Dynamic Semantics versus Dynamic Propositionalism[*]

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The Plot

Assertions, so Stalnaker's (1978) familiar narrative goes, express propositions and are made in context; in fact, context and what is said frequently affect each other. Since language has context-sensitive expressions, which proposition some given assertion expresses may depend on the context in which it is made. Assertions, in turn, affect the context, and they do so by adding the proposition expressed by that assertion to the context.

Stalnaker's narrative has it that all context change is mediated by propositional content; the primary task of a semantic theory, accordingly, consists in assigning a truth-condition determining proposition to each declarative sentence of a given language. But there is also a potential shift in perspective on the horizon here: instead of being all about truth-conditions, a semantics may be all about how an utterance relates an input context (the context in which it is made) to an output context (the context posterior to the utterance). Semantic values then become relational: they are relations between contexts. Some context change, for sure, may be mediated by propositional content, but there is no commitment to the claim that *all* context change is thus mediated. It is this lack of commitment that DYNAMIC theories of meaning exploit in their analyses of various natural language expressions, including modals and conditionals.

Stojnić's *Context and Coherence: The Logic and Grammar of Prominence* (2021) offers a series of interesting criticisms of the classical dynamic paradigm in natural language semantics and offers a sophisticated alternative outlook, one that does recognize a dynamic, context change inducing dimension of meaning but at the same preserves the idea that (declarative) utterances express propositions in context. The purpose of this brief note is to set the record straight: existing dynamic analyses of modals and conditionals compare favorably with Stojnić's high-powered DYNAMIC PROPOSITIONALISM.[1]

Issues with Modus Tollens

Most of the issues that matter here come into view when we look at what dynamic semantic theories have to say about the phenomenon of (apparent) modus tollens failures, so let me explain what this is all about. The count, let us assume, has been murdered; we have narrowed down the list of possible suspects to the gardener and the butler; and we know that whoever did it, did it alone. In this scenario, it seems right to say:

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[1] The analyses to be discussed here stand in the UPDATE SEMANTICS tradition (starting with Veltman 1985, 1996); other prominent dynamic semantic analyses include DISCOURSE REPRESENTATION THEORY (Kamp 1981; Kamp and Reyle 1993), DYNAMIC PREDICATE LOGIC (Groenendijk and Stokhof 1991), and FILE CHANGE SEMANTICS (Heim 1982).

(1) If the butler didn't do it, it must have been the gardener.

But since the butler might in fact be the culprit, it is also true that:

(2) It is not the case that it must have been the gardener.

And (1) and (2) together with the rule of modus tollens allow us to infer:

(3) The butler did it.

Clearly, this conclusion is not warranted, and yet there seems nothing wrong with (1) and (2) — where did we go wrong?

One prominent conclusion to draw here is that the inference rule of modus tollens is invalid.[2] Indeed, various sophisticated analyses of conditionals reject this rule of inference.[3] Here is how the story plays out in an off-the-shelf update semantic proposal (see Gillies 2004).[4] The semantic value of a sentence φ is not a set of points at which it is true (a proposition) but a dynamic rule specifying how an information carrier (a set of possible worlds) changes if updated with φ. For a simple propositional language extended with the epistemic modals *might* ($\Diamond$) and *must* ($\Box$) and the conditional connective ($\Rightarrow$), the update rules look as follows:

i. $s + p = \{w \in s : w(p) = 1\}$
ii. $s + \neg\varphi = s \setminus (s + \varphi)$
iii. $s + (\varphi \wedge \psi) = s + \varphi + \psi$
iv. $s + \Diamond\varphi = \{w \in s : s + \varphi \neq \emptyset\}$
v. $s + \Box\varphi = \{w \in s : s \Vdash \varphi\}$, where $s \Vdash \varphi$ iff $s + \varphi = s$
vi. $s + (\varphi \Rightarrow \psi) = \{w \in s : s + \varphi \Vdash \psi\}$

[2] An alternative proposal, frequently mentioned in the literature just to be dismissed, is that modus tollens does not even license the problematic inference in question here since the modal *must* takes wide scope in (2). Problems abound for wide-scoping strategies, one of them being that they have a tendency to generate false readings. For instance, in 'If it was done before midnight, then the butler might have an alibi but the gardener does not' the modal *might* does not take wide scope over the whole conditional: we are not just saying that the conditional 'If it was done before midnight, then the butler has an alibi but the gardener does not' is possibly true, but rather that the gardener for sure doesn't have an alibi if it was done before midnight (and that the butler might have one if it was). See, for instance, Yalcin 2012 for discussion.

