A Suppositional Theory of Conditionals

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Abstract

Suppositional theories of conditionals take apparent similarities between supposition and conditionals as a starting point, appealing to features of the former to provide an account of the latter. This paper develops a novel form of suppositional theory, one which characterizes the relationship at the level of semantics rather than at the level of speech acts. In the course of doing so, it considers a range of novel data which shed additional light on how conditionals and supposition interact.

1 Supposition and '*If*'-Clauses

Supposition and conditionals appear closely related. (1) and (2) provide different ways to communicate the same information:

(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.

1.1 Conditional Inferences

Consider the following three inference patterns:[1]

[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.

(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 valid for indicative conditionals, in the sense that anyone certain of the premises is committed to accepting the conclusion.[2,3] 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.

(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 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.

Counterexamples 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 for (6); circumstances in which Claude is in London, but might be in Rome were he not, will constitute counter-instances for (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 for (8).

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

[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).

[3] Even those who deny they are in fact validity (such as e.g., Stalnaker (1975), for (DA)) aim to account for their *apparent* validity.

(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 instead. Two brief observations are in order: first, note that following supposition, the discourse particle '*then*' is preferred to '*so*' to indicate that one utterance stands in a consequence relation to another. In this respect, supposition patterns with '*if*'-clauses, which likewise license '*then*' (and not '*so*') in the matrix clause. 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:

($\text{Pres}_{\Rightarrow}$)		$\models \phi \Rightarrow (\psi \Rightarrow (\phi \wedge \psi))$
($\text{DA}_{\Rightarrow}$)		$\models (\phi \vee \psi) \Rightarrow (\neg\phi \Rightarrow \psi)$
($\text{CT}_{\Rightarrow}$)	$\phi \Rightarrow (\psi \Rightarrow \chi)$	$\models \psi \Rightarrow (\phi \Rightarrow \chi)$

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

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

Unlike their unembedded variants, the subjunctive instances of ($\text{Pres}_{\Rightarrow}$), ($\text{DA}_{\Rightarrow}$), and ($\text{CT}_{\Rightarrow}$) appear valid for subjunctives as well. Consider, e.g., (12)-(14):

(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.

In this respect, supposition and '*if*'-clauses behave alike; both have a similar effect on the subjunctive instances of the inference pattern. Whereas the inferences are invalid for subjunctives in their basic form, they improve substantially if the rightmost premise is embedded either (i) under supposition or (ii) in the antecedent of a subjunctive in which the conclusion is nested.

1.2 Counterfactual Usage

The connection between supposition and conditional antecedents is further reinforced by 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.a-b), 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.

a. ?? If he did it, he used the candlestick.

b. If he'd done it, he would've used the candlestick.

What has received less discussion is that this behavior disappears under supposition and in conditional consequents. That is, the second discourse degrades substantially if the first sentence is supposed, rather than asserted, (as in (16)) or embedded in a wide-scope '*if*'-clause (as in (17)).

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

(17) ?? 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 conditional, 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 '*if*'-clauses and supposition have a similar effect, we can account for the improvement in (12)-(14) in the same way.

This rough picture generalizes to explain the availability of counterfactual uses. After a bare assertion that the butler is innocent, the subjunctive in (16) allows us to evaluate its consequent at some (minimally different) possibilities in which he was guilty. However, if supposition and '*if*'-clauses 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 natural language conditional is then characterized using a strict conditional, but one in which the information conveyed by the antecedent is supposed, rather than added to the context directly. §2 discusses extant suppositional theories; §3 introduces an enriched dynamic framework and develops a suppositional theory of the conditional within it. §§4-6 demonstrates how the indicative/subjunctive distinction can be explained within this framework. §7 concludes.

