IMPORT-EXPORT AND 'AND'*

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Abstract *Import-Export* says that a conditional of the form $\ulcorner p > (q > r) \urcorner$ is always equivalent to the corresponding conditional $\ulcorner (p \wedge q) > r \urcorner$. I argue that *Import-Export* does not sit well with a classical approach to conjunction: given some plausible and widely accepted principles about conditionals, *Import-Export* together with classical conjunction leads to absurd consequences. My main goal is to draw out these surprising connections. In concluding I argue that the right response is to reject *Import-Export* and adopt instead a limited version which better fits natural language data, still accounts for the intuitions that motivate *Import-Export*, and fits better with a classical conjunction.

1 Introduction

Gibbard (1981) showed that *Modus Ponens* and *Import-Export*—two *prima facie* plausible principles about natural language conditionals—do not happily co-exist: theorists of the conditional must pledge allegiance to at most one of these, if they do not want to interpret the natural language conditional as the material conditional. McGee (1985) showed that there is good reason to take seriously the possibility that *Modus Ponens* (*MP*) is false and *Import-Export* (*IE*) true. Neglected in the subsequent literature has been the fact that adopting *IE* has striking consequences for a seemingly unrelated issue: the semantics of conjunction. In this paper I argue that adopting *IE* does not sit well with adopting a classical Boolean semantics for 'and': if we adopt *IE* together with some anodyne assumptions about the conditional, then the classical rules of 'and'-introduction and 'and'-elimination cannot be valid.

My main goal is to point out the surprising relation between *IE* and 'and'. In concluding, however, I will suggest that the right conclusion to draw about the

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conditional is that it does not validate *IE* in full generality, but rather validates a slightly weaker principle, which I argue better fits the natural language data; accounts for all the intuitions that motivate *IE* in the first place; and fits better with a classical conjunction.

2 Background

Let us work with a toy language $\mathscr{L}$ containing arbitrarily many atomic sentences $A, B, C\dots$ and closed under the one-place operator $\neg$ and two-place connectives $\wedge$, $>$, and $\supset$. Lower-case italics $p, q, r\dots$ range over arbitrary sentences of the language and lower-case Greek letters range over propositions (sets of possible worlds). $\wedge$ and $\neg$ are intended to correspond to 'and' and 'not', as usual; $\ulcorner p > q \urcorner$ corresponds to the natural language conditional $\ulcorner$If p, then $q\urcorner$ (on either its indicative or subjunctive reading; everything I say here goes for both kinds of conditional); and $\ulcorner p \supset q \urcorner$ to the material conditional, given its standard semantics: $\ulcorner p \supset q \urcorner$ is true just in case p is false or q true.[1] Call the fragment of our language without $>$ the conditional-free fragment, $\mathscr{L}_{CF}$. We assume a stock of possible worlds $\mathscr{W}$ and a valuation function $\mathfrak{I}$ which assigns atomic sentences to subsets of $\mathscr{W}$.[2] Let $[\![p]\!]^{c,w}$ be the truth-value of p at w relative to a context c (a sequence of parameters, specified differently in the various theories we will explore),[3] and let $[\![p]\!]^c$ be the proposition p expresses at c (the set of possible worlds where p is true relative to c, i.e. $\{w : [\![p]\!]^{c,w} = 1\}$). We assume that for all atoms A, $[\![A]\!]^c = \mathfrak{I}(A)$.

Our two key principles about the conditional run as follows:

Modus Ponens (MP): $\forall c : \forall p, q \in \mathscr{L} : ([\![p]\!]^c \cap [\![p > q]\!]^c) \subseteq [\![q]\!]^c$

Import-Export (IE): $\forall c : \forall p, q, r \in \mathscr{L} : [\![p > (q > r)]\!]^c = [\![(p \wedge q) > r]\!]^c$

1 I leave disjunction out of the story here, for simplicity. We could define it as usual out of negation and conjunction; or, if we opt for a non-classical conjunction, we could combine that with a classical disjunction, giving up de Morgan equivalences.

2 I will write $A(w) = 1$ and $A(w) = 0$, etc., for brevity.

3 I write $[\![p]\!]^{f_1, f_2, \dots f_n, w}$ rather than $[\![p]\!]^{\langle f_1, f_2, \dots f_n \rangle, w}$.

Thus *MP* says that, for instance, if both ‘It is raining’ and ‘If it is raining, the picnic is cancelled’ are true, then ‘The picnic is cancelled’ is also true; and likewise that if both ‘It rained yesterday’ and ‘If it had rained yesterday, the picnic would have been cancelled’ are true, then ‘The picnic was cancelled’ is also true. And *IE* says that, for instance, ‘If the picnic was cancelled, then if Mark was excited for the picnic, he was disappointed’ always expresses the same thing (in a given context) as ‘If the picnic was cancelled and Mark was excited for the picnic, he was disappointed’; likewise for ‘If the picnic had been cancelled, then if Mark had been excited for the picnic, he would have been disappointed’ and ‘If the picnic had been cancelled and Mark had been excited for the picnic, he would have been disappointed’.

Both these principles are *prima facie* very natural. But Gibbard (1981) showed that these two principles entail that the natural language conditional is the material conditional, provided we also assume that for any c, if $[\![p]\!]^c \subseteq [\![q]\!]^c$, then $[\![p > q]\!]^c = \mathscr{W}$; i.e. when p entails q, $\ulcorner p > q \urcorner$ is a theorem. This latter assumption, which I call *Conditional Deduction*, seems to me beyond reproach, and has been little challenged in the literature.[4] Briefly, Gibbard’s proof goes as follows (following presentation in Khoo 2013): for any c, p, q, under the assumption that $\ulcorner \neg p \wedge p \urcorner$ is nowhere true,[5] it follows that $[\![\neg p \wedge p]\!]^c \subseteq [\![q]\!]^{c,w}$, and thus by *Conditional Deduction* that $[\![(\neg p \wedge p) > q]\!]^c = \mathscr{W}$, and thus, by *IE*, that $[\![\neg p > (p > q)]\!]^c = \mathscr{W}$. By *MP*, it follows that $[\![\neg p]\!]^c \subseteq [\![p > q]\!]^c$. Next, under the assumption that $[\![q \wedge p]\!]^c \subseteq [\![q]\!]^c$,[6] we know by *Conditional Deduction* that $[\![(q \wedge p) > q]\!]^c = \mathscr{W}$. By *IE*, $[\![q > (p > q)]\!]^c = \mathscr{W}$. By *MP*, $[\![q]\!]^c \subseteq [\![p > q]\!]^c$. Given the meaning of the material conditional $\supset$, on which, again, $[\![p \supset q]\!]^c = [\![\neg p]\!]^c \cup [\![q]\!]^c$, it follows by set theory that $[\![p \supset q]\!]^c \subseteq [\![p > q]\!]^c$. *MP* guarantees that $[\![p > q]\!]^c \subseteq [\![p \supset q]\!]^c$. Thus $\forall c, p, q : [\![p > q]\!]^c = [\![p \supset q]\!]^c$: that is, the natural language conditional $>$ is the material conditional $\supset$.

4 One grounds for rejecting it comes from theorists of conditionals with impossible antecedents who believe that for some inconsistent p and some q, $\ulcorner p > q \urcorner$ is false, but nonetheless p entails q; see Nolan 1997. I will not explore this option here.

5 As we discuss below, this is not validated in full generality by the PK or KM semantics given below, in particular when p is itself a conditional; even in those frameworks, though, we can prove a slightly weaker but still decisive version of Gibbard’s triviality result, on which $\ulcorner p > q \urcorner$ is equivalent to $\ulcorner p \supset q \urcorner$ whenever p itself is conditional-free, provided *MP* and *IE* are both valid.

