q)$. Hence, since R is qualitative (Definition 7), $R(\pi(D_i \cap P), \pi(P \cap Q))$. But π doesn't affect $D_i \cap P$. So: $R(D_i \cap P, \pi(P \cap Q))$. That is: R holds between $D_i \cap P$ and both $P \cap Q$ and $\pi(P \cap Q)$. Hence — since R is orderly (Definition 5) — it holds also between $D_i \cap P$ and their intersection: $R(D_i \cap P, (P \cap Q) \cap \pi(P \cap Q))$. But $\pi(P \cap Q) = ((P \cap Q) \setminus \{j\}) \cup \{k\}$, so their intersection is $(P \cap Q) \setminus \{j\}$. So: $R(D_i \cap P, (P \cap Q) \setminus \{k\})$. Which is to say that k is irrelevant for R 's holding. But k was any world in $(D_i \cap P) \cap Q$, so finiteness plus Definition 5 implies $R(D_i \cap P, \emptyset)$.

Ad (iii): R is orderly. Since $R(D_i \cap P, \emptyset)$, it holds that for any S whatever $R(D_i \cap P, S)$. Whence, since R is active (Definition 6), it follows that $D_i \cap P = \emptyset$. And that contradicts the assumption that $D_i \cap P \not\subseteq Q$. \square

The intuitive version is just this: if R holds between $D_i \cap P$ and Q then the former must be included in the latter. That is because if things didn't go that way then the witnessing counterexample world could play the role of any one of the confirming worlds. But that would mean that confirming worlds play no role. Nothing like that could be something a conditional properly so called

could mean. So $D_i \cap P$ must be included in Q after all.

4 Three facts

So iffiness requires that *if* means *all*. And it requires that no matter what other operators we might in its neighborhood. That spells trouble for fans of old school iffiness — like me — because of three simple facts about how indicative conditionals and epistemic modals play together.⁹

I have lost my marbles. I know that one of them — Red or Yellow — is in the box. But I don't know which. I find myself saying things like:

- (2) Red might be in the box and Yellow might be in the box. So, if Yellow isn't in the box, then Red must be; and if Red isn't in the box, then Yellow must be

Conjunctions of epistemic modals like *Red might be in the box and Yellow might be in the box* are especially useful when the bare prejacent partition the possibilities compatible with the context. The first fact is simply that *ifs* are consistent with such partitioning modals (or rather, conjunctions thereof).

Fact 1. The following are relatively consistent:

- a. *might* S_1 and *might* S_2
- b. *if not* S_1 , then *must* S_2 ; and *if not* S_2 , then *must* S_1

That is: if (a) is a partitioning modal, then the conjunction of (a) and (b) is consistent.

I do not know whether Carl made it to the party. But wherever Carl goes, Lenny is sure to follow. So if Carl is at the party, Lenny must be — Lenny is at the party, if Carl is. We just glossed an *if* with a commingling epistemic *must* by an *if* with no (overt) modal at all. Thus:

⁹“Facts” may be laying it on a little thick. The *judgments* are robust, and the costs high for denying the facts as I put them. That's all true even if what we may say about them is a matter for disputing. But it does not much matter: what I really care about is three characteristic *seeming facts* about *ifs*, *mights*, and *musts* that *at first blush* look like the kind of thing our best story ought to answer to. So let's agree to take them at face value and see where that leads. Later, if your English breaks with mine or if your old school pride overwhelms, you can deny the facts or explain them away as your preferences dictate.

But since iffiness isn't the only game in town — indeed, in some circles, it's really a game only at the edge of town — and since predicting the facts is something any story old school or otherwise must do, we should state the facts in a way that is agnostic on the iffy thesis. So the facts characterize what is true of sentences in (quasi-)English, not what is true of their LFs in some regimented intermediate language.

- (3) a. If Carl is at the party, then Lenny must be at the party \approx
 b. If Carl is at the party, then Lenny is at the party

This pair has the ring of mutual entailers. And for good reason: (3a) looks to be true iff (3b) is.

For suppose that such *ifs* validate a deduction theorem and modus ponens, and that *must* is factive. The left-to-right direction: assume that (3a) is true. And consider the argument:

- (4) If Carl is at the party, then Lenny must be at the party; Carl is at the party; So: Lenny is at the party

The first two sentences — intuitively speaking — entail the third. And that is pushed on us by the assumptions: from the first two sentences we have (by modus ponens) that *Lenny must be at the party*, which by factivity entails *Lenny is at the party*. Apply the deduction theorem and we have that *If Carl is at the party, then Lenny must be at the party* entails *If Carl is at the party, then Lenny is at the party*. Since we have assumed that (3a) is true, it follows that (3b) must be. The right-to-left direction: assume that (3b) is true. And consider:

- (5) If Carl is at the party, then Lenny is at the party; Carl is at the party; So: Lenny must be at the party

This is as intuitive an entailment as we are likely to find. Whence it follows by the deduction theorem that *If Carl is at the party, then Lenny is at the party* on its own entails *If Carl is at the party, then Lenny must be at the party*. And so if (3b) is true so must be (3a). Hence the ring of mutual entailment.

Fact 2. Conditional sentences like these are true in exactly the same scenarios:

- a. *if* S_1 , *then must* S_2
 b. *if* S_1 , *then* S_2

The glossing that this pattern permits is a nifty trick. But that is only half the story. The interaction between *if* and *might* is different, and underwrites a different glossing by underwriting a different set of mutual entailments.

Alas, my team are not likely to win it all this year. It is late in the season and they have made too many miscues. But they are not quite out of it. If they win their remaining three games, and the team at the top lose theirs, my team will be champions. But our last three are against strong teams and their

last three are against cellar dwellers. Still, my spirits high: if they win out, they might win it all. Put another way, within the (relevant) my-team-wins-out possibilities — of which there are some — lies a my-team-wins-it-all possibility; there is a my-team-wins-out possibility that is a my-team-wins-it-all possibility. But that is just to say that there are (relevant) my-team-wins-out-and-wins-it-all possibilities. Maybe not very many, and maybe not so close, but some.