[3] Stojnić says that modus tollens failures are a source of motivation for "non-propositionalist" analyses of modals and conditionals (ch. 10). It is worth noting that one does not have to stray far away from the semantic mainstream to see modus tollens get the boot. Lewis's (1973, ch. 5) truth-conditional analysis of deontic conditionals, to wit, rejects modus tollens by dropping the centering constraint. Kratzer's analysis of conditionals (see Kratzer 2012 and references therein) also rejects modus tollens, insofar as it makes sense to talk about such inference rules in her framework in the first place. But as stressed by e.g. Willer (2012) moving beyond the mainstream into dynamic territory does have something special to offer, insofar as it allows us to reject modus tollens while also preserving desirable inference rules such as modus ponens.

[4] Veltman's (1996) discussion is the classical source of inspiration, though its analysis of conjunction and conditionals differs at important moments of detail that need not detain us here. The critical ideas can be articulated in a variety of ways, including a Yalcin-style domain semantics (see Yalcin 2007, 2012).

An update with an atomic sentence eliminates from the input state all possible worlds at which the sentence is false. Negation is set subtraction. To update with a conjunction, update with the first and then with the second conjunct.[5] Epistemic *might* runs a "test" on the input state: if the prejacent is compatible with the input state, it returns the original input state; otherwise, the test is failed and returns the absurd state (the empty state). Epistemic *must* runs a test as well, asking whether the input state *accepts* the prejacent, i.e. whether updating with the prejacent idles.[6] Finally, a conditional tests whether the input state accepts the consequent once we have updated that state with the antecedent.

Logical consequence can be defined in a variety of ways; for current purposes it suffices to work with a "test-to-test" conception of validity: $\varphi_1, \ldots, \varphi_n \vDash \psi$ just in case for all s, if $s \Vdash \varphi_1$ and … and $s \Vdash \varphi_n$, then $s \Vdash \psi$.[7] Entailment thus amounts to guaranteed preservation of acceptance: if all the premises are accepted, so must be the conclusion. A sentence φ is contradictory just in case only the absurd state accepts it.

It is then easy to see that (1) and (2) fail to entail (3) on their obvious logical form. Let $s = \{w_1, w_2\}$ be such that the butler did it (b) at w_1 and the gardener did it (g) at w_2. Clearly, $s + \Box g = \emptyset$ since s treats the butler as a live suspect, and hence s accepts (2), i.e. $s \Vdash \neg\Box g$. It also accepts (1) since $s + \neg b \Vdash \Box g$ and so $s \Vdash \neg b \Rightarrow \Box g$: under the assumption that it wasn't the butler, it must have been the gardener. And yet it does not follow that the butler in fact did it, since $s + \neg b = \{w_1\}$ and so $s \nVdash b$. What makes all of this possible is that modus tollens is invalid; this, in turn, is a byproduct of the fact that epistemic *might*s (and thus negated *must*s) fail to be persistent in the following sense:

> A sentence φ is persistent with respect to $\Vdash$ just in case for all states s: if $s \Vdash \varphi$ and $s' \subseteq s$, then $s' \Vdash \varphi$.

Modus tollens requires that a conditional together with its negated consequent entail its negated antecedent. This requirement is satisfied in our dynamic system as long as the negated consequent at issue is persistent. For suppose that $s \Vdash \neg\psi$ and that $\ulcorner \neg\psi \urcorner$ is persistent: then $s + \varphi \Vdash \neg\psi$ since updating is eliminative ($s + \varphi$ is guaranteed to be a subset of s). But by assumption $s \Vdash \varphi \Rightarrow \psi$ and so $s + \varphi \Vdash \psi$. Since only the absurd state can support a sentence and its negation, $s + \varphi = \emptyset$, hence $s + \neg\varphi = s$ and so $s \Vdash \neg\varphi$.

Persistence, then, underwrites modus tollens. But not all sentences of our target language are persistent: in particular, the state $s = \{w_1, w_2\}$ supports the claim that it might be the butler,

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[5] We do not need to worry about the intricacies of disjunctions here; for current purposes they can be defined in the usual way as negated conjunctions.

[6] Hence *might* and *must* are duals so that $s + \Box\,\varphi = s + \neg\Diamond\neg\varphi$.

[7] Veltman (1996) discusses various alternatives (see also van Benthem 1986); an "update-to-test" conception of validity is especially popular in the literature: $\varphi_1, \ldots, \varphi_n \vDash \psi$ just in case for all s, $s + \varphi_1 + \ldots + \varphi_n \Vdash \psi$. Update-to-test requires that every state accepts the conclusion once updated with the premises. Such a view of validity would serve our purposes just as well but introduces a few additional complexities that need not detain us here.

but no longer does so if strengthened with the information that the butler is innocent. It does not follow that the assumption of the butler's innocence results in the absurd state, and so we cannot conclude that he is the culprit.

