Conditional Assertion in Commitment Spaces

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1. Introduction

(1) a. *If Fred was at the party, the party was fun*.
b. *If this number is divisible by three, I will propose to Mary.*

(2) Two approaches to conditional sentences:

a. **Conditional proposition (CP):**
i. conditional sentence has a truth value (e.g. Stalnaker, Lewis, Kratzer)
‘Fred was at the party > the party was fun’
ii. conditional sentence has a probability (e.g. Adams, Kaufmann)
P(‘party was fun’ | ‘Fred was there’) > r

b. **Conditional assertions (CA),** e.g. Edgington, Vanderveken, Starr:
Under the condition that Fred was at the party it is asserted that the party was fun.

1 Thanks to DFG, BMBF for financial support; thanks to Clemens Mayr, Stefan Kaufmann for discussion.

(3) Arguments for **CP**:

a. Explains embedding of conditionals, as propositions can be embedded:
   i. *If Fred was at the party, then if Mary was there too, the party was fun.*
   ii. *We all know that if Fred was at the party, the party was fun.*

b. There are established proposals for truth conditions, e.g. Stalnaker 1968:
   ‘if φ then ψ’ = $[\varphi > \psi] = \lambda i[\psi(ms(i, \varphi))]$,
   where ms(i, φ) the maximally similar index to i such that $\varphi(i)$.

(4) Arguments for **CA**:

a. Different speech acts in consequent:
   If Fred was at the party, was it fun? / how fun it must have been! / tell me more about it!

b. Plausibility of Peirce / Ramsey analysis of conditionals:
   ...[T]he consequent of a conditional proposition asserts what is true, not throughout the whole universe of possibilities considered, but in a subordinate universe marked off by the antecedent. (Peirce in the Grand Logic [1893-4]; CP 4.435)

c. Straightforward explanation of presupposition projection (Heim 1983):
   If Fred is a diver, he will bring his wetsuit.
   assume Fred is a diver; divers have wet-suit; Fred has a wet suit.

d. *no* as affirming negative antecedent assertions
   S_1: *If Kelly dates John, she will not marry Bill.*
   S_2: *No, she won't.* (i.e., if Kelly dates John, she will not marry Bill).

(5) Stalnaker 2009 on CA:
“While there are some complex constructions with indicative conditionals as constituents, the embedding possibilities seem, intuitively, to be highly constrained. For example, simple disjunctions of indicative conditionals with different antecedents, and conditionals with conditional antecedents are difficult to make sense of. The proponent of a non-truth-conditional [CA] account needs to explain what embeddings there are, but the proponent of a truth-conditional [CP] account must explain why embedded conditionals don’t seem to be interpretable in full generality.”

(6) My goals:
a. Develop a formal framework for CA,
   this is done within Commitment Space Semantics (Cohen & Krifka 2014, Krifka 2015).
b. Explain (restrictions of) embeddings of conditional clauses
c. Propose a unifying account for indicative and counterfactual conditionals

2. The Dynamic Approach

(7) Assertions as actions that change information state of interlocutors;
modeled as changes of the shared Common Ground
(Stalnaker 1974, 1975, 1978, 2002; cf. also Karttunen 1974).

(8) Information state s often modeled as **context set**,
a set of indices (possible worlds),
update with proposition as intersection: $s + \varphi = s \cap \varphi$

If φ carries a presupposition π,
this has to be satisfied in input information state s, i.e. $s \subseteq \pi$

(9) Update with a conditional sentence (Heim 1983):
$s + [\text{if } \varphi \text{ then } \psi] = s - [[s + \varphi] - [s + \varphi + \psi]]$

Presuppositions of ψ have to be satisfied in information state $s + \varphi$

(10) Is this necessarily a **conditional** update?
No, we would get the same result by update with material implication:
$s + [\varphi \rightarrow \psi] = s + [\neg\varphi \vee \psi]$

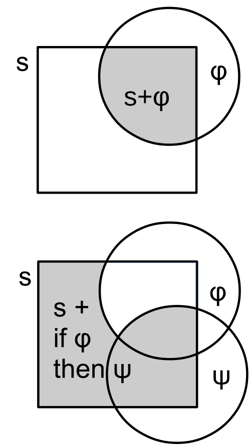

Figure 1: Heimian update with proposition, and with conditional

3. Commitment States and their Updates

(11) Commitment states are **sets of propositions**, the propositions that the participants of a conversation consider to be shared at the current point in conversation.

(12) Commitment states should be **consistent**, i.e. non-contradictory:
a. c is inconsistent iff $c \vDash \varphi$ and $c \vDash \neg\varphi$, for some proposition φ
b. c is consistent iff c it is not inconsistent.

(13) **Update** of commitment states, cf. Figure 2.
a. Update of commitment state c with proposition φ: $c + \varphi = c \cup \{\varphi\}$
b. Consistent update: $c + \varphi = c \cup \{\varphi\}$, if consistent
c. Analytic update: $c + \varphi$, where $c \vDash \varphi$; making φ salient.

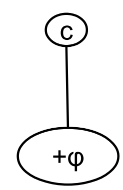

Figure 2: Update of commitment state with f(φ)

(14) Update as function: $c + f(\varphi) = f(\varphi)(c) = \lambda c'[c' \cup \{\varphi\}](c) = c \cup \{\varphi\}$

(15) **Assertion** as expressing commitments to **truth of proposition**:
$c + S_1$ to S_2: *I won the race.* $= f(S_1 \vdash$ 'S_1 won the race'$)(c)$
$= c + S_1 \vdash$ 'S_1 won the race'
$S_1 \vdash \varphi$: S_1 vouches for the truth of φ, accepting social penalties if φ turns out false
cf. Frege 1879, judgement stroke;
Peirce on assertion as "an act of exhibition of the fact that one subjects oneself to the penalties visited on a liar if the proposition asserted is not true", CP 8.337

(16) The **proposition φ** enters the commitment state as a **conversational implicature** that can be cancelled: *Believe it or not, Fred was at the party.*

(17) $C + S_1 \vdash \varphi$, after conversational implicature, no objection by S_2: $C + S_1 \vdash \varphi + \varphi$

(18) See Krifka (2015) for details, including:
– syntactic structure of assertions: $[_{\text{ActP}}\ .\ [_{\text{CommitP}} \vdash [_{\text{TenseP}}\ \psi]]]$
– how the implicature arises: assumption that speaker avoids penalties; cooperation
– questions as requests to commit to a proposition: $[_{\text{ActP}}\ ?\ [_{\text{CommitP}} \vdash [_{\text{TenseP}}\ \psi]]]$
– confirming and denying reactions: *yes, no, I don't know.*

4. Commitment Spaces and their Updates

(19) Commitment spaces (CS) as commitment states with possible future development
Cohen & Krifka 2014, Krifka 2015

(20) A **single-rooted commitment space** is a non-empty set of commitment states C with ∩C ∈ C.
∩C, written √C, **the root** of the commitment space C.
For all c∈C, it holds that √C ⊆ c.