Apart from keeping hope alive, the example also illustrates the mundane fact that we can gloss an indicative with a commingling epistemic *might* by a conjunction under the scope of *might*:

- (6) a. If my team wins out, they might win it all \approx
 b. It might turn out that my team wins out and wins it all

That gloss sounds pretty good. And for good reason: conjunctions that would have to be happy if the truth of (6a) and (6b) could come apart are not happy at all:

- (7) a. #If my team wins out, they might win it all; but they can't win out and win it all
 b. #It might turn out that my team wins out and wins it all, but there's no way that if they win out, they might win it all

That gives us the third fact about how *ifs* play with modals.¹⁰

Fact 3. Sentences like these are true in exactly the same scenarios:

- a. *if* S_1 , *then might* S_2
 b. *it might be that* [S_1 and S_2]

It's now a matter of telling some story, iff or otherwise, that answers to these facts. Old school iffiness will have trouble with them; new school

¹⁰There is a wrinkle: Fact 3 implies that *if* S_1 , *then might* S_2 is true in just the same spots as *if* S_2 , *then might* S_1 . Seems odd:

- (i) a. If I jump out the window, I might break a leg
 b. If I break a leg, I might jump out the window

The first is true, the second an overreaction. I intend, for now, to sweep this under the same rug that we sweep the odd way in which *Some smoke and get cancer/Some get cancer and smoke* don't feel exactly equivalent even though *some* is a symmetric quantifier if ever there was one. (The rug in question seems to be the tense/aspect rug; similar considerations drive the discussion of contraposition of bare conditionals in von Stechow (1997).)

anti-iffiness predict them trivially.

5 Scope matters

Iffy stories take *if* to be a connective, an iffy connective, and the same iffy connective no matter whether we have a commingling epistemic modal or not. In cases where there is a modal, scope issues have to be sorted out. Take a sentence of the form

(8) If S_1 then MODAL S_2

and let S'_1 (S'_2) be the L -representation for sentence S_1 (S_2), and *modal* the L -representation for MODAL. We have a short menu of options for the relevant LF for such a sentence — either the narrowscoped (9a) or the widescoped (9b):

(9) a. (*if* S'_1)(*modal* S'_2)
 b. *modal* (*if* S'_1)(S'_2)

If you want to put your LFs in tree form, be my guest: opting for narrowscoping means opting for sisterhood between MODAL and S_2 ; opting for wide-scoping means opting for sisterhood between MODAL and *if* S_1 *then* S_2 .

The trouble for iffiness is that, since *if* expresses inclusion, neither choice will do. That is because our story also has to answer to the facts. One choice for scope relations seems ruled out by the consistency facts (Fact 1), the other by the entailments (Facts 2 and 3). And that looks like pretty bad news for old school iffiness.

To put the trouble precisely, we need one more ground rule. Contexts, we said, have the job of determining the domains the modals quantify over. Modals, I'll assume, do their job in the usual way by expressing their usual quantificational oomph over those domains: *must* (at i , with respect to C) acts as a universal quantifier, and *might* an existential quantifier, over C_i .

Definition 8 (Modal Force).

1. $\llbracket \textit{might } p \rrbracket^{C,i} = 1$ iff $C_i \cap \llbracket p \rrbracket^C \neq \emptyset$
2. $\llbracket \textit{must } p \rrbracket^{C,i} = 1$ iff $C_i \subseteq \llbracket p \rrbracket^C$

This serves as another justification for requiring C to be well-behaved: reflexivity means that whatever is the case at i is relevant, though perhaps not

decisive, to the truth of a modal claim at i ; euclideaness means that if a possibility is compatible with the context, then that is settled in the context.

Now suppose we plump for narrowscoping. Then, given the ground rules, we cannot predict the consistency of the likes of (2) and that means that we cannot square iffiness with Fact 1.

That stretch of discourse begins with a partitioning modal claim *Red might be in the box and Yellow might be in the box* and goes from there to two *ifs*. Narrowscoping in L :

- (10) a. Modal claim:
- (i) Red might be in the box and Yellow might be in the box
 - (ii) $\text{might } p \wedge \text{might } q$
- b. First conditional:
- (i) If Yellow isn't in the box, then Red must be
 - (ii) $(\text{if } \neg q)(\text{must } p)$
- c. Second conditional:
- (i) If Red isn't in the box, then Yellow one must be
 - (ii) $(\text{if } \neg p)(\text{must } q)$

Any good story has to allow that the bundle of *ifs* in (10b) and (10c) is consistent with the conjunction in (10a). But this — even without taking a stand on how we choose D_i — seems to be beyond what can be delivered by an iffy story.

Observation 3. If (10a) is a partitioning modal with respect to C , then the (narrowscoped) sentences in (10) can't all be true.

Proof. For suppose otherwise — that the regimented formulas in L are all true at a world, say i , with respect to C . Just one of my marbles is in the box. So any world in C_i is either a p -world or a q -world, but not both; C is well-behaved, so $i \in C_i$. Thus: either (1) $i \in \llbracket \neg q \rrbracket$, or (2) $i \in \llbracket \neg p \rrbracket$.

If (1): By hypothesis $\llbracket (\text{if } \neg q)(\text{must } p) \rrbracket^{C,i} = 1$, and so $D_i \cap \llbracket \neg q \rrbracket^C \subseteq \llbracket \text{must } p \rrbracket^C$. Since $i \in D_i$, it then follows that $i \in \llbracket \text{must } p \rrbracket^C$ — which is to say $\llbracket \text{must } p \rrbracket^{C,i} = 1$. Thus C_i has only p -worlds in it. But that is at odds with the second conjunct of (10a): its truth at i guarantees a q -world, hence a $\neg p$ -world, in C_i .

