The Reactive Theories and Norm Change

Dov M. Gabbay[123]

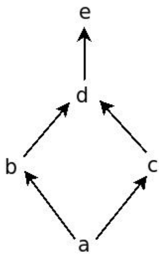
[1]King's College, UK
[2]University of Luxembourg, Luxembourg
[3]Bar-Ilan University, Israel

19-01-2010

New Ideas

- The reactive idea (2004)
- Structured theories and semantics (1990)
- Reactive structured theories (2007)
- Contrary to duties as reactive structure theories

Modal Logic and Possible Worlds



$$a \models \Diamond A \text{ iff } \exists y(aRy \wedge y \models A)$$

Modal Logic and Possible Worlds

Static theoretic evaluation

Axiom	**Condition on R**
$\Box A \to A$	R *reflexive*
$\Box A \to \Box\Box A$	R *transitive*

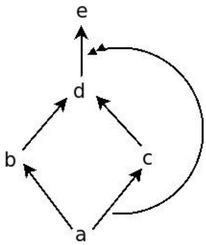
New point of view

$a \models \Diamond A$ *iff* "run up the graph" to find a pint y where $y \models A$

- Actual walking the graph
- No longer philosophical "possible world", just graph and paths on graph

Axiom	**Condition where to go**
$\Box A \to A$	*check locally as well*
$\Box A \to \Box\Box A$	*Run as far as you can. R need not be transitive or reflexive*

Reactive Approach

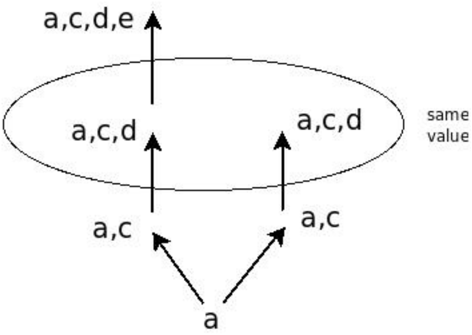


If you pass through $a \to c$, then disconnect $d \to e$

$$a \models \diamond(d \wedge \Box \bot)$$

- ordinay model $= (S, R, a, h)$
- reactive model $= (S, \mathcal{R}, a, h)$

Reactive Approach



Satisfaction in reactive model

$\mathbf{m} \models A$ *iff* A models in the actual world of $\mathbf{m}$

Reactive Approach

Reactive semantics is stronger

The logic defined by this frame cannot be characterized by any class of ordinary frames

Reactive Approach

- Abandon possible world if we want
- Evaluation in information bearing graphs
- Retain possible world view
- Reactive evaluation in reactive models

Ordinary Theory

$$A \wedge \Diamond B$$

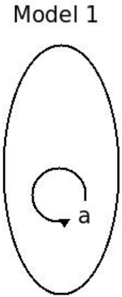


Figure: $a \models A \wedge B$

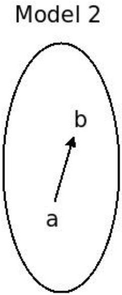


Figure: $a \models A \wedge b \models B$

We can have $a = b$

Structured Theory

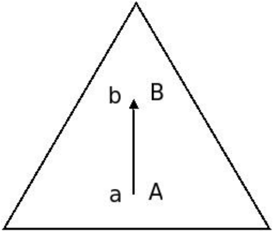


Figure: $a \neq b$

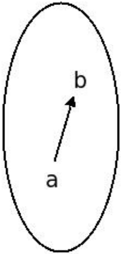
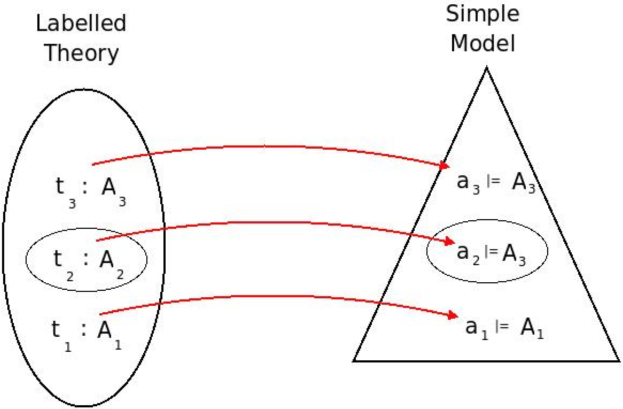


