A Suppositional Theory of Conditionals

Abstract

Supposition and conditionals appear closely related. For example, (1) and (2) seem to play similar roles in discourse:

(1) Suppose that the butler did it. Then the gardener is innocent.

(2) If the butler did it, then the gardener is innocent.

Suppositional Theories take this observation as a starting point, appealing to supposition to provide an account of the natural language conditional. For example, here is J.L. Mackie:

> "The basic concept required for the interpretation of if-sentences is that of supposing [...] To assert 'If p, q' is to assert q within the scope of the supposition that p"(Mackie (1972), 92-93).

This paper develops a suppositional theory of conditionals. However, it differs from extant theories in (i) arguing for a precise semantic connection between instructions to suppose and conditional antecedents, and (ii) providing novel linguistic data in favor of that theory.

1 Supposition and 'If'-Clauses

1.1 Conditional Inferences

Consider the following three inference patterns:[1]

(Pres)	$\phi \models \psi \Rightarrow (\phi \wedge \psi)$	Preservation
(DA)	$\phi \vee \psi \models \neg\phi \Rightarrow \psi$	Direct Argument
(CT)	$\phi \Rightarrow (\psi \Rightarrow \chi), \psi \models \phi \Rightarrow \chi$	Conditional Telescoping

(Pres), (DA) and (CT) are often taken to be intuitively valid for indicative conditionals, in the sense that anyone certain of the premises is committed to accepting the conclusion.[2] Consider, e.g., (3)-(5):

(3) Ada is drinking red wine. (So) if she's eating fish, she's eating fish and drinking red wine.

[1] Throughout, $\rightsquigarrow$ is used for subjunctives, $\dashrightarrow$ for indicatives, $\Rightarrow$ for non-specific (i.e., subjunctive or indicative) conditionals and $\supset$ for the material conditional.

[2] As an anonymous referee for *Mind* points out, someone with a high, but non-maximal degree of confidence in the premises might nevertheless have a low degree of confidence in the conclusion. The relationship between preservation of certainty and probabilistically safe inference involving modality is beyond the scope of this paper. For recent discussion of problems in this area, see Santorio (2018), for a positive response, see Goldstein (2018).

(4) Claude is either in London or Paris. (So) if he's not in London, he's in Paris.

(5) If Lori is married to Kyle, then if she's married to Lyle, she's a bigamist. She's married to Lyle. (So) if she's married to Kyle, she's a bigamist.

In contrast, the same inference patterns are standardly taken to be intuitively invalid for subjunctives:

(6) Ada is drinking red wine. (So) if she were eating fish, she'd be eating fish and drinking red wine.

(7) Claude is either in London or Paris. (So) if he weren't in London, he'd be in Paris.

(8) If Lori were married to Kyle, then if she were married to Lyle, she'd be a bigamist. She's married to Lyle. (So) if she were married to Kyle, she'd be a bigamist.

Counter-instances to (6)-(8) are easily identified. For example, circumstances in which Ada is drinking red wine and eating beef, but would be drinking white wine were she eating fish, will constitute counter-instances to (6); circumstances in which Claude is in London, but might be in Rome were he not, will constitute counter-instances to (7); and circumstances in which Lori is married to Lyle, but would not be, were she to be married to Kyle, will constitute counter-instances to (8).

Notably, however, embedding the rightmost premise under 'Suppose' leads each subjunctive inference pattern to improve considerably:

(9) Suppose Ada were drinking red wine. (Then) if she were eating fish, she'd be eating fish and drinking red wine.

(10) Suppose Claude were in London or Paris. (Then) if he weren't in London, he'd be in Paris.

(11) If Lori were married to Kyle, then if she were married to Lyle, she'd be a bigamist. Suppose she were married to Lyle. (Then) if she were married to Kyle, she'd be a bigamist.

That is, where the non-conditional premise is supposed — rather than asserted — subjunctive instances of (Pres), (DA), and (CT) appear valid. Two brief observations are in order: first, note that in (9)-(11) the discourse particle 'then', rather than 'so', as in (3)-(8), must be used to indicate entailment. Imperative clauses headed by 'suppose' behave like 'if'-clauses in this respect. Like the former, the latter also license the occurrence of 'then', (and, correlatively, preclude the occurrence of 'so'). Second, in addition to being embedded under suppose, the non-conditional premise occurs with an additional layer of past tense morphology in each of (9)-(11). The way in which morphological marking interacts with the entailment patterns is discussed in further detail in §6.

Related to (PRES), (DA) and (CT) are their deduction theorem equivalents, below:

(Pres$_{\Rightarrow}$) $\models \phi \Rightarrow (\psi \Rightarrow (\phi \wedge \psi))$ (CT$_{\Rightarrow}$) $\phi \Rightarrow (\psi \Rightarrow \chi) \models \psi \Rightarrow (\phi \Rightarrow \chi)$

(DA$_{\Rightarrow}$) $\models (\phi \vee \psi) \Rightarrow (\neg\phi \Rightarrow \psi)$

Indicative instances of (Pres$_{\Rightarrow}$), (DA$_{\Rightarrow}$) and (CT$_{\Rightarrow}$) are standardly taken to be valid. Indeed, this follows from the acceptance, for indicatives, of (Pres), (DA) (CT) and the Deduction Theorem.

(DT) $\Gamma,\ \phi \models \psi$ iff $\Gamma \models \phi \Rightarrow \psi$ Deduction Theorem

If the deduction theorem were accepted for subjunctives, we would expect each of (Pres$_{\Rightarrow}$), (DA$_{\Rightarrow}$), and (CT$_{\Rightarrow}$) to have false subjunctive instances, corresponding to the invalid instances of the respective inference patterns (6)-(8). However, the relevant instances, (12)-(14), appear valid.

(12) If Ada were drinking red wine, then if she were eating fish, she'd be eating fish and drinking red wine.

(13) If Claude were in London or Paris, then if he weren't in London, he'd be in Paris.

(14) If Lori were married to Kyle, then if she were married to Lyle, she'd be a bigamist. (So) If Lori were married to Lyle, then if she were married to Kyle, she'd be a bigamist.

Summarizing, whereas the three inference patterns are invalid for subjunctives in their basic form, they improve substantially if the leftmost premise is embedded either (i) under supposition or (ii) in the antecedent of a subjunctive in which the conclusion is nested. In this respect, supposition and subjunctive antecedents appear to have similar effects.

1.2 Counterfactual Usage

The connection between supposition and conditional antecedents is further reinforced by consideration of a second body of data. As has been widely noted, unlike indicatives, subjunctives can be used counterfactually (see, e.g., Stalnaker (1975), von Fintel (1999)). As demonstrated in (15)-(16), the latter, but not the former, are acceptable in discourse contexts which entail the negation of their antecedent.

(15) The butler didn't do it. ??If he did it, he used the candlestick.

(16) The butler didn't do it. If he'd done it, he would've used the candlestick.

However, the second discourse degrades substantially if the first sentence is either embedded under supposition (e.g., (17)) or in the antecedent of an embedding conditional (e.g., (18)).

(17) Suppose that the butler hadn't done it. ??If he'd done it, he would've used the candlestick.

(18) ??If the butler hadn't done it, then if he'd done it, then he would've used the candlestick.

That is, when the antecedent of a subjunctive is inconsistent with (i) an earlier supposition, or (ii) the antecedent of an embedding subjunctive, subjunctives pattern with indicatives in being incompatible with counterfactual uses.

1.3 Summary

The pattern observed in §§1.1-2 is suggestive. Intuitively, the inference patterns (Pres), (DA) and (CT) improve due to the fact that supposition and subjunctive antecedents both require information conveyed by their subordinate clauses to be preserved when evaluating 'downstream' subjunctives. For example, consider (9). Having supposed (rather than merely asserted) that Ada is drinking red wine, we hold this fact fixed when evaluating the conditional in the conclusion. Accordingly, counter-instances (such as the one considered for (6)) cannot arise. Similar considerations will also explain (10)-(11). If we assume that subjunctive antecedents effect subjunctives in their antecedent in the same way as supposition, we can account for (12)-(14) in the same way.

This rough picture generalizes to explain the availability (unavailability) of counterfactual uses. After a bare assertion that the butler is innocent, the subjunctive in (17) allows us to evaluate its consequent at some (minimally different) possibilities in which he was guilty. However, if supposition and subjunctive antecedents require us to hold fixed his innocence, downstream subjunctives whose antecedents entail his guilt will be expected to impose conflicting constraints.

