A Preference Semantics for Imperatives

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Outline

1. Three Observations
2. Previous Analyses
3. A Preference Semantics

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Observation 1
Imperatives Scope Under Connectives

(1) Go home and I'll go to the grocery store.
Assertive Reading I'm going to the store regardless
Conditional Reading I'll go to the store **if** you go home

- At least the assertive reading requires imperative to scope under *and*
- Scoping the imperative meaning over *and* would prevent second conjunct from conveying an assertion

Observation 1
Imperatives Scope Under Connectives

Context: We are all steadfast monogamists. But one parent is advising you to marry Pat while the other is advising you to marry Hilary. Someone asks *What was your parents' advice about who to marry?*

(2) a. Marry Pat and marry Hilary!
b. # Marry Pat and Hilary!

- (2a) requires imperatives to scope under *and*
- Otherwise (2a) and (2b) would be interchangeable

Observation 2
Felicity, Context & Information

(3) # Unicorns don't exist. Bring me a unicorn!

(4) # The door is open. Open the door!

Relatedly:

(5) # I don't have a brother. If I had a brother, call him!

Generalization

The felicity of imperatives depends on the mutual information against which they are issued. Specifically, the possibility of the action they proffer must be open.

Bonus for: saying *why* imperatives are about open actions

Observation 3
Disjunction, Entailment and Imperatives

(6) a. The light is on
b. The light on or it is off

(7) a. Turn the light on!
Turn the light on or turn it off!

Ross' (1944) Moral

However entailment and disjunction are defined for imperatives, they must together yield results that differ from cases involving parallel declarative disjuncts.

Observation 3
More on Entailment

- Entailment is:
  1. Preservation of a 'designated' semantic-value, e.g. 1
  2. Content inclusion, e.g. one set of worlds including another
- Not satisfying:
  1. A special 'entailment' relation for imperatives that does not parallel that given for other clause types
  2. A purely pragmatic relation

The Property Analysis
The Basics (Hausser 1980: 84; Portner 2004: §3.1)

The Property Analysis

The semantic content of an imperative = some property of the addressee(s) (Hausser 1980; Portner 2004, 2007, 2010)

(8) a. Leave!
b. $\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Leaves}(x, w)$
- 'w_c': constant for utterance world

- (8) pairs each x w/w where x is both an addressee in w_c and left in w
- This is all there is to the **semantics** of imperatives on the standard property analysis

The Property Analysis
Scoping Imperatives Under *And*

- Observation 1: imperatives scope under *and*
- On PA, when two imperatives are involved, this amounts to predicate conjunction

(9) a. Pat ran and sang
$\lambda x.\lambda w.\mathsf{Ran}(x, w)$, $\lambda x.\lambda w.\mathsf{Sang}(x, w)$
$\lambda x.\lambda w.\mathsf{Ran}(x, w) \wedge \mathsf{Sang}(x, w)$

b. (2) a. Marry Pat and marry Hilary!
1. $\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Pat}, w)$
2. $\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Hilary}, w)$

So (2a) comes out as:

$\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Pat}, w) \wedge \mathsf{Marry}(x, \mathsf{Hilary}, w)$

The Property Analysis
The Problem: conflating (2a) and (2b)

(2) a. Marry Pat and marry Hilary!
b. Marry Pat and Hilary!

(10) $\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Pat}, w) \wedge \mathsf{Marry}(x, \mathsf{Hilary}, w)$

First Problem for the Property Analysis

(2a) and (2b) both come out as (13), but then why aren't they communicatively equivalent?

The Property Analysis
Mixed Conjunctions

(1) Go home and I'll go to the grocery store.
- $\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Go}(x, w)$
- $\lambda w.\mathsf{Gotogrocery}(\mathsf{me}, w)$

Second Problem for the Property Analysis

1. Due to types, (1a) and (1b) can't be conjoined
2. Further, even if they did, there's no semantic object they could deliver that would capture (1)'s mixed meaning, i.e. it can't be a proposition or a property.

Russell (2007): pulling Portner's pragmatics into semantics provides an analysis of (1)

The Property Analysis
Portner's Context

Portner's Contexts

1. **Common Ground (CG)** The set of mutually accepted propositions
2. **Question Set (QS)** The set of mutually accepted questions
3. **To-Do List (TD)** The function which maps each conversationalist to the set of properties it has been mutually supposed they are to make true

Formally: $C = \langle CG, QS, TD \rangle$

The Property Analysis
Portner's Pragmatics

Portner's Pragmatics: Content Determines Contextual Effect

1. **Declarative Effect** Propositional expressions get added to CG because that's the only thing cooperative and rational speakers can do w/them
2. **Interrogative Effect** Question-denoting expressions get added to QS because that's the only thing cooperative and rational speakers can do w/them
3. **Imperative Effect** Property-denoting expressions get added to TD because that's the only thing cooperative and rational speakers can do w/them

Really? *will run and be you* has an imperative effect?