6 We will question right ‘and’-elimination below, but not left.

The problem is that $>$ is *not* the material conditional. This is almost universally accepted by those who study conditionals.[7] A quick argument: if $>$ were the material conditional, then the negation of $\ulcorner p > q \urcorner$ would entail p. But it does not. For instance, (1) is true whether or not Patch turns out to be a rabbit:

(1) It's not the case that, if Patch is a rabbit, she is a rodent.

That is, (1) does not entail that Patch is a rabbit—contrary to the predictions of a theory which said that the 'if…then' in (1) is the material conditional. It is even clearer, for similar reasons, that the natural language subjunctive conditional is not the material conditional: again, (2) clearly does not entail that Patch is a rabbit.

(2) It's not the case that, if Patch had been a rabbit, she would have been a rodent.

Arguments like this can be easily multiplied, though I will stop here, since the point is well established: $>$ is not $\supset$. Given the plausibility of *Conditional Deduction*, the consensus is that we must therefore validate at most one of *MP* and *IE*.[8]

Again, both principles are *prima facie* plausible. There is much to say in favor of, and against, both. I will not go into the details of this debate here. My main goal in this paper is not to argue for either of these principles, but rather to point out some downstream consequences of one possible choice between them, namely the choice to go with *IE*. McGee (1985), as we will review in more detail below, argued that there is reason to take seriously the possibility that *MP* is invalid and *IE* is valid; and Khoo & Mandelkern (To appear) argue that the subsequent literature has not produced a convincing counterexample to *IE*.[9] So it at least seems possible, given

7 Some, like Lewis (1976), Jackson (1979), Grice (1989), Rieger (2006), have argued that contrasts in assertability between material conditionals and indicative conditionals can be explained pragmatically. But these accounts, even if successful, would not explain embedding data like (1). Moreover, to my knowledge no one has defended the thesis that the subjunctive conditional is the material conditional; but Gibbard's proof is just as worrisome for the subjunctive conditional as for the indicative (at first blush, both seem to validate *Conditional Deduction*, *MP*, and *IE*).

8 Kratzer (1986) claims to evade Gibbard's proof by challenging an implicit premise—that $>$ is a two-place operator—but Khoo (2013) shows persuasively that this does not in fact allow Kratzer to avoid Gibbard's result, and that she does so because, and only because, she invalidates *MP*.

9 A principle which Khoo and Mandelkern call 'Sentential Import-Export'.

the present state of the literature, that *IE* is valid (and *MP* invalid); and this suffices to give us motivation to explore the downstream consequences of validating *IE*.

3 Validating *IE*

I will begin by spelling out three different theories from the literature which validate *IE*. The first theory is due to McGee 1985. McGee builds on Stalnaker (1968), Stalnaker & Thomason (1970)'s theory of conditionals, which validates *MP*, not *IE*. McGee modifies the theory so that it validates *IE*, not *MP*. On McGee's theory, contexts are pairs comprising a Stalnakerian *selection function* f from propositions and worlds to worlds, which (i) takes any proposition and world to a world where that proposition is true (intuitively, the 'closest' world where that proposition is true); (ii) takes a proposition and world to the 'absurd' world (where everything is true) just in case the proposition in question is inconsistent; (iii) takes $\langle\varphi, w\rangle$ and $\langle\psi, w\rangle$ to the same world as long as $f(\varphi, w) \in \psi$ and $f(\psi, w) \in \varphi$; and (iv) takes a world w and proposition φ to w just in case $w \in \varphi$; together with a set of sentences Γ (call this a *premise set*). Then we have the following semantic rules, assuming as above an atomic valuation function $\mathfrak{I}$:

McGee Semantics:

- $[\![A]\!]^{f,\Gamma,w} = 1$ iff $f(\bigcap_{p\in\Gamma} [\![p]\!]^{f,\varnothing}, w) \in \mathfrak{I}(A)$
- $[\![\neg p]\!]^{f,\Gamma,w} = 1$ iff $[\![p]\!]^{f,\Gamma,w} = 0$
- $[\![p \wedge q]\!]^{f,\Gamma,w} = 1$ iff $[\![p]\!]^{f,\Gamma,w} = 1$ and $[\![q]\!]^{f,\Gamma,w} = 1$
- $[\![p > q]\!]^{f,\Gamma,w} = [\![q]\!]^{f,\Gamma\cup\{p\},w}$

Relative to an empty premise set, atomic sentences, negation, and conjunction have their standard classical interpretations. The role of 'if'-clauses in conditionals is solely to add material to the premise set: the conditional's consequent is then evaluated relative to an updated premise set which includes its antecedent. The intersection of the interpreted premise set then serves as an argument for a Stalnakerian selection function. For simple conditionals—conditionals of the form $\ulcorner p > q \urcorner$ where

$p,q \in \mathscr{L}_{CF}$ (i.e. p and q are conditional-free)—the result will be equivalent to Stalnaker's: $\ulcorner p > q \urcorner$ is true just in case the closest p world is a q world. But for complex conditionals, the accounts diverge: in McGee's system, a conditional of the form $\ulcorner p > (q > r) \urcorner$ is true just in case $\ulcorner q > r \urcorner$ is true relative to a premise set to which p has been added, just in case r is true relative to a premise set to which p and q have both been added. This renders $\ulcorner p > (q > r) \urcorner$ equivalent to $\ulcorner (p \wedge q) > r \urcorner$, sufficing to validate *IE*. By contrast, *MP* will not be valid: an easy way to see this is that $\ulcorner p > (\neg p > r) \urcorner$ will always be true, for any p and r; but there are worlds where p is true and $\ulcorner \neg p > r \urcorner$ false.

The second theory is another close variant on Stalnaker's theory, given in Khoo & Mandelkern To appear (I'll call this theory *KM*). This theory has just Stalnaker's selection function as its context parameter, defined as above. Then:

KM Semantics:

- $[\![A]\!]^{f,w} = 1$ iff $w \in \mathfrak{I}(A)$
- $[\![\neg p]\!]^{f,w} = 1$ iff $[\![p]\!]^{f,w} = 0$
- $[\![p \wedge q]\!]^{f,w} = 1$ iff $[\![p]\!]^{f,w} = 1$ and $[\![q]\!]^{f^{p^f},w} = 1$, where f^{p^f} is the selection function s.t. for all $\varphi, w : f^{p^f}(\varphi, w) = f([\![p]\!]^f \cap \varphi, w)$
- $[\![p > q]\!]^{f,w} = [\![q]\!]^{f^{p^f}, f([\![p]\!]^f, w)}$

Atomic sentences and negation are treated classically. Conditionals are treated exactly as in Stalnaker's semantics—the consequent is evaluated relative to the closest world where the antecedent is true—with one key difference: the selection function also records the information in the antecedent (in this respect, it is similar to McGee's premise sets, but the information is carried by updating the selection function, rather than an independent parameter). This means that $\ulcorner p > (q > r) \urcorner$ is true just in case $\ulcorner q > r \urcorner$ is true at the closest p world *and relative to a selection function* whose image always makes p true, which in turn holds just in case r is true at the closest world which makes both p and q true. This, in turn, suffices to ensure that $\ulcorner p > (q > r) \urcorner$ is equivalent to $\ulcorner (p \wedge q) > r \urcorner$, as long as q is conditional-free. Our semantics for conjunction, finally, is classical except that, when q is a conditional,

$\ulcorner p \wedge q \urcorner$ is interpreted in such a way that p is added to the selection function relative to which q is evaluated. This suffices to ensure that *IE* is valid in full generality, even when q is a conditional (more on this below). *MP* will be invalid; the same example which showed this for McGee will show this for KM.

