



# A Uniform Theory of Conditionals

Stalnaker and Beyond

William Starr

03.05.12

## The Direct Argument

Conditional to Disjunction



### The Direct Argument (DA)

- ① It is uncontroversial that (2) follows from (1)
  - (1) If the butler didn't do it, the gardener did
  - (2) Either the butler or the gardener did it
- ② But, (1) also seems to follow from (2)
- ③ Then *if A then B* and *not A or B* are equivalent
- ④ So indicative conditionals are material conditionals

Yet:

- Material conditional analysis of indicatives is terrible!
- $\neg\phi \vDash \phi \supset \phi$ ,  $\neg(\phi \supset \psi) \vDash \phi$

## Outline



- ① Stalnaker on the Direct Argument
- ② Two Kinds of Conditionals
- ③ Stalnaker's Analysis
- ④ A New Analysis

## Stalnaker (1975)

Uniform Theory of Conditionals and Response to Direct Argument



- Stalnaker: the similarity analysis of subjunctive conditionals works for indicatives too
- To make it work, he relies on some ideas about how context and inference work
  - Context: a set of possible worlds
  - Inference: needn't always be captured semantically, sometimes it makes use of context
    - Call these *reasonable inferences*
- Using these ideas he makes the similarity analysis of indicative plausible
- But he also responds to the direct argument: disjunctions do not entail indicative conditionals
  - Yet, it is often reasonable to infer one from the other

## Stalnaker on Context

A Set of Possible Worlds  $c$ 

- Context: the common assumptions of the conversational participants
  - This is information the speaker can expect her interlocutors to use to interpret her utterances
  - These assumptions needn't be true, nor actual beliefs
- This common information can be thought of as a set of possible worlds
  - The set of worlds not ruled out by the common assumptions
  - The conversationally 'live' possibilities
- Stalnaker calls this the **context set**  $c$

## Stalnaker on Context and Assertion

Thinking  $c$ 

- Successful assertions change the shared assumptions of the conversationalists
  - Therefore, they must change  $c$  too
- How should we change  $c$  to reflect that a new proposition  $p$  has been accepted?
- Eliminate all the worlds in  $c$  that incompatible with  $p$ :
  - $c' = c \cap p$
- This shrinks the set of live possibilities

## Stalnaker on Reasonable Inference

Context Changes During an Inference



- For A to semantically entail B:
  - **Every** world in which A is true, B must be true
- But on Stalnaker's model of context, sometimes we ignore certain worlds
  - Worlds outside  $c$
- Sometimes A may not entail B but it may be reasonable to infer B from A in  $c$

## Reasonable Inference

The inference from A to B is reasonable in  $c$  iff $c' = \llbracket A \rrbracket_c \cap c$ , and  $c' \subseteq \llbracket B \rrbracket_{c'}$ 

- The proposition expressed by A in  $c$ , together with  $c$  entails the proposition expressed by B in  $c \cap \llbracket A \rrbracket_c$

## Stalnaker's Uniform Analysis

Overview and Semantics



- Stalnaker's tact: give a semantics for (if  $\phi$ )  $\psi$  that is plausible for both indicatives and subjunctives
- Maintain that indicatives and subjunctives have identical semantics, but differ pragmatically

## Semantics for Both Varieties (Stalnaker 1968, 1975)

- 1 (if  $\phi$ )  $\psi$  is true at  $w$  if and only if  $\psi$  is true at all of the  $\phi$ -worlds most similar to  $w$
- 2  $\llbracket (\text{if } \phi) \psi \rrbracket_f = \{w \mid f(w, \llbracket \phi \rrbracket_f) \subseteq \llbracket \psi \rrbracket_f\}$ 
  - $f(w, \llbracket \phi \rrbracket_f)$ : the set of  $\phi$ -worlds most similar to  $w$
  - $f$  obeys three constraints, e.g.  $f(w, p) \subseteq p$

## Stalnaker's Uniform Analysis

The Pragmatics of Indicatives



## Pragmatics for Indicatives (Stalnaker 1975: 69)

- ① (if  $\phi$ )  $\psi$  is true in  $c$  at  $w \in c$  iff:
  - $\psi$  is true at all of the  $\phi$ -worlds in  $c$  most similar to  $w$
- ②  $\llbracket(\text{if } \phi) \psi\rrbracket_{c,f} = \{w \in c \mid f(w, \llbracket\phi\rrbracket_{c,f} \cap c) \subseteq \llbracket\psi\rrbracket_{c,f}\}$

## Stalnaker on Disjunction

Appropriateness Conditions



## Appropriateness of Disjunctions (Stalnaker 1975: 71)

- Disjunctive assertions appropriate only in a context where either disjunct to be true without the other
  - An assertion of  $A \vee B$  is appropriate if
    - There is a  $A \wedge \neg B$ -world in  $c$
    - There is a  $\neg A \wedge B$ -world in  $c$
  - Suppose we've ruled out the possibility that the Butler did it and the gardener didn't.
- (3) ?? Either the Butler did it, or the gardener did it.