Figure: $a \neq b; a \models A; b \models B$



- $t_1 R t_2 \neq t_3 R t_1 \rightarrow a_i$ related as requested

Reactive Structured Theory

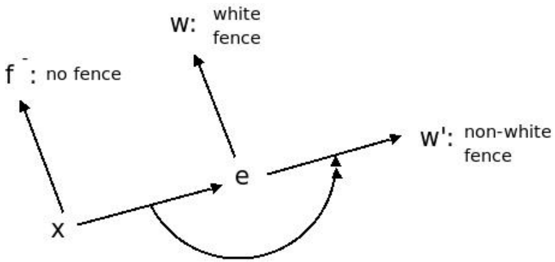
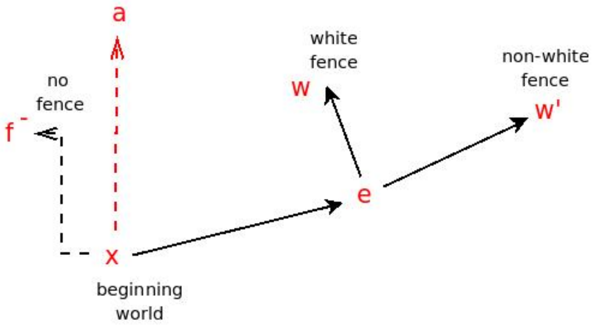


Figure: Theory T

- If you get to *e* you no longer see a world with no fence
- T requires a reactive model such that when we pass an arc leading to a point *e* where no fence is not possible, then double arrows block access to all non white fence worlds.

Reactive Model for the Theory



- T holds in this model if we can assign points as swhown and have a path from x to a satisfying T

Possible Models for the fence theory (From Carmo-Jones)

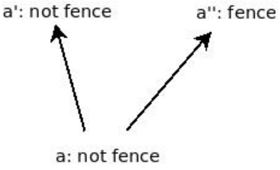
1. There is a white fence, it is fixed that there will be a fence white ore not

$$a \models fence \wedge white \wedge \Box fence$$

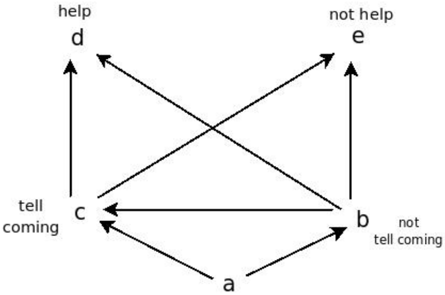
2. There is a fence and it is possible not to have a fence

$$a : fence \longrightarrow a^{'} : \neg fence$$

3. There is no fence and it is possible to have a fence, and it is possible not to have a fence



Reactive Theory for Chishlom



- Ought to help: from *a* block all arcs to *not help*
- If *help* then *tell*: From any first point where $\neg\Diamond\neg help$ block all artcs to $\neg tell$
- If *not help* then ought not tell: From any point $\neg\Diamond hel$ block any arcs to $\neg tell$
- Does not go: Actual world *a* points where $\Box\neg help$

Case analysis of Carano Joes-Chishlom

They describe the model in other terms

- f1 The mand intends not to go and help
- f2 It is potentially possible for the man to help and to tell and potentially possible for the man to help and not tell.
- f3 The man has not in fact told that he is coming to halp although it is still actually possible that he does tell and actually possible he does not tell.

