Means-End Relations and Artifactual Functions

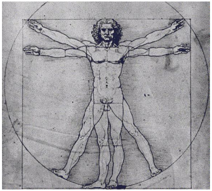
A Sketch

Jesse Hughes

Technical University of Eindhoven

June 4, 2005

Introduction to *Norms in Knowledge*



Epistemology:

- Knowledge of descriptive claims

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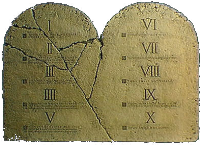

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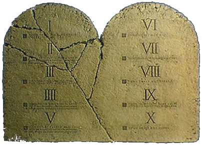

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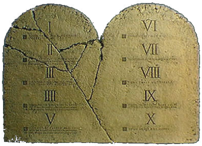

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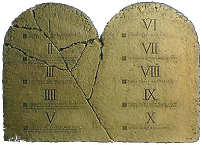

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Introduction to *Norms in Knowledge*

Applied to technical artifacts:

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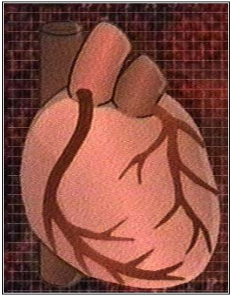
      Artifacts: artifactual functions

Some examples of functional ascriptions



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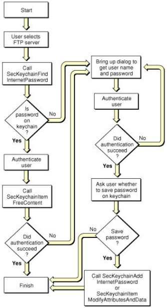

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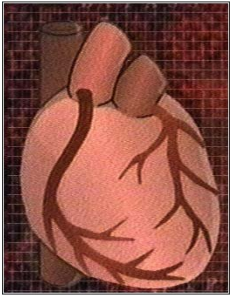

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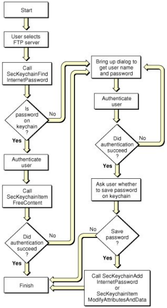

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How functions relate to means and ends

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- Functions imply means-end relations.
- Step one: Provide a semantics for means-end relations.

Outline

1. Means-end relations
   - Propositional Dynamic Logic
   - Means-end relations in PDL

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Propositional Dynamic Logic is a logic of actions.

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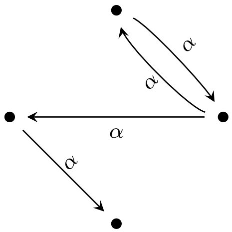
- $\langle\alpha\rangle\varphi$: after doing α, φ *might* hold.

PDL semantics



Possible world semantics with transition systems for each action α.

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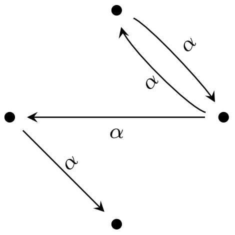

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$w \xrightarrow{\alpha} w'$ means:
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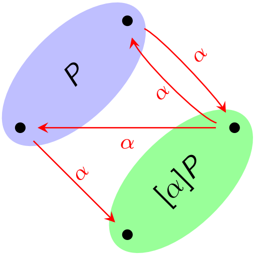

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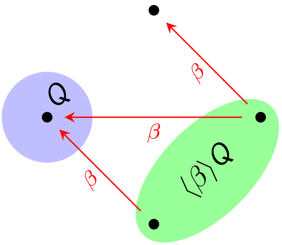

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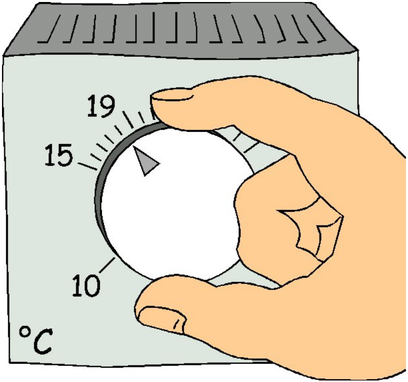
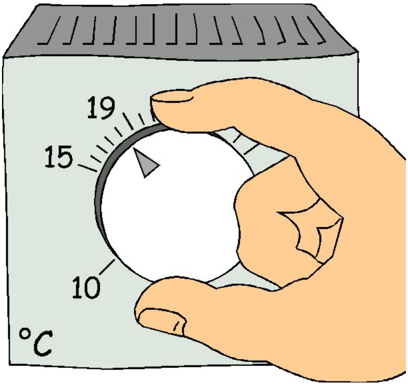
A thermostat example



Thermostat connected to heater.