If (2): By hypothesis $\llbracket (\text{if } \neg p)(\text{must } q) \rrbracket^{C,i} = 1$, and so $D_i \cap \llbracket \neg p \rrbracket^C \subseteq \llbracket \text{must } q \rrbracket^C$. Since $i \in D_i$, it then follows that $i \in \llbracket \text{must } q \rrbracket^C$ — which is to say $\llbracket \text{must } q \rrbracket^{C,i} = 1$. Thus C_i has only q -worlds in it. But that is at odds with the first conjunct of (10a): its truth at i guarantees a p -world, hence a $\neg q$ -world, in C_i . \square

We should *ceteris paribus* go with narrowscoping. But, at least so it appears, *ceteris* are not very *paribus*. So suppose instead that commingling modals scope over the *if*-constructions in which they occur. Now it is the mutual entailments — as in (3) and (6) — that cause trouble. Widescoping in *L*:

- (11) a. For (3a):
 (i) If Carl is at the party, then Lenny must be at the party
 (ii) *must (if p)(q)*
- b. For (3b):
 (i) If Carl is at the party, then Lenny is at the party
 (ii) *(if p)(q)*
- (12) a. For (6a):
 (i) If my team wins out, they might win it all
 (ii) *might (if p)(q)*
- b. For (6b):
 (i) It might turn out that my team wins out and wins it all
 (ii) *might (p ∧ q)*

What is needed is a semantics for the conditional operator (*if* ·)(·) that can predict both patterns. But — assuming widescoped LFs — paths that might lead to one pretty reliably lead away from the other.

So far I have insisted that *i* is always among the relevant worlds to an *if* at *i* ($i \in D_i$) and also that only worlds compatible with the context are relevant ($D_i \subseteq C_i$). Here I am in good company. But perhaps there is even more interaction between domains and contexts.

Some theories say that there can be no difference in domains for conditionals between worlds compatible with the context, others disagree:

Definition 9 (Egalitarianism & Chauvinism).

1. A semantics is *egalitarian* iff if whenever $j \in C_i$ then $D_j = D_i$
2. A semantics is *chauvinistic* iff it is not egalitarian

Egalitarianism requires domains to be invariant across worlds compatible with a context. That means that distinctions made by *D*'s are unaffected when those distinctions are made from behind the veil of ignorance (we don't know which world compatible with *C* is the actual world). Chauvinistic theories allow differences from behind the veil to matter to what possibilities get selected

for domainhood, and thus allowing the possibility that a $j \in C_i$ be such that $D_j \neq D_i$. Once we have agreed that, for any i , D_i selects from the worlds compatible with C and must include i , it is a further question whether we want to be egalitarians or chauvinists.

The history of the conditional is littered with chauvinists. The material conditional analysis is chauvinistic. It says that the only possibility relevant for the truth of an *if* at i in C is i itself. And similarly for an *if* at j — there only j matters. Thus, except in the odd case where the context rules out uncertainty altogether, we will have that $D_j \neq D_i$, for any choice of i and j compatible with C . But it is hard to be a chauvinist. That is because, assuming the particulars of the chauvinistic theory are compatible with there being a $(p \wedge \neg q)$ -world in C_i but not in D_i , no such story will render $(\text{if } p)(q)$ and $\text{must } (\text{if } p)(q)$ mutual entailers. And so — given widescoping — no such story will predict entailments like those in (11) and so will have a hard time with Fact 2.

For consider a $(p \wedge \neg q)$ -world — call it j — and suppose that C_i does, but D_i does not, contain j . Then every possibility in $D_i \cap \llbracket p \rrbracket$ is in $\llbracket q \rrbracket$ and the plain *if* is true (at i , in C): $\llbracket (\text{if } p)(q) \rrbracket^{C,i} = 1$. But not the widescoped *if*. That is because there is a world in C_i — namely j — such that not every possibility in $D_j \cap \llbracket p \rrbracket$ is a possibility in $\llbracket q \rrbracket$. Thus $\llbracket (\text{if } p)(q) \rrbracket^{C,j} = 0$ and so it is not true that the plain *if* is true at every world in C_i and so $\llbracket \text{must } (\text{if } p)(q) \rrbracket^{C,i} = 0$. The reason here is simple: chauvinism plus our ground rules pretty much guarantee that the domain for the modals at i will properly include the domain for indicatives at i . But that plus widescoping means that $(\text{if } p)(q)$ makes a weaker claim than does $\text{must } (\text{if } p)(q)$.

The sad truth is that egalitarianism fares no better. But here it is (12), and hence Fact 3, that is trouble. That is because egalitarianism implies that D_i covers C_i :

Observation 4. Egalitarianism implies that $D_i = C_i$.

Proof. Assume otherwise. $D_i \subseteq C_i$, so there must be a $j \in C_i$ such that $j \notin D_i$. Egalitarianism gives us that $D_j = D_i$. But we know that $j \in D_j$. Contradiction. \square

Thus if D_i reflects some measure of proximity to i , egalitarianism implies that the underlying ordering is centered not pointwise on i but setwise on the worlds compatible with C .

Any such story, whether D_i is derived from some underlying ordering or not, is really a strict conditional story after all — *if*, *might* and *must* quantify over the same domain of possibilities, and an *if* is true at i iff all of the antecedent worlds in that domain are consequent worlds. That means that an *if* at i (in C) is true iff the corresponding material conditional is true at every possibility compatible with C . And that means that such an *if* is true at i iff the material conditional, widescoped by *must*, is true at i . Given well-behavedness (Definition 2), explaining the facts about (11) is then easy: $(if\ p)(q)$ is equivalent to $must\ (p \supset q)$ which, given well-behavedness, is equivalent to $must\ must\ (p \supset q)$. And that, in turn, is equivalent to $must\ (if\ p)(q)$.¹¹

But there is still trouble afoot. From this degree of fit between D_i and C_i it follows straightaway that no two possibilities compatible with C can differ over an *if* issued in C . That is:

Observation 5. Egalitarianism implies

$$\llbracket (if\ p)(q) \rrbracket^{C,i} = 1 \text{ iff for every } j \in C_i : \llbracket (if\ p)(q) \rrbracket^{C,j} = 1.$$