The remainder of the paper develops a new suppositional theory of conditionals (both indicative and subjunctive) which implements this rough picture to account for the data. Informally, the idea is as follows. Supposition has a dual effect on discourse context: (i) it induces a minimal revision to the possibilities under consideration, to incorporate the supposed information; and (ii) it modifies what will count as a minimal revision in the future, ensuring that the information supposed will be preserved. The conditional form (i.e., 'If... (then)... ') is then treated as expressing a strict conditional, but one in which the information conveyed by the antecedent is supposed, rather than added to the context directly.

2 Suppositional Theories: A Brief Overview

A theory of conditionals which makes essential appeal to supposition has been defended (in various, closely related, forms) by a number of authors, including Mackie (1972), Edgington (1995), Barker (1995), DeRose and Grandy (1999), and Barnett (2006). What is common to variants of the theory is a commitment to the claim that, in uttering a sentence of the form 'If ϕ, ψ' (where ϕ, ψ are clauses with declarative mood), an agent performs a speech act equivalent (in some respect) to sequentially: (i) supposing that ϕ, and (ii) asserting that ψ. Call this the Speech Act Suppositional Theory. Below is the formulation of the theory by three of its proponents:

> "[The Speech Act Suppositional Theory] explains conditionals in terms of what would probably be classified as a complex illocutionary speech act, the framing of a supposition and putting something forward within its scope." (Mackie (1972, 100))

> "To assert or believe 'if ϕ, ψ' is to assert (believe) ψ within the scope of the supposition, or assumption, that ϕ." (Edgington (1986, 5))

> "The pragmatic theory of 'if' states that utterance of 'if ϕ, ψ' is such an assertion of ψ grounded on supposition of ϕ where [the speaker] implicates via the presence of 'if ϕ' that their assertion of ψ is so grounded." (Barker (1995, 188))

Neither Mackie or Edgington provides a non-metaphorical gloss of their talk of one speech act occurring within the scope of another. However, the intended position appears relatively clear. Performing a speech act of supposing that ϕ results in a new discourse context (which differs from the discourse context which would result from asserting that ϕ). An assertion of ψ in this new context may differ (in its felicity, its illocutionary effects, etc.) from an assertion of ψ in the prior context. The Speech Act Supposition Theory says, then, that the primary conventionally determined contribution of an 'if'-clause is to indicate that the speaker is performing a speech act equivalent to asserting the consequent in the discourse context created by supposing that the antecedent.

The Speech Act Suppositional theory has a number of appealing features. Most notably, it accounts for the apparent substitutability in context of (1)-(2). However, the theory also faces substantial, well-known challenges:

Embeddability: Conditionals can occur felicitously in sub-sentential environments. Amongst other examples, they can be embedded under negation (e.g., (19)), in the complements of attitude verbs (e.g., (20)), and in the conditionals consequents (e.g., (21)):

(19) It isn't the case that if Lea rolls a six, she'll win.

(20) Jacob (believes/knows/doubts) that if Lea rolls a six, she'll win.

(21) If Caroline rolls a five, then Lea will win if she rolls a six.

This behavior appears to generate a problem for the Speech Act Suppositional Theory (Kolbel (2000)). It is standardly assumed that speech acts cannot be performed using a clause in an embedded environment (though cf. Krifka (2001, 2004)). The proponent of the theory must, accordingly, provide an account of (i) what the conditional contributes to the content of a sentence when it occurs in an embedded environment, and (ii) what the role of the 'if'-clause is in such environments, if not to mark a speech act.

Validity: A minimally adequate theory of conditionals ought to be able to be supplemented with a notion of validity in order to generate predictions about how conditionals interact with other logical vocabulary. The status of inference patterns relating conditionals and expressions such as negation, disjunction and conjunction is amongst the core subject matter of the study of conditionals. Any satisfactory theory should, at least in principle, be capable of adjudicating questions of these kinds.

The problem is that, under the Speech Act Suppositional Theory, the expressions belong to fundamentally different semantic categories. On the theory's standard version, negation, disjunction, conjunction, etc. are assigned their classical, truth-functional meaning. Accordingly, their logical properties are to be understood in terms of their effect on a sentence's truth-conditions. In contrast, any logical properties ascribed to the conditional will arise from its effect on the speech acts which can be performed by an utterance of a sentence, rather than on the truth-conditions of that sentence. Indeed, on the standard version of the theory, sentences with a conditional at widest scope cannot be attributed truth conditions at all.

Speech Act theories have attempted to address both issues, though they diverge in how they do so. In response to the first problem, Mackie (1972, 103) opts for a disjunctive approach, on which conditionals may (sometimes) express a conditional proposition in embedded contexts (where it is a matter of context what proposition that is). Edgington (1995, §7.3) denies that sentences like (19)-(21) are, despite superficial appearances, examples of acceptable embedded conditionals.

More recently, Bradley (2012) proposes taking conditionals to denote vectors of worlds. This allows for a Boolean treatment of embedding under $\wedge$, $\vee$ and $\neg$. As he notes, however, accommodating nested conditionals requires extending the framework to permit arbitrarily higher-order denotations.[3] In response to the second problem, many variants of the speech act suppositional theory have, following Adams (1975), adopted a probabilistic treatment of validity on which an argument is valid iff uncertainty of the conclusion does not exceed the sum of the uncertainty of the premises.

Rather than providing a detailed evaluation of the prospects of these responses,

[3] For additional discussion, see e.g., de Finetti (1995), Jeffrey (1991), Milne (1997, §4).

I wish to show how an alternative form of suppositional theory can avoid both problems altogether. The need for a new form of theory is, in part, independently motivated by the observations in §§1.1-2, since no extant version of the speech act theory accounts for the complex pattern of data surveyed there.

3 Update Semantics with Revision

The present suppositional theory is not a speech act theory, at least in the sense of the previous section. Rather than treating the introduction of suppositions as a specific type of conversational act, I propose instead that instructions to suppose express a specific type of sentence meaning. Since instructions to suppose are distinguished by their effects of discourse context, implementing this idea requires a framework in which the conversational effect of uttering a sentence is encoded in the meaning of the sentence uttered. The dynamic system introduced below is one such framework.

Given an object language enriched with a sentential supposition operator, we can model the introduction of supposition at the level of compositional semantic content. The conditional of natural language is then ascribed the meaning of a strict conditional with an embedded supposition operator (following the informal gloss provided in §1.3). Crucially, this approach allows us to avoid the issues with embeddability and validity which arise for traditional suppositional theories.

3.1 Revising Update Semantics

In static semantics, the meaning of a sentence is a **proposition** — a function from points of evaluation to truth values. In dynamic semantics, the meaning of a sentence is a **context change potential** (CCP) — a function from points of evaluation to points of evaluation.

In standard dynamic frameworks, points of evaluation model discourse contexts (states of a conversation). By identifying meanings with CCPs, dynamic semantics is able to model both how an utterance's evaluation is dependent upon context and how the utterance changes the context at which later utterances are evaluated. The choice of points of evaluation in a dynamic framework will depend on the kinds of discourse context/utterance interaction which the framework aims to represent.

On the picture proposed at the conclusion of §1 supposition interacts with two features of context: (i) it revises what is taken for granted in the conversation, incorporating the information supposed; and (ii) it imposes a constraint on future revisions, requiring that they preserve the supposed information. Accordingly, we will take a point of evaluation (**context**), σ, to be a pair, $\langle c_\sigma, f_\sigma \rangle$, comprising an **information state**, c_σ, and **revision operation**, f_σ.

Where $\mathcal{W}$ is the domain of worlds, $c_\sigma \subseteq \mathcal{W}$. Intuitively, c_σ corresponds to the possibilities compatible with what is taken for granted at σ. We say that σ is absurd iff $c_\sigma = \emptyset$. $f_\sigma : (\mathcal{P}(\mathcal{W}) \times \mathcal{P}(\mathcal{W})) \rightarrow \mathcal{P}(\mathcal{W})$ is a function from pairs of sets of worlds to set of worlds. Intuitively, f_σ is the operation which takes an information state and the propositional information conveyed by an utterance, and returns the (potentially different) information state that results from revising the former with the latter, in the manner proscribed by σ.