The final theory is due to Kratzer (1981, 1986), augmented with a conjunction along the lines suggested in Khoo & Mandelkern To appear; I'll call this theory *PK*, for Pseudo-Kratzer. This theory treats a context as a pair of, first, a modal base function g from worlds to sets of propositions; and, second, a function $\preceq$ from worlds to well-founded partial pre-orders on worlds such that for any world w, w is minimal in $\preceq(w)$.[10] Finally, this approach augments our language with a covert modal $\textsc{m}$ with semantics as below. Then:

PK Semantics:

- $[\![A]\!]^{g,\preceq,w} = 1$ iff $w \in \mathfrak{I}(A)$
- $[\![\neg p]\!]^{g,\preceq,w} = 1$ iff $[\![p]\!]^{g,\preceq,w} = 0$.
- $[\![p \wedge q]\!]^{g,\preceq,w} = 1$ iff $[\![p]\!]^{g,\preceq,w} = 1$ and $[\![q]\!]^{g^{p^{g,\preceq}},\preceq,w} = 1$,
  where $\forall w : g^{p^{g,\preceq}}(w) = g(w) \cup \{[\![p]\!]^{g,\preceq}\}$
- $[\![p > q]\!]^{g,\preceq,w} = [\![q]\!]^{g^{p^{g,\preceq}},\preceq,w}$
- $[\![\textsc{m}(p)]\!]^{g,\preceq,w} = 1$ iff $\forall w' \in \bigcap g(w)$: if w' is minimal in $\preceq_g(w)$, then $[\![p]\!]^{g,\preceq,w'} = 1$,
  where $\preceq_g(w)$ is the limitation of $\preceq(w)$ to $\bigcap g(w)$.

Atoms and negation are treated classically. The only role of a conditional antecedent is to add its information to the ordering source (much as in McGee's theory). Crucially, Kratzer then assumes that conditionals without overt modals (i.e., all conditionals in our limited language, which does not contain overt modals) always contain the covert modal $\textsc{m}$ which takes scope over everything which follows the most deeply-embedded $>$ in the conditional; thus e.g. where r does not contain $\textsc{m}$ or $>$, instead of $\ulcorner p > r \urcorner$ we will have $\ulcorner p > \textsc{m}r \urcorner$; likewise, instead of $\ulcorner p > (q > r) \urcorner$

10 My presentation simplifies Kratzer's in moving directly to a pre-order rather than going by way of an ordering source, and in assuming that $\preceq(w)$ is well-founded for all w (the limit assumption). Both of these simplifications are irrelevant for present purposes.

we will have $\ulcorner p > (q > \textsc{m}r)\urcorner$. $\ulcorner \textsc{m}p\urcorner$ evaluates p at the minimal worlds in the intersection of the modal base, and is true just in case p is true at all those worlds. Putting this all together, simple conditionals of the form $\ulcorner p > \textsc{m}q\urcorner$ will be true just in case all the minimal p worlds consistent with the modal base are q worlds (the resulting semantics for simple conditionals is a slight generalization of the one given in Lewis 1973 for subjunctive conditionals). When it comes to complex conditionals, the clause for conditionals, together with the assumption about covert modals, ensures that we keep track of consecutive antecedents, just as for McGee and KM. So $\ulcorner p > (q > \textsc{m}r)\urcorner$ will be true just in case $\ulcorner q > \textsc{m}r\urcorner$ is true relative to a modal base which includes the information that p is true, which holds just in case r is true at all the minimal worlds where p and q are true. When q is conditional-free, this suffices to guarantee that $\ulcorner p > (q > \textsc{m}r)\urcorner$ is equivalent to $\ulcorner (p \wedge q) > \textsc{m}r\urcorner$. And our clause for conjunction ensures that right conjuncts are evaluated relative to a modal base which includes the information in the left conjunct. This, in turn, suffices to validate *IE* in full generality, even when q is a conditional (more below). *MP*, by contrast, will not be valid; the same example given above shows this.

All three of these theories, then, validate *IE*. They differ in a variety of ways, but what I want to focus on here is their treatment of 'and'. McGee's theory has a classical 'and'. But KM and PK give 'and' a decidedly non-classical treatment. On both those theories, 'and' is fully classical for the conditional-free fragment; but not when we have a conjunction whose right conjunct is a conditional. Then the conditional is evaluated, in KM, relative to a selection function updated with the left conjunct; and in PK, relative to a modal base which is updated with the left conjunct. To illustrate this divergence in their treatment of 'and', consider the conjunction $\ulcorner p \wedge (\neg p > q)\urcorner$ for any conditional-free p. In McGee's theory, this conjunction is true relative to $\langle f, \Gamma, w\rangle$ just in case both p and $\ulcorner \neg p > q\urcorner$ are true relative to $\langle f, \Gamma, w\rangle$, just as we would expect. Consider next PK. We assume that in a conjunction like this, q has the form $\textsc{m}r$. The conjunction $\ulcorner p \wedge (\neg p > \textsc{m}r)\urcorner$ is then true relative to $\langle g, \preceq, w\rangle$ just in case p is true relative to $\langle g, \preceq, w\rangle$ and $\ulcorner \neg p > \textsc{m}r\urcorner$ is true relative to *a different* point of evaluation, namely $\left\langle g^{p^{g,\preceq}}, \preceq, w\right\rangle$. And now notice something important: $\ulcorner \neg p > \textsc{m}r\urcorner$ is *always* true relative to *any* point of evaluation which contains $g^{p^{g,\preceq}}$ as its modal base parameter, *no matter what g* is, and no matter what $\preceq$ and w are. This is, a bit informally, because $[\![\neg p > \textsc{m}r]\!]^{g^{p^{g,\preceq}},\preceq,w} = 1$ just in case all $\preceq(w)$-minimal worlds in a certain set make r true—but what set? We get that set by taking the intersection of $g(w)$, then intersecting that with the intension of p, and then intersecting that with the intension of $\ulcorner\neg p\urcorner$. Whatever we started with, we'll end with the empty set. And so the quantification here ends up vacuous, and $\ulcorner\neg p > \textsc{m}r\urcorner$ is guaranteed to be true. That means that in PK, $\ulcorner p \wedge (\neg p > \textsc{m}r)\urcorner$ is true at any index just in case p is! And that, of course, means that 'and' is highly non-classical in this system. In particular, right conjunction elimination will be invalid: the truth of p at an index will suffice for the truth of $\ulcorner p \wedge (\neg p > \textsc{m}r)\urcorner$, but not for the truth of $\ulcorner\neg p > \textsc{m}r\urcorner$.[11] Conjunction introduction will also be invalid, for similar reasons: we can have p and $\ulcorner q > \textsc{m}r\urcorner$ both true relative to some index, while $\ulcorner p \wedge (q > \textsc{m}r)\urcorner$ is false relative to that same index, since in the conjunction, the right conjunct is evaluated relative to a shifted modal base (intuitively: for the conjunction to be true we would need not only p and $\ulcorner q > \textsc{m}r\urcorner$ to be true, but also for $\ulcorner(p \wedge q) > \textsc{m}r\urcorner$ to be true; and the truth of the latter does not follow from the truth of the former two in a variably strict framework like PK).[12] Things are parallel for KM's theory. $\ulcorner p \wedge (\neg p > q)\urcorner$ will be true relative to any index just in case p is: for the right conjunct will be evaluated relative to a selection function updated with p; which means that q will be evaluated relative to the closest world which makes both p and $\ulcorner\neg p\urcorner$ true; which means it will be evaluated relative to the absurd world, which makes everything true. So right conjunction elimination will be invalid. And conjunction introduction will likewise be invalid, for parallel reasons.