Three Worries

Stojnić offers three interesting criticisms of the dynamic obituary for modus tollens. The first one is that it misses — like all non-propositionalist accounts (including Yalcin's (2007) expressivist story) — an important fact about modus tollens, namely that it *is* a reliable rule of inference in case the consequent of the major premise is truth-conditionally incompatible with the minor premise. Stojnić even goes so far to insist that unless the major and minor premise of the argument are thus related, we do not have an instance of modus tollens in the first place. That is why the argument in our murder mystery does not go through: the consequent of the major premise (1) is interpreted under the assumption that the butler is innocent; the minor premise (2), in contrast, refers to the base state that treats the gardener as well as the butler as live suspects. So, the domain of possibilities relative to which we evaluate the consequent of (1) is not the same as the one relative to which we evaluate (2), in a way that renders the contents of these sentences compatible. Nothing to see here, at least as far as modus tollens is concerned.

The second and third criticisms focus on a specific feature of how our dynamic proposal analyzes conditionals. Conditionals, on this account, are "shifty" in the sense that in evaluating some conditional, we first update the input state with the antecedent and then evaluate the consequent in these lights: it is hard-wired into the semantics of conditionals that their consequents are evaluated given their antecedents. This proposal takes inspiration from Ramsey's (1931) famous proposal for how to evaluate conditionals: accept a conditional if you hypothetically accept its consequent under the supposition of the antecedent. Indeed, since virtually any analysis of *if* tries to do justice to Ramsey's suggestion, shiftiness is a recurring feature in the literature on conditionals, though it comes in different shapes and forms. Kratzer, for instance, thinks of modals as existential or universal quantifiers over possible worlds and of *if*-clauses as restrictors: in (1) 'If the butler didn't do, it must have been the gardener,' we restrict the domain of the modal 'must' to those in which the butler is innocent.

Stojnić agrees that the consequent in (1) is to be interpreted under the assumption of the butler's innocence, but interestingly suggests that this is not because the conditional connective is shifty by semantic design. Rather, what's going on, according to Stojnić, is that *if*-clauses make a distinct possibility — in our example the possibility of the butler being innocent — salient; the conditional connective is interpreted as ELABORATING on this possibility, which results in it being promoted to the "top-ranked" possibility in discourse, thus serving as the restrictor for the epistemic modal *must* in the consequent of the conditional. The appeal to discourse relations is critical here: it is only because the conditional's consequent is interpreted as elaborating on its antecedent that the former is restricted by the latter.

Here is why, according to Stojnić, proposals that hard-wire some form of shiftiness into the semantics of *if* (including dynamic accounts) do not quite cut it:

> These accounts are nevertheless not expressive enough to capture the full range of discourse dependencies that conditionals and modals support. As they only capture the dependence between the antecedent and consequent of a conditional, they fail to account for modal subordination more generally. At the same time, such accounts are in a sense too constrained: they make the dependence of the consequent on the antecedent obligatory, thus making it difficult to account for possible non-restricted interpretations of modals in the consequent (Zvolenszky, 2002). (p. 123)

The first point appeals to the phenomenon of MODAL SUBORDINATION. Consider:

(4) (a) If the maid won't do it, the butler will. (b) He'll use a candlestick.

We read (4) as saying that the butler will do the deed using a candlestick, assuming that the maid won't do it: the second sentence receives a conditional interpretation, just as the conditional consequent does. Stojnić's account identifies a single mechanism at play here: conditional antecedents bring certain possibilities into view that restrict the domain of subsequent modal discourse, given suitable discourse relations. So, the inter-sentential and the cross-sentential domain restriction that we see in (4) work exactly alike: they arise because both claims about the butler are interpreted as elaborating on the possibility brought into view by the conditional antecedent, viz. that the maid won't do it.[8] In contrast, while the shiftiness of *if* delivers inter-sentential domain restrictions of the kind observed in (4) by design, it leaves us with the need for a separate story about the cross-sentential domain restriction that (4) exhibits as well.

The second point refers to the notorious issue that treating *if* as restricting modal quantifier domains by design renders strange conditionals such as (5) trivially true (or acceptable):

(5) If the maid will do it, she ought to do it.

Clearly, the fact that some act is performed does not make it deontically required. And yet if *ought* can only select what is best from the set of possible worlds at which the maid did it, there is no room for quibbling with the truth or acceptability of (5).

In response to problem cases such as (5), one may suggest that in evaluating the *ought*-claim, we re-introduce some worlds at which the prejacent is false — downdate the modal domain that we just updated with the conditional antecedent — the underlying intuition being that deontic *ought* recommends φ over $\ulcorner \neg\varphi \urcorner$ and thus should not be accepted or rejected simply because the facts taken for granted already settle the question in one way or another (see Frank 1997). This strategy needs to explain, however, in what sense the *if*-clause would still serve here as a restrictor on modal quantifier domains. Furthermore, Zvolenszky (2002) worries

[8] An implicit assumption here is that *will* is a modal rather than a temporal operator. Klecha (2014) offers an influential defense of this assumption.

that a downdating approach faces a "flipside problem," namely the inability to predict the acceptability of conditionals such as:

(6) If the Dalai Lama is angry, he ought to be angry.