In order to provide a suitable model of information change, we need to impose a number of constraints on revision operations. Let $\mathrm{L}_0{=}|A|\neg\phi|\phi \wedge \psi|\phi \vee \psi|$. $[\![\cdot]\!]$ is a function from L_0 into $\mathcal{P}(\mathcal{W})$ which respects the standard boolean interpretation of connectives. Intuitively, $[\![\phi]\!]$ is the propositional information conveyed by ϕ. Consider the following three conditions:

(Succ) $f(c, [\![\phi]\!]) \subseteq [\![\phi]\!]$. Success

(Min) If $[\![\phi]\!] \subseteq [\![\psi]\!]$ and $f(c, [\![\psi]\!]) \cap [\![\phi]\!] \neq \emptyset$, Minimality
then $f(c, [\![\phi]\!]) = f(c, [\![\psi]\!]) \cap [\![\phi]\!]$.

(Vac) $f(c, [\![\phi]\!]) = c \cap [\![\phi]\!]$, unless $c \cap [\![\phi]\!] \subseteq \emptyset \subset c$. Vacuity

Success says that revising c with the information conveyed by ϕ will return a subset of the ϕ-worlds. **Minimality** says that, where ϕ is at least as strong as ψ, and the result of revising c with the information conveyed by ψ contains some ϕ-worlds, then revising c with ϕ simply returns those ϕ-worlds. Where f_σ satisfies success and minimality, we will say that σ is adequate. **Vacuity** says that, if c contains some ϕ-worlds, then revising c with the information conveyed by ϕ simply returns subset of ϕ-worlds in c. Where f_σ satisfies vacuity in addition to success and minimality, it corresponds to revision operation on belief states satisfying the basic AGM postulates (Alchourrón et al. (1985)).[4] In this case we will say that σ is proper. The idea, implemented below, will be that every conversation starts at a proper context, but that updates over the course of conversation can yield a context which is improper, yet adequate.

$[\cdot]$ is an interpretation function mapping sentences to CCPs. Intuitively, $\sigma[\phi]$ is the context that results after a successful performance of ϕ in σ. For sentences in L_0, update is intersective:

Definition 1. $\sigma[\phi] = \langle c_\sigma \cap [\![\phi]\!], f_\sigma \rangle$ (for $\phi \in L_0$)

That is, where $\phi \in L_0$, updating σ with ϕ returns the intersection of c_σ with the information conveyed by ϕ, and leaves the revision operation of σ unchanged.

We define support and entailment in terms of information preservation.

Definition 2. *i.* $\sigma \models \phi$ iff $c_\sigma = c_{\sigma[\phi]}$.

ii. $\psi_i, \ldots \psi_j \models \phi$ iff, for all proper σ, $\sigma[\psi_i], \ldots, [\psi_j] \models \phi$

[4] Or, almost. Rather than the Gärdenfors's sixth postulate, the revision operation will satisfy the condition that $K \circ \phi = Cn(\bot)$ iff either (i) $\phi \models \bot$ or (ii) $K \models \bot$.

(if $\sigma[\psi_i], \ldots [\psi_j][\phi]$ is defined).

We say that σ supports ϕ iff the information states of $\sigma[\phi]$ and σ are the same. We say that σ excludes ϕ iff $c_{\sigma[\phi]} = \emptyset$. $\psi_i, \ldots \psi_j$ Strawson entail ϕ iff for any σ, the information states of $\sigma[\psi_i], \ldots [\psi_j]$ and $\sigma[\psi_i], \ldots [\psi_j][\phi]$ are identical (where both are defined). The logic for the fragment L_0 generated by $[\cdot]$ is classical.

3.2 Supposition

Our first task is to employ the framework to model the effects of supposition. To do so, we will extend our language with a monadic operator, $Sup(\cdot)$. On the picture sketched in §1.3, after ϕ is supposed, any revision to the possibilities under consideration must return an information state which incorporates the information ϕ conveys. Accordingly, we need to define an update operation on revision operations. Let $+$ be a function which maps formulae to a function from revision operations to revision operations.

Definition 3. $f^{+\phi}(c, [\![\psi]\!]) = f(c, [\![\phi]\!] \cap [\![\psi]\!])$.

Intuitively, $f^{+\phi}$ is the revision operation just like f, but which preserves the information conveyed by ϕ. That is, it only ever returns an information state which is a subset of $[\![\phi]\!]$. $f^{+\phi}(c, [\![\psi]\!])$ is the f-revision to c which incorporates the information conveyed by both ϕ and ψ. If f is proper, then $f^{+\phi}$ will be adequate. However, $f^{+\phi}$ may be improper despite f being proper. Counterinstances to vacuity will occur for $f^{+\phi}$ wherever c is compatible with ψ, but not with $\phi \wedge \psi$.

Let $\mathrm{L}_1 = \{Sup(\phi) \mid \phi \in \mathrm{L}_0\}$. $\mathrm{L}_0 \cup \mathrm{L}_1$ contains every formula of L_0 and the result of embedding those formulae under $Sup(\cdot)$.

Definition 4. $\sigma[Sup(\phi)] = \langle f_\sigma(c_\sigma, [\![\phi]\!]), f_\sigma^{+\phi} \rangle$.

$Sup(\phi)$ has a dual effect on σ: first, it replaces c_σ with the f_σ-revision of c_σ incorporating the information conveyed by ϕ. Second, it replaces f_σ with the revision operation just like it, but which preserves the information conveyed by ϕ. Informally, $Sup(\phi)$ has the effect of (minimally) changing the set of possibilities under consideration so that it entails the information ϕ conveys, and ensuring that the result of any further suppositional changes also entail this information.

Supposition is **veridical**. After supposing ϕ, the resulting information state incorporates any information entailed by the information conveyed by ϕ. It is also **accumulative**. After a sequence of suppositions, the resulting information state incorporates all of the information conveyed by each. Finally, it is **conservative**. If the information conveyed by ϕ is consistent with σ, then $Sup(\phi)$ and ϕ have the same effect on c_σ.

(Ver) $Sup(\phi) \models \psi, \quad \text{if } \phi \models \psi$ — Veridicality

(Acc) $Sup(\phi), \ldots Sup(\psi) \models \phi \wedge \psi$ — Accumulativity

(CON) $c_{\sigma[Sup(\phi)]} = c_{\sigma[\phi]}$, if $c_{\sigma[\phi]} \neq \emptyset$ CONSERVATIVITY

Before proceeding, it is important to highlight a feature of supposition not modeled in the present framework. The effects of supposition are persistent (they endure beyond its syntactic scope), but they are not irreversible.

(22) a. Suppose that it's raining. Then, the park will be wet.
b. ...But suppose that it isn't. Then, the park will be dry.
b′. ...Suppose that we go for a picnic. Then we'll be miserable.

The discourse in (22.a) can be felicitously extended with (22.b). For this to occur, the former supposition's effects need to be withdrawn: the information state resulting from the latter supposition must no longer preserve the information introduced by the former.

That (22.a-b) are presented as contrasting appears crucial in triggering withdrawal. If (22.a) is followed by (22.b′) instead, no withdrawal is triggered. Given this sensitivity to pragmatic features of the discourse, the prospects of modeling when and how withdrawal occurs within the present framework appear dim. Whereas the addition of supposition can be modeled as simply a special form of update, withdrawal of supposition appears sensitive to facts about speaker intentions and discourse structure which exceed the level of information represented in the contexts of the present model. Instead, withdrawal seems best thought of as a pragmatic mechanism by which the context can be 'reset' to recover felicity. This issue is addressed further in §6.

3.3 Conditionals

Finally, we need to enrich our formal language with a conditional operator. Let $L=L_0 \cup L_1 \cup L_2$ be the extension of $L_0 \cup L_1$ defined so that: If $\phi \in L_0$, then $\phi \in L_2$; If $\phi \in L_0 \cup L_1$ and $\psi \in L_2$, then $\phi \to \psi \in L_2$; Nothing else is a member of L_2.

$\phi \to \psi$ expresses a generalisation of the dynamic strict conditional, defended by e.g., Dekker (1993) Gillies (2004, 2009), Starr (ms) (cf. Kamp (1981) and especially Veltman (1985) for precursors).

Definition 5.
$$\sigma[\phi \to \psi] = \begin{cases} \sigma, \text{ if } \sigma[\phi] \models \psi \\ \langle \emptyset, f_\sigma \rangle, \text{ otherwise.} \end{cases}$$

$\phi \to \psi$ checks whether update with ψ has an effect on the information state of $\sigma[\psi]$. If not, it returns σ; if so, it returns an absurd state, $\langle \emptyset, f_\sigma \rangle$. Stated informally, $\phi \to \psi$ induces a test, which passes iff, after update with ϕ, ψ conveys no new information.