A thermostat example



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Three settings: l, m, h

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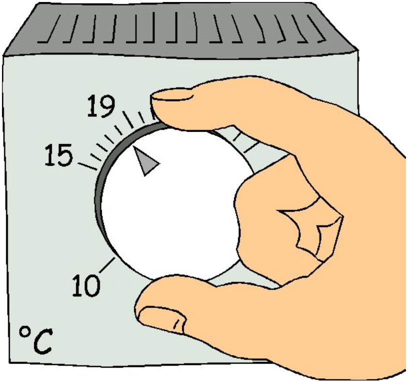

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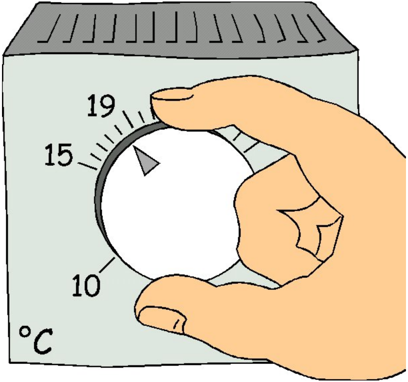

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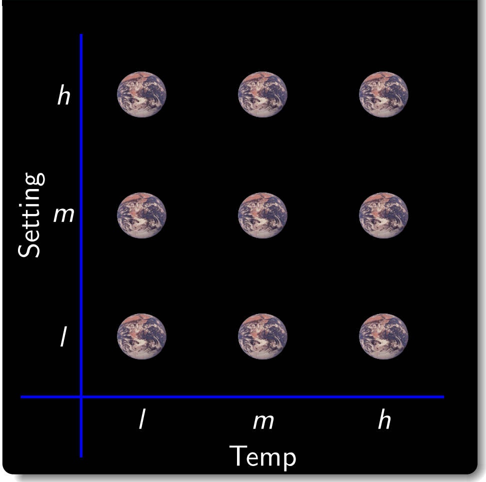
Thermostat



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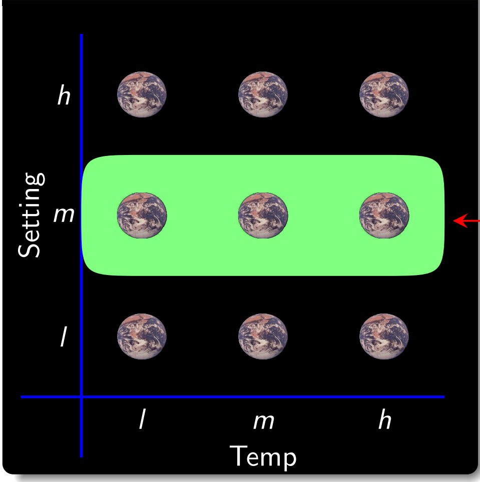

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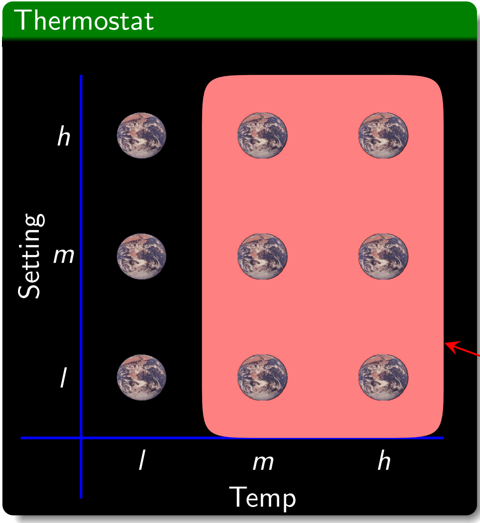