The intuition here is that (6) is acceptable under the background assumption that the Dalai Lama, given his mild manners, does not get angry unless he has a reason for doing so. In fact, (6) may be interpreted as communicating (7):

(7) If the Dalai Lama is angry, he has a reason to be angry.

But if in evaluating the consequent in (6) we simply remove whatever information has been provided by the antecedent, there is no reason to think that (6) is acceptable, any more than we are inclined to accept 'The Dalai Lama ought to be angry' in an out-of-the-blue context. So, the claim that conditional antecedents are modal quantifier restrictors by semantic design (rather than in virtue of some specific discourse relation) appears to be too inflexible to address all the relevant empirical phenomena.[9]

Responses

Let me address these criticisms in turn (leaving some points of general importance to the concluding discussion). First, we already saw that the dynamic semantic proposal described earlier is perfectly able to identify those cases in which modus tollens is a reliable rule of inference: whenever $\ulcorner \neg\psi \urcorner$ is persistent (with respect to the relation of acceptance), $\ulcorner \varphi \Rightarrow \psi \urcorner$ together with $\ulcorner \neg\psi \urcorner$ does license the inference of $\ulcorner \neg\varphi \urcorner$. Persistence is guaranteed if ψ is chosen from the propositional fragment of our target language, for here acceptance of $\ulcorner \neg\psi \urcorner$ by s amounts to s being a subset of some classical proposition. This is why an inference such as (8) is impeccable. But we also get some good cases of modus tollens even if modals are involved: (9) is fine, for instance, since the negated *might* in the minor premise exhibits persistence.

(8) If the butler did it, it was done with a candlestick. But it wasn't done with a candlestick. So, the butler didn't do it.

(9) If the butler did it, there might have been an accomplice. But there can't have been an accomplice. So, the butler didn't do it.

Importantly no appeal to propositions is needed to specify criteria under which modus tollens is reliable.

What remains true is that the dynamic proposal treats the invalid inference of (3) from (1) and (2) as an instance of modus tollens, and so the rule is not perfectly reliable. Stojnić maintains that our reasoning here cannot appeal to modus tollens in the first place, since the minor premise in (2) does not contradict the consequent of the major premise in (1): rules of

[9] Zvolenszky's (2002) discussion is specifically concerned with a Kratzer-style analysis of *if*-clauses as restrictors; part of the point here is that the key concern is of a general nature.

inference are not simply concerned with sentences, but with what they say in context; thus understood, we do not have a counterexample to modus tollens. I am unclear as to why one should think that this outlook is preferable to one that simply treats modus tollens as unreliable; whatever the answer may be, Stojnić's preferred approach can indeed be articulated in update semantics. Here the critical observation is that while updating is not guaranteed to be mediated by some specific proposition, an update always results in a proposition, i.e. $s + \varphi$ is a set of possible worlds. So, of course we can ask how $s + \varphi + \psi$ relates to $s + \neg\psi$ and specifically whether the latter is incompatible with the former — if it is, then modus tollens is reliable. For suppose that $(s + \varphi + \psi) \cap (s + \neg\psi) = \emptyset$ and assume that $s \Vdash \varphi \Rightarrow \psi$ as well as $s \Vdash \neg\psi$. Then $(s + \varphi + \psi) = s + \varphi$ and $s + \neg\psi = s$, so $(s + \varphi) \cap s = \emptyset$ and hence $s + \varphi = \emptyset$ and so $s \Vdash \neg\varphi$. Accordingly, if we wanted to think of valid rules of inference as sensitive to propositional contents in context, update semantics would allow us to do so.

I conclude that even the most basic update semantics has the means to articulate not only the limits but also the scope of the rule of modus tollens.

Now turn to the issue of inter-sentential versus cross-sentential modal domain restriction. Recall:

(4) (a) If the maid won't do it, the butler will. (b) He'll use a candlestick.

For Stojnić, there is a single mechanism at play here: in both (4a) and (4b), the modal *will* is restricted because it is interpreted as elaborating on a possibility introduced by the conditional antecedent. The update story told here, in contrast, only accounts for the inter-sentential domain restriction in (4a), and hence needs to be supplemented with a separate story about modal subordination to capture the effects on the modal *will* in (4b).

And yet it is anything but clear that there is indeed a single mechanism underlying inter-sentential and cross-sentential modal domain restriction. Consider the following examples:

(10) If you go near that bomb, it is going to explode.
(11) (a) Don't go near that bomb! (b) It is going to explode!