Stalnaker (1968, 1975, 2009), Strawson (1986), and, more recently, Starr (2014), defend UNIFORMITY as a constraint on any minimally adequate theory of conditional:

(Uniformity) The semantic contribution of the conditional form is invariant across subjunctives and indicatives.

Uniformity requires that any difference between indicatives and subjunctives is not attributable to an ambiguity in the conditional form itself. According to Uniformity, 'If . . . , (then). . . ' is univocal across subjunctives and indicatives; it is possible to attribute a single semantic clause to the unspecific conditional construction represented by $\phi \Rightarrow \psi$. The present proposal satisfies Uniformity. According to the proposal, the natural language conditional form simply expresses a strict conditional in which the antecedent is embedded under supposition.

Definition 6. *i.* $\phi \Rightarrow \psi =_{def} Sup(\phi) \rightarrow \psi$

ii. $$\sigma[Sup(\phi) \rightarrow \psi] = \begin{cases} \sigma, \text{ if } \sigma[Sup(\phi)] \models \psi \\ \langle \emptyset, f_\sigma \rangle, \text{ otherwise.} \end{cases}$$

Stated informally, $Sup(\phi) \rightarrow \psi$ induces a test which decomposes into two stages: first, it finds the result of updating σ with $[Sup(\psi)]$. This update returns the f_σ-revision of c_σ with ϕ, and replaces f_σ with its ϕ-preserving variant. Second, it checks that the resulting information state is left unchanged when $\sigma[Sup(\phi)]$ is updated with $[\psi]$. If so, it returns σ; if not, it returns an absurd state.

Definition 6 constitutes a semantic implementation of the suppositional theory sketched in §1.3. A conditional encodes instructions to an agent to perform a test in which they update by supposing the antecedent, and then check the effect of incorporating the information in the consequent. Importantly, unlike Speech Act Suppositional Theories, **Definition 6** can easily accommodate the full range of embedding behavior of conditionals (see, e.g., Kolbel (2000) for a succinct overview). Rather than marking a distinctive illocutionary force, the conditional is attributed a denotation of the same type as other expressions in the language (i.e., a CCP), and, as such, embeds in the normal way.[5,6]

This conditional has a number of attractive features. It vindicates the idea behind the Ramsey test, that evaluating a conditional amounts to evaluating its consequent at the result of revising one's information with its antecedent. It avoid's Gärdenfors (1986)'s impossibility result for the AGM Ramsey conditional by following Bradley (2007) in giving up persistence for conditionals (i.e., $c_\sigma \subseteq c_{\sigma'}$, then $\sigma \models \phi \Rightarrow \psi$ if $\sigma' \models \phi \Rightarrow \psi$).

[5] Note that it is left open that conditionals and imperatives headed by 'suppose' differ in many other respects. For example, the former, but not the latter, freely embed under atttitude verbs. Plausibly, however, this can be attributed to a syntactic restriction on complements (since the environment fails to license imperative clauses more generally). Thanks to an anonymous reviewer from *Mind* for emphasising the importance of this point.

[6] Accommodating embedding under quantification would require amendation of the framework. Yet, as the present theory is a conservative extension of update semantics, it would be hoped that this could follow the strategies adopted for integrating that system with DPL (e.g. Groenendijk et al. (1996), van Eijck and Cepparello (1994), Aloni (2000), a.o.).

The conditional is strictly stronger than the material conditional. It will validate Import/Export given the additional requirement that revision operations satisfy the following constraint **(Appendix A, Fact 1)**:

(WI) $f(f(c, [\![\phi]\!]),\ [\![\phi]\!] \cap [\![\psi]\!]) = f(c, [\![\phi]\!] \cap [\![\psi]\!])$ Weak Iteration

As we might expect from Gibbard (1981), the conditional invalidates *modus ponens*. However, it does so in a limited manner—*modus ponens* fails only in instances involving nested conditionals. The principal remains valid in the restricted case where the consequent belongs to L_0. Furthermore, the conditional unrestrictedly validates the variant of *modus ponens* in which the non-conditional premise is supposed, rather than asserted. That is, $Sup(\phi) \to \psi, Sup(\phi) \models \psi$ is a valid inference pattern, regardless of whether ψ is itself a conditional. These logical features make it a reasonable basis on which to construct a theory of the conditional form in natural language. §4 implements this idea, by developing an account of the indicative/subjunctive distinction compatible with **Definition 6**.

4 The Indicative/Subjunctive Distinction

Indicative and subjunctive conditionals diverge in their behavior. One widely recognized difference between the two lies in the contexts which license them. Indicatives (but not subjunctives) are unacceptable in discourse contexts entailing their negation. Whereas (23.b) constitutes an appropriate continuation of the discourse, (23.a) does not.

(23) The butler didn't do it.
   a. ?? If he did it, he used the candlestick.
   b. If he had done it , he'd have used the candlestick.

§3.3 defended an analysis on which the conditional form is univocal. This has the virtue of parsimony. However, to explain the differences between indicatives and subjunctives, the uniform analysis requires supplementation. Following Stalnaker (1975), von Fintel (1997), and Starr (2014) (amongst others), I propose that their difference can be accounted for in terms of a difference in presupposition, triggered by the conditionals' respective morphological marking. Stated simply, indicatives presuppose the possibility of their antecedent; subjunctives do not.

Definition 7.

$$\sigma[\phi \dashrightarrow \psi] = \begin{cases} \sigma[Sup(\phi) \to \psi], & \text{if } \sigma \not\models \neg\phi \\ undefined, & \text{otherwise.} \end{cases}$$

$$\sigma[\phi \rightsquigarrow \psi] = \sigma[Sup(\phi) \to \psi]$$

$\sigma[\phi \dashrightarrow \psi]$ is defined only if σ is compatible with the information conveyed by ϕ. In this case, it applies the test induced by $Sup(\phi) \to \psi$. It follows from conservativity that, for unnested conditionals, $\phi \dashrightarrow \psi$ is Strawson equivalent to $\phi \rightarrow \psi$.[7]

(EQV) $\phi \dashrightarrow \psi \dashv\models \phi \rightarrow \psi$, if $\phi \in \mathrm{L}_0$ EQUIVALENCE

Indeed, we can say something (slightly) stronger. As long as it contains no nested subjunctives, if $\phi \dashrightarrow \psi$ is defined on σ, $\sigma[\phi \dashrightarrow \psi] = \sigma[\phi \rightarrow \psi]$. This is a comforting result, if one is sympathetic to the thought that logic generated by the dynamic strict conditional is appropriate for indicatives. It follows directly that (PRES), (DA), and (CT) are all Strawson valid for $\dashrightarrow$ over the restricted language, as are their nested variants.

Unlike indicatives, subjunctives are assigned trivial licensing conditions. Accordingly, they will permit both counterfactual uses (i.e., uses in discourse contexts entailing the negation of their antecedent) and non-counterfactual uses. (i.e., uses in discourse context which do not). The acceptability of (24) suggests that this is the correct prediction (cf. e.g., Anderson (1951), Stalnaker (1975)).

(24) Maybe the butler did it. If he had done, he would have used the candlestick.

In counterfactual contexts, supposition of a subjunctive's antecedent will return an information state which is disjoint from its input. The test imposed by the subjunctive passes if this information state is left unchanged after update with the consequent. For this reason, equivalence will fail for subjunctives—they are not strawson equivalent to the strict conditional. In contexts which support the negation of its antecedent, the strict conditional is trivially supported. The subjunctive, however, need not be.

Subjunctives are not predicted to be felicitous in all counterfactual contexts in which their presuppositions are satisfied. In line with observations in §1.2, counterfactual use of a subjunctive is predicted to be infelicitous if its antecedent is inconsistent with information previously introduced via supposition (in contrast to, e.g., standard update). If ϕ and ψ are inconsistent, any attempt to revise with ψ after supposing ϕ will return an absurd state. By success, revision preserves prior suppositions. Yet, since they are inconsistent, no state supports both.