The Property Analysis
Goes Dynamic (Russell 2007)

(Simpler version of Russell 2007)

- !: takes property-term and forms dynamic term δ function from contexts to contexts
  - $!\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Leaves}(x, w)$
- $[\![!\pi]\!](C) = \langle CG_C, QS_C, TD_C \cup [\![\pi]\!]\rangle$
  - Fudging that TD is a function for simplicity
- $\triangleright$: takes propositional-term and forms dynamic term δ which denotes a function from contexts to contexts
  - $\triangleright\lambda w.\mathsf{Ran}(\mathsf{alice}, w)$
- $[\![\triangleright\phi]\!](C) = \langle CG_C \cup [\![\phi]\!], QS_C, TD_C\rangle$
- $[\![\delta_1 \wedge \delta_2]\!](C) = [\![\delta_2]\!]([\![\delta_1]\!](C))$

The Property Analysis
The Dynamic Version

(1) Go home and I'll go to the grocery store.

(11) $(!\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Go}(x, w)) \wedge (\triangleright\lambda w.\mathsf{Gotogrocery}(\mathsf{me}, w))$

(12) $[\![(!\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Go}(x, w)) \wedge (\triangleright\lambda w.\mathsf{Gotogrocery}(\mathsf{me}, w))]\!](C)$
$= [\![(\triangleright\lambda w.\mathsf{Gotogrocery}(\mathsf{me}, w))]\!](C')$
$C' = [\![(!\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Go}(x, w))]\!](C)$

Thus property added to TD & proposition added to CG!

The Property Analysis
The Dynamic Version

(2) a. Marry Pat and marry Hilary!
b. Marry Pat and Hilary!

(13) a. $(!\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Pat}, w)) \wedge (!\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Hilary}, w))$

b. $!(\lambda x.\lambda w.\mathsf{Addressee}(x, w_c) \wedge \mathsf{Marry}(x, \mathsf{Pat}, w) \wedge \mathsf{Marry}(x, \mathsf{Hilary}, w))$

- (13a) adds two conflicting properties, while (13b) adds a single uninstantiable property; nice!

The Property Analysis
Two Problems for the Dynamic Version

1. We have two very different ∧'s, propositional & dynamic (implementation artifact?)
2. What about disjunction and conditionals?

(14) You look in the library or I'll look in the lounge

(15) If Chris gets up, close the door

- You can't union or conditionalize contexts
- Charlow (2010): widescope imperative operator and allow *if* to restrict it; disjunction, can't do (14)
- This can't handle (16)

(16) If Chris gets up, I'll call his name and you close the door

Alternative: abandon Portner's model of contexts

The Property Analysis
Observation 2

(3) # Unicorns don't exist. Bring me a unicorn!

(4) # The door is open. Open the door!

- How does Portner connect imperatives to the mutual information?
- In the pragmatics, he assumes that the TDL orders worlds compatible with the CG

The Property Analysis
Observation 1: connecting TDL and CG

Portner's Ordering (2004: §3.2, 2007: 358, 2010: §3)

The To-Do List orders $w \in \bigcap CG$:

- Each agent α: $w <_\alpha w'$ iff:
  1. $\exists P$ in α's TDL column they instantiate in w' & not w
  2. $\nexists P'$ in α's TDL column they instantiate in w & not w'

Portner's Principle (2004: §3.2, 2007: 358, 2010: §3)

For any agent α, the participants in the conversation mutually agree to deem α's actions rational and cooperative to the extent that those actions in any world $w \in \bigcap CG$ tend to make it more likely that there is no $w' \in \bigcap CG$ such that $w <_\alpha w'$.

The Property Analysis
Observation 2: putting the connection to work?

(3) # Unicorns don't exist. Bring me a unicorn!

(4) # The door is open. Open the door!

- First part of (3) eliminates all unicorn worlds, so the property added by the second won't change the ordering
- First part of (4) eliminates all but the door-open worlds, so the property added by the second won't change the ordering
- What's wrong with doing either thing?
- Portner's Principle is silent: the properties added won't change what anyone's rationally expected to do

The Property Analysis

Observation 2: putting the connection to work?

- One thought:
  - Imperative utterances aim at changing the ordering on CG (pragmatic norm)
- This doesn't follow in a principled way from Portner's framework:
  - The point of an imperative utterance is to change the TDL, which is stipulated to determine the ordering
  - So no reason to expect ordering to *change*
  - And even if there were, it would just be by stipulation
- Obvious move:
  - Ditch the TDL, have imperatives operate directly on the ordering.

The Property Analysis

Observation 3

(7) a. Turn the light on!
b. Turn the light on or turn it off!

- Entailment is content inclusion (if you go static)
- $[\![(7a)]\!] \subseteq [\![(7b)]\!]$, so property theory falls to Ross
- Wait, haven't you read Portner (2010)?
- Yes, he gives a dynamic treatment of entailment that cares only about the ordering of worlds
- But this is available on that approach only if it:
  - Gives up the static semantics
  - Gives up TDL, opts for dynamic ordering semantics
- If imperative entailment is really about the ordering, why do they only semantically associate with the TDL?