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 & 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 $\ulcorner$*if* ϕ, $\psi\urcorner$ (where ϕ, ψ are clauses with declarative mood), an agent performs a speech act equivalent 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 $\ulcorner$*if* ϕ, $\psi\urcorner$ 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 $\ulcorner$*if* ϕ, $\psi\urcorner$ is such an assertion of ψ grounded on supposition of ϕ where [the speaker] implicates via the presence of $\ulcorner$*if* $\phi\urcorner$ 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 suppositional 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., (18)), in the complements of attitude verbs (e.g., (19)), and in the conditionals consequents (e.g., (20)):

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

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

(20) 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 an '*if*'-clause 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 (18)-(20) 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.[4] 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, I want 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 suppositional theory defended below 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

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

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 a sentence's evaluation is dependent upon context at which it is uttered and how its utterance changes the context at which later sentences are evaluated. The choice of points of evaluation in a dynamic framework will depend on the kinds of discourse context/utterance interactions 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_σ is a function from pairs of sets of worlds to a set of worlds (i.e., $(\mathcal{P}(\mathcal{W}) \times \mathcal{P}(\mathcal{W})) \rightarrow \mathcal{P}(\mathcal{W})$). 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. Let L_0=$|\mathsf{A}|\neg\phi|\phi \wedge \psi|\phi \vee \psi|$. $[\![\cdot]\!]$ 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.

In order to provide a suitable model of information change, we need to impose a number of constraints on revision operations. Consider the following four conditions:

1.	$f(c, [\![\phi]\!]) \subseteq [\![\phi]\!]$		Success
2.	$f(c, [\![\phi]\!]) \neq \emptyset,$	*if* $[\![\phi]\!] \neq \emptyset$.	Coherence
3.	$f(c, [\![\phi]\!]) = f(c, [\![\psi]\!]) \cap [\![\phi]\!]$	*if* $[\![\phi]\!] \subseteq [\![\psi]\!]$ *and* $f(c, [\![\psi]\!]) \cap [\![\phi]\!] \neq \emptyset$	Minimality
4.	$f(c, [\![\phi]\!]) = c \cap [\![\phi]\!]$	*if* $c \cap [\![\phi]\!] \neq \emptyset$.	Vacuity

Success says that revising c with the information conveyed by ϕ will return a subset of the ϕ-worlds. Coherence says that revising c with the information conveyed by a consistent sentence will return a non-absurd state. 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, coherence 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 and supplementary AGM postulates (Alchourrón *et al.* (1985)).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 $\phi \in \mathsf{L}_0$)

That is, where $\phi \in \mathsf{L}_0$, 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, $\sigma[\psi_i], \ldots, [\psi_j] \models \phi$ (if $\sigma[\psi_i], \ldots [\psi_j][\phi]$ is defined).

We say that σ supports ϕ iff update with ϕ leaves the information state of σ unchanged. We say that σ excludes ϕ iff update of σ with ϕ returns the absurd state. $\psi_i, \ldots \psi_j$ 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 $\phi \wedge \psi$. In this case, revising with ψ will not return a subset of c.

Let $\mathsf{L}_1 = \{Sup(\phi) \mid \phi \in \mathsf{L}_0\}$. $\mathsf{L}_0 \cup \mathsf{L}_1$ 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 ϕ is accepted and, furthermore, ensuring that ϕ remains accepted any further suppositional changes.

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.

(21) 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 (21.a) can be felicitously extended with (21.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 (21.a-b) are presented as contrasting appears crucial in triggering withdrawal. If (21.a) is followed by (21.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 $\mathsf{L}=\mathsf{L}_0\cup\mathsf{L}_1\cup\mathsf{L}_2$ be the extension of $\mathsf{L}_0\cup\mathsf{L}_1$ defined so that: if $\phi \in\mathsf{L}_0$, then $\phi \in\mathsf{L}_2$; if

$\phi \in \mathsf{L}_0 \cup \mathsf{L}_1$ and $\psi \in \mathsf{L}_2$, then $\phi \rightarrow \psi \in \mathsf{L}_2$; and nothing else is a member of L_2.

$\phi \rightarrow \psi$ expresses a generalisation of the dynamic strict conditional, defended by e.g., Veltman (1985), Gillies (2004, 2009), Starr (2014a).

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 ψ is supported at $\sigma[\phi]$. If not, it returns σ; if so, it returns an absurd context, $\langle \emptyset, f_\sigma \rangle$. 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 (2014b), 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*' 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. $$\sigma[Sup(\phi) \rightarrow \psi] = \begin{cases} \sigma & \textit{if } \sigma[Sup(\phi)] \models \psi; \\ \langle \emptyset, f_\sigma \rangle & \textit{otherwise.} \end{cases}$$

Stated informally, $Sup(\phi) \rightarrow \psi$ induces a test which decomposes into two stages: first, it finds the result of updating σ with $Sup(\phi)$. 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 ψ. If so, it returns σ; if not, it returns an absurd context.