That a non-classical 'and' is required in order for theories like PK and KM to validate *IE* was first pointed out to me by Justin Khoo (p.c.), and first observed in the literature, to my knowledge, only in Khoo & Mandelkern To appear. But why do PK and KM need a non-classical 'and' to validate *IE* in full generality? The intuition

11 Left conjunction elimination remains valid.

12 E.g. consider a model with three possible worlds, x, y, z. Assume p, q, r are atoms. Let $g(z) = \varnothing$; let $\preceq(z) = \{\langle z,x\rangle, \langle x,y\rangle, \langle z,y\rangle, \langle z,z\rangle, \langle x,x\rangle, \langle y,y\rangle\}$; and let $p(z) = 1, q(z) = 0, q(x) = r(x) = 1, p(x) = 0, q(y) = p(y) = 1, r(y) = 0$. Then p and $\ulcorner q > \textsc{m}r\urcorner$ are both true at $\langle z, g, \preceq\rangle$, but their conjunction is not.

is the following. In both these theories, *IE* is validated because we keep track of the information in the antecedents of conditionals in our modal parameters as we process a conditional; when we have nested conditionals, we evaluate each successive antecedent relative to the information contained in the antecedents we have already processed. But that means that if we want to validate *IE* in full generality, conjunction must keep track of this information in exactly the same way. In other words, we evaluate q in $\ulcorner p > (q > r)\urcorner$ relative to modal parameters that include the information that p is true; if *IE* is to be valid for the case in which q is itself a conditional, we must likewise evaluate q in $\ulcorner (p \wedge q) > r\urcorner$ relative to modal parameters that are updated with p.

For an illustrative example, consider a conditional of the form $\ulcorner p > ((\neg p > q) > r)\urcorner$, with p and q conditional-free (in PK, we of course assume that q and r have the form $\ulcorner \text{M}s\urcorner$ and $\ulcorner \text{M}t\urcorner$ for some conditional-free and modal-free s and t). For both KM and PK, the second embedded conditional here, $\ulcorner \neg p > q\urcorner$, is interpreted relative to modal parameters that include the information that p, and thus is trivially true. It follows that, in KM and PK, $\ulcorner p > ((\neg p > q) > r)\urcorner$ is equivalent to $\ulcorner p > r\urcorner$. Now *IE* tells us that $\ulcorner p > ((\neg p > q) > r)\urcorner$ is semantically equivalent to $\ulcorner (p \wedge (\neg p > q)) > r\urcorner$. But, if we were to adopt all the semantic entries in PK or KM together with a *classical* ‘and’, then the latter is *not* equivalent to $\ulcorner p > r\urcorner$, since the right conjunct of the antecedent of $\ulcorner (p \wedge (\neg p > q)) > r\urcorner$ is not interpreted relative to modal parameters that are updated with p, and so the right conjunct of the antecedent is not at all trivial. This just follows from the fact that, if ‘and’ is classical, then $\ulcorner p \wedge (\neg p > q)\urcorner$ is not equivalent to p. And so $\ulcorner (p \wedge (\neg p > q)) > r\urcorner$ will not, after all, be equivalent to $\ulcorner p > ((\neg p > q) > r)\urcorner$: PK or KM ammended so that it has a classical conjunction will invalidate *IE* when what is imported/exported is itself a conditional. By contrast, with the non-classical semantics for conjunction given above, both theories will, again, validate *IE* in full generality.

This makes it clear why PK and KM need a non-classical conjunction to validate *IE*. It also raises the converse question: how does McGee validate *IE* with a classical conjunction? McGee, like PK and KM, validates *IE* by stipulating that when we process a conditional with multiple antecedents, we keep track of the information in all the antecedents as we go, evaluating the consequent in light of all that information. But crucially, in McGee's semantics, we *don't* evaluate that information *as we go*, taking into account earlier information. Rather, we just keep track of all the sentences which are antecedents of the conditional, and then evaluate each on its own, relative to the empty set of hypotheses, when we are ready to evaluate the most deeply embedded consequent. More concretely, consider $\ulcorner p > (q > r) \urcorner$. Rather than evaluating q relative to a set of hypotheses which includes the information that p, and then evaluating r relative to a set of hypotheses that includes the information that p and that q, we evaluate both p and q relative to the empty set of hypotheses, and then evaluate r relative to the information derived that way. This means that we *don't* take into account p when evaluating q in the above; q is evaluated as it would be when unembedded. This means that, in $\ulcorner p > ((q > r) > s) \urcorner$, $\ulcorner q > r \urcorner$ is evaluated the same way as when unembedded—it is evaluated relative to an empty premise set—and thus it is evaluated in the same way as when it appears in $\ulcorner (p \wedge (q > r)) > s \urcorner$, where $\wedge$ has classical semantics. This means that McGee can validate *IE* in full generality with a classical conjunction. In particular, in $\ulcorner p > ((\neg p > q) > r) \urcorner$, the embedded conditional $\ulcorner \neg p > q \urcorner$ will not be trivial—because it won't be evaluated relative to a premise set updated with p—and so the whole conditional will not be equivalent to $\ulcorner p > r \urcorner$, but will be equivalent to $\ulcorner (p \wedge (\neg p > q)) > r \urcorner$, where $\wedge$ has classical semantics.

KM and PK thus need a non-classical conjunction to validate *IE*; McGee manages to validate *IE* with a classical conjunction. Let me note, moreover, that KM and PK are the rule, not the exception: as far as I know, McGee's theory is the *only* extant theory of conditionals which validates *IE* in the context of a classical conjunction. Every other theory I know of requires a non-classical 'and' along the lines of the conjunction in KM and PK in order to validate *IE*.[13]

13 Most prominently that of of Gillies 2009, as Khoo & Mandelkern (To appear) discuss.

4 Nothing Added

Good for McGee and bad for KM and PK, we might think. Classical conjunction has many things going for it, simplicity not the least. If we want to validate *IE*, then (it is natural to think) we should do so without introducing excessive weirdness elsewhere in our semantics.

But this response is overhasty. Adopting *IE* together with a classical conjunction forces us to invalidate other plausible principles about the conditional. This counts against any approach which aims to validate *IE* while keeping conjunction classical. (In the end I will argue that the best response is not to accept KM/PK's non-classical conjunction, but rather to reject *IE* in favor of a more limited principle; but more on that to come.)

I will discuss two principles in particular which we cannot reasonably validate if we adopt *IE* together with a classical conjunction. I call the first principle *Nothing Added*.[14]

$$\textit{Nothing Added}\colon \forall c,p,q,r : ([\![p > q]\!]^c = \mathscr{W}) \rightarrow ([\![p > (q > r)]\!]^c = [\![p > r]\!]^c)$$

Nothing Added says that, when $\ulcorner p > q \urcorner$ is a theorem, then $\ulcorner p > (q > r) \urcorner$ will always express the same thing as $\ulcorner p > r \urcorner$. The principle is very natural. Intuitively, $\ulcorner p > q \urcorner$ will be a theorem just in case the truth of p already in some sense guarantees the truth of q, no matter what the world is like. $\ulcorner p > r \urcorner$ will be true at a given world, intuitively, just in case the truth of p at that world in some sense suffices to guarantee the truth of r. But now adding in $\ulcorner > q \urcorner$ in the middle, so we get $\ulcorner p > (q > r) \urcorner$, should not result in a sentence with a different meaning, because the truth of p guarantees the truth of q, *no matter what*; and so whether $\ulcorner p > (q > r) \urcorner$ is true will just boil down to the question of whether $\ulcorner p > r \urcorner$ is true, and *vice versa*.

