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:

$$(\textsc{Pres}_{\Rightarrow}) \quad \models \phi \Rightarrow (\psi \Rightarrow (\phi \wedge \psi)) \qquad (\mathrm{CT}_{\Rightarrow}) \quad \phi \Rightarrow (\psi \Rightarrow \chi) \models \psi \Rightarrow (\phi \Rightarrow \chi)$$

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

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

$$(\mathrm{DT}) \quad \Gamma,\ \phi \models \psi \text{ iff } \Gamma \models \phi \Rightarrow \psi \qquad \textsc{Deduction Theorem}$$

If the deduction theorem were accepted for subjunctives, we would expect each of ($\textsc{Pres}_{\Rightarrow}$), ($\mathrm{DA}_{\Rightarrow}$), and ($\mathrm{CT}_{\Rightarrow}$) 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 $c_\sigma = \emptyset$. $f_\sigma : (\mathcal{P}(\mathcal{W}) \times \mathcal{P}(\mathcal{W})) \to \mathcal{P}(\mathcal{W})$ 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 $f(c, [\![\psi]\!]) \cap [\![\phi]\!] \neq \emptyset$, then $f(c, [\![\phi]\!]) = f(c, [\![\psi]\!]) \cap [\![\phi]\!]$.	Minimality
(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) $K \models \bot$.

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

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) $Sup(\phi) \models \psi$, 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 $\phi \rightarrow \psi \in L_2$; Nothing else is a member of L_2.

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

$\phi \rightarrow \psi$ 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, $\phi \rightarrow \psi$ 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, $Sup(\phi) \rightarrow \psi, Sup(\phi) \models \psi$ 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 differ in meaning. As (23) demonstrates, subjunctives (but not indicatives) are unacceptable in discourse contexts entailing their antecedent. Conversely, as (24) demonstrates, indicatives (but not subjunctives) are unacceptable in discourse contexts entailing its negation.

(23) Thieves broke into my apartment.
  a. If they broke in, they didn't take anything.
  b. ?? If they had broken in, they wouldn't have taken anything.

(24) Thieves did not break into my apartment.
  a. ?? If they broke in, they didn't take anything.
  b. If they had broken in, they wouldn't have taken anything.

§3.3 defended an analysis on which the conditional form is univocal. This has the virtue of parsimony. However, the uniform analysis requires supplementation to explain the differences between indicatives and subjunctives. 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 presuppose the possibility of its negation.

4.1 Indicatives

On the basis of (15.a) (and following von Fintel (1997) and Gillies (2007)(a.o.)), suppose that indicative conditionals presuppose the possibility of their antecedent.

Definition 7. $$\sigma[\phi \dashrightarrow \psi] = \begin{cases} \sigma[Sup(\phi) \to \psi], \text{ if } \sigma \not\models \neg\phi \\ undefined, \quad \text{otherwise.} \end{cases}$$

$\sigma[\phi \dashrightarrow \psi]$ 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 $\phi \to \psi$.[7]

(Eqv) $\phi \dashrightarrow \psi \mathrel{=\!|\!\models} \phi \to \psi$, 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, $\sigma[\phi \dashrightarrow \psi] = \sigma[\phi \to \psi]$. 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.

4.2 Subjunctives

On the basis of (23.b), suppose that, whereas indicatives presuppose the possibility of their antecedent, subjunctives presuppose the possibility of its negation.

Definition 8. $$\sigma[\phi \rightsquigarrow \psi] = \begin{cases} \sigma[Sup(\phi) \to \psi], \text{ if } \sigma \not\models \phi \\ undefined, \quad \text{otherwise.} \end{cases}$$

$\sigma[\phi \rightsquigarrow \psi]$ is defined only if σ is compatible with the information conveyed by $\neg\phi$. In this case, it applies the test induced by $Sup(\phi) \to \psi$. The suggested presupposition is the same as that proposed by Karttunen and Peters (1979), and accounts for the acceptability of counterfactual uses of subjunctives.

Unlike indicatives, subjunctives do not undergo presupposition failure in contexts which support the negation of their antecedent. In such contexts, supposition of the antecedent returns the minimal-revision of the input information state which supports the antecedent (along with a revision operation which preserves the information conveyed by the antecedent). Clearly, this information state will include possibilities which are considered counterfactual at the original discourse context. The test imposed by the subjunctive passes if this information state is left unchanged after update with the consequent. However, 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. 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.