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. While doing so, it avoids Gärdenfors (1986)'s impossibility result for the AGM Ramsey conditional, since it follows Bradley (2007) in giving up persistence for conditionals (i.e., it denies that if $\sigma' \models \phi \Rightarrow \psi$ and $c_\sigma \subseteq c_{\sigma'}$, then $\sigma \models \phi \Rightarrow \psi$).

The conditional is strictly stronger than the material conditional. It will validate Import/Export as long as we impose the following additional constraint on revision **(Appendix A, Fact 1)**.

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

Weak iteration says that revising c successively with the information conveyed by ϕ and $\phi \wedge \psi$ will have the same effect as simply revising c with $\phi \wedge \psi$. This corresponds to Darwiche & Pearl (1997)'s first constraint on iterated belief revision, and will be assumed in what follows.

The conditional invalidates *modus ponens*. However, it does so in a limited manner. *Modus ponens* fails only in instances involving nested subjunctive conditionals. Indeed, this prediction is arguably desirable (cf. Mandelkern (2020)).

(22) a. If the match had lit when struck, then if it had been wet when struck, then it would have lit when wet.
b. The match lit when struck.
c. So, if it been wet when struck, it would have lit when wet.

(22.a) is tautologous. Yet someone who accepts (22.b) need not accept (22.c). On the present account, the explanation is simple. Under supposition that the match lit, revising with the information that the match was wet return a state which incorporates the information it lit and that it was wet. However, (22.c) is evaluated at a context in which the information that the match lit is supported but is not supposed. At such a state, revising with the information that the match was wet need not return a state which preserves the information that it lit.

Modus ponens remains valid in the restricted case where the consequent is non-conditional. 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. This prediction also appears correct. If (22.b) is replaced by an instruction to suppose that the match had been struck, the inference improves considerably. In the next section, we turn to providing a semantics for conditionals in natural langauge, 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 (15.a-b) (repeated) demonstrated, indicatives (but not subjunctives) are unacceptable in counterfactual discourse contexts; that is, discourses which entail the negation of their antecedent.

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

b. If he'd done it, he would've used the candlestick.

§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 (2014b) (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 don't.

4.1 Indicatives

On the basis of (15.a) (and following, e.g., Stalnaker (1975), Karttunen & Peters (1979),von Fintel (1997), Gillies (2009); **?** and Starr (2014b)), we'll assume that indicative conditionals presuppose the possibility of their antecedent.

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

$\sigma[\phi \dashrightarrow \psi]$ 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 $\phi \to \psi$.[5]

(Eqv) $\phi \dashrightarrow \psi \dashv\models \phi \to \psi$, if $\phi, \psi \in \mathrm{L}_0$ Equivalence

Indeed, we can say something (slightly) stronger. Where $\phi \dashrightarrow \psi$ belongs to the closure of L_0 under $\dashrightarrow$ and 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. Similarly, the indicative will validate *modus ponens*, Import/Export and the deduction theorem.

4.2 Subjunctives

We will assume that subjunctives, in contrast, have trivial presuppositions.

Definition 8. $\sigma[\phi \rightsquigarrow \psi] = \sigma[Sup(\phi) \to \psi]$

Unlike indicatives, subjunctives do not undergo presupposition failure in contexts which support the negation of their antecedent. In such contexts, supposition of

[5] 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 $\psi \in \mathsf{L}_0$, $c_{\sigma[Sup(\phi)][\psi]} = c_{\sigma[\phi][\psi]}$. So, for all σ on which $\phi \dashrightarrow \psi$ is defined, $\sigma[\phi \dashrightarrow \psi] = \sigma[\phi \to \psi]$.

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.

Like indicatives, subjunctives are defined in non-counterfactual contexts. The acceptability of (23) suggests that this is the correct prediction (cf. e.g., Anderson (1951), Stalnaker (1975)).