The sentence in (10) reads — unambiguously — as a conditional warning: getting close to the bomb is going to set if off. (11b) has such a reading as well, but it is not obligatory: one can also read (11b) unconditionally, stating that the bomb is bound to go off no matter what. There is thus an important difference between the inter-sentential modal domain restriction in (10) and its cross-sentential cousin in (11b): the former is obligatory, while the latter is optional. Likewise for the modal expression *might*: (12) says that getting near the bomb might set it off; (13b) allows for a stronger reading on which the bomb's going off is an unconditional possibility.

(12) If you go near that bomb, it might explode.

(13) (a) Don't go near that bomb! (b) It might explode.[10]

The natural conclusion to draw is that, just as the tradition holds, *if*-clauses restrict modal quantifier domains as a matter of semantic convention; cross-sentential modal domain restriction, in contrast, exhibits the kind of flexibility that we see with anaphora more generally and depends on broadly pragmatic features such as the presence or absence of certain discourse relations. At a minimum, any alternative account that postulates a single mechanism at work here needs to explain why the two types of domain restriction sometimes seem to diverge in the set of readings that are made available. It is not obvious that the final story will end up being superior to the more classical path of distinguishing between shiftiness and modal anaphora right from the start.

The previous observation connects with a general concern about Stojnić's framework: it readily generates possible readings of natural language modal constructions that are at best marginal and in some cases explicitly characterized by Stojnić as unavailable. I will return to this issue momentarily but before that let me briefly address the final argument against hard-wiring domain restriction into the semantics of *if*-clauses: that doing so trivializes non-trivial (and in fact intuitively wrong) conditionals such as (5).

(5) If the maid will do it, she ought to do it.

A simple-minded downdating response, as we have seen, struggles to predict the acceptability of certain conditionals that share the same form as (5). But let me sketch a way to refine it so that we can make proper empirical predictions without abandoning the thesis that *if*-clauses are restrictors (drawing on Willer 2014).[11]

Start with the idea that deontic *ought* requires that its prejacent be entailed by the set of deontically ideal worlds in context; what those worlds are is determined Kratzer-style by an ordering source d understood as a set of propositions, as follows: $w <_d w'$ just in case (i) for some $p \in d$, $w \in p$ and $w' \notin p$ and (ii) for all $p \in d$, if $w' \in p$ then $w \in p$; w is *minimal* in s given d, $w \in s_d$, just in case (i) $w \in s$ and (ii) there is no $w' \in s$ such that $w' <_d w$. Finally, we shall assume that context underdetermines deontic ordering sources: $\delta(w)$ is the ordering source given w and $\delta(s) = \{\delta(w): w \in s\}$. The basic suggestion then is that deontic *ought* tests whether the prejacent is entailed by each contextually permissible set of deontically ideal worlds. One minor wrinkle (to which we already alluded earlier): deontic *ought* is to be evaluated with respect to a state that is "non-trivial" in the sense that it leaves room for the prejacent as well as its negation to be a possibility, and we appeal to a downdating operation to

[10] Klecha (2011) draws attention to the empirical fact that cross-sentential modal subordination is optional for some modal expressions (including *going to*, *might*, and *bound to*) and obligatory for others (such as *will*, *would*, and *could*). Building on Frank (1997), Klecha accounts for this fact in a dynamic framework that distinguishes between definite modals (which come with a familiarity presupposition and obligatorily undergo modal subordination) and indefinite modals (which lack a familiarity presupposition and optionally undergo modal subordination).

[11] I focus here on deontic *ought* but submit that the strategy to be outlined generalizes to other modal expressions.

enforce that constraint. Here I choose the most direct path and assume that each set of possible worlds s is associated with a system of spheres $S(s)$ centered on s that captures a fallback relation determining how s should be weakened when giving up on an existing commitment: $s - \varphi$ selects the minimal element $s'$of $S(s)$ such that $s' + \neg\varphi \neq \emptyset$. The update rule for deontic *ought* would then be as follows:

$$s + O\phi = \{w \in s: \forall d \in \delta(s).\, (s - \varphi - \neg\varphi)_d \Vdash \varphi\}$$

This readily takes care of cases such as (5), assuming that the maid's doing it does not make it right: downdating with the antecedent re-introduces possible worlds at which the deed is not done, which rank at least as highly as those at which it is.

Furthermore, we avoid Zvolenszky's "flipside problem" by making reasonable predictions about conditionals such as (6).

(6) If the Dalai Lama is angry, he ought to be angry.