(21) Update with a proposition φ, cf. Figure 3:
F(φ) = λC{c∈C | √C + f(φ) ⊆ c}

(22) C + F(φ) = F(φ)(C) = {c∈C | √C + f(φ) ⊆ c},
undefined if f(φ)(√C) is undefined
(in case this is contradictory)

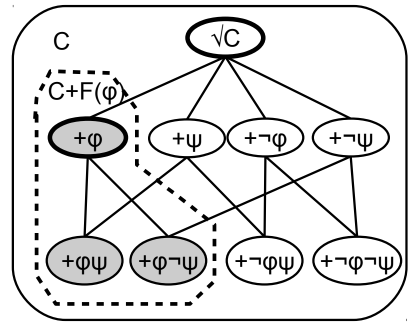

Figure 3: Update of commitment space with F(φ)

(23) Denegation of speech acts, cf. Figure 4:
(cf. Searle 1969, Hare 1970, Dummett 1973)
a. *I don't promise to come.*
b. *I don't claim that Fred spoiled the party.*

(24) Formal representation of denegation:
C + ~𝔄 = C – [C + 𝔄]
this is dynamic negation in Heim 1983

(25) Speech acts that do not change the root:
meta speech acts (cf. Cohen & Krifka 2014).

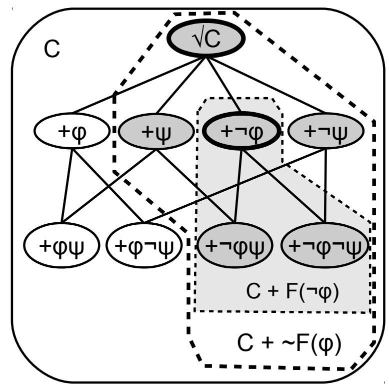

Figure 4: Update with ~F(φ) vs. F(¬φ)

(26) **Revisionary** update rules
if regular update (22) is not defined:
go to maximally compatible commitment state
C + F(φ) = {c + f(φ) | ∃c′[c′ ∈ C ∧ maxcomp(c, c′, φ)]},
where maxcomp(c, c′, φ) iff c is a maximal c with c⊆c′ such that c+f(φ) can be performed.

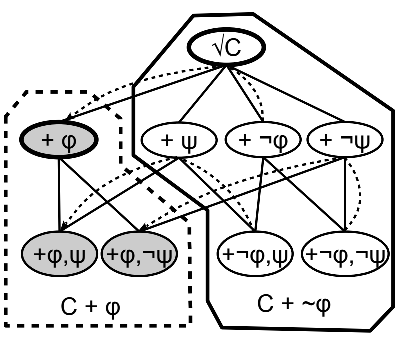

Figure 5: Revisionary update
[C + ~F(φ)] + F(φ)

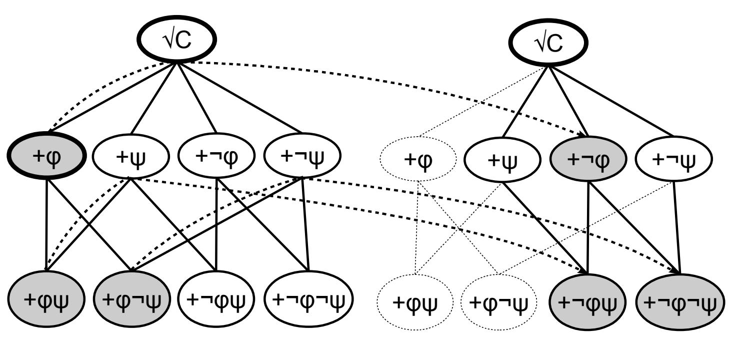

Figure 6: Revisionary update
[C + F(φ)] + F(¬φ)

(27) Dynamic conjunction
[𝔄 ; 𝔅] = λC[𝔅(𝔄(C))] (functional composition)

(28) Boolean conjunction and disjunction

a. $[\mathfrak{A} \,\&\, \mathfrak{B}] = \lambda C'[\mathfrak{A}(C') \cap \mathfrak{B}(C')]$

b. $[\mathfrak{A} \vee \mathfrak{B}] = \lambda C'[\mathfrak{A}(C') \cup \mathfrak{B}(C')]$

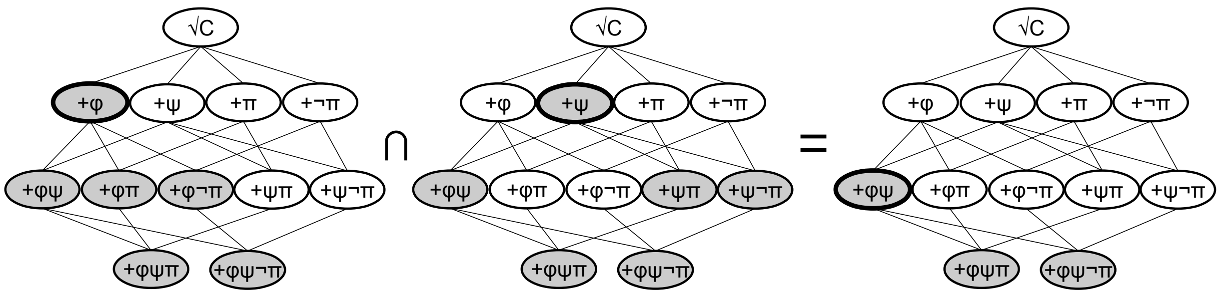

Figure 7: Conjunction $C + [F(\varphi) \,\&\, F(\psi)] = [C + F(\varphi)] \cap [C + F(\psi)]$