Proof. $\llbracket (if\ p)(q) \rrbracket^{C,i} = 1$ iff $D_i \cap \llbracket p \rrbracket \subseteq \llbracket q \rrbracket$. Given egalitarianism: iff, for any $j \in C_i$, $D_j \cap \llbracket p \rrbracket \subseteq \llbracket q \rrbracket$. Equivalently: iff, for any $j \in C_i$, $C_j \cap \llbracket p \rrbracket \subseteq \llbracket q \rrbracket$ — that is, iff for every such j , $\llbracket (if\ p)(q) \rrbracket^{C,j} = 1$. \square

Any story with this equivalence — when coupled with widescoping — will have a hard time with entailments like those in (12) and so will have trouble with Fact 3. That is because, given the usual quantification oomph for the modals (Definition 8), we get triviality:

Observation 6. Egalitarianism implies:

$$\llbracket might\ (if\ p)(q) \rrbracket^{C,i} = 1 \text{ iff } \llbracket must\ (if\ p)(q) \rrbracket^{C,i} = 1$$

Proof. Note that $\llbracket might\ (if\ p)(q) \rrbracket^{C,i} = 1$ iff the plain conditional $(if\ p)(q)$ is true somewhere in C_i . But by Observation 5 the plain *if* is true somewhere in

¹¹For the record: (i) Stalnaker (1975) is not officially agnostic about chauvinism, but that is only because he there requires that \leq_i induce a total order that is centered pointwise on i . But the pragmatic mechanisms he develops there are agnostic on the chauvinism question — what he says about how the context constrains selection functions is compatible with both egalitarianism and chauvinism. (ii) I myself see every reason for egalitarianism and none for chauvinism — for one thing that makes for an easy explanation of why negated *ifs* sounds so much like a conjunction of antecedent and negated consequent all under the scope of *might*. (iii) I like the result that egalitarianism implies strictness for *if*, since that is an upshot I like anyway — for more on context-dependent strictness see, e.g., von Fintel (1998, 2001); Gillies (2004, 2007, 2008).

C_i iff it is true everywhere in C_i . And it is true everywhere in C_i just in case $\llbracket \text{must}(\text{if } p)(q) \rrbracket^{C,i} = 1$. \square

When coupled with widescoping, such a story can account for the mutual entailment between (12a) and (12b), but only by trivializing: *might* ($p \wedge q$) entails *must* (*if* p)(q). Not a happy result.

Iffiness requires conditionals, if they are to be properly so called, to have a structure that does not play nice with modals. For no way of resolving the relative scopes will work (and there is no good reason to think we should settle for anything less than a uniform story). What causes the trouble is that *if*, to be iffy, has to expression inclusion. But the Facts don't seem to allow that. If we widescop, then sometimes that seems all right — when the modal in question has universal quantificational oomph. But only when: when the modal is existential, *if* looks more like conjunction than inclusion. And narrowscoping is no better, rendering all manner of coherent bits of discourse inconsistent.

That is pretty bad news for iffiness. True, we could save iffiness by denying some Fact or other. That is both boring and inadvisable. That strategy wears its boringness on its sleeve. That strategy is inadvisable because the Facts were chosen not at random but with an eye to the competition: they are facts that new school anti-iffiness predicts so easily hardly anyone has taken notice.

6 Iffiness lost

Lewis (1975) famously argued that *ifs* appearing in certain quantificational constructions (under adverbs of quantification) are not properly iffy, that the *if* in

$$\left. \begin{array}{c} \text{Always} \\ \text{Sometimes} \\ \text{Never} \end{array} \right\} \text{if a man owns a donkey, he beats it}$$

is not a conditional operator but instead acts as a non-connective whose only job is to mark an argument-place. The relevant structure is not a Q -ADVERB scoped over a conditional, he said, but something like

$$Q\text{-ADVERB} + \textit{if-clause} + \textit{then-clause}$$

The job of the *if*-clause is to restrict the domain over which the adverb (unselectively) quantifies, and allegedly that restricting job is a job that cannot be done by treating *if* as a conditional connective. If Q -ADVERB is universal,

maybe an iffy *if* will work; but if it is existential, then conjunction does better. I want to set the issue about adverbial (and adnominal, for that matter) quantifiers aside for two reasons. First because I doubt the allegation sticks.¹² But that is another argument for another day. And second because it will do us good to focus on simple cases.

Still, the trouble for iffiness that is center stage here is quite a lot like this. We have to make room for interaction between *if*-clauses and the domains our modals quantify over. But that interaction is tricky. That is because it looks impossible to assign *if* the same conditional meaning — thereby taking its contribution to be an iffy one — in all of our examples. Indeed, when the modal is universal a conditional relation looks good; but when the modal is existential, conjunction looks better.

This is pretty much the same trouble Lewis saw for *if*'s occurring under adverbs of quantification, and led him to conclude that such *if*'s are non-connectives. Just as with adverbial quantifiers, there is a fast and easy solution to the problem if we get rid of the old school idea that *if* is a conditional connective and plump instead for anti-iffiness.¹³

The most forceful way of putting the anti-iffy thesis is Kratzer's:

The history of the conditional is the history of a syntactic mistake. There is no two-place “if... then” connective in the logical forms for natural languages. “If”-clauses are devices for restricting the domains of various operators. Kratzer (1986, p. 11)

Instead of searching for a conditional operator properly so called that contributes the same bit whether it commingles with a modal or not, we search for an operator for *if* to restrict.

And, for indicative conditionals, we do not have to search far: the operators are (possibly covert) epistemic modals. Take a conditional sentence of the form

(8) If S_1 then S_2

Anti-iffiness says that its LF does not have some conditional operator linking S_1 and S_2 . Instead it's just a modal claim expressing some quantificational force

¹²There are ways to get the jobs done after all: see, e.g., Belnap (1970); Dekker (2001); von Stechow (2003).

¹³See, e.g., Kratzer (1981, 1986); von Stechow (1998). But it has also gone in for some rough treatment by von Stechow and Iatridou (2003).