But it turns out that, given some anodyne background assumptions, it is impossible to validate both *Nothing Added* and *IE* in a framework with classical conjunction without arriving at absurd conclusions. As an illustration to begin, note that McGee does not validate *Nothing Added*. For McGee, $\ulcorner p > (\neg p > q) \urcorner$ is a theorem, since q

14 $\rightarrow$ is the meta-language material conditional.

will be true relative to any premise set which includes both p and $\ulcorner \neg p \urcorner$. *Nothing Added* would then say that, for any r, $\ulcorner p > ((\neg p > q) > r) \urcorner$ is equivalent to $\ulcorner p > r \urcorner$. But these are inequivalent in McGee's semantics. The easiest way to see this is by way of *IE*. Since McGee validates *IE*, $\ulcorner p > ((\neg p > q) > r) \urcorner$ is equivalent in his semantics to $\ulcorner (p \wedge (\neg p > q)) > r \urcorner$. For simplicity, let p, q, and r be arbitrary different atoms. Suppose we evaluate $\ulcorner (p \wedge (\neg p > q)) > r \urcorner$ and $\ulcorner p > r \urcorner$ relative to an empty premise set, at a world w where both p and r are true, and a selection function f. $\ulcorner p > r \urcorner$ will be true at this index no matter what, since f will take $\left\langle [\![p]\!]^{\varnothing, f}, w \right\rangle$ to w, by the fourth constraint on selection functions above. But now suppose that $f([\![p]\!]^{\varnothing, f} \cap [\![\neg p > q]\!]^{\varnothing, f}, w) = w' \neq w$, and suppose that $r(w') = 0$ (these assumptions are perfectly consistent). Then $\ulcorner (p \wedge (\neg p > q)) > r \urcorner$ will be false at $\langle \varnothing, f, w \rangle$; but then, by *IE*, $\ulcorner p > ((\neg p > q) > r) \urcorner$ is false at $\langle \varnothing, f, w \rangle$. Since $\ulcorner p > r \urcorner$ is true at $\langle \varnothing, f, w \rangle$, it follows that $\ulcorner p > ((\neg p > q) > r) \urcorner$ is not equivalent to $\ulcorner p > r \urcorner$.

So *Nothing Added* is not valid in McGee's semantics—whereas, by contrast, *Nothing Added* is valid in PK's and KM's semantics (I leave the proof to readers). This divergence is not an accident, for we can show that, given two innocuous background assumptions, it is impossible to validate *IE* and *Nothing Added* while keeping conjunction classical without arriving at absurd consequences. Those assumptions are, first, *Conditional Deduction*, the principle adverted to in Gibbard's proof which says that if p entails q, then $\ulcorner p > q \urcorner$ is a theorem; and, second, a principle I'll call *Equivalence*:

Equivalence: $\forall p, q : (\forall c, r : [\![p > r]\!]^c = [\![q > r]\!]^c) \rightarrow \forall c : [\![p]\!]^c = [\![q]\!]^c$

Equivalence says that, given two sentences p and q, as long as $\ulcorner p > r \urcorner$ and $\ulcorner q > r \urcorner$ are semantically equivalent *no matter what r is*, then p and q must be semantically equivalent as well. This is a principle that is validated by every semantics I know for the conditional; its converse (that conditionals with semantically equivalent antecedents are equivalent) has been challenged,[15] but I do not know of any challenges to *Equivalence*.

15 See Santorio To appear and citations therein.

Now suppose we take on board *IE*, *Nothing Added*, *Conditional Deduction*, and *Equivalence*. We also make the classical *Quodlibet* assumption that, as long as p itself is conditional-free, $\ulcorner p \wedge \neg p \urcorner$ is nowhere true, and thus entails everything. Then for any c, for any $q \in \mathscr{L}$ and $p \in \mathscr{L}_{CF}$:[16]

i. $[\![(p \wedge \neg p) > q]\!]^c = \mathscr{W}$ — *Conditional Deduction, Quodlibet*

ii. $[\![p > (\neg p > q)]\!]^c = \mathscr{W}$ — *IE*, (i)

iii. $\forall r \in \mathscr{L} : [\![(p \wedge (\neg p > q)) > r]\!]^c =$
$[\![p > ((\neg p > q) > r)]\!]^c =$
$[\![p > r]\!]^c$ — *IE*, *Nothing Added*, (ii)

iv. $[\![p]\!]^c = [\![p \wedge (\neg p > q)]\!]^c$ — *Equivalence*, (iii)

Now suppose that conjunction is classical, in particular that it validates right conjunction elimination.[17] Since from (iv) we can conclude that whenever p is true, so is $\ulcorner p \wedge (\neg p > q) \urcorner$, right conjunction elimination then lets us conclude that $\ulcorner \neg p > q \urcorner$ is also true. In other words, we arrive at the conclusion that p entails $\ulcorner \neg p > q \urcorner$; i.e. that $\forall c : \forall q \in \mathscr{L} : \forall p \in \mathscr{L}_{CF} : [\![p]\!]^c \subseteq [\![\neg p > q]\!]^c$. But this conclusion is clearly false: it is, in fact, one of the worst consequences of the material conditional analysis of the conditional. For, given classical negation (which is not in dispute here), this conclusion entails that the *falsity* of $\ulcorner \neg p > q \urcorner$ entails the falsity of p; more succinctly, the falsity of $\ulcorner p > q \urcorner$ entails the truth of p. Call this principle *Ex falso*:

Ex falso: $\forall c : \forall q \in \mathscr{L} : \forall p \in \mathscr{L}_{CF} : [\![\neg(p > q)]\!]^c \subseteq [\![p]\!]^c$

But *Ex falso* is unacceptable: as we saw above, ‘It’s not the case that if Patch is a rabbit, she is a rodent’ does *not* entail that Patch is a rabbit. The same goes for counterfactuals: ‘It’s not the case that if Patch had been a rabbit, she would have

16 We limit our attention to p in the conditional-free fragment, because $\ulcorner (p \wedge \neg p) > q \urcorner$ will not always be a theorem when p itself is a conditional, according to KM and PK, as I discuss further below. Likewise in discussion of *Absurdum* below.

17 (iv) on its own is already problematic, at least for subjunctives. I return to this point in §6.

been a rodent' is certainly true; but this obviously does not entail that Patch is a rabbit.

In sum: *Nothing Added*, *Conditional Deduction*, and *Equivalence* entail *Ex falso*, if 'and' is classical and *IE* is true. *Ex falso* is clearly false, and *Conditional Deduction* and *Equivalence* look hard to challenge. So if 'and' is classical, *IE* is in direct tension with a very appealing principle, namely *Nothing Added*. By contrast, with a non-classical 'and' like that of KP or KM, there is no such tension.

5 Absurdum

We find similar tension between *IE*, classical 'and', and a second principle which I'll call *Absurdum*:[18]

$$\textit{Absurdum}: \forall c : ([\![p > q]\!]^c = \varnothing) \rightarrow ([\![p > (q > \bot)]\!]^c = \mathscr{W})$$

Absurdum says that if $\ulcorner p > q \urcorner$ is inconsistent, then $\ulcorner p > (q > \bot) \urcorner$ is a theorem. *Absurdum* is quite attractive. If $\ulcorner p > q \urcorner$ is inconsistent, then p must somehow guarantee that q is false—otherwise there would be some model where $\ulcorner p > q \urcorner$ is true. So p and q must be inconsistent. Under the assumption that p and the subsequent assumption that q, then, anything at all will follow; in other words, $\ulcorner p > (q > \bot) \urcorner$ should be a theorem.

PK and KM both validate *Absurdum*. But, again given some anodyne background assumptions, there is no plausible way to validate *Absurdum* while validating *IE* and keeping conjunction classical. For the sake of illustration, note first that McGee invalidates *Absurdum*. For McGee, $\ulcorner p > (\neg p > q) \urcorner$ is a theorem; and so, assuming p is consistent, $\ulcorner p > \neg(\neg p > q) \urcorner$ is *inconsistent* relative to the empty premise set and any selection function. Then *Absurdum* says that $\ulcorner p > (\neg(\neg p > q) > \bot) \urcorner$ should be a theorem, relative to the empty premise set and any selection function. But in McGee's framework, it's not. By *IE*, this will be equivalent to $\ulcorner (p \wedge \neg(\neg p > q)) > \bot \urcorner$. Since conjunction is classical for McGee, the antecedent of this conditional will be

18 $\bot$ is an atom true only at the absurd world; $\top$ is an atom everywhere true.

consistent, and so the whole conditional will be false at any world. Thus McGee fails to validate *Absurdum*.