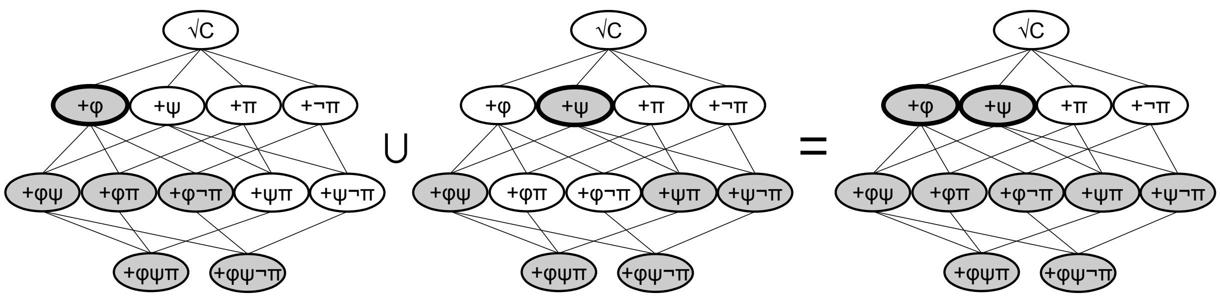

Figure 8: Disjunction $C + [F(\varphi) \vee F(\psi)] = [C + F(\varphi)] \cup [C + F(\psi)]$

(29) Disjunction of two regular speech acts does not result in single-rooted CS, problem of disjunction as speech acts, Dummett, 1973, Gärtner & Michaelis, 2010

(30) Proposal: Commitment spaces do not need to have a single root

a. A **commitment space** is a non-empty set of commitment states C

b. $c \in C$ is **a root** of C iff there is no c' with $c' \subset c$ such that $c' \in C$

c. $\surd C = \{c \in C \mid \neg\exists c' \in C[c' \subset c]\}$ is the **set of roots** of C.

(31) Update affects all roots of a commitment space:

$F(\varphi) = \lambda C\{c \in C \mid \exists c' \in \surd C[c' + f(\varphi) = c]\}$

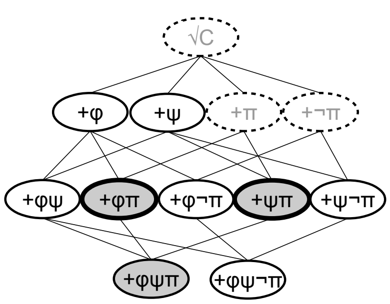

Figure 9:
$C + [F(\varphi) \vee F(\psi)] + F(\pi)$

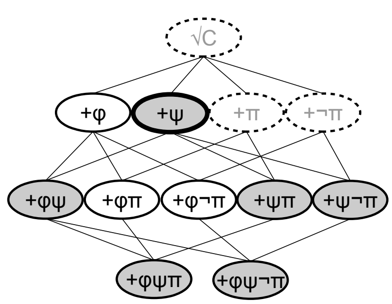

Figure 10:
$C + [F(\varphi) \vee F(\psi)] + F(\psi)$

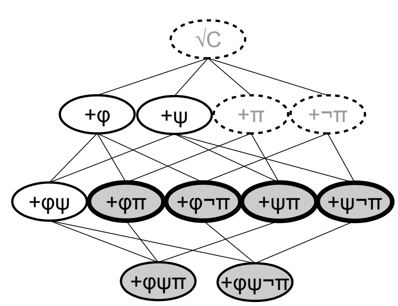

Figure 11:
$C + [F(\varphi) \vee F(\psi)] + [F(\pi) \vee F(\neg\pi)]$

(32) Boolean laws,
e.g. double negation, excluded middle, de Morgan

a. $C + \sim\sim\mathfrak{A} = C - [C + \sim\mathfrak{A}] = C - [C - [C + \mathfrak{A}]]$
$= C + \mathfrak{A}$

b. $C + [\mathfrak{A} \vee \neg\mathfrak{A}] = [C + \mathfrak{A}] \cup [C - [C + \mathfrak{A}]] = C$

c. $C + \sim[\mathfrak{A} \vee \mathfrak{B}] = [C - [[C + \mathfrak{A}] \cup [C + \mathfrak{B}]]$
$= [C - [C + \mathfrak{A}]] \cap [C - [C + \mathfrak{B}]]$
$= C + [\sim\mathfrak{A} \;\&\; \sim\mathfrak{B}]$

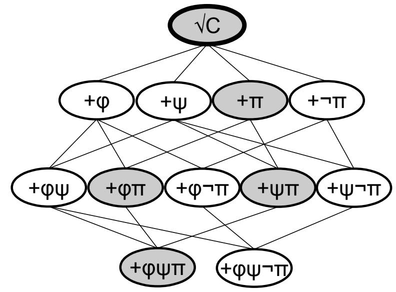

Figure 12: Monopolar question whether π
C + ?(π)

(33) Questions as metalinguistic speech acts (Krifka 2015):

a. $C + ?(\varphi) = \surd C \cup C + F(\varphi)$

b. Question by S_1 to S_2 whether φ: $C + ?(S_2 \vdash \varphi)$

5. Conditional Assertions

5.1 Representation of conditional sentences

(34) First proposal for conditionals (to be revised): $[\varphi \Rightarrow \psi] = \lambda C\ \{c \in C \mid \varphi \in c \rightarrow \psi \in c\}$

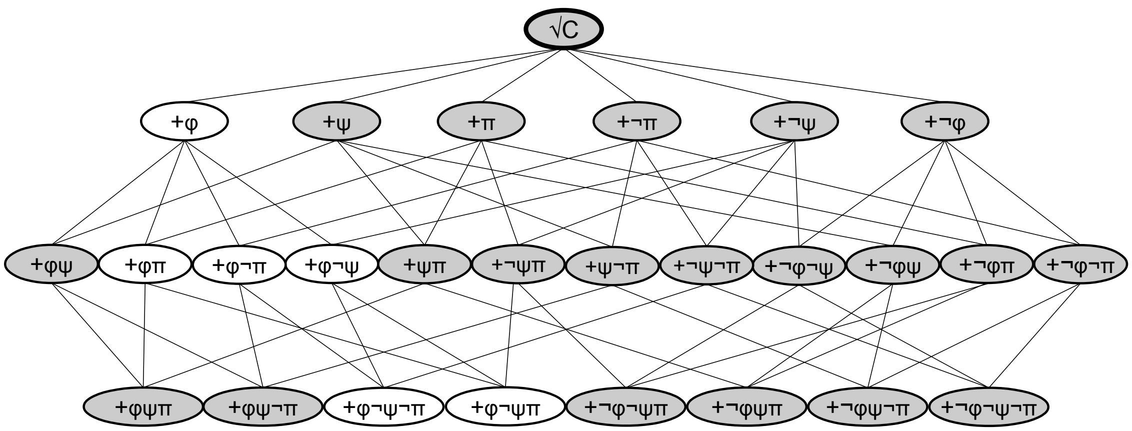

Figure 13: $C + [\varphi \Rightarrow \psi] = \{c \in C \mid \varphi \in C \rightarrow \psi \in C\}$
$C + [F(\varphi) \Rightarrow F(\psi)] = C + [[F(\varphi)\ ;\ F(\psi)] \vee \sim F(\varphi)] = C + [\sim F(\varphi) \vee F(\psi)]$