The guiding intuition here is that the Dalai Lama is angry if and only if there is a reason to be: we shall thus assume that the deontic ordering source for every world at which the Dalai Lama is angry will rank worlds at which he is over worlds at which he is not (and vice versa). To illustrate, let a be the proposition that the Dalai Lama is angry and $\overline{a}$ be the complement of that proposition, and assume that our input state s consists of two possible worlds w_1 and w_2 so that $w_1 \in a$ and $w_2 \in \overline{a}$. Say now that $\delta(w_1) = \{a\}$ and $\delta(w_2) = \{\overline{a}\}$. Then updating with the antecedent of (6) will result in $s' = s + a = \{w_1\}$ and $\delta(s') = \{\{a\}\}$. In evaluating the consequent we introduce some $\overline{a}$-worlds but also keep $\delta(s')$ fixed, and so those newly introduced worlds are guaranteed to be ranked lower than the a-world w_1. Importantly, despite the downdating the *if*-clause continues to play a restricting role, as it eliminates $\delta(w_2) = \{\overline{a}\}$ from the set of eligible deontic ordering sources (i.e. while $\delta(s) = \big\{\{a\}, \{\overline{a}\}\big\}$we have $\delta(s + a) = \big\{\{a\}\big\}$).

A closer look at the classical dynamic approach to conditionals reveals that it has plenty to say about the limits as well as the scope of modus tollens and (given minimal embellishments) also addresses Zvolenszky-style concerns about treating *if*-clauses as modal domain restrictors by semantic design. There is, indeed, the need for a separate story about cross-sentential modal domain restriction. At the same time, cross-sentential and inter-sentential modal domain restriction do seem to exhibit some critical differences when it comes to the range of possible readings that are available in context. Any account that tries to model these two phenomena using a single mechanism needs to explain why the one is more restricted than the other. It remains to be seen whether the final story is better than what is already on the market.

Concluding Remarks

We already saw that Stojnić's analysis of conditionals and modus tollens raises the following question: if both inter-sentential and cross-sentential modal domain restriction are governed by the same mechanism, why is the latter more flexible than the former? The more general

concern here is that letting discourse relations mediate modal domain restriction across the board — rather than taking a divide-and-conquer strategy that treats at least some modal domain restriction phenomena as hard-wired semantic effects — overgenerates readings of modal expressions in context. Let me conclude by elaborating on this issue a bit further, focusing on Stojnić's very own discussion of the notorious problem of EPISTEMIC CONTRADICTIONS.

Yalcin (2007) notes that (14a) sounds terrible when asserted and also when supposed, as in (14b); it does not live happily in the antecedent of conditionals either, as (14c) shows.

(14) a. It is not raining and it might be raining.
b. ?? Suppose it is not raining and it might be raining…
c. ?? If it is not raining and it might be raining, then I am uninformed about the weather.

The fact that (14a) cannot even be supposed to be true blocks a classical pragmatic explanation of its infelicity that is familiar from discussions of Moore's paradox. So, it seems to be the job of our semantics for *might* to tell us why (14a) is marked. Various proposals can be found in the literature.

On the vanilla dynamic view, we start out with the observation that (14a) is a contradiction, as there is no non-empty state that can support both conjuncts. Furthermore, updating with (14a) leads to the empty state: $s + \neg r + \Diamond r = \emptyset$, whatever the input state.[12] Add to this the assumption that conditionals have a "visibility presupposition" (von Fintel 2001; Gillies 2007) in the sense that they require their antecedents to be (dynamically) compatible with the input state — $s + (\varphi \Rightarrow \psi)$ is defined only if $s + \Diamond\phi \neq \emptyset$ — and it follows immediately that (14c) is off. The appeal to the internal dynamics of conjunction is critical here; if instead we had chosen an "internally static" update rule for conjunction, a violation of the visibility presupposition for conditionals such as (14c) would not be guaranteed:

$$s + (\varphi \wedge \psi) = (s + \varphi) \cap (s + \psi)$$[13]

So, it really matters here that the second conjunct is evaluated "locally" in light of updating s with the first conjunct φ, rather than "globally" with respect to s prior to updating with φ.

Stojnić's approach to the problem of epistemic contradictions has a dynamic flavor as well but once again appeals to discourse relations rather than a shifty semantics to create local contexts for evaluating modal information. Here is what we hear about the antecedent of (14c):

[12] To see this, recall that *might*s test whether the prejacent is compatible with the input state. But once we have updated with 'It is not raining' (the first conjunct), we can no longer consistently update with 'It is raining' and so an update with 'It might be raining' (the second conjunct) is guaranteed to result in the absurd state.
[13] To see this, if s affords both worlds at which it is raining and worlds at which it is not, it of course passes the test imposed by the second conjunct. So, now an update with (14a) just amounts to adding the proposition that it is raining, which is perfectly consistent.