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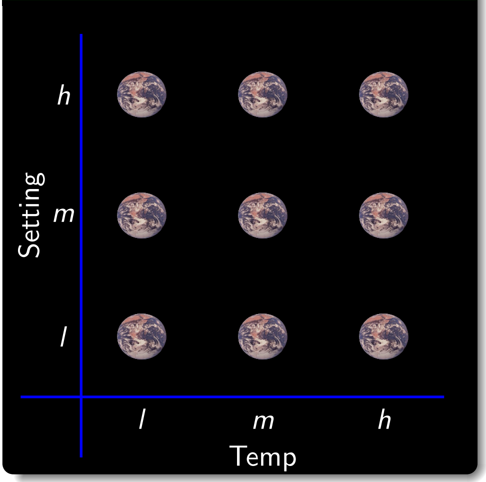

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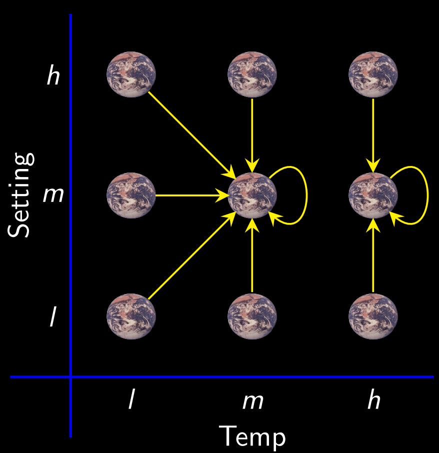

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- Change setting:
  - **set**(l)
  - **set**(m)
  - **set**(h)
- **set**(m) changes:
  - setting to m,
  - temp $\geq m$.

Weak and strong means-end relations

A means is an action α that can realize one's end φ.

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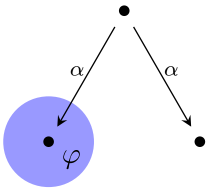
Two interpretations:



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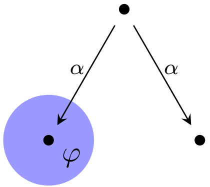

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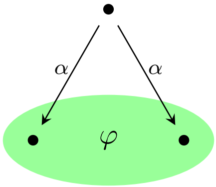

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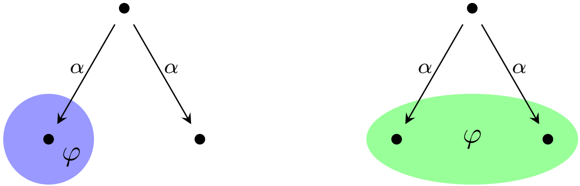

Weak: α *might* realize φ. Strong: α *will* realize φ.

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Strong is slightly subtler.

Strong means-end relations in PDL

In *w*, α is a *strongly sufficient means* to φ

Doing α in *w* will yield φ

Strong means-end relations in PDL

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$$\underbrace{\text{Doing } \alpha \text{ in } w \text{ will yield } \varphi}_{w \models [\alpha]\varphi}$$

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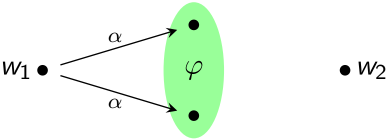

But. . .
both w_1 and w_2 satisfy $[\alpha]\varphi$!

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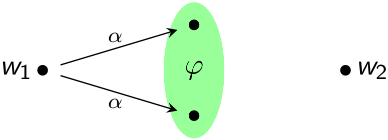
$\underbrace{\text{Doing } \alpha \text{ in } w \text{ will yield } \varphi}_{w \models [\alpha]\varphi}$ and one can do α in w.



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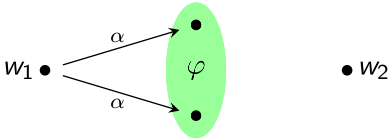

But...
both w_1 and w_2 satisfy $[\alpha]\varphi$!

Fix: $w \models \langle\alpha\rangle$**True**
$\Updownarrow$
one <u>*can*</u> do α in w.

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In w, α is a *strongly sufficient means* to φ

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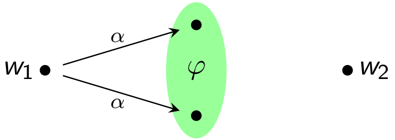

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Additional topics on means-end relations
(All the thrilling details we won't discuss)

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- Necessary means to an end.
- Conditional means-end relations.
- Practical consequences of means-end relations.
- Efficacy via fuzzy logic.