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

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: ($\text{Pres}_{\Rightarrow}$), ($\text{DA}_{\Rightarrow}$) and ($\text{CT}_{\Rightarrow}$). By the deduction theorem for the strict conditional, if we know that $\Gamma, Sup(\phi) \models \psi$, it follows that $\Gamma \models Sup(\phi) \rightarrow \psi$. Secondly, 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 or in a wide-scoping '*if*'-clause. If ϕ and ψ are inconsistent, any attempt to revise with ψ after supposing ϕ will return an absurd state. 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 & 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) $\phi \rightsquigarrow \psi \mathrel{=\!\mid\!\models} \phi \dashrightarrow \psi$ 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. 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.

Suppose that you arrive home to find the door to your apartment ajar, but none of the contents missing. In such a context, (24) and (25) constitute a compelling Adams pair.[6]

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

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

It would be reasonable to accept an assertion of (24) in context (given the contents of the apartment). It would, likewise, be reasonable to accept an assertion of (25) (given the primary goals of thievery). Yet, on minimal assumptions, Collapse implies that the two are contraries.[7] Given Collapse, where both are defined, a context will support (24) only if it excludes (25) (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 at which both are defined. Crucially, however, there is reason to think that this is not what happens. Specifically, there is reason to think that subjunctive conditionals are shifty. When asserted at a context which is compatible with the conditional's antecedent, subjunctives appear to trigger a covert shift to a context which incorporates the information their antecedent is false. A speaker who asserts (25) implicates 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 for this context shift. First, note that (25) passes the 'Hey, wait a minute!'-test for accommodation. Hearers can reasonably respond to an assertion of (25) (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

[6] 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.

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

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

if the information objected to would otherwise be covertly incorporated into the context via accommodation. Crucially, no such response is licit for (24).

The felicity of 'Hey, wait a minute!' responses is fragile. If (25) is employed as part of an argument against its antecedent (as in (26), 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 incorporated into the context. Yet in (26), 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 (24) can coherently proceed to assert (25) (e.g., as part of an argument that thieves did not break in). However, a speaker who asserts (25) cannot coherently go on to assert (24). 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 (25) 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 kind of accommodation. In particular, the falsity of the antecedent cannot be a presupposition of the subjunctive, given the availability of non-counterfactual uses such as (23).

In fact, precisely this pattern of accommodation can be predicted from an independently motivated pragmatic principle. There is generally accepted to be pragmatic pressure on speakers to employ expressions with stronger presuppositions, where possible (Heim (1991, 515), Sauerland (2003, 2008)). If (i) two expressions have the same at-issue content but (ii) the presuppositions of one are strictly stronger than the presuppositions of the other, then using the expression with stronger presuppositions is pragmatically preferred as long those presuppositions are satisfied. Succinctly, speakers should aim to maximize presupposition.

On the account developed above, indicatives and subjunctives have the same at-issue content. However, the presuppositions of the former are strictly stronger than the presuppositions of the latter. Accordingly, by the directive to maximize presupposition, where both are defined there is a pragmatic preference for using an indicative over the corresponding subjunctive; in contexts compatible with its antecedent, use of the subjunctive will be dispreferred.

As a number of authors have noted, the preference for employing expressions with stronger presuppositions gives rise to an implicature if an alternative with weaker presuppositions is used instead (Percus (2006), Sauerland (2008), Lauer (2016)).[8] A speaker who uses a subjunctive implicates that the presuppositions of the

[8] Following Percus this implicature is sometimes termed an 'anti-presupposition'.

corresponding indicative were not satisfied (since otherwise it should have been used). The indicative's presuppositions are satisfied iff the context is compatible with its antecedent. So, assuming speakers aim to maximize presupposition, subjunctives will be expected implicate that their antecedent is ruled out by the context.

This explains the covert shift in context observed above. By using a subjunctive like (25), the speaker generates a not-at-issue implicature that the indicative's presuppositions were not satisfied. Accommodating this implicature requires covert shift to a context in which which the antecedent is ruled out—that is, a context in which it is accepted that thieves did not break in. But the status of (25) at the new context can differ from the status of (24) at the old context, without posing any challenge to Collapse.