(35) Conditionals in terms of updates:
$C + [\mathfrak{A} \Rightarrow \mathfrak{B}] = \{c \in C \mid c \in C + \mathfrak{A} \rightarrow c \in C + \mathfrak{A} + \mathfrak{B}\}$

(36) Equivalent to Peirce / Ramsey condition:

a. $[\mathfrak{A} \Rightarrow \mathfrak{B}] = [[\mathfrak{A}\ ;\ \mathfrak{B}] \vee \sim\mathfrak{A}]$

b. $[\mathfrak{A} \Rightarrow \mathfrak{B}] = [\sim\mathfrak{A} \vee \mathfrak{B}]$ (in case there are no anaphoric bindings between $\mathfrak{A}$ and $\mathfrak{B}$)

(37) Antecedent itself is not a speech act; *if/wenn* updates without commitment;
cf. verb final order in German, typical for embedded clauses without illocutionary force:
Wenn Fred auf der Party war, [*dann war die Party lustig*].
cf. lack of speech act operators in antecedent
*If Fred (*presumably) was at the party, then the party (presumably) was fun.*

(38) *if/wenn* takes a proposition, turns it into an update function:
$[\![[_{ActP}\ [_{CP}\ \textit{if}\ \varphi]\ [\textit{then}\ [_{ActP}\ .\ [_{CommitP} \vdash [_{TP}\ \psi]]]]]\!]^S = [F(\varphi) \Rightarrow S{\vdash}\psi]$, S: speaker

(39) Conditional assertion analysis of conditionals:
C + S: *if φ then ASSERT ψ* = $C + [[F(\varphi)\ ;\ F(S{\vdash}\psi)]\ \vee \sim F(\varphi)]$

(40) Requirements for $[\mathfrak{A} \Rightarrow \mathfrak{B}]$: Grice 1988, Warmbröd 1983, Veltman 1985, cf. (36)(a)
a. Update of C with $\mathfrak{A}$ must be pragmatically possible i.e. informative and
b. Update of $C + \mathfrak{A} + B$ must be pragmatically possible not excluded

(41) Allows for other speech acts, e.g. questions:
$C + S_1$ to S_2: *if φ then QUEST ψ* = $C + [[F(\varphi);\ ?(S_2{\vdash}\psi)]\ \vee \sim F(\varphi)]$,
answer to question + $F(S_2{\vdash}\psi)$ would entail that antecedent is true (exclusion of $\sim F(\varphi)$)

5.2 Conjunction of conditionals

(42) Conjunction of conditionals
$[[\mathfrak{A} \Rightarrow \mathfrak{B}]\ ;\ [\mathfrak{A}' \Rightarrow \mathfrak{B}']] = [\mathfrak{A} \Rightarrow \mathfrak{B}]\ \&\ [\mathfrak{A}' \Rightarrow \mathfrak{B}'] = [\mathfrak{B} \vee \neg\mathfrak{A}]\ \&\ [\mathfrak{B}' \vee \neg\mathfrak{A}']$

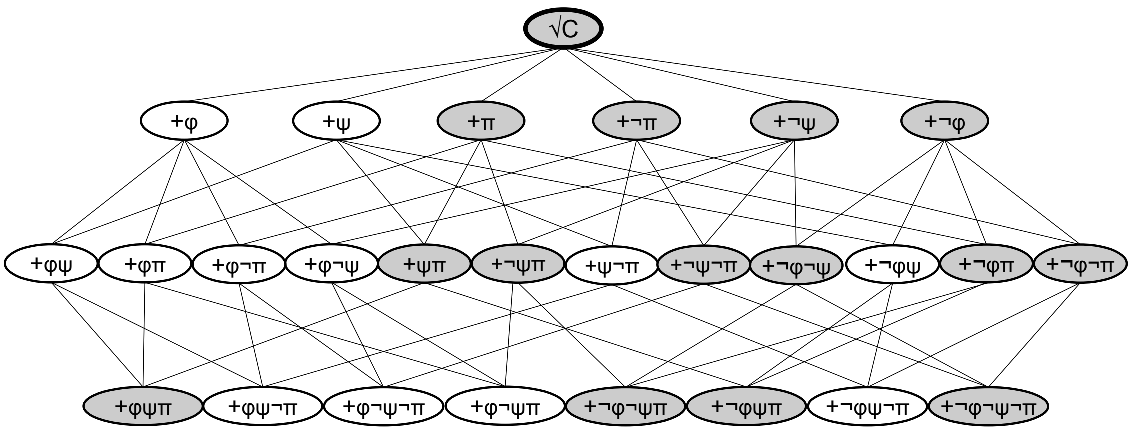

Figure 14: $C + [[F(\varphi) \Rightarrow F(\psi)]\ \&\ [F(\psi) \Rightarrow F(\pi)]] = C + [F(\varphi) \Rightarrow F(\psi)] \cap C + [F(\psi) \Rightarrow F(\pi)]$

(44) Transitivity: $[C + [\mathfrak{A} \Rightarrow \mathfrak{B}]\ \&\ [\mathfrak{B} \Rightarrow \mathfrak{C}]] \subseteq C + [\mathfrak{A} \Rightarrow \mathfrak{C}]$

(45) For CP analysis, transitivity needs stipulation about ms relation:
$[\varphi > \psi] \wedge [\psi > \pi] = \lambda i[\psi(ms(i,\varphi)) \wedge \pi(ms(i,\psi))]$,
$[\varphi > \pi] = \lambda i[\pi(ms(i,\varphi))]$,
$[\varphi > \psi] \wedge [\psi > \pi] \subseteq [\varphi > \pi]$ if $ms(i,\varphi) = ms(i,\psi)$

(46) Not designed to handle default rules, nonmonotonic reasoning, e.g.
If Tweety is a bird, it can fly;
If Tweety is a penguin, it is a bird;
But: *If Tweety is a penguin, it cannot fly.*
cf. Veltman 1996 for default rules in dynamic semantics, to be adapted here

5.3 Disjunction of conditionals

(47) Disjunction of conditionals often considered problematic
(cf. Barker 1995, Edgington 1995, Abbott 2004, Stalnaker 2009).