## The Direct Argument is Reasonable

From *Or* to *If*

- Suppose  $B \vee G$  is felicitously asserted in  $c_0$ 
  - Then there are  $B \wedge \neg G$  and  $\neg B \wedge G$ -worlds in  $c_0$
  - All  $\neg B \wedge \neg G$ -worlds are eliminated in  $c_1 = c_0 \cap \llbracket B \vee G \rrbracket_{c_0}$
- The inference to (if  $\neg B$ )  $G$  will be reasonable if
  - (4)  $c_1 \subseteq \llbracket(\text{if } \neg B) G\rrbracket_{c_1,f}$
- $\llbracket(\text{if } \neg B) G\rrbracket_{c_1,f} = \{w \in c_1 \mid f(w, \llbracket\neg B\rrbracket_{c_1,f} \cap c_1) \subseteq \llbracket G \rrbracket_{c_1,f}\}$ 
  - By Success  $\forall w : f(w, \llbracket\neg B\rrbracket_{c_1,f} \cap c_1) \subseteq (\llbracket\neg B\rrbracket_{c_1,f} \cap c_1)$
  - Since all of the  $\neg B$ -worlds in  $c_1$  are  $G$ -worlds, this means that  $f(w, \llbracket\neg B\rrbracket_{c_1,f} \cap c_1) \subseteq \llbracket G \rrbracket_{c_1,f}$
  - So  $\llbracket(\text{if } \neg B) G\rrbracket_{c_1,f} = c_1!$
- Condition (4) holds so, the inference is reasonable!

## Reasonable Inference

Further Applications



- Stalnaker's indicative semantics invalidates:
  - Antecedent Strengthening**  $A \rightarrow B \vDash (A \wedge B) \rightarrow C$
  - Disjunctive Antecedents**  $(A \vee B) \rightarrow C \vDash (A \rightarrow C) \wedge (B \rightarrow C)$
  - Transitivity**  $A \rightarrow B, B \rightarrow C \vDash A \rightarrow C$
  - Contraposition**  $A \rightarrow B \vDash \neg B \rightarrow \neg A$
- Yet they often sound plausible!
- As it turns out, these are also reasonable inferences (w/a little tweaking)

## Two Kinds of Conditionals

Indicative and Subjunctive



## 'Indicative' Conditionals

- (5) a. If Bob danced, Leland danced  
b. If Bob is dancing, Leland is dancing

## 'Subjunctive' Conditionals

Past (looking) antecedent + modal consequent

- (6) a. If Bob **had** danced, Leland **would** have danced  
b. If Bob **had** danced, Leland **might have** danced  
c. If Bob **had** danced, Leland **could have** danced  
d. If Bob **danced**, Leland **would** dance  
e. If Bob **were** to dance, Leland **would** dance

## Two Kinds of Conditionals

Felicitous After Denying Antecedent?



- (7) a. # Bob never danced. If Bob danced, Leland danced.  
b. # Bob isn't dancing. If Bob is dancing, Leland is dancing.
- (8) a. Bob never danced. If Bob had danced, Leland would have danced.  
b. Bob never danced. If Bob had danced, Leland might have danced.

## Felicitous After Denying Antecedent?

- ① Indicative conditionals? ×  
② Subjunctive conditionals? ✓

## Two Kinds of Conditionals

The Subjunctive Suggestion



## The Subjunctive Suggestion

Assertions of *if Bob had danced, Leland would have danced* often suggest that Bob didn't dance.

- Evidence for the suggestion?
  - Infelicity of asserting that Bob did dance and then asserting the subjunctive conditional
- (9) # Bob definitely danced. If Bob had danced, Leland would have danced.
- As discussed earlier in semester, this suggestion isn't an entailment or presupposition

## Two Kinds of Conditionals

Ingredients of a Subjunctive Antecedent



- (10) a. If Bob **had** danced, Leland would have danced  
b. If Bob **were** to dance, Leland would dance  
c. If Bob **danced**, Leland would dance
- Antecedents: past tense look, not past meaning
- (11) Bob died yesterday. If he **had died tomorrow** instead, he would have been 98 years old.
- Not possible w/genuine past tense *had died*
- (12) Yesterday I went to the Black Lodge. By the time I got there, Bob had died, but Cooper hadn't.
- (13) # I will go to the Black Lodge tomorrow. By the time I get there, Bob had died, but Cooper hadn't.

## Two Kinds of Conditionals

Ingredients of a Subjunctive Antecedent



- Past tense does not contribute its normal meaning in subjunctive antecedents
  - This is not true for indicative antecedents
- (11) Bob died yesterday. If he had died tomorrow instead, he would have been 98 years old.
- (14) # If Bob died tomorrow, he  $\left\{ \begin{array}{l} \text{was} \\ \text{will be} \end{array} \right\}$  98 years old
- So we have one more difference between the two kinds

## Two Kinds of Conditionals

The Data So Far



## Felicitous After Denying Antecedent?

- 1 Indicative conditionals? ×
- 2 Subjunctive conditionals? ✓

## The Subjunctive Suggestion

Assertions of *if Bob had danced, Leland would have danced* often suggest that Bob didn't dance.

- Suggestion not asserted, presupposed or entailed

## Subjunctive Antecedents and Past Tense

Unlike indicative antecedents, subjunctive ones have past tense morphology that does not have past tense meaning.

## Towards an Explanation

Stalnaker's Distinction



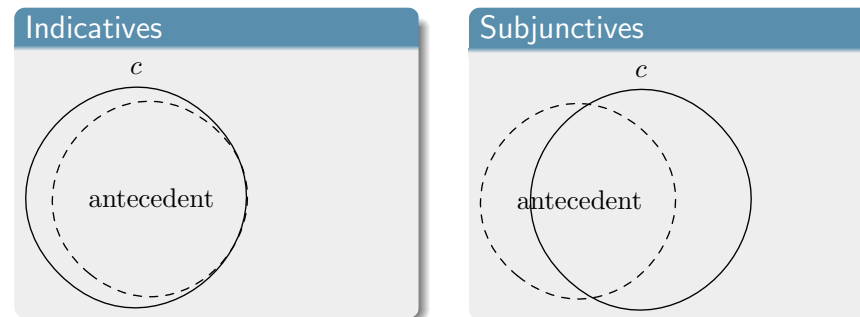
## Stalnaker's Distinction (Stalnaker 1975: §3)

- 1 Indicative conditionals concern only antecedent worlds within the live possibilities  $c$ , which represent what's being taken for granted in the discourse.
- 2 Subjunctive conditionals concern antecedent worlds that may not be among  $c$ , that is they may be counterfactual from the perspective of the discourse.