Outline

Where do functions come from?

Historic account:

The function of o is f

$$\Updownarrow$$

the fact that o does f explains the existence of o.

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Includes a *social* aspect.

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Includes a *social* aspect.

Tough question. Let's avoid it.

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A *functional ascription* f includes the following components.

- an artifact type T,

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One expects: $\alpha(o, \tau)$ is a means to $\varphi(o, \tau)$.

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A return to the thermostat

Thermostats are used to regulate temperature.

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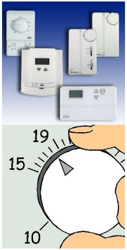

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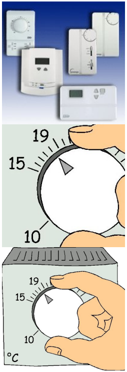

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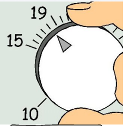

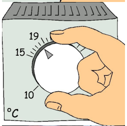

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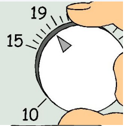

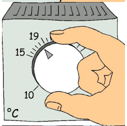

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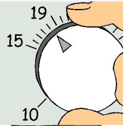

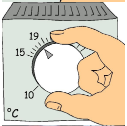

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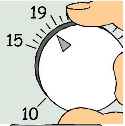

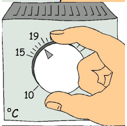

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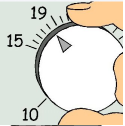
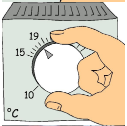
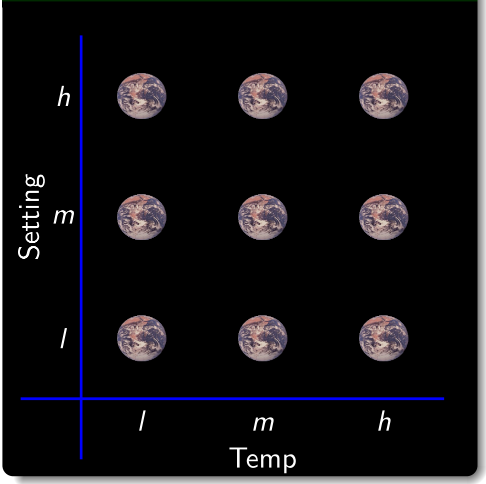




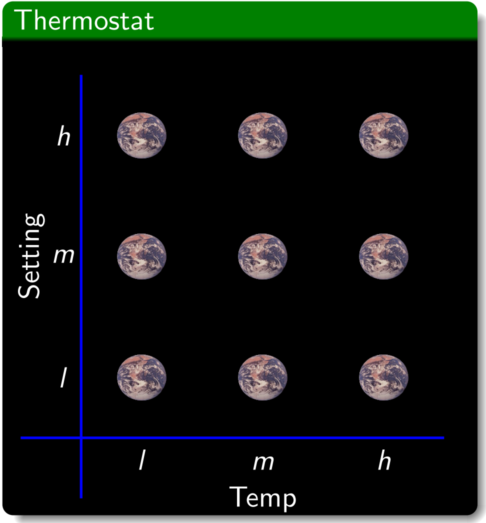
Contexts and transition systems

Thermostat



Each f-context $\langle o, x\rangle$ determines a PDL model.

Contexts and transition systems

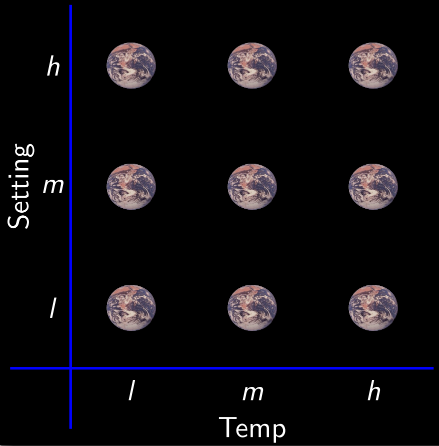


Each f-context $\langle o, x \rangle$ determines a PDL model.