(48) A good offer with which you only can gain, not loose?
If you open the green box, you'll get 10 euros,
or if you open the red box you'll have to pay 5 euros.

But we have the following equivalence (also for material implication)
$[[\mathfrak{A} \Rightarrow \mathfrak{B}] \vee [\mathfrak{A}' \Rightarrow \mathfrak{B}']] \quad = [[\sim\mathfrak{A} \vee \mathfrak{B}] \vee [\sim\mathfrak{A}' \vee \mathfrak{B}']]$
$= [[\sim\mathfrak{A} \vee \mathfrak{B}'] \vee [\sim\mathfrak{A}' \vee \mathfrak{B}]] = [[\mathfrak{A} \Rightarrow \mathfrak{B}'] \vee [\mathfrak{A}' \Rightarrow \mathfrak{B}]]$

Equivalent to: *If you open the **green** box, you'll pay five euros,*
*or if you open the **red** box, you'll get 10 euros.* (!)

(49) Typically the two antecedents are understood as mutually exclusive, resulting in a tautology:
a. $[[\mathfrak{A} \Rightarrow \mathfrak{B}] \vee [\mathfrak{A}' \Rightarrow \mathfrak{B}']] \quad = [[\sim\mathfrak{A} \vee \sim\mathfrak{A}'] \vee [\mathfrak{B} \vee \mathfrak{B}']]$
$= [\sim[\mathfrak{A} \,\&\, \mathfrak{A}'] \vee [\mathfrak{B} \vee \mathfrak{B}']] \quad = [[\mathfrak{A} \,\&\, \mathfrak{A}'] \Rightarrow [\mathfrak{B} \vee \mathfrak{B}']]$
b. if $C + [\mathfrak{A} \,\&\, \mathfrak{A}'] = \emptyset$, this is pragmatically excluded, or results in tautology,
but antecedents of disjunctions are easily understood as mutually exclusive
c. Following Gajewski (2002), systematic tautology results in ungrammaticality.

(50) Johnson-Laird & Savary 1999: (a) and (b) should entail (c)
a. *If there is a king in the hand then there is an ace in the hand,*
or else if there is a queen in the hand then there is an ace in the hand.
b. *There is a king in the hand.*
c. *There is an ace in the hand.*
But this does not hold for material implication or for the model here:
As $[\mathfrak{A} \Rightarrow \mathfrak{B}] \vee [\mathfrak{A}' \Rightarrow \mathfrak{B}] = [\sim\mathfrak{A} \vee \sim\mathfrak{A}' \vee \mathfrak{B}]$, denying $\mathfrak{A}$ gives us $[\sim\mathfrak{A}' \vee \mathfrak{B}]$,
hence from (a) and (b) we can just conclude:
d. *If there is a queen in the hand then there is an ace in the hand.*

(51) Jackson, 1979 for material implication, here adapted to commitment states:
$[[\mathfrak{A} \Rightarrow \mathfrak{B}] \vee [\mathfrak{B} \Rightarrow \mathfrak{C}]] = [\mathfrak{B} \vee \sim\mathfrak{B}] \vee [\sim\mathfrak{A} \vee \mathfrak{C}]$,
as $[\mathfrak{B} \vee \sim\mathfrak{B}]$ is a tautology, the formula itself is.

(52) For the CP theory, conditionals should not be difficult to disjoin;
$[\varphi > \psi] \vee [\varphi' > \psi']$ is not equivalent to $[\varphi > \psi'] \vee [\varphi' > \psi]$,
$[\varphi > \psi] \vee [\psi > \pi]$ is not a tautology.

(53) Some disjoined conditionals are easy to understand, cf. example by Barker 1995:
a. *Either the cheque will arrive today, if George has put it into the mail,*
or it will come with him tomorrow, if he hasn't.
b. Parenthetical analysis:
The cheque will arrive today (if George has put it into the mail)
or will come with him tomorrow (if he hasn't).

d. [ASSERT(ψ) V ASSERT(π)]; [F(φ) ⇒ ASSERT(ψ)]; [F(¬φ) ⇒ ASSERT(ω)]
(conjunctive analysis of conditionals cf. Meyer 2015)
e. Implies correctly that one of the consequents is true, not in CP theory.

5.4 Negation of conditionals

(54) As propositional negation cannot apply to updates, we discuss denegation:
a. ~[𝔄 ⇒ 𝔅] = ~[~𝔄 V 𝔅] = [𝔄 & ~𝔅]
b. But the following clauses are not equivalent
(i) *I don't claim that if the glass dropped, it broke*.
(ii) *The glass dropped and/but I don't claim that it broke*.
c. Reason: Pragmatics requires that 𝔄 is informative,
hence (i) implicates that it is not established that the glass broke, in contrast to (ii).
d. Another reason: (ii) establishes the proposition *the glass dropped*
without any assertive commitment, just by antecedent.

(55) How is negation interpreted? Example by Barker (1995):
a. *It's not the case that if God is dead, then everything is permitted*.
'The assumption that God is dead does not license the
(assertion of) the proposition that everything is permitted.'
b. Barker suggests an analysis in terms of metalinguistic negation.

(56) Punčochář 2015 suggests as negation of *if φ then ψ*:
a. *Possibly: φ but not ψ*,
i.e. it might be the case that the antecedent is true and the conseqent is false.
b. Worked out in a framework of dynamic interpretation.

(57) Implementation in Commitment State Semantics:
a. C + ◇𝔄 $=_{def}$ C iff C + 𝔄 is defined , i.e. leads to a set of consistent commitment states.
b. Punčochář's weak negation corresponds to ◇~
it is not the case that.../one cannot say that as 'the following act cannot be performed'
c. Cf. assertability of assertional speech act in (72)
d. Use of *no* to express this kind of negation:
i. S_1: *If God is dead, then everything is permitted.* – S_2: *No.*
ii. S_1: *This number is prime.*
S_2: ***No**, there is no evidence for it. It might have very high prime factors.*

(58) Applied to conditionals:
a. C + ◇~[𝔄 ⇒ 𝔅] = C iff C + ~[𝔄 ⇒ 𝔅] ≠ Ø
iff C + [𝔄 & ~𝔅] ≠ Ø
i.e. in C, 𝔄 can be assumed without assuming 𝔅

(59) Égré & Politzer 2013 assume three readings of conditionals, leading to different negations.
However, it seems more plausible that there is only one reading and one negation,
but different more specific cases from which this negated meaning follows.