As Stalnaker (1975: 69) puts it “the idea [for indicative conditionals] is that when a speaker says *if A*, then everything he is presupposing to hold in the actual situation is presupposed to hold in the hypothetical situation in which *A* is true.”

## Towards an Explanation

Stalnaker's Distinction: in pictures



## Towards an Explanation

Stalnaker's Distinction and the Data



## Felicitous After Denying Antecedent?

- ① Indicative conditionals? ×
- ② Subjunctive conditionals? ✓

- Since an indicative conditional says something about antecedent worlds in  $c$ , it makes sense for it to presuppose that there is at least one such world
- After denying antecedent: no antecedent worlds in  $c$
- So indicative should be infelicitous
- Subjunctive may reach outside  $c$ , so same reasoning does not apply to them

## Towards an Explanation

Stalnaker's Distinction and the Data



## The Subjunctive Suggestion

Assertions of *if Bob had danced, Leland would have danced* often suggest that Bob didn't dance.

- Suggestion not asserted, presupposed or entailed
- Subjunctive allows antecedent worlds outside  $c$ , but indicative does not
- Choosing the subjunctive over the indicative indicates that it is important that there are antecedent worlds outside  $c$
- One reason it may be important: antecedent is false
- Suggestion results from strategic reasoning

## Towards an Explanation

Stalnaker's Distinction and the Data



## Subjunctive Antecedents and Past Tense

Unlike indicative antecedents, subjunctive ones have past tense morphology that does not have past tense meaning.

## Modal Hypothesis (Isard 1974; Lyons 1977; Iatridou 2000)

- ① Past tense in subjunctive antecedents serves a modal function rather than a temporal one: locates antecedent event among a set of possibilities that may contain counterfactual ones.
- ② Past tense morphology serves purely temporal function in indicative antecedents, so they remain concerned with the live contextual possibilities.

## Towards an Explanation

Linguistic Encoding of Stalnaker's Distinction



- The Modal Hypothesis explains:
  - ① Why fake past tense behavior correlates w/indicative vs. subjunctive
  - ② How Stalnaker's Distinction is linguistically encoded
- Suppose we follow the Modal Hypothesis
- Then we should be able to take our indicative semantics for  $q$  *if*  $p$  and add modal operator to antecedent to get our semantics for subjunctives
  - Indicative: (if  $\phi$ )  $\psi$
  - Subjunctive: (if  $\langle \phi \rangle$ )  $\psi$
- Bittner (2010: 2): subjunctives and indicatives in Kalaallisut are identical except that the former contain a modal particle in their antecedents and consequents

## Stalnaker's Uniform Analysis

## Overview and Semantics



- Stalnaker's tact: give a semantics for  $(\text{if } \phi) \psi$  that is plausible for both indicatives and subjunctives
- Maintain that indicatives and subjunctives have identical semantics, but differ pragmatically

## Semantics for Both Varieties (Stalnaker 1968, 1975)

- 1  $(\text{if } \phi) \psi$  is true at  $w$  if and only if  $\psi$  is true at all of the  $\phi$ -worlds most similar to  $w$
- 2  $\llbracket (\text{if } \phi) \psi \rrbracket_f = \{w \mid f(w, \llbracket \phi \rrbracket_f) \subseteq \llbracket \psi \rrbracket_f\}$ 
  - $f(w, \llbracket \phi \rrbracket_f)$ : the set of  $\phi$ -worlds most similar to  $w$
  - $f$  obeys three constraints, e.g.  $f(w, p) \subseteq p$

## Problem 1

Worlds Outside  $c$ 

$$\llbracket (\text{if } \phi) \psi \rrbracket_{c,f} = \{w \in c \mid f(w, \llbracket \phi \rrbracket_{c,f} \cap c) \subseteq \llbracket \psi \rrbracket_{c,f}\}$$

- This analysis predicts that what we assert with indicative conditionals is false at every world outside  $c$
- So, suppose you rightly assert *if the light in the next room is on, then it isn't off*
  - But it turns out we were falsely assuming for the purposes of our conversation that time is absolute
  - Then the actual world isn't in  $c$
- Then what you said is actually false!

## Stalnaker's Uniform Analysis

## The Pragmatics of Indicatives



## Pragmatics for Indicatives (Stalnaker 1975: 69)

- 1  $(\text{if } \phi) \psi$  is true in  $c$  at  $w$  iff:
  - If  $w \in c$ ,  $\psi$  is true at all of the  $\phi$ -worlds in  $c$  most similar to  $w$
- 2  $\llbracket (\text{if } \phi) \psi \rrbracket_{c,f} = \{w \in c \mid f(w, \llbracket \phi \rrbracket_{c,f} \cap c) \subseteq \llbracket \psi \rrbracket_{c,f}\}$ 
  - Antecedent worlds  $f(w, \llbracket \phi \rrbracket_{c,f} \cap c)$  are all within  $c$ !