The present account predicts the pattern observed in §§1.1-1.2.. (PRES), (DA) and (CT) are invalid for $\rightsquigarrow$. Revision with ψ in a context which supports ϕ but excludes ψ can return a new context which fails to support ϕ. Each inference pattern can, nevertheless, be made valid if the non-conditional premise is embedded under supposition (and if weak iteration is imposed, in the case of (CT)). Proofs are provided in **Appendix A**. However, a simple, informal gloss

[7] By conservativity, wherever $\sigma \not\models \neg\phi$, $c_{\sigma[Sup(\phi)]} = c_{\sigma[\phi]}$. That is, if σ is compatible with ϕ, then $f_\sigma(c_\sigma, [\![\phi]\!]) = c_\sigma \cap [\![\phi]\!]$. Hence, if $\phi \dashrightarrow \psi$ is defined on σ, and $\psi \in \mathrm{L}_0$, $c_{\sigma[Sup(\phi)][\psi]} = c_{\sigma[\phi][\psi]}$. So, for all σ on which $\phi \dashrightarrow \psi$ is defined, $\sigma[\phi \dashrightarrow \psi] = \sigma[\phi \rightarrow \psi]$.

is also available: information introduced via supposition must be preserved by later revisions. Accordingly, after supposing ϕ, revision with ψ cannot return a context which fails to support ϕ. Furthermore, since the deduction theorem is valid for $\rightarrow$, the same result also accounts for the conditional variants: ($\text{Pres}_{\Rightarrow}$), ($\text{DA}_{\Rightarrow}$) and ($\text{CT}_{\Rightarrow}$). By the deduction theorem for the strict conditional, if we know that $\Gamma, Sup(\phi) \models \psi$, it follows that $\Gamma \models Sup(\phi) \rightarrow \psi$. Hence, the present theory accounts for the full range of observations in §1.

5 Collapse

According to a popular thesis, the differences between indicatives and subjunctives are exhausted by their difference in definedness conditions (Stalnaker (1975), Karttunen and Peters (1979), and von Fintel (1997), a.o.). The proposal in the preceding section is one way of implementing this thesis. However, an immediate consequence of this approach for the logic of conditionals is the validity of **collapse**—the principle that corresponding indicatives and subjunctives are Strawson equivalent:

(Cll) $\phi \rightsquigarrow \psi \,\dashv\models\, \phi \dashrightarrow \psi$ Collapse

To see why this result holds in the present framework, note that the indicative is defined at a context iff that context is compatible with ϕ. Yet, at any context which is compatible with ϕ, both $\phi \rightsquigarrow \psi$ and $\phi \dashrightarrow \psi$ are equivalent to the strict conditional.

Importantly, collapse is consistent with the observation in §4 that indicatives and subjunctives differ in meaning. For example, within the present framework, the two conditionals denote distinct CCPs. It is also compatible with the attribution of distinct logics to indicatives and subjunctives. Since Strawson equivalence is non-transitive, the entailments of one need not be entailments of the other.

The primary objection to collapse comes from the existence of **Adams pairs**: contrary indicatives and subjunctives which permit divergent judgments. Here is one example: Sherlock is conducting interviews with guests who were present on the night of the murder. The butler and the vicar are by no means friends. Nevertheless, the vicar attests that he was with the butler throughout the period when the murder took place and that he is not guilty. (25.a-b) and (26.a-b) constitute Adams pairs in this context:

(25) a. If the butler did it, the vicar covered for him.
b. If the butler had done it, the vicar would have covered for him.

(26) a. If the butler did it, the vicar denounced him.
b. If the butler had done it, the vicar would have denounced him.

Corresponding members of these pairs elicit very different responses. Whereas, given the vicar's testimony, we are inclined to accept (25.a), there is no corresponding pressure to accept (25.b). And while (26.b) appears plausible, given the vicar's inclinations, (26.a) should clearly be denied. Yet, collapse implies that (25.a)-(26.b) and (25.b)-(26.a) are equivalent, where both are defined.

Adams pairs obviously generate a substantial explanatory burden for any theory which entails collapse. However, it is a burden which has the potential to be met. For Adams pairs to constitute a counterexample to collapse, judgments regarding the two conditionals must be elicited relative to a single context which satisfies the presuppositions of both (i.e., it must be compatible with their antecedent). Crucially, however, there is reason to think that this is not what happens.

Assertions of (25.b) and (26.b) appear to carry a not-at-issue entailment that the speaker takes the butlers' innocence for granted. We can consider two different forms of evidence in favor of this entailment.

The first form of evidence comes from the presence of order effects in discourses formed of Adams pairs. A speaker who asserts (25.a) can coherently proceed to assert (26.b) (e.g., as part of an argument that the butler is innocent). However, a speaker who asserts (26.b) cannot coherently go on to assert (25.a). This contrast is precisely what would be expected if an assertion of the subjunctive carried an entailment that its antecedent was ruled out in the context. If the assertion of the subjunctive implies that its antecedent is ruled out, then, assuming this information is accepted, the indicative will be unlicensed in the context following its utterance. No such problem is raised by the opposite sequence of assertions since the subjunctive is licensed regardless of the context's information state.

The second form of evidence is comes from the 'Hold up/Hey, wait a minute!' test. As Shanon (1976) and von Fintel (2004) observe, the availability of 'Hold up/Hey, wait a minute!'-responses provides a test for the accommodation of not-at-issue material.

(27) A: The Colonel's wife was in the drawing room.
B: Hey, wait a minute! I didn't know the Colonel had a wife!

(28) A: The Colonel has a wife and she was in the drawing room.
B: ?? Hey, wait a minute! I didn't know the Colonel had a wife!

B's response in (27) is felicitous, since before evaluating A's utterance hearers must first accommodate the not-at-issue entailment that the Colonel has a wife. In contrast, A's utterance in (28) requires no such accommodation, leading B's response to be decidedly odd.

The subjunctive members of the Adams pairs pass the test for accommodated not-at-issue material. Hearers could reasonably respond to an assertion of either (in the relevant context) by objecting 'Hey, wait a minute! We can't rule out that the butler did it'. Crucially, note that no such response is licit for (25.a)-(25.b).

The felicity of this response is fragile. If (26.b) is employed as part of an argument against its antecedent (as in (29), below), the response is notably marked.

(29) A: If the butler had done it, the vicar would have denounced him. But he didn't, so the butler is probably innocent.

B: ??Hey, wait a minute! We can't rule out that the butler did it.

Yet this fragility is congruent with the proposed test. The retort is illicit unless the material objected to would otherwise be covertly incoporated into the context. Yet in (29), the speaker is explicitly arguing that the butler is innocent, rather than allowing it (merely) to be accommodated.

If an assertion of (25.b) or (26.b) carries a not-at-issue entailment that their antecedent is ruled out, that entailment can be expected to be accommodated prior to the evaluation of the assertion (assuming co-operative interlocutors). Yet, if accommodation of this kind takes place, then judgments about the pairs will not constitute a counterexample to collapse. The evaluation of the subjunctive will take place at a different context to the indicative (one at which the indicative is undefined).

While we have some evidence that the subjunctive carry an entailment of this kind, we lack an explanation of why. In particular, the falsity of its antecedent cannot be taken to be a presupposition, given the availability of non-counterfactual uses such as (24). The ability for the entailment to be canceled in cases like this suggests that it is better conceived of as arising from a pragmatic process, rather than being semantically encoded. In fact, there is independent reason to think this is precisely what happens. There is a simple, and widely endorsed pragmatic principle which, along with the difference in presuppositions between indicatives and subjunctives, will allow us to derive the entailment directly (cf. Schlenker (2005), Leahy (2011)).

5.1 The Fluidity of Context

Differences in the licensing conditions of expressions can give rise to corresponding differences in their pragmatic behavior. 'All' and 'both' are standardly taken to differ only at the level of their licensing conditions. The latter, unlike the former, carries a presupposition that its NP complement has exactly two individuals in its denotation.

(30) a. All of the victim's children are suspects.

b. Both of the victim's children are suspects.

This difference in licensing conditions is accompanied by two differences at the level of pragmatics. First, use of the former is dispreferred in contexts in which the latter is licensed. That is, if it is common ground that the victim had exactly two children then, unlike (30.b), an utterance of (30.a) will be decidedly odd.

Second, and relatedly, use of the former will typically implicate that the licensing conditions of the latter are not satisfied. That is, an utterance of (30.a) suggests that the victim has at least three children.[8]

While implementations differ in detail, there is broad consensus on the explanation of these observations, originating with Heim (1991, 515) and Sauerland (2003, 2008).[9] All other things being equal, it is assumed that speakers are under pragmatic pressure to employ utterances with stronger licensing conditions. Or, stated a little more carefully:

Maximize Presupposition

> If: (*i.*) ϕ and ψ are strawson equivalent;
> (*ii.*) both are defined at σ; and
> (*iii.*) the presuppositions of ψ entail the presuppositions of ϕ;
> then there is a preference for asserting ψ over ϕ at σ.