Preference, Rationality & Context

Information

- Informational contents (*propositions*) are sets of possible worlds
  - These sets distinguish ways world might be (worlds in the set) from ways it isn't (worlds excluded from set)
- One informational content is particularly useful for understanding how linguistic interactions unfold:

Contextual Possibilities (c)

As communication and inquiry unfold, a body of information accumulates. Think of this information as what the agents are mutually taking for granted in some way. I call the set of worlds embodying this information c, short for *contextual possibilities*. (Stalnaker 1978; Lewis 1979)

Preference, Rationality & Context

Information and the Process of Inquiry

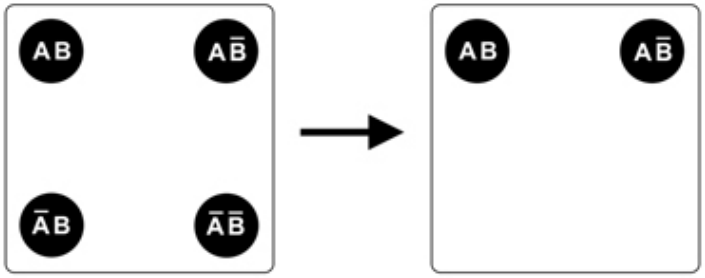

Figure: Accepting the information that A

- Inquiry progresses by gaining information, i.e. the elimination of worlds.
- $\{w_{AB}, w_{A\bar{B}}, w_{\bar{A}B}, w_{\bar{A}\bar{B}}\} \Rightarrow \{w_{AB}, w_{A\bar{B}}\}$

Preference, Rationality & Context

Issues

- It's not just information that accumulates in communication and inquiry (Bromberger 1966)
- There are issues (e.g. Hamblin 1958; Roberts 1996).
- They can be thought of as ways of grouping worlds in c into competing alternative propositions.

Alternatives (C) (e.g. Groenendijk 1999)

Alternatives represent open, competing propositions the agents are concerned with deciding between; their **issues**. Formally, this grouping of c may be identified with a set of sets of worlds; call it C. There is no need to also keep track of c: it is just the intersection of all the alternatives in C.

Preference, Rationality & Context

Issues and Inquiry

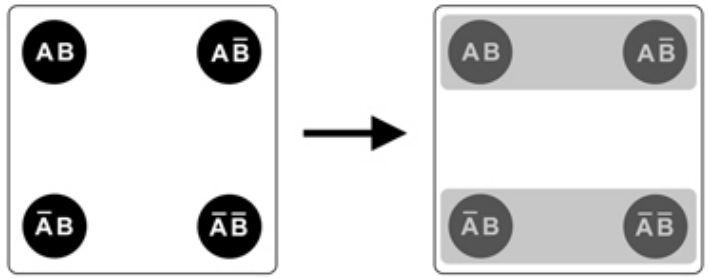

Figure: Recognizing the issue whether A

- Inquiry also progresses by recognizing issues, i.e. introducing alternatives
- $\{\{w_{AB}, w_{A\overline{B}}, w_{\overline{A}B}, w_{\overline{AB}}\}\} \Rightarrow \{\{w_{AB}, w_{A\overline{B}}\}, \{w_{\overline{A}B}, w_{\overline{AB}}\}\}$

Preference, Rationality & Context

Preferences

- Agents not only gather information and identify competing alternatives, they form **preferences** regarding those alternatives
- Central to **decision theoretic** approaches to rational choice, as applied in philosophy, AI and economics (e.g. Ramsey 1931; Hansson & Grüne-Yanoff 2009)
- Identifying an issue introduces a goal of finding *any* of the alternatives
- Forming a preference introduces a hunch about or desire for finding a particular alternative
- Of particular interest: the preferences being mutually taken for granted for the purposes of an interaction

Preference, Rationality & Context

Preferences

- A body of preferences can be represented as a binary **preference relation** on the alternatives
- I.e. a set of pairs of propositions constructed from c

Preference State (R)

- R: binary relation on a set of alternatives
- $R(a, a')$: a is preferred to a'
- Each pair in R is called a *preference*
- Set of (non-empty) alternatives over which R is defined: issues at stake in R, C_R
- Set of worlds among those alternatives: the contextual possibilities written c_R

Preference, Rationality & Context

Preference & Order

Preferences order Worlds Too

R induces an ordering on c_R:

$$w \succ_R w' \text{ iff } w \in a, w' \in a' \ \&\ R(a, a')$$

- In fact, this is what some authors call a preference order (e.g. van Benthem & Liu 2007)
- But having a relation over alternatives instead allows me to model information, issues and preference with one formal structure
- This order will be relevant later on