More generally, suppose we take on board the following background principles:

$$\textit{Taut1}: \forall c : \forall p, q \in \mathscr{L} : ([\![p]\!]^c \neq \varnothing \wedge [\![p > q]\!]^c = \mathscr{W}) \rightarrow [\![p > \neg q]\!]^c = \varnothing$$

$$\textit{Taut2}: \forall c : \forall p, q \in \mathscr{L} : ([\![p > \bot]\!]^c = \mathscr{W}) \rightarrow ([\![p]\!]^c = \varnothing)$$

Taut1 says that, if p is consistent and $\ulcorner p > q \urcorner$ is a theorem, then $\ulcorner p > \neg q \urcorner$ is inconsistent. If p is consistent, then $\ulcorner p > q \urcorner$ will be a theorem only if, intuitively, the truth of p somehow guarantees the truth of q, no matter what the world is like; but then $\ulcorner p > \neg q \urcorner$ will always be false. *Taut2* says that if $\ulcorner p > \bot \urcorner$ is a theorem, then p is inconsistent. This, again, seems very plausible: if $\ulcorner p > \bot \urcorner$ is a theorem, then this means that the truth of p somehow guarantees the truth of $\bot$; but since $\bot$ is never true, this can only hold if p is never true. Indeed, *Taut2* follows from *Taut1* given the very plausible assumption that $\ulcorner p > \top \urcorner$ is a theorem for any p (a principle, again, which as far as I know everyone accepts). Suppose then that $\ulcorner p > \bot \urcorner$ is a theorem. If p were consistent, then, by *Taut1*, it would follow that $\ulcorner p > \top \urcorner$ is inconsistent, contrary to our assumption. So it must be that p is inconsistent. *Taut1* and *Taut2* are validated (or nearly validated)[19] by every semantics for the conditional I know, and seem very plausible to me.

Now, taking these assumptions on board, consider any $p \in \mathscr{L}_{CF}$ and any $q \in \mathscr{L}$ and any c relative to which p is consistent:

i. $[\![(p \wedge \neg p) > q)]\!]^c = \mathscr{W}$ — *Conditional Deduction, Quodlibet*

ii. $[\![p > (\neg p > q)]\!]^c = \mathscr{W}$ — *IE*, (i)

iii. $[\![p > \neg(\neg p > q)]\!]^c = \varnothing$ — *Taut1*, (ii)

iv. $[\![p > (\neg(\neg p > q) > \bot)]\!]^c = \mathscr{W}$ — *Absurdum*, (iii)

v. $[\![(p \wedge \neg(\neg p > q)) > \bot]\!]^c = \mathscr{W}$ — *IE*, (iv)

19 Technically McGee's semantics won't validate *Taut2*, but it will validate a restricted principle which quantifies not over all contexts, but over all contexts whose premise set is consistent with p.

vi. $[\![p \wedge \neg(\neg p > q)]\!]^c = \varnothing$ *Taut2*, (v)

Now, if 'and' is classical, then (given our classical semantics from negation) from (vi) we can conclude that, whenever p is consistent and in $\mathscr{L}_{CF}$, we have for any c, q : $[\![p]\!]^c \subseteq [\![\neg p > q]\!]^c$ (otherwise we would have that $[\![p]\!]^c$ is consistent with $[\![\neg(\neg p > q)]\!]^c$ and thus that $[\![p \wedge \neg(\neg p > q)]\!]^c$ is consistent). The same of course holds whenever p is inconsistent; and so we arrive again at *Ex falso*. Once more, then, classical conjunction puts *IE* in tension with a very intuitive principle, this time *Absurdum*, given background assumptions (*Taut1* and *Taut2*, together with *Conditional Deduction* and *Quodlibet*) which seem difficult to challenge.

6 Restricted Import-Export

Import-Export thus does not sit easily with a classical conjunction. Given some innocuous background assumptions, if we adopt classical conjunction, then we cannot validate *IE* together with *Nothing Added* or with *Absurdum*, at risk of validating the obviously false principle *Ex falso*.

My main goal here has been to draw out the surprising connections between *IE* and conjunction. There are a variety of ways we could respond to these results. Accepting *Ex falso* seems like a non-starter to me. So does rejecting one of the background assumptions (*Conditional Deduction, Quodlibet, Equivalence, Taut1, Taut2*), though proponents of non-classical logics may be more inclined to go that way. It seems to me, then, that we must reject one of the following: (i) classical conjunction; (ii) *IE*; and (iii) *Nothing Added*; and likewise we must reject one of the following: (i) classical conjunction; (ii) *IE*; and (iii) *Absurdum*.

So what are we to do? In concluding, I will, very briefly, argue that the right response to these results is to reject *IE* on a limited basis. What I propose is, essentially, to split the difference between McGee's approach on the one hand—which has classical 'and', *IE*, and neither of *Nothing Added* nor *Absurdum*—and KM/PK's approach—which has *IE*, *Nothing Added*, and *Absurdum*, together with a non-classical 'and'. The best route, I will argue, is neither of these, but instead maintains classical conjunction, *Nothing Added*, and *Absurdum*, but rejects *IE* in favor of a slightly weaker principle.

Let me start with some negative remarks. Following McGee's route—validating *IE* with a classical conjunction, and therefore invalidating *Nothing Added* and *Absurdum*—is *prima facie* unattractive insofar as those latter principles are very natural (though one could certainly deny them). Following KM/PK's route—adopting a non-classical conjunction, together with *IE*, *Nothing Added*, and *Absurdum*—likewise has serious drawbacks. It should be acknowledged that the non-classical conjunctions under discussion behave classically except when a right conjunct is a conditional; and the non-classical conjunctions under consideration bear a close resemblance to non-classical conjunctions which have been motivated and defended in the dynamic semantics literature on the basis of facts about anaphora, presupposition, and—most closely related to present considerations—epistemic modality.[20] But there are serious drawbacks to accepting KM/PK's non-classical 'and'. I will mention two. The first is that the non-classical 'and' advocated by PK and KM invalidates certain logical principles which seem very intuitive in natural language, even when 'and' conjoins conditionals. The most prominent of these is the principle of non-contradiction, which says that $\ulcorner p \wedge \neg p \urcorner$ is a contradiction, for any p. This principle is not valid in PK or KM; in particular, we will get countermodels when p itself is a conditional. That is, some sentences of the form $\ulcorner (q > r) \wedge \neg (q > r) \urcorner$ are consistent in these frameworks (the key point is that the second, negated conditional is interpreted relative to modal parameters updated with the first, and thus can be false while the first is true). This seems like a bad result, one not borne out by natural language;[21] (3) for instance seems just as contradictory as (4):

(3) If Bob is in his office, Sue is; and, it's not the case that if Bob is in his office, Sue is.

20 See e.g. Heim 1982, 1983, Groenendijk et al. 1996. In Mandelkern To appear, I defend a non-classical conjunction on the basis of considerations about epistemic modality. But it differs substantially from the one under discussion here, both in motivation and in its logical profile; in particular, unlike the one under consideration here, that conjunction Strawson-validates all classical logical laws.

21 See Mandelkern 2018 for a parallel result concerning dynamic 'and'.

(4) Bob is in his office and it's not the case that Bob is in his office.