Maximize Presupposition says that if two expressions are equivalent at those contexts at which both are defined, but the presuppositions of one outstrip the presuppositions of the other, then as long as the stronger presuppositions are true, the former expression should be preferred.[10]

Maximize Presupposition directly explains why use of 'all' is marked in contexts in which it is common ground that the victim had exactly two children. However, it also explains why, where the common ground is unopinionated about the number of children the victim has, use of 'all' carries a not-at-issue entailment that the victim had three or more children. Assume 'both' and 'all' both carry a presupposition of plurality. The licensing conditions of (30.b) are strictly stronger than the licensing conditions of (30.a) (in virtue of the additional presupposition of duality associated with 'both'). So, by Maximize Presupposition, if the speaker took the former to be licensed, she would have used it. Since she didn't, she must assume that the speaker has at least three children.[11] Accordingly, absent objection, this information will be accommodated, leading it to be incorporated into the common ground prior to evaluating her utterance.

[8] The weaker implication (that the victim does not have exactly 2 children) is blocked either by the presupposition of plurality associated with 'both' or, if 'all' is taken to lack a plurality presupposition, by the availability of the singular definite 'The victim's child is a suspect' which in this case will also have strictly stronger presuppositions than (30.a) (see Heim (1991) and Sauerland et al. (2005) for discussion).

[9] There is room for disagreement over the status of Maximize Presupposition as a pragmatic principle; see Schlenker (2012) and Lauer (2016) for discussion.

[10] Since they are orthogonal to the present discussion, I set aside issues involving local accommodation, though see Percus (2006) and Singh (2011) for discussion.

[11] As with normal scalar implicatures within a neo-Gricean framework, the derivation requires the idealization that the speaker is opinionated about the licensing conditions of the alternatives to her utterance. Absent this assumption, we will instead derive the implicature that the speaker is not certain that the licensing condition of (30.b) is satisfied. See Sauerland (2008, §2.1) for discussion.

Crucially, the same reasoning generalizes directly to the case of conditionals. On the view defended above, indicatives have strictly stronger presuppositions than subjunctives. Unlike the latter, they presuppose that their antecedent is compatible with the context. As such, where both are defined, Maximize Presupposition predicts that their use will be preferred. That a speaker uses a subjunctive can be expected to generate a not-at-issue entailment that she takes its antecedent to be ruled out in context. Absent objections, this entailment will be incorporated to the common ground prior to evaluating her utterance.

Accordingly, we have both empirical and theoretical reason to think that judgments about the indicative and subjunctive members of Adam's are elicited relative to different contexts. Prior to their evaluation, the latter require hearers to accommodate a modified context, one whose information state excludes the antecedent and at which the indicative is therefore unlicensed. If this is correct, then our divergent intuitions about pairs like (25.a-b) and (26.a-b) will not correspond to a counterexample to Collapse, after all.[12]

The tendency for subjunctives to trigger accommodation to a counterfactual context also allows us to account for a second significant point of divergence between the two types of conditionals (Stalnaker (1975), Bennett (2003), Khoo (2017)). Indicatives convey facts about what information is accepted in context. An utterance of (25.a) in context reports Sherlock's access to the vicar's testimony. In contrast, subjunctives are widely taken to convey 'wordly' facts (Lewis (1973)). An utterance of (25.b) in context appears to report on the dispositions of the vicar rather than anything about what the speaker knows.

The information sensitivity of indicatives is expected on the account defended in §3. Where licensed, their consequents will be evaluated at that subset of the context's information state which is compatible with their antecedent. Hence, the acceptability of an utterance of $\phi \dashrightarrow \psi$ is determined entirely by the

[12] Like other forms of pragmatic inference, entailments derived via Maximize Presuppositions are widely recognized to be cancellable (see, in particular, Lauer (2016, §2.2)). For example, consider the indicative and subjunctive variants of Anderson (1951)'s example:

(1) a. If Jones has taken arsenic, he's showing the symptoms he's actually showing.
b. If Jones had taken arsenic, he'd be showing the symptoms he's actually showing.

As Stalnaker (1975) and von Fintel (1997) observe, (1.b) can naturally figure as part of an argument in favor of the possibility of its antecedent. In contrast, (1.a) carries a strong sense of redundancy, and cannot be expected to figure in a successful argument for anything.

Given the presuppositions ascribed to indicatives, that (1.a) appears redundant is unsurprising. After all, it presupposes precisely what it is, intuitively, intended to establish. (1.b) has no such presupposition and, hence, can be used in an argument that Jones might have taken arsenic.

Crucially, (1.b) does not implicate that its antecedent is ruled out in context. Again, this is to be expected. The implicature of the subjunctive is generated by the need to explain why a speaker did not use the indicative. Yet, in this case, there is an independently available explanation: the indicative form presupposes what the speaker intends to establish. Accordingly, her interlocutors cannot conclude from her use of the subjunctive that she took indicative to be unlicensed—indeed, to do so would be incompatible with the intuitive point of her utterance.

information state of a context. In contrast, where the not-at-issue entailment above is triggered and accommodated, subjunctives will be evaluated at a body of information which excludes their antecedent. Accordingly, the body of information at which their consequent is evaluated will be dependent on the revision operation of the context. The information insensitivity of subjunctives in such environments can be expressed in terms of a constraint on the revision operation of context.

Wordliness   For all c, c': if $c \cap [\![\phi]\!] = c' \cap [\![\phi]\!] = \emptyset$, then $f(c, [\![\phi]\!]) = f(c', [\![\phi]\!])$.

A revision operation is worldly iff it is invariant over information state inputs in counterfactual revisions. Where the revision operation of a context is worldly, subjunctives will have the same status across all counterfactual contexts which agree with it on the revision operation. That is, if $f_\sigma = f_{\sigma'}$ and $\sigma[\phi] = \sigma'[\phi] = \emptyset$, then $\sigma \models \phi \rightsquigarrow \psi$ iff $\sigma' \models \phi \rightsquigarrow \psi$. Accordingly, imposing a constraint of worldliness on permissible contexts will lead counterfactual subjunctives to communicate something about the differences speakers take to be minimal, rather than the information they possess.

6 Supposition and Mood

An appealingly simple hypothesis is that the morphological marking found in indicative/subjunctive-antecedents has precisely the same semantic contribution in the complement clause of imperatives headed by 'suppose'. This would succinctly explain the contrast in (31). The supposition is not predicted to be compatible with counterfactual use unless it carries 'subjunctive' morphology:

(31) The butler didn't do it. Suppose he [had/??did]. Then there'd be blood on the candlestick.

The simple hypothesis predicts that the effect of supposition on 'downstream' conditionals and additional suppositions is independent of its morphological marking. This appears to be borne out, as (32)-(33) demonstrate:

(32) a. Suppose the Mets outscored the Cubs.
b. . . . Then, if the Cubs had scored 12, the Mets would have scored 13.

(33) a. The Mets outscored the Cubs.
b. . . . So, if the Cubs had scored 12, the Mets would have scored 13.

In the discourse context generated by (32.a), (32.b) is judged true. Despite lacking an additional layer of past tense marking, the information conveyed by the complement clause of the former appears required to be preserved when evaluating the latter. In contrast, the same subjunctive can naturally be judged false if it occurs in a discourse context following (33.a) instead.

The explanatory power of the simple hypothesis, along with its relative elegance, give us substantial reason to accept it. However, if we are to do so, we will require some explanation of why the inferences in (9)-(11) appear easier to reject when the supposition is stripped of past-tense morphology. If additional past-tense morphology merely has an effect on presuppositions, we would expect (34)-(36) and (9)-(11) to be equally good.

(34) Suppose Ada is drinking red wine. (Then) if she were eating fish, she'd be eating fish and drinking red wine.

(35) Suppose Claude is in London or Paris. (Then) if he weren't in London, he'd be in Paris.

(36) If Lori were married to Kyle, then if she were married to Lyle, she'd be a bigamist. Suppose she's married to Lyle. (Then) if she were married to Kyle, she'd be a bigamist.

To account for this contrast, I propose, we need to recognize the additional effect that morphological marking can have on discourse structure. A discourse is not a mere collection of utterances. Understanding a discourse requires understanding the relations between distinct utterances. Grammatical mood can play a role in guiding this process. In particular, a shift between 'indicative'/'subjunctive' morphology often indicates that two claims are being presented as contrasting.