## Stalnaker's Uniform Analysis

## The Pragmatics of Indicatives, Take 2



## Pragmatics for Indicatives: a second chance?

- 1  $(\text{if } \phi) \psi$  is true in  $c$  at  $w$  iff:
  - $\psi$  is true at all of the  $\phi$ -worlds in  $c$  most similar to  $w$
- 2  $\llbracket (\text{if } \phi) \psi \rrbracket_{c,f} = \{w \mid f(w, \llbracket \phi \rrbracket_{c,f} \cap c) \subseteq \llbracket \psi \rrbracket_{c,f}\}$ 
  - We've eliminated the restriction to worlds in  $c$
  - Antecedent worlds  $f(w, \llbracket \phi \rrbracket_{c,f} \cap c)$  are all within  $c$ !

## Another Problem

With Modus Ponens



## Problem: Modus Ponens for Indicative Assertions Goes Invalid

- Let  $w \notin c$  be a  $\phi \wedge \neg\psi$ -world.
- Let  $\psi$  be true at all of the  $\phi$ -worlds in  $c$  most similar to  $w$ :  $f(w, [\phi]_{c,f} \cap c) \subseteq [\psi]_{c,f}$ .
- So the conditional proposition expressed is true at  $w$ , but  $w$  is a world where  $\phi \wedge \neg\psi$ !
- So the consequent doesn't follow from the conditional and its antecedent.

## More Definitions, More Problems

Stalnaker's Distinction Violated



## Stalnaker's Distinction

- 1 Indicative conditionals concern **only** antecedent worlds within the live possibilities  $c$ , which represent what's being taken for granted in the discourse.

Modified Stalnaker's (1975: 69) semantics and pragmatics:

- Antecedent worlds:  $f(w, [\phi]_{c,f} \cap c) \cup f(w, [\phi]_{c,f})$
- Not a subset of  $c$ ! Only those in the left set are!
- But then we have no account of the contrasts Stalnaker's distinction was supposed to explain!

## Stalnaker's Uniform Analysis

The Pragmatics of Indicatives



## Pragmatics for Indicatives: a third chance?

- 1 (if  $\phi$ )  $\psi$  is true in  $c$  at  $w$  iff:
  - (i) If  $w \in c$ ,  $\psi$  is true at all of the  $\phi$ -worlds in  $c$  most similar to  $w$
  - (ii) If  $w \notin c$ ,  $\psi$  is simply true at all of the  $\phi$ -worlds which are most similar to  $w$
- 2  $[(\text{if } \phi) \psi]_{c,f} = \{w \mid f(w, [\phi]_{c,f} \cap c) \subseteq [\psi]_{c,f} \text{ if } w \in c \text{ \& } f(w, [\phi]_{c,f}) \subseteq [\psi]_{c,f} \text{ if } w \notin c\}$ 
  - Antecedent worlds:  $f(w, [\phi]_{c,f} \cap c) \cup f(w, [\phi]_{c,f})$
  - Maybe what Stalnaker (1975: 69) intended?
  - But: It would allow  $c \not\subseteq [(\text{if } \phi) \psi]_{c,f}$ , but we needed this fact in Stalnaker's reply to the Direct Argument

## Another Problem for Stalnaker Analysis

Incompatible with the Modal Hypothesis



- The Modal Hypothesis explains:
  - 1 Why fake past tense parallels indicative/subjunctive
  - 2 How Stalnaker's Distinction is linguistically encoded
- To get subjunctive semantics, take indicative semantics for  $q$  if  $p$  and add modal operator to antecedent
  - Indicative: (if  $\phi$ )  $\psi$ , Subjunctive: (if  $\triangleleft\phi$ )  $\psi$
  - (if  $\phi$ )  $\psi$  limited to  $\phi$  worlds in  $c$
  - Semantics of  $\triangleleft\phi$ : allow  $\phi$  worlds outside  $c$
- Not possible w/Stalnaker's semantics:
  - (if  $\phi$ )  $\psi$  already allows  $\phi$  worlds outside  $c$ , so that can't be what  $\triangleleft$  is doing
- So Stalnaker's analysis cannot enjoy the benefits of endorsing the Modal Hypothesis



## Stalnaker's Uniform Analysis

What is the Analysis Anyway?



## The Pragmatic Constraint? (Stalnaker 2005: n.13)

Both kinds of conditionals... have the same abstract semantics, but a context-dependent parameter of the interpretation — the selection function — is differently constrained by the different grammatical constructions. So, on this theory, the difference between the two kinds of conditionals is a semantic difference in two different senses, but a purely pragmatic difference in a third sense. The difference is semantic, first in the sense that there will normally be a difference in the proposition expressed by the contrasting conditional sentences, even when uttered in similar situations. And it is semantic also in the sense that the difference is marked by a conventional linguistic device (the tense/aspect/mood difference). But the distinction is pragmatic in that the device works by the way it constrains features of the context. The semantic rule that gives the truth conditions of the conditional as a function of the contextual parameter will be the same for both kinds of conditionals.

## Stalnaker's Uniform Analysis

Summary



- ① Either gives bad truth-conditions, invalidates modus ponens or doesn't embody Stalnaker's Distinction
  - But we would like a theory that does embody that distinction!
- ② When modified to embody Stalnaker's Distinction, MP is violated
- ③ Incompatible with attractive hypothesis about how Stalnaker's Distinction is linguistically encoded
  - Fails entirely to explain correlation between fake past tense and indicative/subjunctive behavior
- ④ Way forward:  $(\text{if } \phi) \psi$  limited to  $\phi$  worlds in  $c$ , but  $\triangleleft \phi$  allows  $\phi$  worlds outside  $c$  in  $(\text{if } \triangleleft \phi) \psi$

## Information Change and Semantics

Two Views



- Everybody agrees that conversation takes place against an ever-changing background of information
  - Call it  $c$  for the *contextual possibilities/info*
  - Classic models: Stalnaker (1978), Lewis (1979)