- o: the artifact used.

Contexts and transition systems

Thermostat



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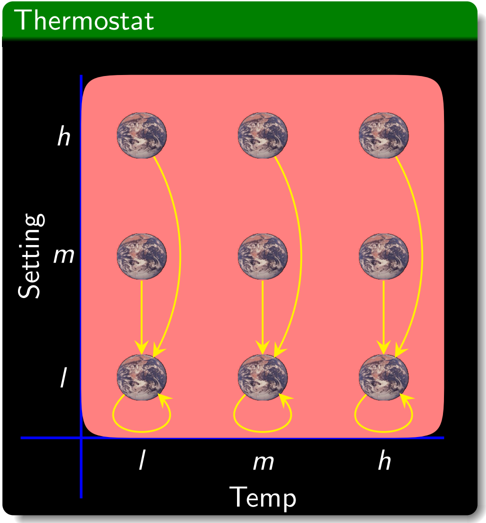

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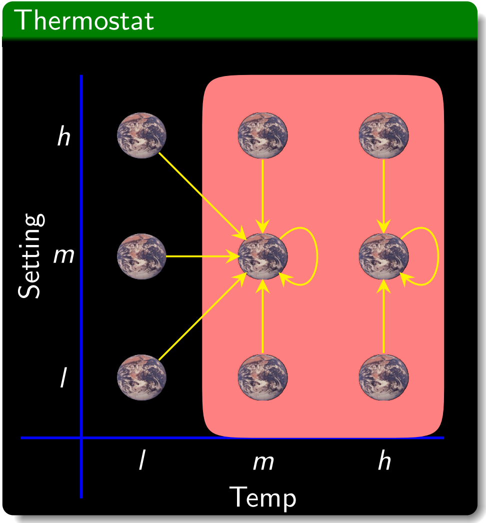
Contexts and transition systems



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Contexts and transition systems

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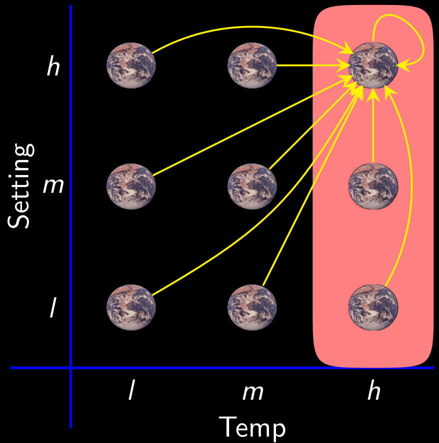

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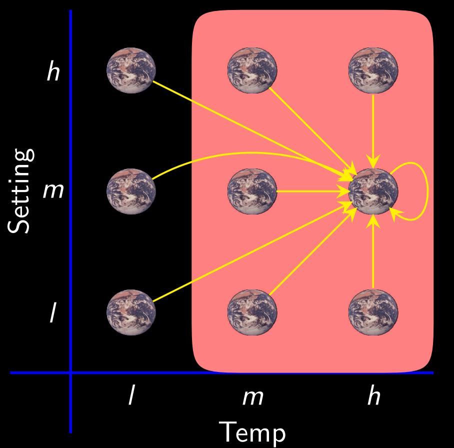
Contexts and transition systems

Thermostat



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Contexts and transition systems

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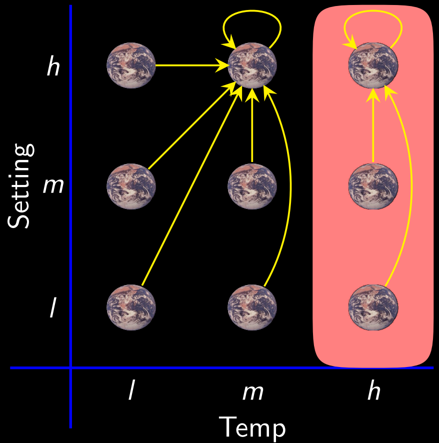