Suppose you have a language L_1 and a stronger language L_2 you want to express the contents of an L_2-theory Δ^{L_2} using the language L_1. It may not be possible to find $\Omega^{L_1} \equiv \Delta^{L_2}$. But under special models of L_1, defined by semantic conditions $\mathcal{S}_i$ we have

$$\Delta^{L_2} \equiv \bigvee_{\mathcal{S}_i} \Omega_i^{L_1}$$

Remark 5.5 (Conflicting Norms) *We can cope more easily with conflicting norms. The modern world is full of them. Think of*

1. *There should be no fence*
2. *There should be no dog*
3. *If there is a dog there should be a fence*
4. *If there is a fence it should be demolished*
5. *There is a dog*

Let us analyse this example using our methods of Section 5 (proof theory).

We get the following theories, corresponding to the clauses and figures of the example

To use proof theory as described in Section 5, we impose Figure 74 on Figure 76 and get Figure 77.

We now impose Figure 75 on Figure 77 and get Figure 78.

We now impose Figure 74 on Figure 78 (since there is a dog at $x : dog$, there should be no fence, and get Figure 79.

The impossible situation arises at node e_2. e_2 inherits two CTDs, as seen in Figure 80.

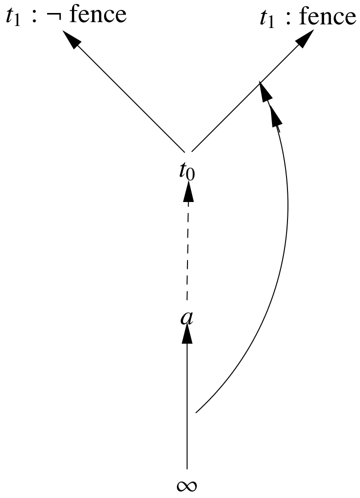


Figure 72: Dog 1: there should be no fence

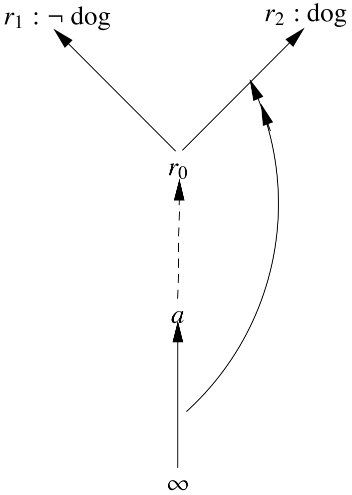


Figure 73: Dog 2: there should be no dog

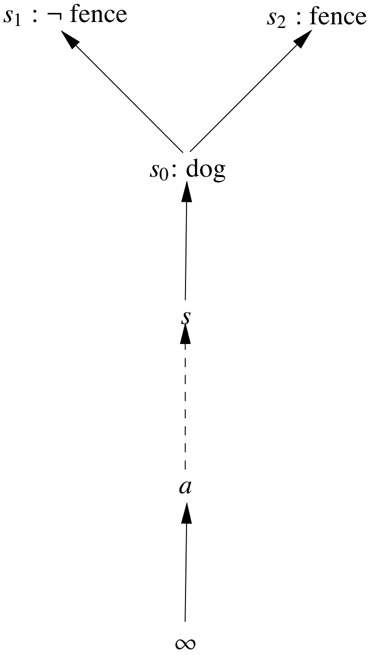


Figure 74: Dog 3: if there is a dog there should be a fence

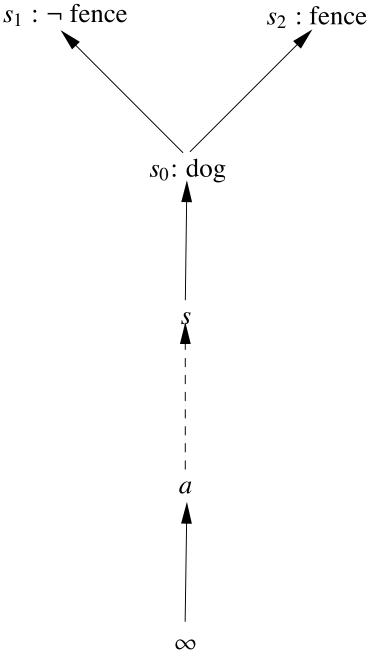


Figure 74: Dog 3: if there is a dog there should be a fence

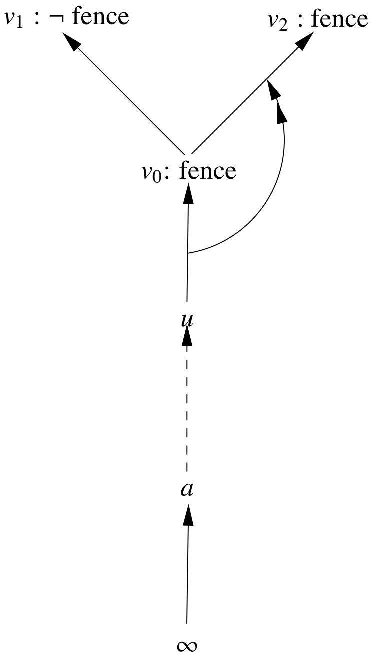


Figure 75: Dog 4: if there is a fence it should be demolished (i.e. go to ¬fence

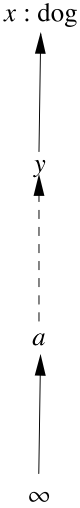


Figure 76: Dog 5: there is a dog in the evaluation world

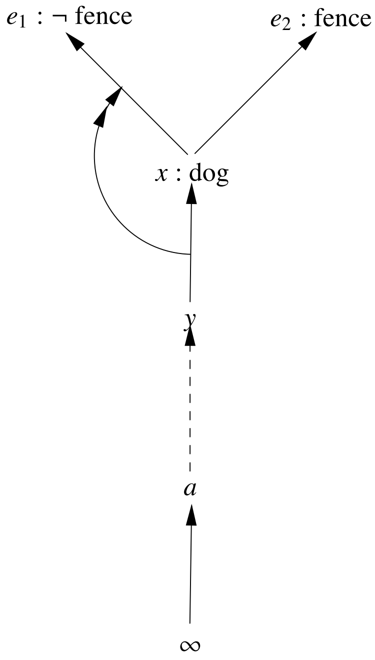


Figure 77: Dog 6

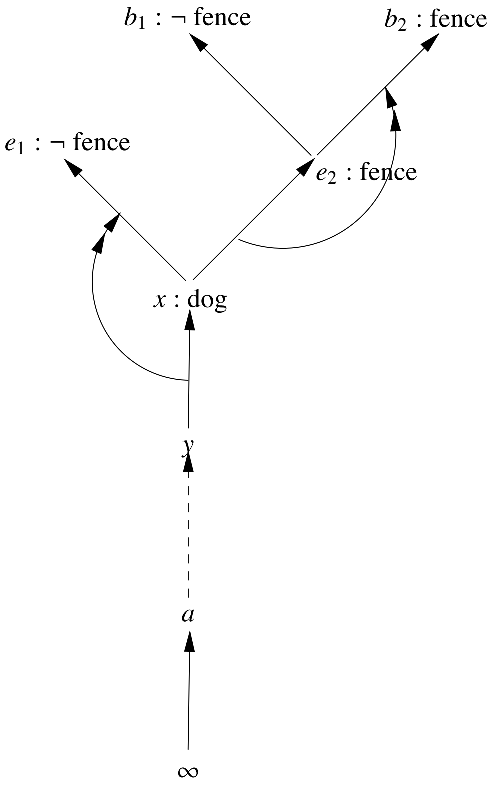