**Classical Picture** Semantics delivers propositions and pragmatics provides rules for changing background information (Stalnaker)

**Dynamic Picture** Semantics operates directly on background information

**In Short:** meaning is information vs. meaning is information change potential

## Information

The Convenient Model Meets a Different Kind of Semantics



## Informational Dynamic Semantics

- ① Assign each  $\phi$  a function  $[\phi]$  characterizing how it changes the information embodied by  $c$ :  $c[\phi] = c'$
- ② Think of this information as a way of tracking the agent's current state of mind
- ③  $[\phi]$  is the characteristic role that  $\phi$  plays in changing an agent's mental states

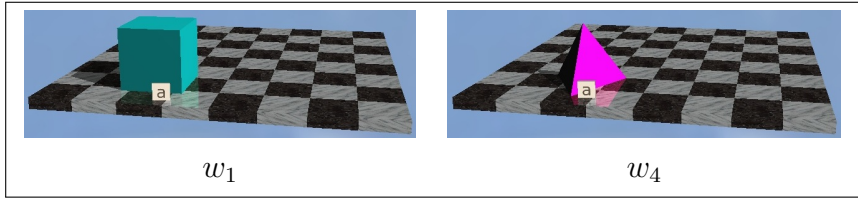
Formal Inspirations: Pratt (1976); Heim (1982); Veltman (1996)



# Informational Dynamic Semantics

For Epistemic *Might* (Veltman 1996)

- $c[\text{Might}(\text{Cube})] = \{w \in c \mid c[\text{Cube}] \neq \emptyset\}$  'Test'  
 $= c$  or  $\emptyset$
- $c = \{w_1, w_4\}[\text{Might}(\text{Cube})] = ?$
- $\{w_1, w_4\}[\text{Cube}] =$



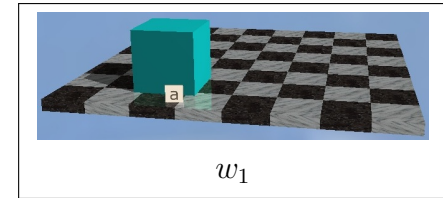
$c$



# Informational Dynamic Semantics

For Epistemic *Might* (Veltman 1996)

- $c[\text{Might}(\text{Cube})] = \{w \in c \mid c[\text{Cube}] \neq \emptyset\}$
- $c = \{w_1, w_4\}[\text{Might}(\text{Cube})] = ?$
- $\{w_1, w_4\}[\text{Cube}] = \{w_1\} \neq \emptyset$



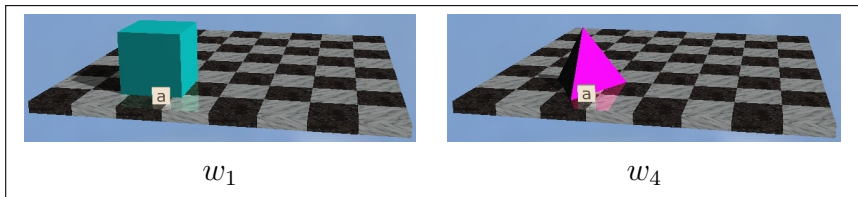
$w_1$



# Informational Dynamic Semantics

For Epistemic *Might* (Veltman 1996)

- $c[\text{Might}(\text{Cube})] = \{w \in c \mid c[\text{Cube}] \neq \emptyset\}$
- $c = \{w_1, w_4\}[\text{Might}(\text{Cube})] = c$
- $\{w_1, w_4\}[\text{Cube}] = \{w_1\} \neq \emptyset$



$c' = c$



# Informational Dynamic Semantics

Semantic Concepts

## Support

$$c \models \phi \iff c[\phi] = c$$

## Entailment

$$\phi_1, \dots, \phi_n \models \psi \iff c[\phi_1] \cdots [\phi_n] \models \psi$$

## Truth in $w$ (Starr 2010: Ch.1)

$$w \models \phi \iff \{w\}[\phi] = \{w\}$$

## Propositions

$$\llbracket \phi \rrbracket = \{w \mid w \models \phi\}$$

## A New Analysis

The Semantics of Conditionals



- Dynamic semantics:  $c[\phi] = c'$  (Veltman 1996)
  - $c[A] = \{w \in c \mid w(A) = 1\}$ ,  $c[A \wedge B] = c[A][B]$ ,  
 $c[A \vee B] = c[A] \cup c[B]$ ,  $c[\neg A] = c - c[A]$

## The Basic Analysis (Gillies 2009; Starr 2010: Ch.2)

- Test that all  $\phi$ -worlds in  $c$  are  $\psi$  worlds:  $c[\phi][\psi] = c[\phi]$ 
    - If yes, return  $c$ ; if not, return  $\emptyset$
  - Presuppose that  $\phi$  is consistent with  $c$ :  $c[\phi] \neq \emptyset$
- $$c[(\text{if } \phi) \psi] = \begin{cases} \{w \in c \mid c[\phi][\psi] = c[\phi]\} & \text{if } c[\phi] \neq \emptyset \\ \text{Undefined} & \text{otherwise} \end{cases}$$

- Note: test concerns **only antecedent worlds within  $c$**

## A New Analysis

Motivating The Basic Analysis



- This provides an improved logic for indicative conditionals (Starr 2010: Ch.2); Stalnaker invalidates:

Import-Export  $A \rightarrow (B \rightarrow C) \not\models (A \wedge B) \rightarrow C$ Antecedent Strengthening  $A \rightarrow B \not\models (A \wedge B) \rightarrow C$ Disjunctive Antecedents  $(A \vee B) \rightarrow C \not\models (A \rightarrow C) \wedge (B \rightarrow C)$ Transitivity  $A \rightarrow B, B \rightarrow C \not\models A \rightarrow C$ Contraposition  $A \rightarrow B \not\models \neg B \rightarrow \neg A$ 