> The first conjunct introduces a hypothetical scenario in which there is an absence of rain. The second conjunct, 'It might be raining,' elaborates on this scenario, describing it further … [T]he Elaboration relation between the two conjuncts makes the proposition elaborated on — the proposition comprising the epistemically accessible worlds in which it is not raining — prominent. *Might* in the second conjunct selects the most prominent possibility as its restrictor: consequently, it selects the proposition just promoted by Elaboration. (p. 127)

So, a bit more precisely, Stojnić suggests that the antecedent of (14c) has the following logical form:

(15) $\text{AND}(\langle comp \coloneqq r \rangle, \text{ELAB}(\boldsymbol{w}_0, \text{MIGHT}(@E, \text{NOT}(r))$

Here r is the proposition that it is raining; $\boldsymbol{w}_0$ is the top-ranked possibility in discourse, which according to the semantics for conjunction is the scenario described by the first conjunct (i.e., that it is raining). The Elaboration relation then effectively requires that the *might*-claim take this proposition as its restrictor, leading to an inconsistent interpretation.

Stojnić further stresses that the infelicity of epistemic contradictions must be the result of linguistic conventions rather than of pragmatic reasoning:

> If the effect on prominence associated with the Elaboration were merely a byproduct of pragmatic reasoning, we would expect the interlocutors to reinterpret, selecting some other body of information as the restrictor for the modal (perhaps that of the speaker) … [F]rom the standpoint of pragmatic considerations it is mysterious indeed why we are stuck with the interpretation we are actually stuck with. But this robust, persistent infelicity that remains even in the presence of more plausible alternative interpretations is precisely what we would expect if such infelicity were forced as a matter of linguistic constraints on the evaluable interpretation: specifically if it were a matter of linguistically encoded rule that Elaboration promotes the possibility elaborated on, in this case, the possibility *that it is not raining*, and that modals look for the most prominent possibility as their restrictor, the inconsistent truth-conditions would be calculated as a matter of grammar. (pp. 129–130)

Now, it is true that if (15) captures the logical form of our epistemic contradictions in (14), their infelicity is a pure matter of meaning. But that does not get us all the way toward predicting some "robust, persistent infelicity that remains even in the presence of more plausible alternative interpretations," since the question now is why exactly Yalcin's examples should have the logical form that Stojnić claims they have, in particular, why the second conjunct should elaborate on the first.

The simple point is that Elaboration need not promote the topmost possibility; it can promote others too. To see this, observe:

(16) a. It might be raining. John isn't going to the game.
b. It might be raining. The match would be canceled.

Stojnić's system allows 'It might be raining' to first add the proposition that it is raining as the top-most possibility $\boldsymbol{w}_0$and then the proposition that it might be raining to the special slot $comp$. But the assertion of the first sentence then promotes the proposition that it might be raining as the top-most possibility $\boldsymbol{w}_0$, demoting that it is raining to second position $\boldsymbol{w}_1$ in the stack. This is all perfectly sensible, but it also shows that Elaboration is very flexible. In (16a), the second sentence can be read as elaborating on the topmost proposition: there is a chance of rain, and (thus) John isn't going to the game. In (16b) what is elaborated on is the proposition that it is raining, i.e. (16b) says that if it is raining, the match would be canceled; as we have seen, this proposition is not top-ranked once the assertion of 'It might be raining' has been processed.

That Elaboration can act on more than one possibility in discourse is perfectly plausible. But it also shows that, even if we assume that Yalcin's cases involve some Elaboration relation, we cannot exclude a logical form such as the following:

(17) AND($\langle comp \coloneqq r \rangle$,ELAB($\boldsymbol{w}_1$,MIGHT($@E$, NOT($r$))

Here $\boldsymbol{w}_1$ is the space of possibilities before adding the information, i.e. the input common ground. Since this one may very well have the absence of rain as a possibility, we do not get an inconsistent interpretation. Indeed, insofar as cases as (16b) are paradigmatic examples of Elaboration, there isn't a reason why such an interpretation would not be available.

The point here is a general one. Stojnić insists that anaphora resolution — including modal anaphora resolution — is entirely a matter of linguistic convention, and not (as the tradition would have it) a partly extra-linguistic affair (p. 5). What is true about dynamic propositionalism is that once we have assigned some logical form to some sentence, discourse relations and all included, its meaning, including how anaphora is to be resolved, is settled; the flipside is that determining logical form must now plausibly involve pragmatic reasoning, including considerations of charity. For instance, in response to Winograd's (1972) well-known case, Stojnić proposes the presence of different explanatory discourse relations at the level of logical form.

(18) The city council denied the demonstrators a permit.
a. They feared violence.
b. They advocated violence.

Here the occurrence of 'they' naturally receives different interpretations in (18a) and (18b). Stojnić (p. 73) suggests that in (18a) we have a *subject-based* explanatory discourse relation (hence 'they' refers to the city council) at the level of logical form; in (18b) the relation is *object-based* (hence 'they' refers to the demonstrators). Whatever the specific virtues and vices of this suggestion may be, it should be uncontroversial that assigning logical forms of such richness

cannot be driven by semantics alone but must appeal to world knowledge (e.g., on what grounds city councils normally license or deny permits) and considerations about speakers' communicative intentions.