(37) If Bob comes to the party, we'll drink wine.
a. ...If Mary were to come, we'd do shots.
b. ...If Mary comes, we'll do shots.

Whereas, in its discourse context, (37.a) is most naturally heard as introducing an incompatible alternative to the possibility of Bob attending and us all drinking wine, this reading is notably less prominent for (37.b). The most natural interpretation of the latter (but not of the former) implies that, if both Mary and Bob come, we'll drink wine and do shots.

If, as suggested in §3.2, contrast can trigger withdrawal of suppositions, this would provide an explanation of why the inferences in (34)-(36) are degraded. Withdrawing the downstream effect of supposition prior to evaluating the final subjunctive will result in the inference no longer being valid. Clearly, much more needs to be done to investigate the relation between supposition, mood and discourse structure. The brief discussion in this section has aimed merely to demonstrate an approach which can allow us to preserve a simple, univocal account of both supposition and 'indicative'/'subjunctive' morphology.

7 Conclusion

On the present account, the natural language conditional is decomposed into a strict conditional and an embedded instruction to suppose. This reflects the observation, in §1, that 'if'-clauses and supposition have similar effects on 'downstream' conditionals. The primary difference between the two is in what qualifies as 'downstream': whereas the effects of the latter persist beyond sentence boundaries, the effecs of the former are restricted to the conditional's consequent. Thus, in a slogan, the proposal can be summarized as: conditional antecedents are sentence level suppositions; supposition is a discourse level conditional antecedent.

8 Appendix

Fact 1. $Sup(\phi \wedge \psi) \rightarrow \chi \mathrel{=\!\!|\!\!\models} Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi)$, given weak iteration.

Proof. Observe that $Sup(\phi \wedge \psi) \rightarrow \chi \mathrel{=\!\!|\!\!\models} Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi)$ if for all proper σ: $\sigma[Sup(\phi \wedge \psi)] = \sigma[Sup(\phi)][Sup(\psi)]$. By **Definition 4**, for an arbitrary choice of σ, $\sigma[Sup(\phi \wedge \psi)] = \langle f_\sigma(c_\sigma, [\![\phi]\!] \cap [\![\psi]\!]), f_\sigma^{+\phi\wedge\psi}\rangle$. In comparison, $\sigma[Sup(\phi)][Sup(\psi)] = \langle f_\sigma^{+\phi}(f_\sigma(c_\sigma, [\![\phi]\!]), [\![\psi]\!]),\ (f_\sigma^{+\phi})^{+\psi}\rangle$. First, note that $f_\sigma^{+\phi\wedge\psi} = f_\sigma^{+\phi+\psi}$. Next, note $f_\sigma^{+\phi}(f_\sigma(c_\sigma, [\![\phi]\!]), [\![\psi]\!]) = f_\sigma(f_\sigma(c_\sigma, [\![\phi]\!]), [\![\phi]\!] \cap [\![\psi]\!])$. Yet, by weak iteration, $f_\sigma(f_\sigma(c_\sigma, [\![\phi]\!]), [\![\phi]\!] \cap [\![\psi]\!]) = f_\sigma(c_\sigma, [\![\phi]\!] \cap [\![\psi]\!])$. So $c_{\sigma[Sup(\phi)][Sup(\psi)]} = c_{\sigma[Sup(\phi\wedge\psi)]}$. Hence, $\sigma[Sup(\phi \wedge \psi)] = \sigma[Sup(\phi)][Sup(\psi)]$. Yet σ was arbitrary. So $Sup(\phi \wedge \psi) \rightarrow \chi \mathrel{=\!\!|\!\!\models} Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi)$. □

Fact 2. *i.* $Sup(\phi) \models Sup(\psi) \rightarrow (\phi \wedge \psi)$;
ii. $Sup(\phi \vee \psi) \models (\neg\phi) \rightarrow \psi$;

Fact 3. $Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi), Sup(\psi) \models Sup(\phi) \rightarrow \chi$, given weak iteration.

Proof. **Fact 2.*i.*:** $Sup(\phi) \models Sup(\psi) \rightarrow (\psi \wedge \phi)$ iff for all proper σ, $\sigma[Sup(\phi)][Sup(\psi)] \models \phi \wedge \psi$. First, note that for an arbitrary choice of σ, $c_{\sigma[Sup(\phi)][Sup(\psi)]} = f_\sigma^{+\phi}(c_{\sigma[Sup(\phi)]}, [\![\psi]\!])$. Yet, by Def.3, it follows that $f_\sigma^{+\phi}(c_{\sigma[Sup(\phi)]}, [\![\psi]\!]) = f_\sigma(c_{\sigma[Sup(\phi)]}, [\![\phi]\!] \cap [\![\psi]\!])$. By success, we know that $f_\sigma(c_{\sigma[Sup(\phi)]}, [\![\phi]\!] \cap [\![\psi]\!]) \subseteq [\![\phi \wedge \psi]\!]$. So, $\sigma[Sup(\phi)][Sup(\psi)] \models \phi \wedge \psi$. Yet, since σ was arbitrary, $Sup(\phi) \models Sup(\psi) \rightarrow (\psi \wedge \phi)$. □

Proof. **Fact 2.*ii.*:** $Sup(\phi \vee \psi) \models Sup(\neg\phi) \rightarrow \psi$ iff for all proper $\sigma, \sigma[Sup(\phi \vee \psi)][Sup(\neg\phi)] \models \psi$. Again, we know that for an arbitrary choice of σ, $c_{\sigma[Sup(\phi\vee\psi)][Sup(\neg\phi)]} = f_\sigma^{+\phi\vee\psi}(c_{\sigma[Sup(\phi\vee\psi)]}, [\![\neg\phi]\!])$ and that $f_\sigma^{+\phi\vee\psi}(c_{\sigma[Sup(\phi\vee\psi)]}, [\![\neg\phi]\!]) = f_\sigma(c_{\sigma[Sup(\phi\vee\psi)]}, [\![\phi \vee \psi]\!] \cap [\![\neg\phi]\!])$. Yet $[\![\phi \vee \psi]\!] \cap [\![\neg\phi]\!] = [\![\psi]\!]$. So, by success, $f_\sigma(c_{\sigma[Sup(\phi\vee\psi)]}, [\![\phi \vee \psi]\!] \cap [\![\neg\phi]\!]) \subseteq [\![\psi]\!]$. And so, $\sigma[Sup(\phi \vee \psi)][Sup(\neg\phi)] \models \psi$. Yet, since σ was arbitrary, $Sup(\phi \vee \psi) \models Sup(\neg\phi) \rightarrow \psi$. □

Proof. **Fact 3.:** $Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi), Sup(\psi) \models Sup(\phi) \rightarrow \chi$ iff for all proper σ, if $\sigma \models Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi)$, then $\sigma[Sup(\psi)][Sup(\phi)] \models \chi$. For an arbitrary proper σ, suppose $\sigma \models Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi)$. Then $\sigma[Sup(\phi)][Sup(\psi)] \models \chi$. So, it suffices to demonstrate that $\sigma[Sup(\phi)][Sup(\psi)] = \sigma[Sup(\psi)][Sup(\phi)]$.