5.5 Conditional consequents

(60) Conditional consequents are easy to interpret, example: Barker (1995)
If all Greeks are wise, then if Fred is Greek, he is wise.

(61) $[\mathfrak{A} \Rightarrow [\mathfrak{B} \Rightarrow \mathfrak{C}]] = [\sim\mathfrak{A} \vee [\sim\mathfrak{B} \vee \mathfrak{C}]]$
$= [[\sim\mathfrak{A} \vee \sim\mathfrak{B}] \vee \mathfrak{C}]$
$= [\sim[\mathfrak{A} \,\&\, \mathfrak{B}] \vee \mathfrak{C}] \quad = [[\mathfrak{A} \,\&\, \mathfrak{B}] \Rightarrow \mathfrak{C}]$

(62) CP analysis achieves this result under stipulation:
a. $[\varphi > [\psi > \pi]] = \lambda i[[\psi > \pi](ms(i, \varphi))]$
$= \lambda i[\lambda i'[\pi(ms(i', \psi)](ms(i, \varphi))]$ Necessary assumption:
$= \lambda i[\pi(ms(ms(i, \varphi), \psi))]$ $ms(ms(i, \varphi), \psi)$
b. $[[\varphi \wedge \psi] > \pi] = \lambda i[\pi(ms(i, [\varphi \wedge \psi]))]$ $= ms(i, [\varphi \wedge \psi])$

(63) Barker (1995) mentions a possible counterexample to the rule of conjoining antecedents:
a. *If Fred is a millionaire, then even if if he <u>does</u> fail the entry requirement, we should (still) let him join the club*.
b. Problem: scope of *even* cannot extend over conditional after conjunction of antecedents

5.6 Conditional antecedents

(64) Conditional antecedents are difficult to interpret (cf. Edgington, 1995, Gibbard, 1981)
If Kripke was there if Strawson was there, then Anscombe was there.

(65) Syntactic problem, as antecedent is not a CP / TP, but an ActP:
$[_{ActP} [_{CP}\ \textit{if}\ [_{TP}\ \varphi]]\ [\textit{then}\ [_{ActP}\ .\ [_{CommitP} \vdash [_{TP}\ \psi]]]$,
where $\varphi = [_{ActP} [_{CP}\ \textit{if}\ [_{TP}\ \varphi_{antecdent}]]\ [\textit{then}\ [_{ActP}\ .\ [_{CommitP} \vdash [_{TP}\ \varphi_{conseequent}]]]$,
as a result, F cannot apply to $[\![\varphi]\!]$ – but see section 5.7 for possible coercion

(66) If we assume in spite of that the following analysis:
$[[\mathfrak{A} \Rightarrow \mathfrak{B}] \Rightarrow \mathfrak{C}] = [\sim[\mathfrak{A} \Rightarrow \mathfrak{B}] \vee \mathfrak{C}] \quad = [\sim[\sim\mathfrak{A} \vee \mathfrak{B}] \vee \mathfrak{C}]$
$= [[\mathfrak{A} \,\&\, \sim\mathfrak{B}] \vee \mathfrak{C}] \quad = [[\mathfrak{A} \vee \mathfrak{C}] \,\&\, [\sim\mathfrak{B} \vee \mathfrak{C}]]$
$= [[\mathfrak{A} \vee \mathfrak{C}] \,\&\, [\mathfrak{B} \Rightarrow \mathfrak{C}]]$
$= [[\mathfrak{A} \,\&\, [\mathfrak{B} \Rightarrow \mathfrak{C}]] \vee [\mathfrak{C} \,\&\, [\mathfrak{B} \Rightarrow \mathfrak{C}]]]$
a. 1st disjunct problematic, as antecedent $\mathfrak{A}$ introduces proposition without speaker commitment.
b. 2nd disjunct problematic, as it states consequent $\mathfrak{C}$ without conditionalization.

(67) Sometimes conditional antecedents appear fine (Gibbard):
If the glass broke if it was dropped, it was fragile.
a. Read with stress on *broke*, whereas *if it was dropped* is deaccented
b. Evidence for *if it was dropped* to be topic
c. Facilitates reading *If the glass was dropped, then if it broke, it was fragile*; this is a conditional antecedent.

(68) For CP theorists, conditional antecedents should be fine:
a. $[[\varphi > \psi] > \pi] = \lambda i[\pi(ms(i, \lambda i'[\psi(ms(i', \varphi))))]$.
b. True at an index i when π is true at the index i′ that is maximally similar to i such that the proposition $[\varphi > \psi]$ is true.
c. Paraphrase of (64): *If it holds that if Strawson was there, then Kripke was there, then Anscombe was there.*
d. Paraphrase for (67): *If it holds that if the glass was dropped, then it broke, then the glass was fragile.*
e. The CP account does not explain why (64) is hard to understand, and why (67) require deaccenting of the embedded *if*-clause.

5.7 Conditionals as complements of propositional attitudes

(69) Conditionals occur as arguments of propositional attitudes:
a. *Bill thinks / regrets / hopes / doubts that if Mary applies, she will get the job.*
b. *Bill thinks / regrets / hopes / doubts that Mary will get the job if she applies.*

(70) Structure of *that* clauses: $[_{CP}$ *that* $[_{TenseP}$ …]] suggests CP analysis of conditionals, not compatible with CA analysis.

(71) Wide scope interpretation of antecedent not generally feasible:
a. *Bill thinks that if Mary applies, she will get the job.*
≈ *If Mary applies, Bill thinks that she will get the job.*
b. *Bill thinks that if this number is divisible by 3, he will propose to Mary.*
≉ *If this number is divisible by 3, Bill thinks that he will propose to Mary.*

(72) Sketch of proposal: Coercion of assertion to proposition, $\mathfrak{A} \rightsquigarrow$ '$\mathfrak{A}$ is assertable',

(69)(a) $\rightsquigarrow$ Bill thinks / regrets / hopes / doubts
that it is **assertable** that if Mary applies, she will get the job

Assertability of $\mathfrak{A}$ at a commitment space C:
A speaker S that initiates C + $\mathfrak{A}$ has a winning strategy, i.e. can ultimately defend this update.

(73) Evidence for this coercion: discourse / speech act operators in *that* clauses
a. *they thought that, frankly, they made more complex choices every day in Safeway than when they went into the ballot box*

(74) Sometimes speech acts can embed (Krifka 2014):
a. *Bill thinks Mary presumably will apply.* No complementizer, discourse operator,
b. *Bill glaubt, Maria wird sich wohl bewerben.* No comp, discourse op, verb second

5.8 Conclusion

(75) There is a coherent formal account of conditionals for CA theories.