If subjunctives trigger accommodation of the negation of their antecedent this explains how they can elicit different judgments to the corresponding indicatives in cases involving Adams pairs. It also corroborates the tests for covert shifting discussed above, involving order effects and 'Hey, wait a minute!'-responses. Before concluding I will briefly consider how this shifty picture of subjunctives interacts with the role they play in reasoning.

As we observed, the subjunctive can sometimes be employed as part of an argument in favor of the negation of its antecedent (as in (26.a-c)).[9]

(26) 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 thieves didn't break in.

This seems surprising if, as is being claimed, the utterance of (26.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.[10] Instead, I propose, we should take (26.a-c) to exemplify 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.

Counterfactual subjunctives illuminate explanatory relationships between claims. Suppose that we know that a patient has a certain disease and exhibits certain symptoms. One strategy for investigating the relationship between the symptoms and the disease is to ask whether, if the patient had not had the disease, she

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

[10] Indeed, there may be independent reason to think that (26) is not an instance of *modus tollens* reasoning. *Modus tollens* would permit us to derive the stronger variant of (26.c), in which the '*presumably*' hedge is dropped. Accordingly, to the extent as a speaker cannot utter (26.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*.

would still have exhibited the symptoms. Put another way, when incorporating counterfactual information the revision operation employed in conditionals and supposition is sensitive to relations of explanatory dependence. Supposing that some currently accepted claim had been false not only eliminates commitment to that claim, it also eliminates commitment to claims which were explanatorily dependent upon it (and it alone).

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.[11]

On this model, the reasoning underlying (26.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. (26.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, (27)—originally due to Anderson (1951)—can be cited as evidence that his symptoms are consistent with his having done so.

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

This use of (27) 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 way 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

[11] 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.

accepted in the hypothetical context, this is evidence that, after revision with $\neg\phi$, ψ would continue to possess an explanation.

On this model, the reasoning underlying (27) 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, (27) 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 (28). The supposition is not predicted to be compatible with counterfactual use unless it carries subjunctive morphology:

(28) 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 (29)-(30) demonstrate:

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

(30) 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 (29.a), (29.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 (30.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 (31)-(33) and (9)-(11) to be equally good.

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

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

(33) 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 mere collection of utterances. Understanding a discourse requires understanding the relations between distinct utterances (Hobbs (1985), Roberts (1996, 2012), Kehler (2002), Asher & Lascarides (2003)). 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.

(34) 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, (34.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 (34.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 (31)-(33) 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 supposition operator. 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 effects of the former are restricted to its syntactic scope. Thus, in a slogan, the proposal can be summarized as: '*if*'-clauses are sentence level suppositions; supposition is a discourse level '*if*'-clause.

8 Appendix

Fact 1. $Sup(\phi \wedge \psi) \to \chi \dashv\models Sup(\phi) \to (Sup(\psi) \to \chi)$, given weak iteration.

Proof. Observe that $Sup(\phi \wedge \psi) \to \chi \dashv\models Sup(\phi) \to (Sup(\psi) \to \chi)$ 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 $Sup(\phi \wedge \psi) \to \chi \dashv\models Sup(\phi) \to (Sup(\psi) \to \chi)$. □

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

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

Proof. **Fact 2.*i*.:** $Sup(\phi) \models Sup(\psi) \to (\psi\wedge\phi)$ 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, $Sup(\phi) \models Sup(\psi) \to (\psi \wedge \phi)$. □

Proof. **Fact 2.*ii*.:** $Sup(\phi \vee \psi) \models Sup(\neg\phi) \to \psi$ 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, $Sup(\phi \vee \psi) \models Sup(\neg\phi) \to \psi$. □

Proof. **Fact 3.:** $Sup(\phi) \to (Sup(\psi) \to \chi), Sup(\psi) \models Sup(\phi) \to \chi$ iff for all proper σ, if $\sigma \models Sup(\phi) \to (Sup(\psi) \to \chi)$, then $\sigma[Sup(\psi)][Sup(\phi)] \models \chi$. For an arbitrary proper σ, suppose $\sigma \models Sup(\phi) \to (Sup(\psi) \to \chi)$. 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 $Sup(\phi) \to (Sup(\psi) \to \chi), Sup(\psi) \models Sup(\phi) \to \chi$. □

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