First, we know that $f_{\sigma[Sup(\phi)][Sup(\psi)]} = f_\sigma^{+\phi+\psi}$ and $f_{\sigma[Sup(\psi)][Sup(\phi)]} = f_\sigma^{+\psi+\phi}$. By Definition 3, for all c, χ, $f_\sigma^{+\phi+\psi}(c, [\![\chi]\!]) = f_\sigma^{+\psi+\phi}(c, [\![\chi]\!]) = f_\sigma(c, [\![\phi]\!] \cap [\![\psi]\!] \cap [\![\chi]\!])$. So $f_{\sigma[Sup(\phi)][Sup(\psi)]} = f_{\sigma[Sup(\psi)][Sup(\phi)]}$. Next, note that $c_{\sigma[Sup(\phi)][Sup(\psi)]} = f^{+\phi}(c_{\sigma[Sup(\phi)]}, [\![\psi]\!])$ and $c_{\sigma[Sup(\psi)][Sup(\phi)]} = f^{+\psi}(c_{\sigma[Sup(\psi)]}, [\![\phi]\!])$. But we know that $f^{+\phi}(c_{\sigma[Sup(\phi)]}, [\![\psi]\!]) = f_\sigma(f_\sigma(c_\sigma, [\![\phi]\!]), [\![\phi]\!] \cap [\![\psi]\!])$ and $f_\sigma^{+\psi}(c_{\sigma[Sup(\psi)]}, [\![\phi]\!]) = f_\sigma(f_\sigma(c_\sigma, [\![\psi]\!]), [\![\psi]\!] \cap [\![\phi]\!])$. But, by weak iteration, $f_\sigma(f_\sigma(c_\sigma, [\![\phi]\!]), [\![\phi]\!] \cap [\![\psi]\!]) = f_\sigma(c_\sigma, [\![\phi]\!] \cap [\![\psi]\!]) = f_\sigma(f_\sigma(c_\sigma, [\![\psi]\!]), [\![\psi]\!] \cap [\![\phi]\!])$. So $f_{\sigma[Sup(\phi)][Sup(\psi)]} = f_{\sigma[Sup(\psi)][Sup(\phi)]}$ and $c_{\sigma[Sup(\phi)][Sup(\psi)]} = c_{\sigma[Sup(\psi)][Sup(\phi)]}$. But σ was arbitrary. So $Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi), Sup(\psi) \models Sup(\phi) \rightarrow \chi$. □

References

Adams, E. W. (1975), *The Logic of Conditionals: An Application of Probability to Deductive Logic*, D. Reidel Pub. Co., ht, Holland.

Alchourrón, C. E., Gärdenfors, P. and Makinson, D. (1985), 'On the logic of theory change: Partial meet contraction and revision functions', *Journal of Symbolic Logic* **50**(2), 510–530.

Aloni, M. (2000), Conceptual covers in dynamic semantics, *in* L. Cavedon, P. Blackburn, N. Braisby and A. Shimojima, eds, 'Logic, Language and Computation', Vol. 3, CSLI.

Anderson, A. R. (1951), 'A note on subjunctive and counterfactual conditionals', *Analysis* **12**(2), 35–38.

Barker, S. J. (1995), 'Towards a pragmatic theory of 'if'', *Philosophical Studies* **79**(2), 185–211.

Barnett, D. (2006), 'Zif is if', *Mind* **115**(459), 519–566.

Bennett, J. (2003), *A Philosophical Guide to Conditionals*, Oxford University Press.

Bradley, R. (2007), 'A defence of the ey test', *Mind* **116**(461), 1–21.

Bradley, R. (2012), 'Multidimensional possible-world semantics for conditionals', *Philosophical Review* **121**(4), 539–571.

de Finetti, B. (1995), 'The logic of probability', *Philosophical Studies* **77**(1), 181–190.

Dekker, P. (1993), Transsentential Meditations: Ups and Downs in Dynamic Logic, PhD thesis, University of Amsterdam: Institute for Logic, Language and Computation.

DeRose, K. and Grandy, R. E. (1999), 'Conditional assertions and "biscuit" conditionals', *Noûs* **33**(3), 405–420.

Edgington, D. (1986), 'Do conditionals have truth-conditions', *Cr'itica* **18**(52), 3–30.

Edgington, D. (1995), 'On conditionals', *Mind* **104**(414), 235–329.

Gärdenfors, P. (1986), 'Belief revisions and the ramsey test for conditionals', *Philosophical Review* **95**(1), 81–93.

Gibbard, A. (1981), Two recent theories of conditionals, *in* W. Harper, R. C. Stalnaker and G. Pearce, eds, 'Ifs', Reidel, pp. 211–247.

Gillies, A. S. (2004), 'Epistemic conditionals and conditional epistemics', *Noûs* **38**(4), 585–616.

Gillies, A. S. (2009), 'On truth-conditions for if (but not quite only if)', *Philosophical Review* **118**(3), 325–349.

Goldstein, S. (2018), Modal credence.

Groenendijk, J., Stokhof, M. and Veltman, F. (1996), Coreference and modality, *in* S. Lappin, ed., 'Handbook of Contemporary Semantic Theory', Blackwell, pp. 179–216.

Heim, I. (1991), Artikel und definitheit, *in* A. von Stechow and D. Wunderlich, eds, 'Handbuch der Semantik', de Gruyter, pp. 487–535.

Jeffrey, R. (1991), 'Matter-of-fact conditionals', *Aristotelian Society Supplementary Volume* **65**(1), 161–209.

Kamp, H. (1981), The paradox of the heap, *in* U. Mönnich, ed., 'Journal of Symbolic Logic', Dordrecht, pp. 225–277.

Karttunen, L. and Peters, S. (1979), Conventional implicatures, *in* C.-k. Oh and D. Dineen, eds, 'Syntax and Semantics', Vol. 11 of *1*, Academic Press, pp. 1–56.

Khoo, J. (2017), 'Backtracking counterfactuals revisited', *Mind* **126**(503), 841–910.

Kolbel, M. (2000), 'Edgington on compounds of conditionals', *Mind* **109**(433), 97–108.

Krifka, M. (2001), 'Quantifying into question acts', *Natural Language Semantics* **9**(1), 1–40.

Krifka, M. (2004), 'Semantics below and above speech acts'.

Lauer, S. (2016), 'On the status of 'maximize presupposition'', *Semantics and Linguistic Theory* **26**, 980.

Leahy, B. (2011), 'Presuppositions and antipresuppositions in conditionals', *Semantics and Linguistic Theory* **21**.

Lewis, D. K. (1973), *Counterfactuals*, Blackwell.

Mackie, J. L. (1972), *Truth, Probability and Paradox: Studies in Philosophical Logic*, Oxford, Clarendon Press.

Milne, P. (1997), 'Bruno de finetti and the logic of conditional events', *British Journal for the Philosophy of Science* **48**(2), 195–232.

Percus, O. (2006), Anti-presuppositions, *in* A. Ueyama, ed., 'Theoretical and empirical studies of reference and anaphora: Toward the establishment of generative grammar as an empirical science. Report of the Grant-in-Aid for Scientific Research (B), Project No. 15320052', Japan Society for the Promotion of Science, pp. 52–73.

Santorio, P. (2018), Credence for epistemic discourse.

Sauerland, U. (2003), 'Implicated presuppositions'.

Sauerland, U. (2008), Implicated presuppositions, *in* A. Staube, ed., 'Sentence and Context', de Gruyter.

Sauerland, U., Andersen, J. and Yatsushiro, K. (2005), *The Plural is Semantically Unmarked*.

Schlenker, P. (2005), The lazy frenchman's approach to the subjunctive: Speculations on reference to worlds and semantics defaults in the analysis of mood, *in* T. Geerts, I. van Ginneken and H. Jacobs, eds, 'Romance Languages and Linguistic Theory 2003: Selected papers from 'Going Romance XVII'', pp. 269–309.

Schlenker, P. (2012), 'Maximize presupposition and gricean reasoning', *Natural Language Semantics* **20**(4), 391–429.

Shanon, B. (1976), 'On the two kinds of presuppositions in natural language', *Foundations of Language* **14**(2), 247–249.

Singh, R. (2011), 'Maximize presupposition! and local contexts', *Natural Language Semantics* **19**(2), 149–168.

Stalnaker, R. (1975), 'Indicative conditionals', *Philosophia* **5**(3), 269–286.

Stalnaker, R. C. (1968), 'A theory of conditionals', *Americal Philosophical Quarterly* pp. 98–112.

Stalnaker, R. C. (2009), 'On hawthorne and magidor on assertion, context, and epistemic accessibility', *Mind* **118**(470), 399–409.

Starr, W. (ms), 'Indicative conditionals, strictly'.

Starr, W. B. (2014), 'A uniform theory of conditionals', *Journal of Philosophical Logic* **43**(6), 1019–1064.

Strawson, P. F. (1986), If and "", *in* R. E. Grandy and R. Warner, eds, 'Philosophical Grounds of Rationality: Intentions, Categories, Ends', Oxford University Press, pp. 363–380.

van Eijck, J. and Cepparello, G. (1994), 'Dynamic modal predicate logic'.

Veltman, F. (1985), *Logics for Conditionals*, Jurriaans.

von Fintel, K. (1997), The presupposition of subjunctive conditionals, MIT Press.

von Fintel, K. (1999), 'Npi licensing, strawson entailment, and context dependency', *Journal of Semantics* **16**(2), 97–148.

von Fintel, K. (2004), Would you believe it? the king of france is back! presuppositions and truth-value intuitions, *in* A. Bezuidenhout and M. Reimer, eds, 'Descriptions and Beyond', Oxford University Press.