Tradition appeals to features of context to move from relatively sparse logical forms to what is said. Dynamic propositionalism enriches logical forms so that that no extra-linguistic supplementation is needed. And yet the role of extra-linguistic context has not been eliminated; it has shifted: it is now critical for determining what rich logical form a sentence has. Insofar as all modal domain restriction is now dependent on the presence of certain coherence relations at the level of logical form, and insofar as assigning logical form is a process involving pragmatic reasoning, the observed robustness of inter-sentential modal domain restriction remains a bit of a mystery. Hard-wiring certain domain restrictions into the semantics of natural language connectives may very well be what is called for.

Stojnić maintains that dynamic propositionalism has distinct advantages over dynamic semantics. The minimal conclusion of this note is that this claim calls for further elaboration. It may very well be an elaboration worth waiting for: *Context and Coherence* offers an intriguing new vision for how to think about the nature of context dependence

References

van Benthem, Johan. 1986. *Essays in Logical Semantics*. Dordrecht: Reidel.

Frank, Anette. 1997. *Context Dependence in Modal Constructions*. Ph.D. thesis, University of Stuttgart.

Fintel, Kai von. 2001. 'Counterfactuals in a Dynamic Context.' In *Ken Hale: A Life in Language*, ed. Michael Kenstowicz, 123–152. Cambridge, MA: MIT Press.

Gillies, Anthony. 2004. 'Epistemic Conditionals and Conditional Epistemics.' *Noûs* 38(4): 585–616.

Gillies, Anthony. 2007. 'Counterfactual Scorekeeping.' *Linguistics and Philosophy* 30(3): 329–360.

Groenendijk, Jeroen, and Martin Stokhof. 1991. 'Dynamic Predicate Logic.' *Linguistics and Philosophy* 14(1):39–100.

Kamp, Hans. 1982. 'A Theory of Truth and Representation. ' In *Formal Methods in the Study of Language, Part 1*, eds. Jeroen Groenendijk, Theo Janssen, and Martin Stokhof, 277–320. Amsterdam: Mathematisch Centrum.

Kamp, Hans, and Uwe Reyle. 1993. *From Discourse to Logic: Introduction to Model-Theoretic Semantics of Natural Language, Formal Logic and Discourse Representation Theory*. Dordrecht: Kluwer Academic Press.

Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases*. Ph.D. thesis, University of Massachusetts, Amherst.

Klecha, Peter. 'Optional and Obligatory Modal Subordination.' In *Proceedings of Sinn & Bedeutung* 15, eds. Ingo Reich, Eva Horch, and Dennis Pauly, 365–379. Saarbrücken: Saarland University Press.

Klecha, Peter. 2014. 'Diagnosing Modality in Predictive Expressions.' *Journal of Semantics* 31(3): 443–455.

Kratzer, Angelika. 2012. *Modals and Conditionals*. New York: Oxford University Press.
Lewis, David K. 1973. *Counterfactuals*. Cambridge, MA: Harvard University Press.
Ramsey, Frank P. 1931. *The Foundations of Mathematics.* London: Routledge and Kegan Paul.
Stalnaker, Robert C. 1978. "Assertion." In *Syntax and Semantics* 9, ed. Peter Cole, 315–332. New York: New York Academic Press.
Stojnić, Una. 2021. *Context and Coherence: The Logic and Grammar of Prominence*. New York: Oxford University Press.
Veltman, Frank. 1985. *Logics for Conditionals*. Ph.D. thesis, University of Amsterdam.
Veltman, Frank. 1996. 'Defaults in Update Semantics.' *Journal of Philosophical Logic* 25(3): 221–261.
Willer, Malte. 2012. 'A Remark on Iffy Oughts.' *Journal of Philosophy* 109(7): 449–461.
Willer, Malte. 2014. 'Dynamic Thoughts on Ifs and Oughts.' *Philosophers' Imprint* 14(28): 1–30.
Winograd, Terry. 1972. *Understanding Natural Language*. New York: Academic Press.
Yalcin, Seth. 2007. 'Epistemic Modals.' *Mind* 116(464): 983–1026.
Yalcin, Seth. 2012. 'A Counterexample to Modus Tollens.' *Journal of Philosophical Logic* 41(6): 1001–1024.
Zvolenszky, Zsófia. 2002. 'Is a Possible Worlds Semantics for Modality Possible?" In *Proceedings of Semantics and Linguistic Theory 12*, ed. Brandon Jackson, 339–358. Ithaca, NY: Cornell University Press.