\mathcal{Q} , saying that among the (relevant) S_1 -worlds, \mathcal{Q} of them are S_2 -worlds. The modal is the operator, the *if*-clause restricts its domain of quantification.¹⁴ When no overt modal is present — as in (12) — take it to be *must*.

So it is the modals, not the *ifs*, that take center stage. They have logical forms along the lines of $\text{MODAL}(p)(q)$, with the usual quantificational force:

Definition 10 (Modal Force, Amended).

1. if defined, $\llbracket \text{might}(p)(q) \rrbracket^{C,i} = 1$ iff $(C_i \cap \llbracket p \rrbracket) \cap \llbracket q \rrbracket^C \neq \emptyset$
2. if defined, $\llbracket \text{must}(p)(q) \rrbracket^{C,i} = 1$ iff $(C_i \cap \llbracket p \rrbracket) \subseteq \llbracket q \rrbracket^C$

This plus two assumptions buys an anti-iffy semantics that easily squares with both the consistency facts (Fact 1) and the mutual entailments (Facts 2 and 3).

First: assume that when no restrictor is explicit — as in *Blue might be in the box* or *Yellow must be in the box* — the first argument in the LF of the modal is filled by your favorite tautology (\top). In those cases there is nothing to choose between an analysis that follows our earlier Definition 8 and an analysis that follows Definition 10, and so the latter generalizes the former.

Second: assume that the job of *if*-clauses is to make a (non-trivial) restrictor explicit. Since we are supposing that plain *ifs* — those without an explicit commingling modal — carry a covert *must*, that is about all we need to predict that stretches of conditional and modal talk like that in (2) are consistent and the mutual entailments like those in (3) and (6).¹⁵ Collecting the pieces:

Definition 11 (Anti-iffy Semantics).

1. A sentence of the form *if* S_1 *then* S_2 has LF:

- a) $\text{MODAL}(S'_1)(S^*)$ if $S_2 = \text{MODAL } S^*$
- b) $\text{must}(S'_1)(S'_2)$ otherwise

2. Truth conditions as in Definition 10

(Here S'_1 (S'_2) is the LF for sentence S_1 (S_2).

¹⁴That means opting for sisterhood between MODAL and S_2 , and dominance between MODAL and *if* S_1 .

¹⁵Equivalently, we could treat all *ifs* as implicitly modal: *if* S_1 *then* S_2 invariably gets an analysis along the lines of $\text{must}(S'_1)(S'_2)$. If S_2 happens to carry a modal — in particular if S_2 has as LF $\text{modal}(\top)(r)$ — then the well-behavedness of C guarantees that $\text{must}(S'_1)(S'_2)$ is true at i in C iff $\text{modal}(S'_1)(r)$ is. The inner modal carries the day, but under the restriction imposed by the outer modal. This is equivalent to what Geurts (2005) calls “fusing” of the two modals.

Return to the case of the missing marbles. Taking the *if*-clauses to be restrictors:

- (13) a. Modal claim:
- (i) Red might be in the box and Yellow might be in the box
 - (ii) $might(\top)(p) \wedge might(\top)(q)$
- b. First “conditional”:
- (i) If Yellow isn’t in the box, then Red must be
 - (ii) $must(\neg q)(p)$
- c. Second “conditional”:
- (i) If Red isn’t in the box, then Yellow must be
 - (ii) $must(\neg p)(q)$

It’s modals all the way down. And the modals can all be true together.

Observation 7 (Anti-Iffy Prediction of Fact 1). Assume the Anti-iffy Semantics (Definition 11). And suppose, in C , that (13a) is a partitioning modal. Then the sentences in (13) are relatively consistent.

It is easy enough to see how. I am in i and there are just two worlds compatible with the facts I have, i and j . The first is a $(p \wedge \neg q)$ -world, the second a $(q \wedge \neg p)$ -world. The restrictors in (13a) are trivial, so it is true at i iff C_i has a p -world in it and a q -world in it; i witnesses the first conjunct, j the second. The restricting *if*-clause of (13b) makes sure that the *must* ends up quantifying only over the $\neg q$ -worlds compatible with C : (13b) is true at i iff all of the worlds $C_i \cap \llbracket \neg q \rrbracket$ are p -worlds. And the only one, i , is. Similarly for the *must* in (13c): it quantifies over the $\neg p$ -worlds in C_i , checking to see that they are all q -worlds.

It is just as easy to square this picture with Facts 2 and 3.

Observation 8 (Anti-Iffy Prediction of Facts 2 and 3). Assume the Anti-iffy Semantics (Definition 11). Then:

1. $If S_1, then S_2 \approx If S_1, then must S_2$
2. $If S_1, then might S_2 \approx might [S_1 and S_2]$

Take them in order. the interaction of *if* and *must* at stake in Fact 2. The two conditionals *If Carl is at the party, then Lenny must be at the party* and *If Carl is at the party, then Lenny is at the party* have the same LF: $must(p)(q)$. It would thus be hard, and pretty undesirable, for them not to entail one another.

And the interaction of *if* and *might*:

- (14) a. For (6a):
- (i) If my team wins out, they might win it all
 - (ii) $\text{might}(p)(q)$
- b. For (6b):
- (i) It might turn out that my team wins out and wins it all
 - (ii) $\text{might}(\top)(p \wedge q)$

If (14b) is true at i in C then C_i has a $(p \wedge q)$ -world in it. But then that same world must be in $C_i \cap \llbracket p \rrbracket$. It is a q -world, and that will witness the truth of (14a) at i . Going the other direction: if (14a) is true at i in C , then there are some q -worlds in $C_i \cap \llbracket p \rrbracket$. Any one of those will do as a $(p \wedge q)$ -world in C_i , and that is sufficient for (14b) to be true at i .

These explanations are wicked easy. And, given the trouble for iffiness, it looks like the only game in town is to deny that *if* is a conditional operator in the first place. That stings.