Preference, Rationality & Context

Information in a Preference State

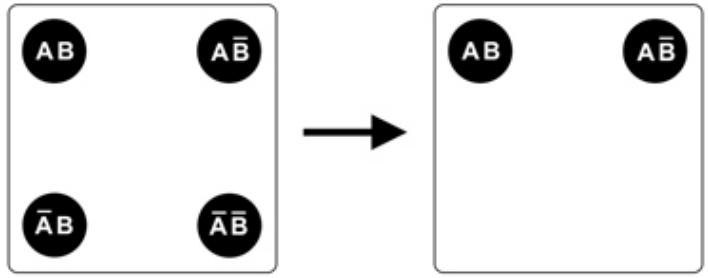

Figure: Accepting the information that A

- $\{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}, w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\} \Rightarrow \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}\}$
- $\{\, \langle \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}, w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\}, \varnothing \rangle \,\} \Rightarrow \{\, \langle \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}\}, \varnothing \rangle \,\}$

Preference, Rationality & Context

Issues in a Preference State

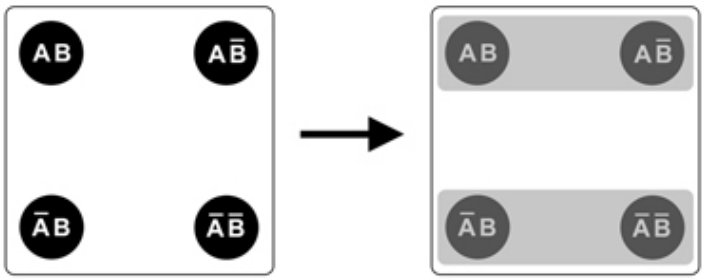

Figure: Recognizing the issue whether A

- $\{\{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}, w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\}\} \Rightarrow \{\{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}\}, \{w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\}\}$
- $\{\, \langle \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}, w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\}, \varnothing \rangle \,\}$
  $\Rightarrow \{\, \langle \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}\}, \varnothing \rangle, \langle \{w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\}, \varnothing \rangle \,\}$

Preference, Rationality & Context

Preference and Inquiry

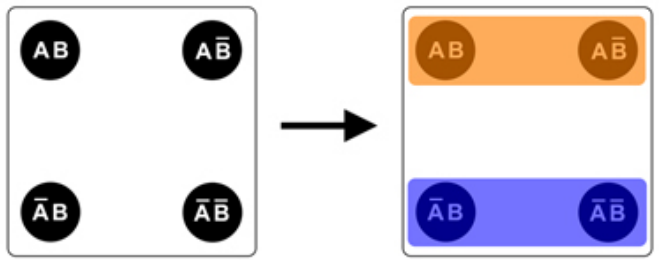

Figure: Coming to prefer A (to ¬A)

- $\{\, \langle \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}, w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\}, \varnothing \rangle \,\}$
  $\Rightarrow \{\, \langle \{w_{\mathsf{AB}}, w_{\mathsf{A\overline{B}}}\}, \{w_{\mathsf{\overline{A}B}}, w_{\mathsf{\overline{AB}}}\} \rangle \,\}$

Preference, Rationality & Context

Preference and Inquiry

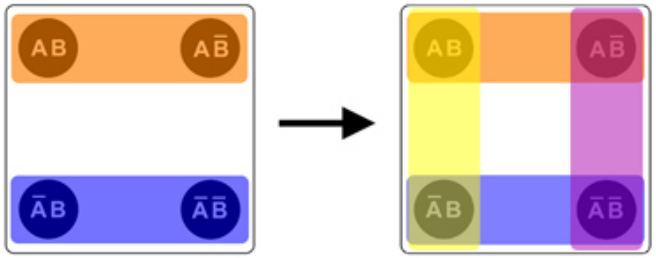

Figure: Preferring A and adding preference for B

- $\{\langle\{w_{AB}, w_{A\bar{B}}\}, \{w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}\rangle\} \Rightarrow$
  $\{\langle\{w_{AB}, w_{A\bar{B}}\}, \{w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}\rangle, \langle\{w_{AB}, w_{\bar{A}B}\}, \{w_{A\bar{B}}, w_{\bar{A}\bar{B}}\}\rangle\}$

Preference, Rationality & Context

What Are Rational Preference Like?

Exclusivity

- $\forall a, a' : a \cap a' = \varnothing$ if $R(a, a')$
- *When you strictly prefer one thing to another, the two can't be compatible.*

No Absurdity

- $\forall a \neq \varnothing : \langle a, \varnothing\rangle \in R$ & $\langle \varnothing, a\rangle \notin R$
- *Always prefer non-absurd alternatives to absurd one.*

Irreflexivity

- $\forall a : \langle a, a'\rangle \notin R$ if $a' \subseteq a$
- *You can't strictly prefer an alternative to something that entails it.*

Preference, Rationality & Context

What Are Rational Preference Like?