[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, $\sigma[\phi \dashrightarrow \psi] = \sigma[\phi \to \psi]$.

Like indicatives, subjunctives are defined at contexts which are **unopinionated** about their antecedent (i.e., $\sigma \not\models \phi$, and $\not\models \neg\phi$). As a result, subjunctives permit **non-counterfactual** uses. They are felicitous in discourse contexts which do not entail the negation of the antecedent. The acceptability of (25) suggests that this is the correct prediction (cf. e.g., Anderson (1951), Stalnaker (1975)).

(25) Maybe thieves broke in to my apartment.
If they had broken in, they wouldn't have taken anything

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 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: (Pres$_{\Rightarrow}$), (DA$_{\Rightarrow}$) and (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 can be seen as one way of implementing this thesis. However, an immediate consequence of all such approaches for the logic of conditionals is the validity of **collapse**—the principle that corresponding indicatives and subjunctives are Strawson equivalent:

(Cll) $\phi \rightsquigarrow \psi \mathrel{=\!\!|\models} \phi \dashrightarrow \psi$ Collapse

To see why this result holds in the present framework, note that both are defined at a context iff that context is compatible with ϕ and $\neg\phi$. 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. Importantly, Adams pairs are sensitive to the information available at a context. In contexts unopinionated about both the antecedents and consequents of corresponding conditionals, collapse appears to be in good standing. For example, suppose that you are about to arrive home from holiday. You do not know whether your apartment has been broken into, and, likewise, do not know whether anything is missing. In such a context, judgments about conditionals like (23.a) and (23.b) appear required to coincide. Given your information, you cannot accept that thieves would have taken something if they broke in without accepting that they will have taken something, if they did (and *vice versa*).

In order to generate an Adams pair, we instead need to consider contexts which are opinionated about the corresponding conditionals consequents. Suppose that you arrive home to find the door to your apartment ajar, but none of the contents missing. In such a context, (26) and (27) constitute a compelling Adams pair.[8]

(26) If thieves broke in, they didn't take anything.

(27) If thieves had broken in, they would have taken something.

It would be reasonable to accept an assertion of (26) in context (given the contents of the apartment). It would, likewise, be reasonable to accept an assertion of (27) (given the primary goals of thievery). Yet, on minimal assumptions, collapse implies that the two are contraries.[9] Given collapse, where both are defined, a context will support (26) only if it excludes (27) (and *vice versa*).

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 unopinionated about their antecedent). Crucially, however, there is reason to think that this is not what happens. When asserted at contexts unopinionated about their antecedent but opinionated about their consequent, subjunctives appear to trigger a covert shift to a context which incorporates the information their antecedent is false. For example, a speaker who asserts (27) at a context in which it is established that nothing is missing suggests that she is taking it for granted that thieves did not break in. Accordingly, absent any objection, we can expect the assertion to be evaluated at a context at which this information is accommodated.

We can consider two different forms of evidence of context shift. First, note that (27) passes the 'Hey, wait a minute!'-test for accommodation. Hearers can

[8] Adam's original pair exhibit the same pattern of contextual information. Our divergent judgments about (‡.a-b) are dependent upon the presumption that Kennedy was killed:

(‡) a. If Oswald didn't kill Kennedy, someone did.

b. If Oswald hadn't killed Kennedy, someone would have.

[9] The assumption is the validity of Strong Boethius' Thesis for indicatives and subjunctives:

(SBT) $\phi \Rightarrow \psi, \phi \Rightarrow \neg\psi \models \bot$

reasonably respond to an assertion of (27) (in the relevant context) by objecting 'Hey, wait a minute! We can't rule out that thieves broke in'. Yet, as von Fintel (2004) (following Shanon (1976)) notes, such responses are licit only if the information objected to would otherwise be covertly incorporated into the context via accommodation. Crucially, no such response is licit for (26).

The felicity of 'Hey, wait a minute!' responses is fragile. If (27) is employed as part of an argument against its antecedent (as in (28), below), the response is marked. This appears congruent with the proposed test. The retort is illicit unless the material objected to would otherwise be covertly incoporated into the context. Yet in (28), the speaker is explicitly arguing that thieves did not break in, rather than allowing it (merely) to be accommodated.