7 Iffiness regained

The problem for iffiness is that there is an interaction between *if*-clauses and the domains our modals quantify over. That is an interaction that seems hard to square with the thesis that *if* is a binary operator with a conditional meaning if we assume that it has the same meaning in each of the cases we care about here.

But we have overlooked a possibility. We insisted that for a story to be iffiness it must say that $(\text{if } p)(q)$ at i in C expresses some relation R between $D_i \cap P$ and Q , where P and Q are the sets of antecedent and consequent worlds. That is all right. But we unthinkingly assumed that the context relevant for figuring out what these sets of worlds are must always be C just because that was the context as it stood when the *if* was issued. That was a mistake, and setting it straight sets the record straight for old school iffiness.

The Ramsey test — the schoolyard version, anyway — says that a conditional *if* S_1 *then* S_2 , uttered against some background context, is true just in case adding the information carried by S_1 to that context lands you in a spot in which S_2 is true. That is pretty much right. But since truth depends on context and index, that means that “adding the information carried by S_1 ” has two jobs

to do and we have to keep track of how both get done. One job is to restrict the set of possibilities throughout which we check for S_2 's truth. We check to see whether, for every (relevant) possibility in which S_1 is true, S_2 is true. That is the *index-shifting* job. The other job is to contribute to the background context against which we check for S_2 's truth. When we check whether S_2 is true at some S_1 -possibility, we do so not with respect to the context as it was when the conditional was issued, but the derived or subordinate context got by hypothetically adding the information carried by the antecedent to it. That is the *context-shifting* job.

Here is the simplest way to keep track of both jobs *if*-clauses do:

Definition 12 (Iffiness + Shiftiness).

1. if defined, $\llbracket (if\ p)(q) \rrbracket^{C,i} = 1$ iff $C_i \cap \llbracket p \rrbracket^C \subseteq \llbracket q \rrbracket^{C+p}$
2. $C + p = \lambda i. C_i \cap \llbracket p \rrbracket^C$

Such a story about *if* is iff: *if* expresses is a relation between relevant antecedent and consequent worlds and that relation lives up to all the constraints we insisted on earlier. Hence *if* expresses inclusion. And it expresses that no matter whether it scopes over a universal modal or an existential modal or no modal at all in the consequent.

And it is doubly shifty. It is index-shifty since the truth of $(if\ p)(q)$ at i depends on the truth of the constituent q at worlds other than i . It is context-shifty since the truth of $(if\ p)(q)$ in C depends on the truth of the constituent q in contexts other than C . That doubly shiftiness is what makes it possible for an iff semantics to predict what needs predicting about how modals and *if*s interact.

Even before showing that precisely, we can see how that can be. The difference between interpreting q against the backdrop of the prior context C and against the backdrop of $C + p$ is a difference that makes no difference if q has no context sensitive bits in it. So sometimes the doubly shiftiness goes unnoticed. But if q does have context sensitive bits in it — if it has some bit, like *might* or *must*, whose semantic value depends non-trivially on C — then this is a difference that makes all the difference. For example: consider a modal like *must* q . Then C and $C + p$ determine different sets of possibilities. Since *must* q depends exactly on whether that set of possibilities has only q -worlds in it, we get a difference. Thus if *must* q is the consequent of an indicative, context-shiftiness matters.

The trouble for fans of iffiness is that there is interaction between our modal and conditional talk, and no way of sorting out scope issues seems up to getting that interaction right. But that is because we forgot to keep track of the context-shifting job of *if*-clauses. And doing that, even in the simple context-shifting in Definition 12, is enough to make iffiness sit better with the facts.

I know that just one of my marbles is in the box — either Red or Yellow — but do not know which it is. I say we narrowscope the modals. Then all of these can be true together:

- (10) a. Modal claim:
- (i) Red might be in the box and Yellow might be in the box
 - (ii) $\text{might } p \wedge \text{might } q$
- b. First conditional:
- (i) If Yellow isn't in the box, then Red must be
 - (ii) $(\text{if } \neg q)(\text{must } p)$
- c. Second conditional:
- (i) If Red isn't in the box, then Yellow must be
 - (ii) $(\text{if } \neg p)(\text{must } q)$

Observation 9 (Iffy Prediction of Fact 1). Assume the Iffiness + Shiftiness Semantics (Definition 12). And suppose, in C , that (14a) is a partitioning modal. Then the sentences in (10) are relatively consistent.

Here is why. Suppose — for concreteness and without loss of generality — that C contains just two worlds: i , a $(p \wedge \neg q)$ -world and j , a $(q \wedge \neg p)$ -world. So (10a) is true at i .

And so are the two *ifs*. Take (10b). It is true at i in C , given the iffy + shifty semantics, iff all the possibilities in $C_i \cap \llbracket \neg q \rrbracket$ are possibilities that $\llbracket \text{must } p \rrbracket^{C+\neg q}$ maps to true. Thus we have to see whether the following holds:

$$\text{if } k \in C_i \cap \llbracket \neg q \rrbracket \text{ then } \llbracket \text{must } p \rrbracket^{C+\neg q, k} = 1$$

Iff this is so is the *if* true at i in C . But $C_i \cap \llbracket \neg q \rrbracket = \{i\}$, so we have to see whether or not $\llbracket \text{must } p \rrbracket^{C+\neg q, i} = 1$. Equivalently: the *if* is true at i iff $(C + \neg q)_i \subseteq \llbracket p \rrbracket$. And since i is in fact a p -world the *if* is true at i in C . And *mutatis mutandis* for (10c).

It is also easy to predict the pattern of entailments in Facts 2 and 3. Narrowscoping the modal in (3):

- (15) a. For (3a):
- (i) If Carl is at the party, then Lenny must be at the party
 - (ii) $(if\ p)(must\ q)$
- b. For (3b):
- (i) If Carl is at the party, then Lenny is at the party
 - (ii) $(if\ p)(q)$

Observation 10 (Iffy Prediction of Facts 2 and 3). Assume the Iffiness + Shiftiness Semantics (Definition 12). Then:

1. $If\ S_1, then\ S_2 \approx If\ S_1, then\ must\ S_2$
2. $If\ S_1, then\ might\ S_2 \approx might\ [S_1\ and\ S_2]$

Since $must\ q$ entails q the entailment from (15a) to (15b) is straightforward. So suppose (15b) is true at i (with respect to C). Then all of the p -worlds in C_i are q -worlds. But if they are all worlds at which q is true, then i — and so, given well-behavedness, every world in C_i — is equally a world at which $must\ q$ is true. And so (15a) is true, at i in C , if (15b) is. That is just what Fact 2 requires.