Exclusivity

- $\forall a_0, a_1 : \langle a_0, a_1\rangle \notin R$ if
  $\langle a_2, a_3\rangle \in R$ & $a_2 \subseteq a_1$ & $a_3 \subseteq a_0$
- *If you prefer a to b, you can't also prefer something that entails b to something that entails a.*

Semantics, Pragmatics & Irrational Preferences

- Words can get us into irrational preference states
  - So none of these axioms are enforced in the semantics
- Rather, recognizing their satisfaction and frustration is part of pragmatics
  - As it should be: pragmatics is about general rational cooperation

Preference, Rationality & Context

Using Preference to Make Rational Choices

- How do you use preference to decide what, rationally, you should do?
- Roughly: find which alternative is best according to those preference, and try to make sure the actual world is in that alternative
- In decision theory, this takes the form of defining choice functions
- A choice function maps a preference state R to the set of best alternatives according to R

Preference, Rationality & Context

Two Choice Functions That Aren't Right

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Dominance

Given R, a is among the best alternatives just in case it is preferred to every other alternative.

- $D(R) = \{a \in A_R \mid \forall a' \neq a \in A_R : R(a, a')\}$
  - Where $A_R = ((\text{dom}\, R) \cup (\text{ran}\, R)) - \varnothing$

Weak Dominance

Given R, a is among the best alternatives just in case no alternative is preferred to it.

- $W(R) = \{a \in A_R \mid \nexists a' \in A_R : R(a', a)\}$
  - Where $A_R = ((\text{dom}\, R) \cup (\text{ran}\, R)) - \varnothing$

Preference, Rationality & Context

The Choice Function: Logical Weak Dominance

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Logical Weak Dominance

Given R, a is among the best alternatives just it's not dispreferred (it's in $W(R)$), it isn't entailed by any (other) weakly dominant alternative and it doesn't entail any dispreferred alternative.

- $$L(R) = \{a \in W(R) \mid \nexists a' \in W(R) : a' \subset a \;\&\; \nexists a' \in (A_R - W(R)) : a \subseteq a'\}$$
  - Where $A_R = ((\text{dom}\, R) \cup (\text{ran}\, R)) - \varnothing$

Fact (Choice and Order)

$W(R)$ is identical to the set of smallest alternatives which contain the most $\succ_R$-maximums.

Preference, Rationality & Context

Preference and Inquiry

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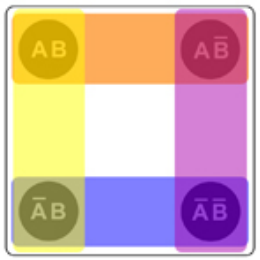

Figure: Preference for A with preference for B added to it

- $\{\langle\{w_{\mathsf{AB}}, w_{\mathsf{A\bar{B}}}\}, \{w_{\bar{\mathsf{A}}\mathsf{B}}, w_{\bar{\mathsf{A}}\bar{\mathsf{B}}}\}\rangle, \langle\{w_{\mathsf{AB}}, w_{\bar{\mathsf{A}}\mathsf{B}}\}, \{w_{\mathsf{A\bar{B}}}, w_{\bar{\mathsf{A}}\bar{\mathsf{B}}}\}\rangle\}$
- Two weakly dominant alternatives, orange and yellow
- Neither entail the other nor a dispreferred alternative
- So $L(R) = \{\{w_{\mathsf{AB}}, w_{\mathsf{A\bar{B}}}\}, \{w_{\mathsf{AB}}, w_{\bar{\mathsf{A}}\mathsf{B}}\}\}$

The Semantics: some preliminaries

Radicals & Worlds

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Radicals (Informational Core)

- Basic sentences: mood marker + radical, e.g. $!\rho$
  - Mood markers: $!, \triangleright, ?$
  - Atomic radicals: $\mathsf{A}, \mathsf{B}, \mathsf{C}$, etc.
  - Logically complex radicals: $\neg\rho, \rho_1 \wedge \rho_2, \rho_1 \vee \rho_2$

Worlds

A possible world is a function which maps atomic radicals to a unique truth-value, 1 or 0

- Dynamic Meaning: function from contents to contents
- $R[\phi] = R'$: R' is the result of applying ϕ to R (Veltman 1996)

The Semantics
Atomic Radical Semantics

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Radical Semantics

- $c[\mathsf{A}] = \{w \in c \mid w(\mathsf{A}) = 1\}$, for any atomic radical A

- Subsentential semantics
- Filters alternatives for worlds were radical is true

Radical Connective Semantics

- $c[\neg\rho] = c - c[\rho]$
- $c[\rho_1 \wedge \rho_2] = (c[\rho_1])[\rho_2]$
- $c[\rho_1 \vee \rho_2] = c[\rho_1] \cup c[\rho_2]$

The Semantics
Imperative Semantics

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Imperative Semantics

$R[!\rho] = R \cup \{\langle a[\rho], a - a[\rho]\rangle \mid a \in A_R\}$

- Where $A_R = (\,((\mathrm{dom}\ R) \cup (\mathrm{ran}\ R)) - \varnothing\,) \cup c_R$