Figure 78: Dog 7

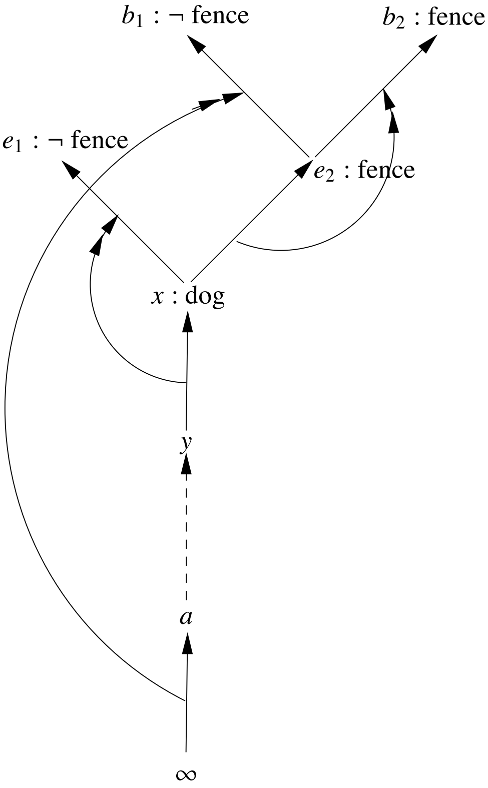


Figure 79: Dog 8

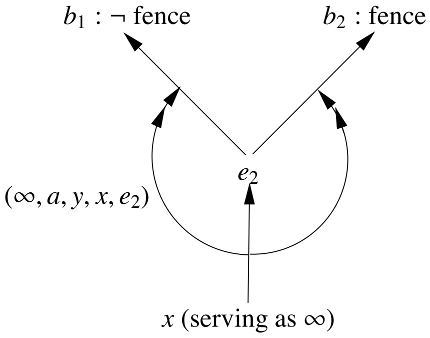
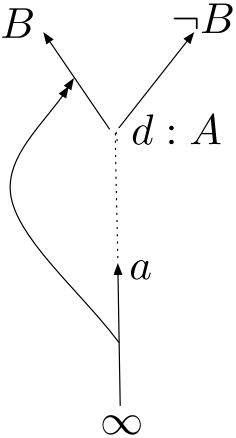


Figure 80: dog9

Norm

$$\Box A \Rightarrow \bigcirc \neg B$$



Change of Norms

Model		Norm		Norm on Norms
	Impose		Impose	
Δ_1	$\Longleftarrow$	Δ_2	$\Longleftarrow$	Δ_3

Change of Norms

Non-Monotonic Logic

to decide between conflicting Norms

$$a, x_1, x_2, \ldots, x_n, d$$
$$A_0, A_1, A_2, \ldots, A_n, B$$

$$x_2, \ldots, x_n, d$$
$$E_2, \ldots, E_n, C$$

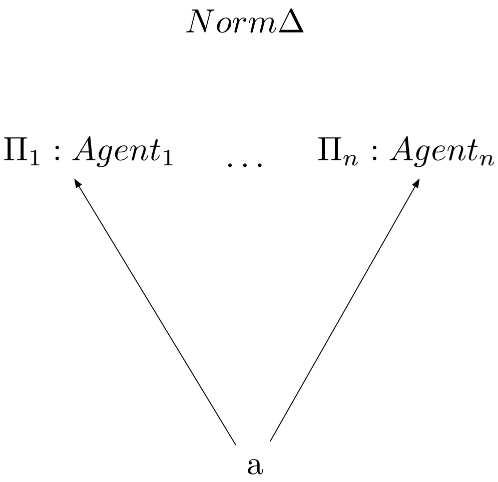
Change of Norms

$$Models \qquad\qquad Norm$$

$$\Delta_1 \qquad \overset{\Longrightarrow}{impose} \qquad \Delta_2$$

$$\Delta_1^{'}$$

Change of Norms



Model

Patterns for n agents interactions

Dynamic Logic

$$Model \models \Box_{\varphi}\psi$$

$$iff$$

$$\begin{array}{c} Apply\,\varphi \\ to\,Model \end{array} \models \quad \psi$$

1. Run φ and change Model
2. Impose φ