It is nice, though not so surprising, that if can mean something iff when the commingling operator is a universal modal like $must$. That if can mean the same iff thing — inclusion! — when it commingles with the existential $might$ is surprising. But no less nice for it.

Take the existential modal in (6):

- (16) a. For (6a):
- (i) If my team wins out, they might win it all
 - (ii) $(if\ p)(might\ q)$
- b. For (6b):
- (i) It might turn out that my team wins out and wins it all
 - (ii) $might\ (p \wedge q)$

The most noteworthy bit is going from (16a) to (16b). Note that (16a) is true at i (with respect to C) just in case all of the p -worlds in C_i are worlds where $might\ q$, evaluated in $C + p$, is true. Well-behavedness guarantees that

$$if\ j, k \in C_i \cap \llbracket p \rrbracket \text{ then } (C + p)_j = (C + p)_k = C_i \cap \llbracket p \rrbracket$$

If there is a q -world in $(C + p)_j$, then $might\ q$ is true throughout this set. Since $might\ q$ is an existential modal, if it is true with respect to $C + p$ it must also

be true with respect to C . (Updating contexts with $+$ is monotone.) Whence it follows that the *if* with a commingling *might* is true at i iff among the p -worlds in C_i lies a q -world. And any such q -world will do to witness the truth of *might* ($p \wedge q$) at i in C .

Indicatives play well with epistemic modals. That interaction seemed hard to square with old school iffiness. For, assuming iffiness, the *if* in *if p , then (modal) q* pretty much means *all*, saying that the (relevant) worlds where p is true are all worlds where q is true. And that's got to be so whether q carries a modal decoration or not. But no way of resolving the relative scopes can then be made to fit the facts about how indicatives and modals interact.

But that is because we mistakenly thought that antecedents of conditionals only have one job to do. They shift the index at which we check to see if the consequent is true. But since truth depends on both index and context, they also contribute to the context in which we do that checking. Once we let antecedents do both their index-shifting and context-shifting jobs there is no special problem posed for old school iffiness. It is still true that *if* pretty much means *all*. Narrowscope the modals. Then *(if p)(might q)* in C means that all the C -relevant p -worlds are worlds where *might q* is true. Similarly: *(if p)(must q)* in C means that all the C -relevant p -worlds are worlds where *must q* is true. But the context for figuring out whether, at a given p -world, *might q* or *must q* is true is not C but the subordinate or derived context got by adding the information that p to it. This shiftiness makes it plain and easy to make iffiness fit the facts about how indicatives and modals interact.

8 Bonus material

Not every fan of old school iffiness will want to follow me this far. But there is a cost to cutting their trip short since they must then deny or explain away one of the Facts. (That was the boring way of being old school.) And iffiness, they'll no doubt point out, is not without its own costs: the price of iffiness is shiftiness twice over. Some count that as a cost. So I want to end by pointing out four kinds of dynamics that come with shiftiness *gratis*.

The iffy story as I have told it here takes the truth of an indicative, at an index in a context, to be doubly shifty. That doubly shifty behavior makes the semantics dynamic in the sense that interpretation both affects and is affected by the values of contextually filled parameters. Whether *(if p)(q)* is true at i in C depends on C ; the indicative can be true at i for some choices of C and

false at i for others. So interpretation is context-dependent. Whether $(if\ p)(q)$ is true at i in C also depends on the subordinate context $C + p$. Interpreting the indicative in C affects — temporarily — the context for interpreting some subparts of it. So interpretation is also context-affecting.

It is also dynamic in the sense that it makes certain sentences “unstable” — the truth-value a sentence gets in C is not a stable or persistent property since it can have a different truth-value in a context C' that contains properly more information.

Definition 13 (Persistence).

1. p is *t-persistent* iff $\llbracket p \rrbracket^{C,i} = 1$ and $C' \subseteq C$ imply $\llbracket p \rrbracket^{C',i} = 1$
2. p is *f-persistent* iff $\llbracket p \rrbracket^{C,i} = 0$ and $C' \subseteq C$ imply $\llbracket p \rrbracket^{C',i} = 0$

p is *persistent* iff it is both f- and t-persistent.

The boolean bits are, of course, both t- and f-persistent and so persistent full-stop. But not the modals: *might*, being existential, is f- but not t-persistent; *must* goes the other way. And since *if* is a strict conditional, equivalent to a necessity modal scoped over a material conditional, its pattern of persistence is just like that for *must*.¹⁶

These two senses in which the story is dynamic are two sides of the same coin. Together they explain how it is that the narrowscoped conditionals $(if\ \neg p)(must\ q)$ and $(if\ \neg q)(must\ p)$ are consistent with the partitioning modals in $might\ p \wedge might\ q$. From the fact that $i \in \llbracket (if\ \neg p)(must\ q) \rrbracket^C$ and $i \in \llbracket \neg p \rrbracket^C$ it does not follow that $i \in \llbracket must\ q \rrbracket^C$. Indeed, with my marbles lost, this is sure to be false at i in C since $might\ p$ is true. What *is* true at i is that — in the subordinate or derived context $C + \neg q$ — $must\ q$ is true. That is allowed because *must* isn't f-persistent. But that is not at odds with the *might* claim. And *mutatis mutandis* for the other *if*.