This amounts to a three-step process:

1. Admit all of the preferences in R
2. For each non-empty alternative a in C_R, introduce a local preference for the ρ-worlds in a over the non-ρ-worlds in a
3. Introduce a global preference for all of the ρ-worlds in c_R over the non-ρ-worlds

The Semantics
An Example

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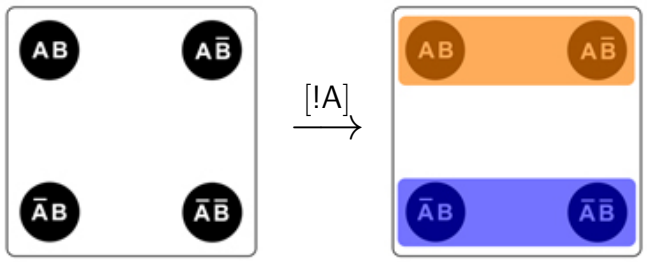

Figure: R to $R[!\mathsf{A}]$

$R = \{\langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}, w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}, \varnothing\rangle\} \Rightarrow$
$\{\ \langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}, w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}, \varnothing\rangle, \langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}\}, \{w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}\rangle\ \}$

The Semantics
An Example

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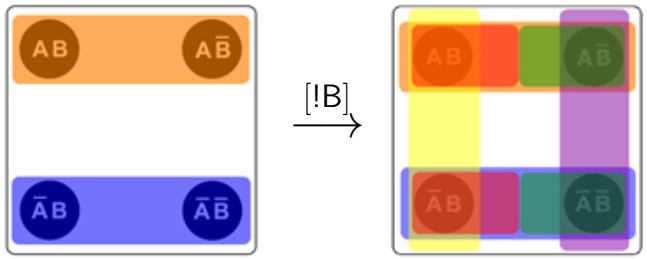

Figure: $R[!\mathsf{A}]$ to $R[!\mathsf{A}][!\mathsf{B}]$

$\{\ \langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}, w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}, \varnothing\rangle, \langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}\}, \{w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}\rangle\ \} \Rightarrow$
$\{\ \langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}, w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}, \varnothing\rangle, \langle\{w_{\mathsf{AB}}, w_{\mathsf{A}\overline{\mathsf{B}}}\}, \{w_{\overline{\mathsf{A}}\mathsf{B}}, w_{\overline{\mathsf{AB}}}\}\rangle,$
$\langle\{w_{\mathsf{AB}}\}, \{w_{\mathsf{A}\overline{\mathsf{B}}}\}\rangle, \langle\{w_{\overline{\mathsf{A}}\mathsf{B}}\}, \{w_{\overline{\mathsf{AB}}}\}\rangle,$
$\langle\{w_{\mathsf{AB}}, w_{\overline{\mathsf{A}}\mathsf{B}}\}, \{w_{\mathsf{A}\overline{\mathsf{B}}}, w_{\overline{\mathsf{AB}}}\}\rangle\ \}$

The Semantics
An Example, Applying the Pragmatic Concepts

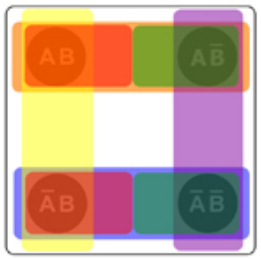

Figure: $R[!A][!B]$

- 5 weakly dom alt's: c_r, yellow, orange, reds
- All entail c_r, so it's out
- Reds entail yellow, so it's out
- Top red entails orange, so orange is out
- Bottom red entails blue (dispreferred alt), so it's out

$\{\langle\{w_{AB}, w_{A\bar{B}}, w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}, \varnothing\rangle, \langle\{w_{AB}, w_{A\bar{B}}\}, \{w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}\rangle,$
$\langle\{w_{AB}\}, \{w_{A\bar{B}}\}\rangle, \langle\{w_{\bar{A}B}\}, \{w_{\bar{A}\bar{B}}\}\rangle,$
$\langle\{w_{AB}, w_{\bar{A}B}\}, \{w_{A\bar{B}}, w_{\bar{A}\bar{B}}\}\rangle\}$

The Semantics
An Example, Applying the Pragmatic Concepts

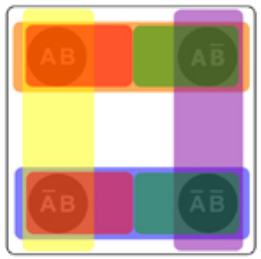

Figure: $R[!A][!B]$

- Top red is the best choice
- Good: accepting !A and !B should make that the uniquely best alt
- Indeed: $R[!A \wedge !B] = (R[!A])[!B]$
- W/o local prefs we get an incorrectly disjunctive interpretation