Second, note that the pair of conditionals is subject to order effects. A speaker who asserts (26) can coherently proceed to assert (27) (e.g., as part of an argument that thieves did not break in). However, a speaker who asserts (27) cannot coherently go on to assert (26). This contrast is precisely what would be expected if an assertion of the subjunctive triggered accommodation of the information that its antecedent is false. In the context following such accommodation, the presupposition of the indicative will be unsatisfied.

If an assertion of (27) in context triggers accommodation of the negation of its antecedent, then judgments about the pair will not constitute a counterexample to collapse. The evaluation of the subjunctive takes place at a different context to the indicative (one at which the indicative is undefined). We still require, however, an explanation of why the subjunctive would trigger this accommodation in contexts opinionated about its consequent but unopinionated about its antecedent. In particular, the falsity of its antecedent cannot be taken to be a presupposition, given the availability of non-counterfactual uses such as (25.b).

In fact, there is reason to think that the pattern of accommodation can be predicted from simple pragmatic principles (cf. Karttunen and Peters (1979)). First, there is generally accepted to be pragmatic pressure to avoid asserting trivialities (see e.g., Stalnaker (1978, 187)). If (i) an assertion would be trivial at a context, but (ii) there is information which, if added to the context would avoid triviality, then that assertion can be expected to trigger accommodation to a new context which incorporates that information. Second, note that in contexts unopinionated about their antecedents, the account in §§3-4 predicts that indicatives and subjunctives are equivalent to the strict conditional. Yet, the strict conditional is trivially supported (excluded) in any context which already supports (excludes) its consequent. Thus, in contexts unopinionated about their antecedents, but opinionated about their consequents, indicatives and subjunctives are predicted to be trivially supported or trivially excluded.

In the case of the subjunctive, a repair strategy is readily available. For example, unless the information that thieves did not break into the apartment is accommodated, (27) will be trivially excluded in its context. However, after the relevant accommodation, supposition of its antecedent will trigger revision to a

counterfactual information state, which, crucially, need no longer incorporate the information that nothing is missing. Accordingly, it should be unsurprising that an assertion of (27) has a not-at-issue implication that its antecedent is false—for the assertion to be pragmatically licit, this information must be accommodated.

No such repair strategy is available in the case of the indicative. For example, accommodating the information that thieves did not break in would result in a context at which (26) is undefined (in virtue of its its antecedent being excluded). Accordingly, asserting an indicative at a context opinionated about its consequent is predicted to bear a strong suggestion of redundancy (a prediction which is seemingly borne out in the case of (26)).

Positing covert accommodation can explain the divergent judgments about (26)-(27) in contexts which support their consequent but are unopinionated about their antecedents. However, it does not explain the fact that, as observed above, the subjunctive can be used in such contexts as part of an argument in favor of the negation of its antecedent (as in (28.a-c))).[10]

(28) a. Maybe thieves broke in and maybe not.
b. If thieves had broken in, they would have taken something.
c. But nothing is missing, so (presumably) thieves didn't break in.

This seems surprising if, as is being claimed, the utterance of (28.b) requires the audience to temporarily accommodate information which entails the conclusion of the argument. In particular, the speaker cannot be aiming to convince her audience of the negation of the antecedent via simple *modus tollens* reasoning.[11] Instead, I propose, (28.a-c) exemplifies a more complex reasoning strategy. Rather than offering a deductive argument in favor of the claim that thieves didn't break in, we can interpret the speaker as engaging in a form of abductive reasoning.

Subjunctives frequently serve to illuminate the explanatory relationship between claims. Suppose that we know that a patient has a certain disease and exhibits certain symptoms. One way to evaluate the relationship between the symptoms and the disease is to consider a (counterfactual) subjunctive of the form 'If the patient had not had the disease, she would not have exhibited the symptoms'. The revision operation employed in evaluating conditionals appears primarily sensitive, in counterfactual revisions, to relations of explanatory dependence (e.g., causation, grounding, etc.). Revising with the negation of some currently supported claim will not only eliminate commitment to that claim, but also

[10] I am very grateful to an anonymous reviewer at *Mind* for emphasizing the importance of such uses of subjunctives for the discussion of collapse.