So we have dynamics twice over. But so far none of this looks quite like the thing that is called “dynamic semantics”. In that sense of dynamics, meaning isn't associated with truth conditions or propositions, but with context change potentials. Take an information state s to be a set of worlds, and say that what a sentence means is how its LF updates information states. That assigns to

¹⁶This pattern makes the treatment of indicatives here similar in some respects to the data semantic treatment of indicatives in Veltman (1985). But there are important differences between the two stories. Here's one: $(if\ p)(might\ q)$ is data semantically equivalent to $(if\ p)(q)$. That won't do given Fact 3.

sentences the semantic type usually reserved for programs and recipes; they express relations between states — intuitively, the set of pairs between states such that executing the program in the first state terminates in the second. We can think of all sentences in this way thereby treating them as instructions for changing information states. Thus: the meaning of a sentence p is how it changes an arbitrary information state. Thus: the meaning of a sentence p is how it changes an arbitrary information state. We might put that by saying the denotation $\llbracket p \rrbracket$ applied to s results in state s' ; in post-fix notation $s[p] = s'$.¹⁷ Now say that p is true in s iff $s[p] = s$, for then the information p carries is already present in s .¹⁸

Having gone this far, we can make good on the Ramsey test this way:

Definition 14 (Dynamic Iffiness).

$$s[(if\ p)(q)] = \{i \in s : q \text{ is true in } s[p]\}$$

Some programs have as their main point to make such-and-such the case; others to see whether such-and-such. Programs of the latter type are *tests* and they either return their input state (if such-and-such) or fail (otherwise). That is the kind of program Definition 14 says *if* is.¹⁹ It says an *if* tests s to see whether the consequent is true in $s[p]$. But — in good Ramseyian spirit — $s[p]$ is just the subordinate context got by hypothetically adding p to s . Truth isn't persistent here, either. That is because a state may pass a test posed by an existential (are there p -possibilities?) and yet have some narrower, less uncertain state fail it (no more p -possibilities!). And dually for the universal *must* and *if*.

An iffy story that goes like this is dynamic in this third sense. But the iffy story as I have told it here doesn't look much like a dynamic semantics in that sense. We have assigned truth-conditions to indicatives. And we can recover propositions if the mood strikes us. But the two stories are in fact the same: lack of persistence plus the global behavior of the modals and *ifs* in

¹⁷For the fragment without *ifs* the updates are as you would expect. For the *if*-free fragment of L , define $\llbracket \cdot \rrbracket$ as follows:

- $s[p_{\text{atomic}}] = \{i \in s : i(p_{\text{atomic}}) = 1\}$
- $s[\neg p] = s \setminus s[p]$
- $s[p \wedge q] = s[p][q]$
- $s[\textit{might } p] = \{i \in s : s[p] \neq \emptyset\}$

It then follows straightaway that — for the *if*-free fragment — $s[p] = s \cap \llbracket p \rrbracket$.

¹⁸This generalizes the plain vanilla story about satisfaction we were taught when first learning propositional logic: as the story usually goes, a boolean p is true relative to a set of possibilities s iff all the possibilities in s are in $\llbracket p \rrbracket$. But that is equivalent to saying that adding $\llbracket p \rrbracket$ to the information in s produces no change: $s \cap \llbracket p \rrbracket = s$ iff $s \subseteq \llbracket p \rrbracket$.

¹⁹See, e.g., Gillies (2004).

the doubly shifty story make it equivalent to a dynamic story of the indicative that dispenses with the assignment of propositions of the normal sort from the beginning.²⁰ Even though I told the story about truth-values assigned at contexts and indices, it is equivalent to a story about changing information states. So we have dynamics thrice over.

We have gotten this far, and found ways to predict the Facts about how indicatives and epistemic modals interact, without taking a stand on when one sentence entails another. Entailment is usually taken to be preservation of truth at a point of evaluation: iff q is true at a point if p_1, \dots, p_n are all true at that point do the latter entail the former. Not necessarily so in a dynamic semantics. Often enough, what is important and what we want an entailment relation to capture is not preservation of truth but preservation of information flow — what must be true after adding the information of the premises. Similarly, since the story as I have told it turns out to be a dynamic one, we ought to expect other possibilities. That is because truth is sensitive to both context and index and contexts can shift about as we move from the p_i 's to q . The natural way of making sure entailment is sensitive to those shifts is to augment the context with the information of the premises, evaluating q not in C but in $(C + p_1) + \dots + p_n$. And that corresponds exactly to the dynamic update-to-test entailment relation. That is the fourth way in which the semantics here is, at least at the periphery, dynamic.²¹

It is not just dynamics that comes for free with iffiness like this. There are natural properties that indicative conditionals seem to have but which — at least so I was taught — no propositional operator can have all at once. Suppose *if* is at least as strong as material implication, that strict implication is at least as strong as the indicative, that (17a) and (17b) are true in the same spots.

- (17) a. If Carl is away, then if Lenny is away then Sector 7G is empty
 b. If Carl is away and Lenny is away, then Sector 7G is empty.

Then — again, so I was taught — *if* must have the truth-conditions of material implication. Riots in the streets, dogs and cats living together, mass hysteria, and all the rest.²² Some have gotten used to this sad state of affairs either by

²⁰The standard benchmark for *bona fide* dynamics is whether the interpretation function $[\cdot]$ is either *non-introspective* (Can it be that $s[p] \not\subseteq s$?) or *non-continuous* (Can it be that $s[p] \neq \bigcup_{i \in s} [p]$?). In this set-up, the behavior of indicatives is not continuous.

²¹See Gillies (2008) for the details on how the iffy story as I have put it is equivalent to a more directly dynamically iffy semantics.

²²For versions of the argument see Gibbard (1981); Veltman (1985); Kratzer (1986); Edgington

dropping a condition — the equivalence in (17) for fans of variably strictness — or embracing the horseshoe. And some have marshaled anti-iffiness to save our bacon.²³ Better to find a way out than live with those choices.

Iffiness buys you exactly that. That is a bonus — but not exactly *gratis* since saying just how seems like a different paper.²⁴

(1995, 2006); Gillies (2008).

²³In particular, Kratzer (1986).

²⁴Again, see Gillies (2008).

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