## Entailment (Dynamic Strawson Entailment)

$$\phi_1, \dots, \phi_n \models \psi \Leftrightarrow \forall c : c[\phi_1] \cdots [\phi_n] \models \psi$$

if  $c[\phi_1] \cdots [\phi_n][\psi]$  is defined

## A New Analysis

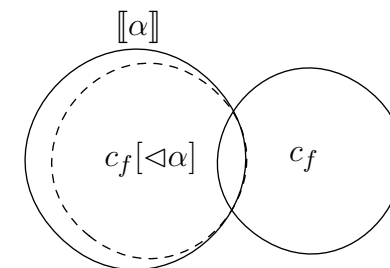
Extending the Basic Analysis: give a semantics for  $\triangleleft\phi$ What  $\triangleleft\phi$  Should Do

Given  $c$ ,  $\triangleleft\phi$  delivers a set  $c'$  of  $\phi$ -worlds that may not be included in  $c$ . Under a Lewis-Stalnaker analysis, this set is calculated as follows. Look at each world  $w$  in  $c$ . If  $w$  is an  $\phi$ -world it is allowed into  $c'$ . If  $w$  is not a  $\phi$ -world, the  $\phi$ -worlds most similar to  $w$  are placed into  $c'$  instead of  $w$ . These worlds need not come from  $c$ .

Semantics for  $\triangleleft\phi$ Let  $f$  be a selection function::

$$c_f[\triangleleft\phi] = \{w' \mid \exists w \in c : w' \in f(w, \llbracket\phi\rrbracket)\}_f$$

## A New Analysis

Picturing Semantics for  $\triangleleft\alpha$ Figure: Relationship between  $\llbracket\alpha\rrbracket$ ,  $c_f$  and  $c_f[\triangleleft\alpha]$ 

- Since  $\triangleleft$  has same syntax as tense, it shouldn't be scoping over logically complex *sentences*; so  $\alpha$  is atomic
- In general, the expanded worlds may come from outside  $c$ ,  $\exists f: c_f[\triangleleft\alpha] \not\subseteq c_f$ ; Stalnaker's Distinction  $\checkmark$

## A New Analysis

Contrast When Antecedent is Denied: Indicatives



(7) # Bob never danced. If Bob danced, Leland danced.

(7') #  $\neg B$ . (if B) L

$$c[\neg B]((\text{if } B) L) = \begin{cases} \{w \in c \mid c[\neg B][B][L] = c[\neg B][B]\} & \text{if } c[\neg B][B] \neq \emptyset \\ \text{Undefined} & \text{otherwise} \end{cases}$$

- This update is undefined, since the presupposition fails

## A New Analysis

Contrast When Antecedent is Denied: Subjunctives



(8) Bob never danced. If Bob had danced, Leland would have danced.

(8')  $\neg B$ . (if  $\triangleleft B$ ) L

$$c_f[\neg B]((\text{if } \triangleleft B) L) = \begin{cases} \{w \in c_f \mid c_f[\neg B][\triangleleft B][L] = c_f[\neg B][\triangleleft B]\} & \text{if } c_f[\neg B][\triangleleft B] \neq \emptyset \\ \text{Undefined} & \text{otherwise} \end{cases}$$

- This update will (probably) be defined
- $\triangleleft$  can reach outside  $c$ , so presupposition is weakened by subjunctive antecedent
- Weakened but not eliminated: requires antecedent to be  $f$ -visible, i.e.  $f$  must find some  $\phi$  world

## A New Analysis

Summary



- 1 A uniform semantics for two kinds of conditionals
  - Same semantics for (if  $\phi$ )  $\psi$
  - Difference resides in subjunctive antecedent:  $\triangleleft \alpha$
- 2 Embodies Stalnaker's Distinction:
  - And so explains subjunctive suggestion and contrast w/denying antecedent
- 3 Embodies Stalnaker's Distinction by pursuing the Modal Hypothesis
  - This explains the correlation between fake past and subjunctive/indicative

## The New Analysis

Import-Export



(15) a. If Adam had come, then there would have been a fight if Bob had come

b. (if  $\triangleleft A$ ) ((if  $\triangleleft B$ ) F)

(16) a. If Adam had come and Bob had come, there would have been a fight

a. (if  $\triangleleft A \wedge \triangleleft B$ ) F

## Import-Export

(if  $\triangleleft \alpha_1$ ) ((if  $\triangleleft \alpha_2$ )  $\psi$ )  $\equiv \equiv$  (if  $\triangleleft \alpha_1 \wedge \triangleleft \alpha_2$ )  $\psi$ 

- **Invalid** on Lewis-Stalnaker semantics
- **Valid** on present analysis

## The New Analysis

Disjunctive Antecedents



- (17) a. If Bob had danced or Sarah had sang, Andy would have cried  
 b. So, if Bob had danced, Andy would have cried, and if Sarah had sang, Andy would have cried
- (18) a.  $(\text{if } (\langle B \vee \langle S \rangle) C)$   
 b.  $(\text{if } \langle B \rangle C) \wedge (\text{if } \langle S \rangle C)$

## Disjunctive Antecedents

$$(\text{if } (\langle \alpha \vee \langle \beta \rangle) \psi) \models ((\text{if } \langle \alpha \rangle \psi) \wedge ((\text{if } \langle \beta \rangle \psi))$$