(76) CA fares better in explaining which semantic operations can be applied to conditionals.

(77) Conditional clauses as complements of propositional attitude predicates remain a problem for the CA account, but there are strategies for a solution.

6. Counterfactual Conditional Assertions

(78) Indicative conditionals considered so far:
The antecedent can be informatively added to the commitment space.
In particular, C + *if φ then ASSERT ψ* pragmatically implicates that $C + F(\varphi) \neq \emptyset$

(79) This is systematically violated with counterfactual conditionals:
a. *If Mary had applied, she would have gotten the job.*
b. *If the number had been divisible by three, Fred would have proposed to Mary.*

(80) Proposal:
a. The counterfactual conditional requires to "thin out" the commitment states at the root of the commitment space C so that the antecedent F(φ) can be assumed.
b. This requires "going back" to a hypothetical larger commitment space in which the actual commitment space is embedded.
c. Notion of a **generalized** commitment space, with a **background** part and an **actual** part.

(81) A **generalized commitment space** is a pair of commitment states $\langle C_b, C_a\rangle$, where
a. $C_a \subseteq C_b$
b. $\neg\exists c\in C_b\,[C_a < c]$, where $C_a < c$ iff $c\notin C_a$ and $\exists c'\in C_b\,[c'\subset c]$, i.e. C_a is a "bottom" part of C_b

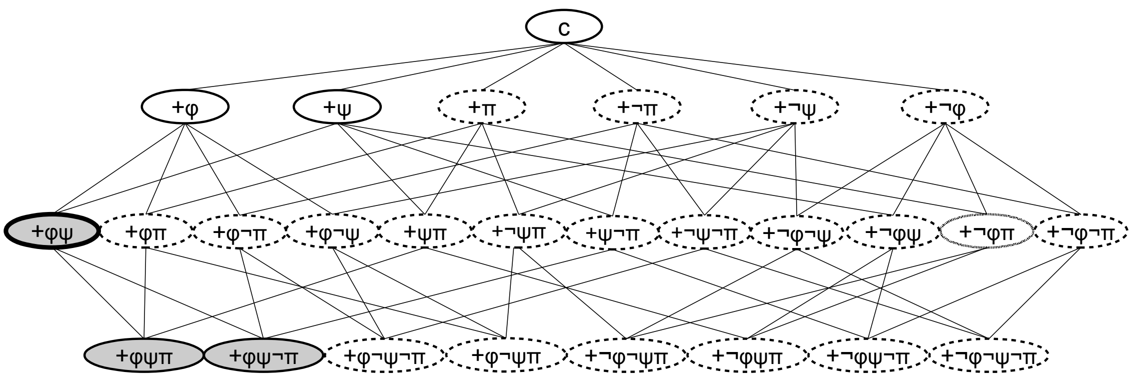

Figure 15: Generalized Commitment Space ⟨C, C + F(φ) + F(ψ)⟩
with root (fat border), actual commitment space (grey area),
commitment states above the actual (solid border) and commitment states beside the root (dotted border)

(82) Regular update of a general commitment space:
$\langle C_b, C_a\rangle + \mathfrak{A} = \langle\{c\in C_b \mid \neg\,[C_a + \mathfrak{A}] < c\},\ [C_a + \mathfrak{A}]\rangle$

(83) Update with denegation "prunes" the background commitment space C_b:

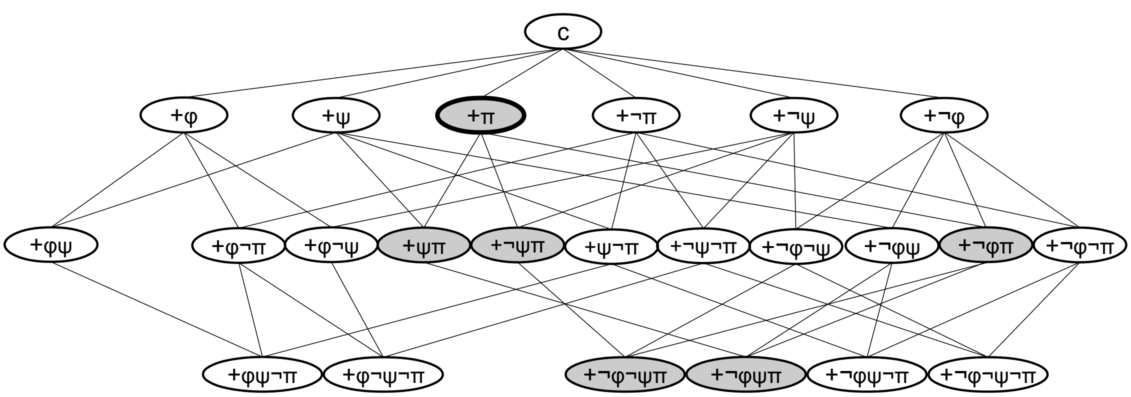

Figure 16: Update wit denegation: ⟨C, C + F(π)⟩ + ~F(φ)

(84) Conditional updates involve denegation and prune C_b as well:

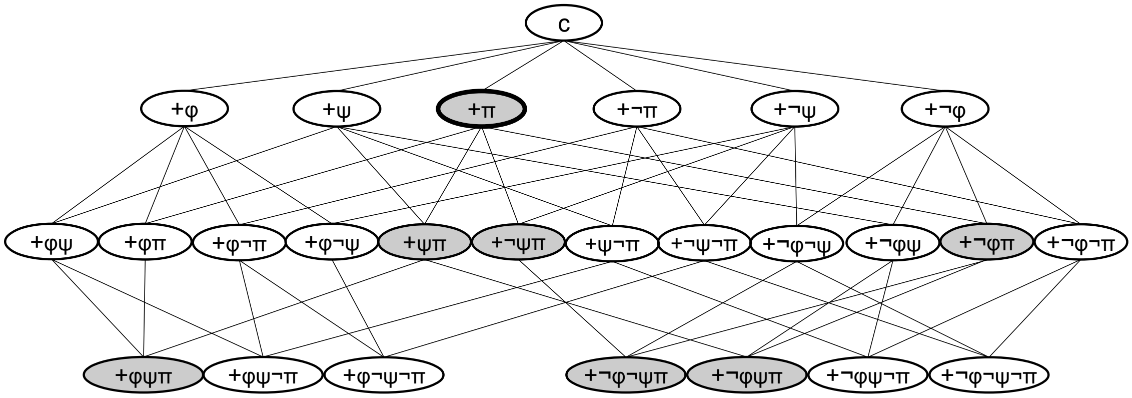

Figure 17: Update of $\langle C, C + F(\pi)\rangle$ with $[F(\varphi) \Rightarrow F(\psi)]$, i.e. with $[\sim F(\varphi) \vee F(\psi)]$

(85) Counterfactual conditionals:
a. Go back / up from the actual root(s) to the next commitment state(s) that can be updated with the antecedent.
b. Update the commitment states under these roots.
c. This leads to pruning of the background commitment space only.