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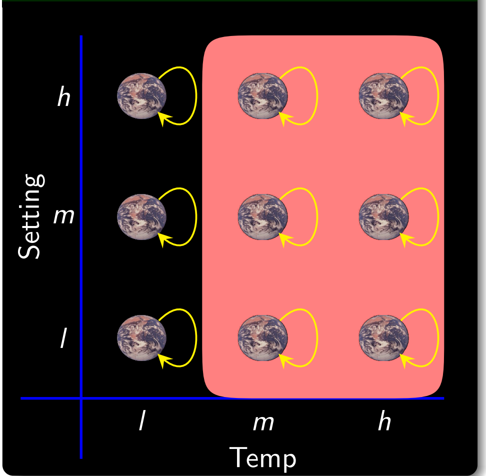
Contexts and transition systems

Thermostat



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Fulfillment

An artifact o *(weakly/strongly) fulfills f* wrt τ

$$\Updownarrow$$

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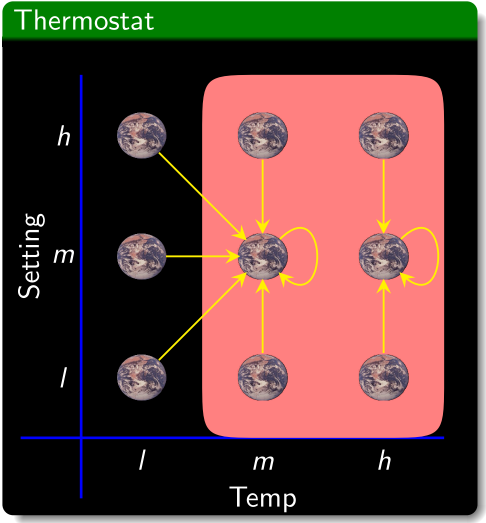

Token	fulfills f
Working	l, m, h

Contexts and transition systems

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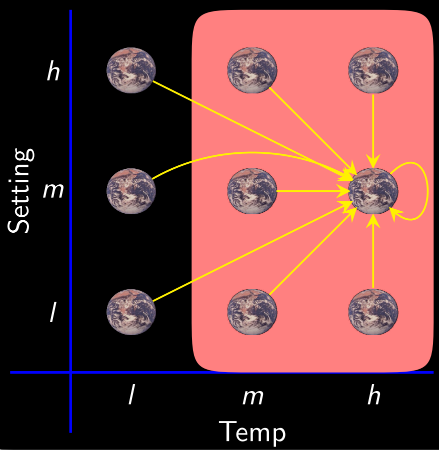

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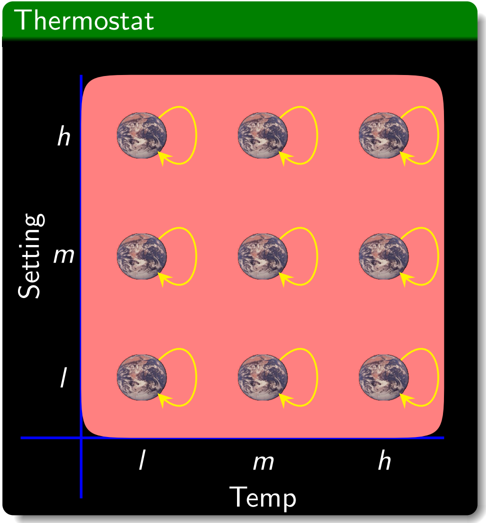
Contexts and transition systems



Token	fulfills f
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A thermostat t fulfills f wrt x

$\Updownarrow$

Setting t to x realizes $T \geq x$.

A thermostat t *universally fulfills* f

$\Updownarrow$

t fulfills f wrt every x.

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Normal fulfillment:

every "*normal*" $o \in T'$ fulfills f.

Normal tokens: the controversial bits

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Normal tokens are useful fictions.
Express how T-things are expected to behave.

Normal tokens: the excuses

We add fictional objects to our semantics?

What are you thinking?

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- Distinguishes subtypes.

Normal tokens: subtypes

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Normal flare guns aren't normal guns.

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- A philosophical treatment of "normal tokens".
- Add efficacy to functions.
- A formalization of malfunction.
- Types and function inheritance.
- Everything else.