- **Invalid** on Lewis-Stalnaker semantics
- **Valid** on present analysis

## The New Analysis

Towards Another Phenomena



- Conditional semantics from Starr (2010: Ch.2) has more bells and whistles
- One of them is relevant here: stacks of contexts, rather than just contexts
- Starr (2010: Ch.2) uses this allows to give a uniform analysis of interrogative and conditional *if*
- Here, it will allow me to analyze various phenomena involving sequences of conditionals

## Hypothetical Additions

Logical Tourism



- Information is not only taken for granted in conversation and inquiry
- Agents routinely entertain certain enrichments of the information they are taking for granted
- Acts like supposition introduce these enrichments; the speech acts which follow may exploit what's entertained in addition to what's taken for granted
- Real virtuosity comes in the ways that what's entertained can be related to what's accepted

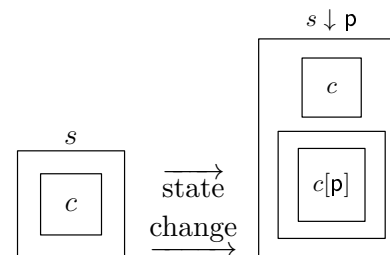
## States of Inquiry

States of Inquiry and Hypothetical Change



**Proposal:** represent hypothetical change via states of inquiry

Let  $s$  be a state of inquiry — *state* for short



- 1  $s = \langle c \rangle$  — nothing entertained
- 2  $s \downarrow p = \langle c, \langle c[p] \rangle \rangle$  —  $c[p]$  is entertained
- 3 Call  $s \downarrow p$  Subordination

Figure: Supposing  $p$

(Related proposal: Kaufmann 2000)



# Another Operation

For Suppositional Discourse and Reasoning

Conclusion:  $s \uparrow q$

Relates what's entertained to what's accepted via an entailment test. Let  $s = \langle c, \langle c[p] \rangle \rangle$ :

- If  $c[p]$  (what's entertained) entails  $q$ ,  $c$  remains as is
- Otherwise, something *actually* contradictory has been proposed, i.e. we are brought to:  $\langle \emptyset, \langle c \rangle \rangle$

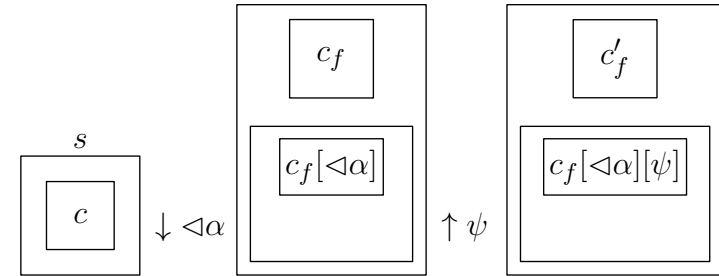
$$s \uparrow q = \langle \{w \in c \mid c[p] \models q\}, \langle c[p][q] \rangle \rangle$$



# Decomposing the Conditional Further

A Sequence of Stack Updates

$$s[(\text{if } \langle \alpha \rangle \psi)] = (s \downarrow \langle \alpha \rangle) \uparrow \psi$$



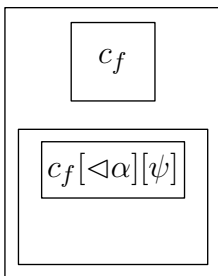
$$c'_f = \{w \in c_f \mid c_f[\langle \alpha \rangle] \models \psi\}$$

$$= c_f \text{ or } \emptyset$$



# Successful Updates

Create Subordinate Contexts



**Modal Subordination:** Roberts (1989)

- (19) a. Your cabin **wasn't** raided by a coyote.  
 b. But if a coyote had raided your cabin, it would've eaten your dinner.  
 c. **It** would've eaten your meat first.

- (19) is interpreted against subordinate context
- Specifically:  $\langle c_f[\langle R \rangle][E] \rangle \uparrow F$
- Which context sentences are interpreted against is determined by discourse connections like anaphora



# Reverse Sobel Sequences

Another Application

von Fintel (2001); Gillies (2007)

- (20) a. If Sophie had gone to the parade, she would have seen Pedro dance  
 b. But of course, if Sophie had gone to the parade and been stuck behind someone tall, she would not have seen Pedro dance
- (21) a. If Sophie had gone to the parade and been stuck behind someone tall, she would not have seen Pedro dance  
 b. # But of course, if Sophie had gone to the parade, she would have seen Pedro dance

## Reverse Sobel Sequences

The Explanation in Symbols



- (22) a. (if  $\triangleleft S$ ) P  
 b. (if  $\triangleleft S \wedge \triangleleft T$ )  $\neg P$

- (23) a. (if  $\triangleleft S \wedge \triangleleft T$ )  $\neg P$   
 b. # (if  $\triangleleft S$ ) P

- Both  $s[(22a)][(22b)]$  and  $s[(22a)] \uparrow (22b)$  are identical
- By contrast  $s[(23a)][(23b)]$  and  $s[(23a)] \uparrow (23b)$  are not
  - First tests:  $c_f[\triangleleft S] \models P$
  - Second tests:  $c_f[\triangleleft S][\triangleleft T][\neg P][\triangleleft S] \models P$ 
    - This test fails!
- There is a strong bias towards the second, inconsistent discourse structure; hard to defeat, not impossible

## Reverse Sobel Sequences

Are Sometimes Good (Moss to appear: §4)



(Context: speaker wants to indirectly convey the information that Mary would have turned down a marriage proposal from John.)