[11] Indeed, there may be independent reason to think that (28) is not an instance of *modus tollens* reasoning. *Modus tollens* would permit us to derive the stronger variant of (28.c), in which the 'presumably' hedge is dropped. Accordingly, to the extent as a speaker cannot utter (28.a-c) as a single, pointful piece of discourse without the hedge, it is implausible that we should analyse it as an instance of *modus tollens*.

commitment to claims which were explanatorily dependent upon it (and it alone). Hence, if the subjunctive is accepted, this will be evidence that the symptoms are explained by the disease. If it is not, it will be evidence that the symptoms have some other explanation which persists after revision.

For this reason, subjunctive conditionals in counterfactual environments can serve as a guide to abductive support. Suppose a context's information state incorporates ψ, but is as yet unopinionated about ϕ. To assess whether ψ provides abdutive support for ϕ, one way of proceeding is to: (i) add ϕ hypothetically to one's information, and (ii) consider the status of $\neg\phi \rightsquigarrow \neg\psi$ in the resulting context. If the subjunctive would be accepted in the hypothetical context, this is defeasible evidence that ϕ provides an explanation of ψ, and, hence, that the latter abductively supports the former.[12]

On this model, the reasoning underlying (28.a-c) can be reconstructed as follows: the conversation's initial state incorporates the information that nothing is missing but is (as yet) unopinionated about whether thieves broke in. (28.b) triggers temporary accommodation of the information that thieves did not break in. The conditional will be supported iff revising this accommodated state with the (now counterfactual) information that thieves *did* break in would result in a state which also incorporated the claim that something *was* taken. Yet, that this condition is satisfied is a defeasible reason for thinking that nothing being missing provides abductive support for the claim that thieves did not break in.

As well as figuring in arguments for the negation of their antecedent, subjunctives can also be employed as part of an argument for their antecedent's possibility. Stalnaker (1975) and von Fintel (1997) observe that in contexts which are unopinionated about whether Jones took arsenic (29)—originally due to Anderson (1951)—can be cited as evidence that his symptoms are consistent with his having done so.

(29) If Jones had taken arsenic, he'd be showing the symptoms he in fact shows.

This use of (29) can be accounted for by a reasoning strategy of the same kind. Suppose a context's information state incorporates ψ, but is unopinionated about ϕ. To assess whether $\neg\phi$ would provide an explanation of ψ one of of proceeding is to: (i) add ϕ hypothetically to one's information and, (ii) consider the status of $\neg\phi \rightsquigarrow \psi$ at the resulting context. If the subjunctive would be accepted in the hypothetical context, this is evidence that, after revision with $\neg\phi$, ψ would continue to possess an explanation.

[12] Why defeasible? One possibility is that ϕ and ψ are both explanatorily dependent on a further claim, χ. While in standard conditional evaluations commitment to χ would unaffected by revision with either $\neg\phi$ or $\neg\psi$, in so called 'backtracking'-counterfactuals, revising with the negation of a claim can eliminate commitment to a further claim on which it was dependent (see, e.g., Jackson (1977), Lewis (1979), Bennett (1984, 2003), and Khoo (2017) a.o., for discussion). Hence the test can be defeated in the case in which the conditional in question receives a non-standard, backtracking interpretation.

On this model, the reasoning underlying (29) can be reconstructed as follows: the conversation's initial state incorporates the information that Jones exhibits certain symptoms, but is agnostic between multiple potential causes (including arsenic). To avoid triviality, (29) triggers temporary accommodation of the information that Jones did not take arsenic. The conditional will be supported iff revising this accommodated state with the (now counterfactual) information that Jones *did* take arsenic would result in a state which preserves the information about his symptoms. Yet, that this condition is satisfied constitutes a (defeasible) reason for thinking that his having taken arsenic would explain his symptoms (as Stalnker and von Fintel observe).

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 (30). The supposition is not predicted to be compatible with counterfactual use unless it carries 'subjunctive' morphology:

(30) 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 (31)-(32) demonstrate:

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

(32) 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 (31.a), (31.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 (32.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 (33)-(35) and (9)-(11) to be equally good.

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

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

(35) 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.

(36) 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, (36.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 (36.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 (33)-(35) 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 $Sup(\phi) \rightarrow (Sup(\psi) \rightarrow \chi), Sup(\psi) \models Sup(\phi) \rightarrow \chi$. □

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