$\{\langle\{w_{AB}, w_{A\bar{B}}, w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}, \varnothing\rangle, \langle\{w_{AB}, w_{A\bar{B}}\}, \{w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}\rangle,$
$\langle\{w_{AB}\}, \{w_{A\bar{B}}\}\rangle, \langle\{w_{\bar{A}B}\}, \{w_{\bar{A}\bar{B}}\}\rangle,$
$\langle\{w_{AB}, w_{\bar{A}B}\}, \{w_{A\bar{B}}, w_{\bar{A}\bar{B}}\}\rangle\}$

The Semantics
An Example, Applying the Pragmatic Concepts

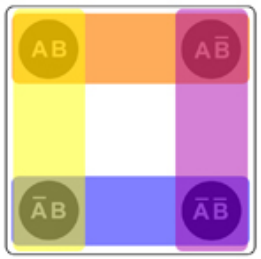

Figure: $R[!A] \cup R[!B]$

- Blue and yellow are the best **choices**
- Indeed: $R[!A \vee !B] = R[!A] \cup R[!B]$

$\{\langle\{w_{AB}, w_{A\bar{B}}, w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}, \varnothing\rangle, \langle\{w_{AB}, w_{A\bar{B}}\}, \{w_{\bar{A}B}, w_{\bar{A}\bar{B}}\}\rangle,$
$\langle\{w_{AB}, w_{\bar{A}B}\}, \{w_{A\bar{B}}, w_{\bar{A}\bar{B}}\}\rangle\}$

The Semantics: Observation 1
Marriage

(2) a. Marry Pat and marry Hilary!
b. Marry Pat and Hilary!

(13) a. $!P \wedge !H$
b. $!(P \wedge H)$

Further detail:

- In context, we're monogamists so $w_{P\bar{H}}$ is eliminated
- Thus: $R = \{\langle\{w_{P\bar{H}}, w_{\bar{P}H}, w_{\bar{P}\bar{H}}\}, \varnothing\rangle\}$
- $R[!P \wedge !H] = (R[!P])[!H]$
- We know what $R[!P]$ will look like, so let's focus on the second transition

The Semantics: Observation 1

Marriage Dilemma

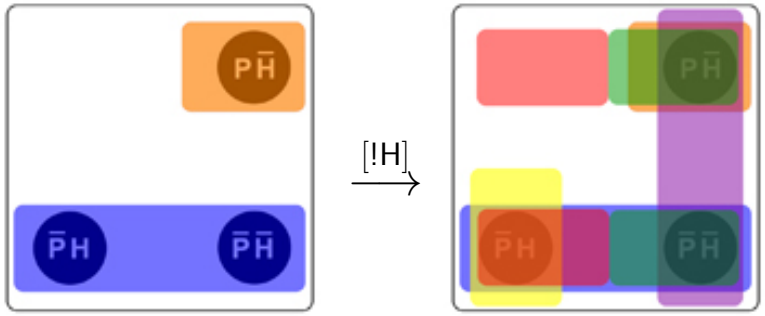

Figure: Updating $R[!\mathsf{P}]$ with $!\mathsf{H}$

- Verdict: irrational, but potentially useful
- First, eliminate absurd pref, indeed both local ones

The Semantics: Observation 1

Marriage Dilemma

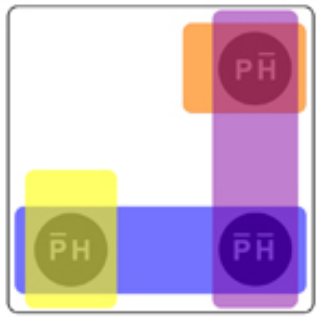

Figure: $R[!\mathsf{P}][!\mathsf{H}]$, minus local prefs

- There's no best alternative!
- To make a choice, you must give up one of the preferences
- One of the pieces of advice
- So this utterance is **conflicted**, but potentially **useful**

The Semantics: Observation 1

Marriage Contradiction

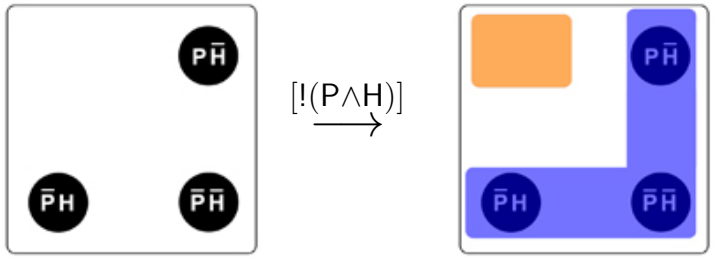

Figure: $R[!(\mathsf{P} \wedge \mathsf{H})]$

- Again irrational: absurd pref, no best alt
- But there's nothing you can get rid of to get a useful set of prefs
- Verdict: **conflicted** and **useless**

The Semantics: Observation 1

The Mixed Example

(1) Go to the grocery store and I'll go home

(17) $!\mathsf{G} \wedge \triangleright \mathsf{H}$

Declarative Semantics

$R[\triangleright\rho] = \{\langle a_0[\rho], a_1[\rho]\rangle, \ldots, \langle a_n[\rho], a_{n+1}[\rho]\rangle, \langle c_R[\rho], \varnothing\rangle\}$