- (24) a. If John had proposed to Mary and she had said *yes*, he would have been really happy  
 b. But if John had proposed to Mary, he would have been really unhappy

- This discourse structure:  $s[(24a)][(24b)]$ 
  - Not:  $s[(24a)] \uparrow (24b)$
- This an issue for strict semantic accounts (von Stechow 2001; Gillies 2007), but not mine

## Reverse Sobel Sequences

Anaphora Correlates w/Inconsistency



(25) Although John was seriously considering a proposal to Mary, he didn't end up proposing. He never even bought a ring.

- (26) a. If John had offered Mary **an engagement ring** and she had said *yes*, he would have been really happy  
 b. # But if John had offered **it** to Mary, he would have been really unhappy

- Parallel to Moss's case, but w/anaphora from first conditional to second
- Anaphora forces second conditional to be interpreted against the subordinate state created by the first
- Hence inconsistency

## Reverse Sobel Sequences

Summary



- 1 Independently motivated apparatus explains inconsistency of reverse Sobel sequences
  - Needed for analysis of interrogative/conditional *if*
  - Needed for modal subordination
- 2 More flexible than von Stechow (2001); Gillies (2007)
- 3 But explains correlation with anaphoric dependence unlike Moss (to appear)

## The Theory

## Summary



- ① Unlike Stalnaker's, this theory gives a unified explanation of:
  - The contrast with denied antecedents
  - The subjunctive suggestion
  - Correlation between fake past and subjunctive/indicative
- ② This theory delivers a better logic of indicatives & subjunctives than Stalnaker's
  - Import-Export, Disjunctive Antecedents
- ③ It also offers a competitive analysis of reverse Sobel sequences that links them to anaphoricity

Thanks!



## References I



- BITTNER, M (2010). 'Conditionals as Attitude Reports.' Ms. Rutgers University, URL [http://www.rci.rutgers.edu/~mbittner/pdf%20files%20for%20web/bittner10\\_jos.pdf](http://www.rci.rutgers.edu/~mbittner/pdf%20files%20for%20web/bittner10_jos.pdf).
- VON FINTEL, K (2001). 'Counterfactuals in a Dynamic Context.' In M KENSTOWICZ (ed.), *Ken Hale: a Life in Language*, 123–152. Cambridge, Massachusetts: The MIT Press. URL <http://mit.edu/fintel/www/conditional.pdf>.
- GILLIES, A (2007). 'Counterfactual Scorekeeping.' *Linguistics & Philosophy*, **30**(3): 329–360. URL [http://rci.rutgers.edu/~thony/counterfactualscorekeeping\\_landp.pdf](http://rci.rutgers.edu/~thony/counterfactualscorekeeping_landp.pdf).
- GILLIES, A (2009). 'On Truth-Conditions for *If* (but Not Quite Only *If*).' *Philosophical Review*, **118**(3): 325–349. URL <http://rci.rutgers.edu/~thony/truth-conditions-if-phil-review-2009.pdf>.
- HEIM, I (1982). *The Semantics of Definite and Indefinite Noun Phrases*. Ph.D. thesis, Linguistics Department, University of Massachusetts, Amherst, Massachusetts.
- IATRIDOU, S (2000). 'The Grammatical Ingredients of Counterfactuality.' *Linguistic Inquiry*, **31**(2): 231–270.

## References II



- ISARD, S (1974). 'What Would You Have Done If...' *Theoretical Linguistics*, **1**: 233–55.
- KAUFMANN, S (2000). 'Dynamic Context Management.' In M FALLER, S KAUFMANN & M PAULY (eds.), *Formalizing the Dynamics of Conversation*, 171–188. Stanford, CA: CSLI Publications.
- LEWIS, DK (1979). 'Scorekeeping in a Language Game.' *Journal of Philosophical Logic*, **8**(3): 339–359.
- LYONS, J (1977). *Semantics*, vol. 2. Cambridge, England: Cambridge University Press.
- MOSS, S (to appear). 'On the Pragmatics of Counterfactuals.' *Noûs*. URL <http://www-personal.umich.edu/~ssmoss/counterfactuals.pdf>.
- PRATT, VR (1976). 'Semantical Considerations on Floyd-Hoare Logic.' In *Proceedings of the 17th IEEE Symposium on Foundations of Computer Science*, 109–121.
- ROBERTS, C (1989). 'Modal Subordination and Pronominal Anaphora in Discourse.' *Linguistics and Philosophy*, **12**(6): 683–721.
- STALNAKER, RC (1968). 'A Theory of Conditionals.' In N RESCHER (ed.), *Studies in Logical Theory*, 98–112. Oxford: Basil Blackwell Publishers.



## References III



- STALNAKER, RC (1975). 'Indicative Conditionals.' *Philosophia*, 5: 269–286. Page references to reprint in Stalnaker (1999).
- STALNAKER, RC (1978). 'Assertion.' In P COLE (ed.), *Syntax and Semantics 9: Pragmatics*, 315–332. New York: Academic Press. References to reprint in Stalnaker (1999).
- STALNAKER, RC (1999). *Context and Content: Essays on Intentionality in Speech and Thought*. Oxford: Oxford University Press.
- STALNAKER, RC (2005). 'Conditional Propositions and Conditional Assertions.' In J GAJEWSKI, V HACQUARD, B NICKEL & S YALCIN (eds.), *New Work on Modality*, vol. 51 of *MIT Working Papers in Linguistics*. Cambridge, MA: MITWPL.
- STARR, WB (2010). *Conditionals, Meaning and Mood*. Ph.D. thesis, Rutgers University, New Brunswick, NJ. URL <http://williamstarr.net/research/dissertation.pdf>.
- VELTMAN, F (1996). 'Defaults in Update Semantics.' *Journal of Philosophical Logic*, 25(3): 221–261. URL <http://www.pgrim.org/philosophersannual/xix/velt/index.htm>.