Second, while adopting a non-classical conjunction lets us avoid *Ex falso*, adopting *IE* together with *Nothing Added* still allows us to arrive at an unsavory conclusion, *whatever conjunction we adopt*. Namely, as our first result showed, given our background assumptions, these together entail that p and $\ulcorner p \wedge (\neg p > q) \urcorner$ are semantically equivalent for conditional-free p. This conclusion on its own is difficult to assess for indicative conditionals, which are generally felicitous only if their antecedents are compatible with the context (Stalnaker 1975); but is clearly unacceptable for subjunctive conditionals. Thus suppose that it's sunny, and that if it had rained the picnic would have been cancelled. Then (5) is true and (6) false:

(5) It's sunny, and if it had rained the picnic would have been cancelled.

(6) It's sunny, and if it had rained the picnic would not have been cancelled.

By contrast, if we validate both *IE* and *Nothing Added*, we predict both of these to be true. Thus these two principles together already seem to be in tension, whatever conjunction we adopt, suggesting that we should not try to validate both of them after all.[22]

Both of these options thus have clear drawbacks. There is an alternative, however. To motivate it, a bit of review is in order. The year is 1980: the Republican American presidential candidate Reagan is ahead in the polls, followed by the Democrat Carter. Well behind both is Anderson, a second Republican. McGee (1985) noted that the following conditional sounds clearly true in this situation:

(7) If a Republican wins the election, then if Reagan doesn't win, Anderson will.

McGee noted, however, that the following conditional sounds clearly false:

(8) If Reagan doesn't win the election, Anderson will.

22 Thanks to an anonymous referee for this journal and David Boylan for pointing this out to me.

Since we nonetheless leave open the possibility that a Republican will win the election, it seems as though it can't be that the truth of 'A Republican will win the election', together with the truth of (7), entails that (8) is true. This is McGee's famous counterexample to *MP*. At the same time, McGee noted that (7) sounds equivalent to (9):

(9) If a Republican wins the election and Reagan doesn't win, Anderson will.

That felt equivalence counts as evidence in favor of *IE*.

The conclusion that *IE* is valid, however, is not unavoidable. Other researchers have indeed explored *IE* and have found no convincing (to my mind) counterexamples to the principle.[23] But, as far as I know, none of those explorations has looked

23 See Khoo & Mandelkern To appear for a survey. An intriguing possible exception to this, brought to my attention by an anonymous referee for this journal, comes from Etlin 2008. Etlin provides the following pair (slightly modified):

(10) If this match had lit at noon today, then if it had been soaked in water last night it would have lit at noon today.

(11) If this match had lit at noon today and it had been soaked in water last night, then it would have lit at noon today.

(10) has a salient reading on which it is not true, while (11) has only a true reading; these together thus constitute a *prima facie* counterexample to *IE* (and to *RIE*, the weaker principle I'll take up in a moment) for subjunctives (but not for indicatives: corresponding indicative pairs pattern together). One conclusion we could draw from cases like this is that *RIE* is false for subjunctives, but true for indicatives. This would open up two substantial explanatory questions, however: First, why do indicatives and subjunctives pattern differently here? Second, why does *RIE* seem to hold in so many cases even for subjunctives? A different strategy would be to argue that (10) and (11) do not constitute a genuine counterexample to *RIE*. This would avoid opening up those two explanatory questions. One way to pursue this strategy would be to note, first, that there is *a* reading of (10) on which it sounds true (brought out if we add a 'still' in the consequent of the nested conditional). Second, the reading on which (10) strikes us as false is well-glossed with a concessive, 'even if' conditional:

(12) Even if this match had lit at noon today, if it had been soaked in water last night it would have lit at noon today.

Note, by contrast, that (11) does not have a natural parallel paraphrase:

(13) Even if this match had lit at noon today and it had been soaked in water last night, it would have lit at noon today.

While (13) is perfectly well-formed, it does not express a natural thought, and (perhaps, therefore) is not a natural gloss on any reading of (11). So one take on Etlin's case is the following: the prominent false reading of (10) is as an 'even if' conditional, while the prominent true reading of (11) is as an ordinary conditional; assuming these readings differ at some level of logical form, the fact that the conditionals diverge in intuitive truth conditions *on this different readings* is not evidence against in particular at instances of *IE* where what is being imported and exported is itself a conditional, i.e. at pairs of the form $\ulcorner p > ((q > r) > s)\urcorner$ and $\ulcorner (p \wedge (q > r)) > s)\urcorner$. *IE*, of course, predicts pairs of this form to be equivalent; and readers may have noticed that both of the proofs above make crucial use of precisely this instance of *IE* (in step (iii) of the first, and step (v) of the second). This means that those proofs would be blocked if we adopted a weaker version of *IE*, which says that the predicted equivalences of *IE* hold *except* when what is being imported and exported is itself a conditional:

Restricted Import-Export (RIE):
$\forall c : \forall p, r \in \mathscr{L} : \forall q \in \mathscr{L}_{CF} : [\![p > (q > r)]\!]^c = [\![(p \wedge q) > r]\!]^c$

RIE says that $\ulcorner p > (q > r)\urcorner$ and $\ulcorner (p \wedge q) > r\urcorner$ will always be equivalent unless q is itself in the conditional fragment, in which case these may come apart.

The first thing to note about *RIE* is that it lets us escape the results presented so far: that is, there is no difficulty validating *RIE* with a classical conjunction, together with *Nothing Added* and *Absurdum*. Indeed, if we take either the KM or the PK semantics given above and replace the non-classical conjunctions there with classical conjunctions, we arrive at semantic theories which validate *RIE* but not *IE*; which have classical conjunction; which validate *Nothing Added* and *Absurdum*, together with all the background principles assumed above; and which do not validate *Ex falso*.

RIE thus lets us validate something close to *IE*, while avoiding the tensions pointed out above. *RIE* at first blush looks hopelessly *ad hoc*. But this appearance is somewhat misleading. First, the appearance of gerrymandering is greatly diminished

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RIE. This strategy is attractive because, first, it allows us to account for the intuition that *RIE* usually seems to be valid, for both subjunctives and indicatives; second, because it straightforwardly accounts for the fact that we don't find similar cases with indicatives, since the indicative 'even if' variation of (12) does not make much sense:

(14) Even if this match lit at noon today, if it was soaked in water last night it lit at noon today.

My inclination, then, is to pursue this explanation of Etlin's data; more would have to be said, of course, about the distinction between concessive and ordinary conditionals to spell this out. It is worth noting, though, that those who accept Etlin's case against *RIE* for subjunctives may still find *RIE* attractive for indicatives.

when we look at *RIE* from a semantic rather than a syntactic point of view: as we have just seen, from the perspective of a Kratzerian or Stalnakerian theory of the conditional, there is a sense in which it is simpler to validate *RIE* than it is to validate *IE*. And, more importantly, I will argue that intuitions about natural language actually match the predictions of *RIE*: conditionals $\ulcorner p > (q > r) \urcorner$ and $\ulcorner (p \wedge q) > r \urcorner$ are always felt to be equivalent, *unless* q is itself a conditional. In that case, intuitions about their truth-values can diverge. For the first part of this claim, I refer readers to the existing literature. My contribution is to the second part: when q is a conditional, $\ulcorner p > (q > r) \urcorner$ and $\ulcorner (p \wedge q) > r \urcorner$ do not invariably strike speakers as equivalent.

A variation of McGee's case provides a nice illustration of this. Suppose that we know that Reagan is well ahead of both Carter and Anderson in the polls, but we don't know the relative standing of Anderson and Carter. Now consider the following conditional:

(15) If a Republican will win the election, and Anderson will win if Reagan doesn't win, then both Republicans are currently in a stronger position to win than Carter.

(15) strikes me as likely true in the scenario as described. If a Republican will win the election, presumably it will be Reagan, since we know he is in the strongest position to win. But if it's *also* the case that Anderson will win if Reagan doesn't, then that must be because Anderson is in a stronger position than Carter at present. And so we know that both Anderson and Reagan are in a stronger position to win than Carter: Reagan because we already know that he's ahead of Carter, and Anderson because the conditional fact that Anderson will win if Reagan doesn't, together with our background knowledge that Reagan is ahead, suggests that Anderson must be doing better than Carter. (15), then, strikes me as likely to be true.