- Where $R = \{\langle a_0, a_1\rangle, \ldots, \langle a_n, a_{n+1}\rangle\}$

- Two steps:
  1. Use ρ to filter each alt
  2. Distill new info $c_R[\rho]$
- We know what $R[!\mathsf{G}]$ will look like, so let's focus on the second transition

The Semantics: Observation 1

The Mixed Example

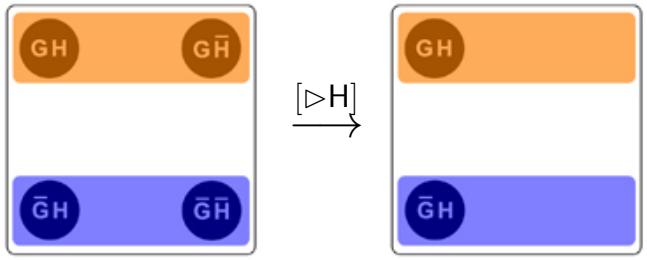

Figure: $R[!G \wedge \triangleright H] = R[!G][\triangleright H]$

- The best alternative involves you going to the grocery store and my going home
- Success.

The Semantics: Observation 2

Dependence on Contextual Information

(3) # Unicorns don't exist. Bring me a unicorn!
$R[\triangleright \neg U][!B]$

(4) # The door is open. Open the door!
$R[\triangleright O][!O]$

- For (4): norm of imperative utterance is to introduce a preference
  - This one idles, hence odd
- For the R in (3), $w_{\overline{UB}}$ is out

The Semantics: Observation 2

Dependence on Contextual Information

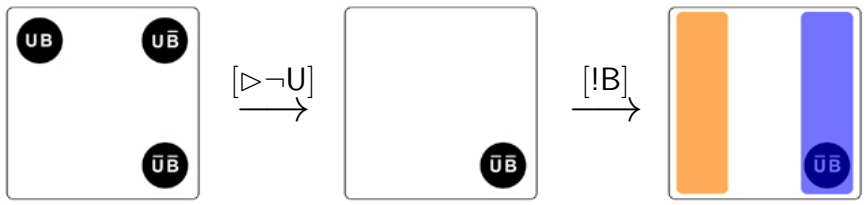

Figure: $R[\triangleright \neg U][!B]$

- This is **irrational**: the absurd alt is uniquely preferred!

The Semantics: Observation

Dynamic Entailment

Entailment

Entailment is the incremental preservation of whatever tracks a given sentence type's characteristic role in inquiry and conversation. Declarative entailment is the incremental preservation of information. Interrogative entailment is the incremental preservation of issues. Imperative entailment is the incremental preservation of Logical Weakly Dominated alternatives, or equivalently: $\succ_R$.

Declarative Entailment

$\triangleright\rho_1, \ldots, \triangleright\rho_n \vDash \triangleright\rho$ iff $\forall R : c_{R[\triangleright\rho_1]\cdots[\triangleright\rho_n]} = c_{R[\triangleright\rho_1]\cdots[\triangleright\rho_n][\triangleright\rho]}$.

- Premises entail conclusion iff adding premises to any info makes info provided by conclusion redundant.

The Semantics: Observation 3

Dynamic Imperative Entailment

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Imperative Entailment

$!\rho_1, \ldots, !\rho_n \vDash !\rho$ iff $\forall R : \succ_{R[!\rho_1]\cdots[!\rho_n]} = \succ_{R[!\rho_1]\cdots[!\rho_n][!\rho]}$.

- Premises entail conclusion iff adding premises to any preferences makes the conclusion redundant with respect to the ordering of live possibilities.
- In effect, the conclusion is redundant with respect to informing any agent what to do when they've accepted the premises.

The Semantics: Observation 3

Ross' Puzzle

NYU

Figure: $R[!A]$ vs. $R[!A] \cup R[!B]$

- $w_{AB} \not\succ_{R[!A]} w_{A\bar{B}}$, but $w_{AB} \succ_{R[!A]\cup R[!B]} w_{A\bar{B}}$
- So adding $!A \vee !B$ after adding $!A$ will change the ordering/best alternatives
- Hence, no entailment

The Semantics

Conditionals

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Conditional Semantics

$R[(\text{if } \phi)\, \psi] = \{r \in (R \cup (R[\phi])[\psi]) \mid c_{R[\phi]} = c_{(R[\phi])[\psi]}\}$

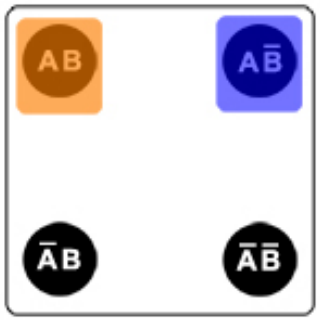

Figure: $R[(\text{if } A)\, !B]$

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Thank you!

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