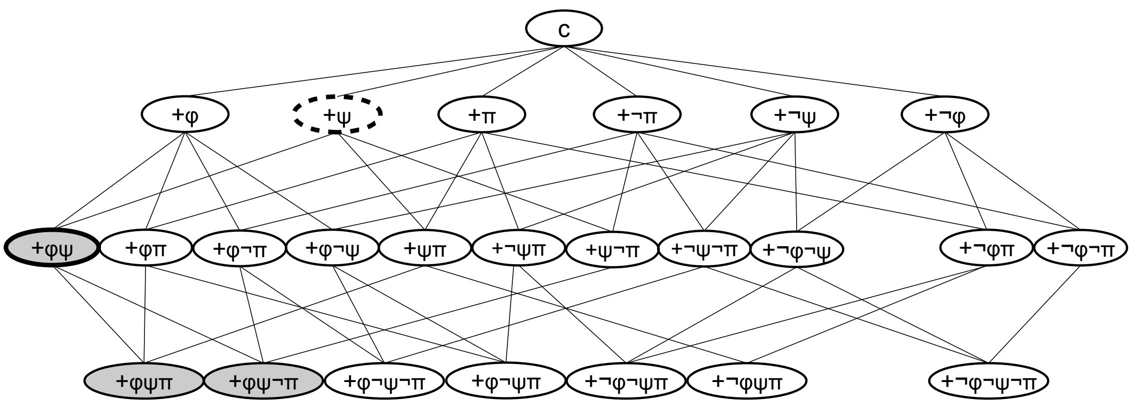

Figure 18: Counterfactual update:
$\langle C, C + F(\psi) + F(\varphi)\rangle + [F(\neg\varphi) \Rightarrow F(\pi)]$, involving interpretation at the next compatible root $C + F(\psi)$

(86) Counterfactual conditional informs about hypothetical commitment states, which may have an effect under revisionary update, cf. (26)

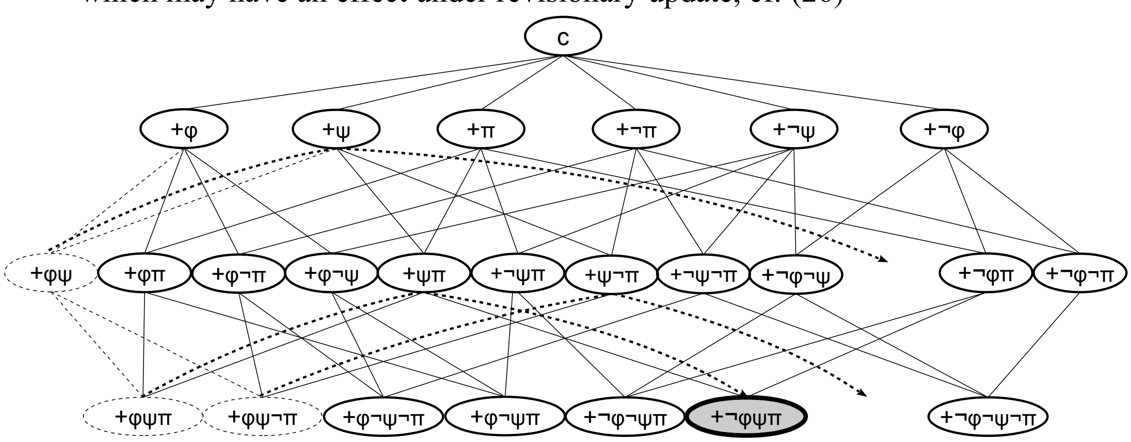

Figure 19: Revisionary update of generalized commitment space of Figure 18 with $+F(\neg\varphi)$ leading to new commitment space that respects the counterfactual information.

(87) Explaining of "fake past tense" in counterfactual conditionals (cf. Dudman 1984, Iatridou 2000, Ritter & Wiltschko 2014, Karawani 2014, Romero 2014).
a. Past tense shifts commitment space from actual to a "past" commitment space; this does not actually have to be a state that the actual conversation passed through, but might be a hypothetical commitment space.
b. As conversation happens in time, leading to increasing commitments, this is a natural transfer from the temporal to the conversational dimension.

(88) Ippolito 2008 treats "fake tense" as real tense – going back in real time where the counterfactual assumption was still possible. Problem with time-independent clauses:
If this number had turned out to be divisible by three, I would have proposed to Mary.
If this number was divisible by three, I would propose to Mary.

(89) Going from c to a commitment state c′ ⊂ c with fewer assumptions to make a counterfactual assertion may involve going to different worlds for which a commitment state c′ is possible. See Krifka 2014 for a model with branching worlds.

(90) Other instances of temporal talk applied to common grounds:
a. *I remember you. Your name was Fred, right?*
b. *What was your name again?,* cf. Sauerland & Yatsushiro 2014.

7. Conclusion

(91) The paper developed a framework for conditional clauses as conditional assertions (to be extended to other conditional speech acts)

(92) This was done within the framework of Commitment Space Semantics, which incorporates information about the possible future developments of the common ground in conversation.

(93) It was argued that this explains the limited semantic combinations of conditional sentences than the analysis as conditional propositions.

(94) The analysis was tentatively extended to counterfactual conditionals, where past tense indicates a shift from the actual commitment space to a past commitment space.

(95) On a more general note:

Conditionalization is a phenomenon of conversation (if φ is the case, then I assert ψ), not a phenomenon of truth-conditional semantic content (I assert the proposition 'if φ then ψ').

Conjunction and disjunction can also be seen as a phenomenon of conversation:
a. Commitments after F([φ ∧ ψ]) and F(φ) & F(ψ)] are the same
b. Commitments after F([φ ∨ ψ]) and F(φ) V F(ψ) are the same
c. Commitments after F(¬φ) are stronger than commitments after ~F(φ)

Commitment operations &, V, ~, ⇒
are partially mirrored by propositional operations ∧, ∨, ¬, >

Primacy of operations on commitments, "trickling down" to propositions?

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