But now consider (16):

(16) If a Republican will win the election, then if Anderson will win if Reagan doesn't, then both Republicans are currently in a stronger position to win than Carter.

(16), *unlike* (15), does not seem likely to be true. After all, if a Republican wins the next election, then of course it already follows that Anderson will win if Reagan doesn't. And so that embedded conditional doesn't tell us anything more, beyond that a Republican will win the election. In other words, (16) strikes me as being equivalent to 'If a Republican will win the election, then both Republicans are currently in a stronger position to win than Carter'. But that does not strike me as having any better than even odds of being true: a Republican winning the election doesn't show that both Republicans are in a stronger position to win than Carter. In other words, the set-up described by 'If a Republican wins the election, then if Anderson will win if Reagan doesn't, then…' seems clearly consistent with the following situation: Reagan is well ahead; then Carter; and then Anderson. And in this situation, it's not the case that both Republicans are ahead. In short, my credence in (15) is very high; my credence in (16) is at best middling. If my credences in these can rationally come apart, then they cannot express the same proposition.

I conclude that (15) and (16) are not semantically equivalent. But now note that (15) has the form $\ulcorner p > ((q > r) > s)\urcorner$, and (16) has the form $\ulcorner (p \wedge (q > r)) > s\urcorner$—with $p =$'a Republican will win the election', $q =$'Reagan doesn't win', $r =$'Anderson will win', and $s =$'both Republicans are currently in a stronger position to win than Carter'. That means that, if *IE* is valid, then (15) and (16) are semantically equivalent. And indeed, McGee, PK, and KM all predict this equivalence, by validating *IE*—though in different ways. McGee, by validating *IE* with a classical conjunction, predicts that both (15) and (16) have the truth conditions which, intuitively, only (15) has—i.e. that both conditionals are clearly true in the situation as described. PK and KM validate *IE* by generalizing in the opposite direction: they predict that (15) and (16) both have the truth conditions which, intuitively, only (16) has—i.e. that neither conditional is clearly true in the situation as described.

But, as we have seen, contrary to these predictions, (15) and (16) seem to mean different things. And so *IE* is not valid; for if *IE* were, then (15) and (16) would be semantically equivalent. In particular, this divergence shows that *IE* fails for pairs of the form $\ulcorner p > ((q > r) > s)\urcorner$ and $\ulcorner (p \wedge (q > r)) > s)\urcorner$, just as *RIE* predicts. Conditionals, it seems, cannot themselves be imported and exported *salva veritate*.

Pairs like (15) and (16) are not hard to replicate. Suppose that we hope to find out about John's preference ordering over apple, blueberry, and pecan pie. We know that John prefers apple over both blueberry and pecan. We don't know whether he prefers blueberry or pecan. Then we overhear someone saying each of the following:

(17) If John would choose fruit, and if he would choose blueberry if not apple, then he prefers both apple and blueberry to pecan.

(18) If John would choose fruit, then if he would choose blueberry if not apple, then he prefers both apple and blueberry to pecan.

My intuition is that, in this situation, (17) seems true, but (18) does not, for parallel reasons to those given above.

Thus I am inclined to think that the right way out of the tangle I have identified in this paper is the following. All the intuitions that have been adduced in the literature in favor of *IE* are in fact consistent with *IE* being invalid and just the weaker principle *RIE* being valid. Moreover, contrasts like that between (15) and (16) show that *IE* fails precisely where *RIE* predicts it to: when we import and export a sentence which is itself a conditional. So we should accept *RIE* instead of *IE*. Doing so lets us adopt a fully classical semantics for conjunction, while still validating *Nothing Added* and *Absurdum*, without arriving at the absurd conclusion that p and $\ulcorner p \wedge (\neg p > q)\urcorner$ are equivalent, or that $\ulcorner \neg(p > q)\urcorner$ entails p. (There are, again, many ways we could spell out an approach like this; two options are obtained, again, by replacing the non-classical conjunctions in KM and PK with classical conjunction).

7 Conclusion

IE does not sit easily with classical 'and'. I have illustrated this by showing that, if we have classical 'and' and *IE*, there are two very natural principles which we cannot validate, at risk of absurdity. I have argued that the best resolution to this puzzle is to reject *IE* in favor of a slightly weaker principle, *RIE*, which better fits data from natural language, and which allows us to hold onto both of those principles and classical conjunction.

Others may prefer to find a different way out of this tangle; my main goal here has been to identify a mess which so far has been passed over in dignified silence.

References

Etlin, David. 2008. Modus ponens revisited. Manuscript, MIT.

Gibbard, Allan. 1981. Two recent theories of conditionals. In William L. Harper, Robert Stalnaker & Glenn Pearce (eds.), *Ifs*, 211–247. Dordrecht: Reidel.

Gillies, Anthony. 2009. On the truth conditions of if (but not quite only if). *Philosophical Review* 118(3). 325–349.

Grice, Paul. 1989. *Studies in the way of words*. Cambridge: Harvard University Press.

Groenendijk, Jeroen, Martin Stokhof & Frank Veltman. 1996. Coreference and modality. In *Handbook of contemporary semantic theory*, 179–216. Oxford: Blackwell.

Heim, Irene. 1982. *The semantics of definite and indefinite noun phrases*: University of Massachusetts, Amherst dissertation.

Heim, Irene. 1983. On the projection problem for presuppositions. In Michael Barlow, Daniel P. Flickinger & Nancy Wiegand (eds.), *The West Coast Conference on Formal Linguistics (WCCFL)*, vol. 2, 114–125. Stanford Stanford University Press. http://dx.doi.org/10.1002/9780470758335.ch10.

Jackson, Frank. 1979. On assertion and indicative conditionals. *Philosophical Review* 88. 565–89.

Khoo, Justin. 2013. A note on Gibbard's proof. *Philosophical Studies* 166(1). 153–164.

Khoo, Justin & Matthew Mandelkern. To appear. Triviality results and the relationship between logical and natural languages. *Mind* .

Kratzer, Angelika. 1981. The notional category of modality. In H. Eikmeyer & H. Rieser (eds.), *Words, worlds, and contexts: New approaches in word semantics*, 38–74. de Gruyter.

Kratzer, Angelika. 1986. Conditionals. *Chicago Linguistics Society* 22(2). 1–15.

Lewis, David. 1973. *Counterfactuals*. Oxford: Blackwell.

Lewis, David. 1976. Probabilities of conditionals and conditional probabilities. *The Philosophical Review* 85. 297–315. http://dx.doi.org/10.2307/2184045.

Mandelkern, Matthew. 2018. Dynamic non-classicality. Manuscript, All Souls College.

Mandelkern, Matthew. To appear. Bounded modality. *The Philosophical Review* .

McGee, Vann. 1985. A counterexample to modus ponens. *The Journal of Philosophy* 82(9). 462–471.

Nolan, Daniel. 1997. Impossible worlds: A modest approach. *Notre Dame Journal of Formal Logic* 38(4). 535–572.

Rieger, Adam. 2006. A simple theory of conditionals. *Analysis* 66(3). 233–240.

Santorio, Paolo. To appear. Alternatives and truthmakers in conditional semantics. *Journal of Philosophy* .

Stalnaker, Robert. 1968. A theory of conditionals. In Nicholas Rescher (ed.), *Studies in logical theory*, 98–112. Oxford: Blackwell.

Stalnaker, Robert. 1975. Indicative conditionals. *Philosophia* 5(3). 269–86.

Stalnaker, Robert C. & Richmond H. Thomason. 1970. A semantic analysis of conditional logic. *Theoria* 36(1). 23–42.