

Computer Simulation As a Tool for the Philosopher

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Computing in philosophy

- Pedagogy (Logic, Ethics, Causation, Mathematical Philosophy)
- Philosophy of computation, AI, technology
- Automated reasoning, automated theorem proving
- Computer aided model construction
- Simulation

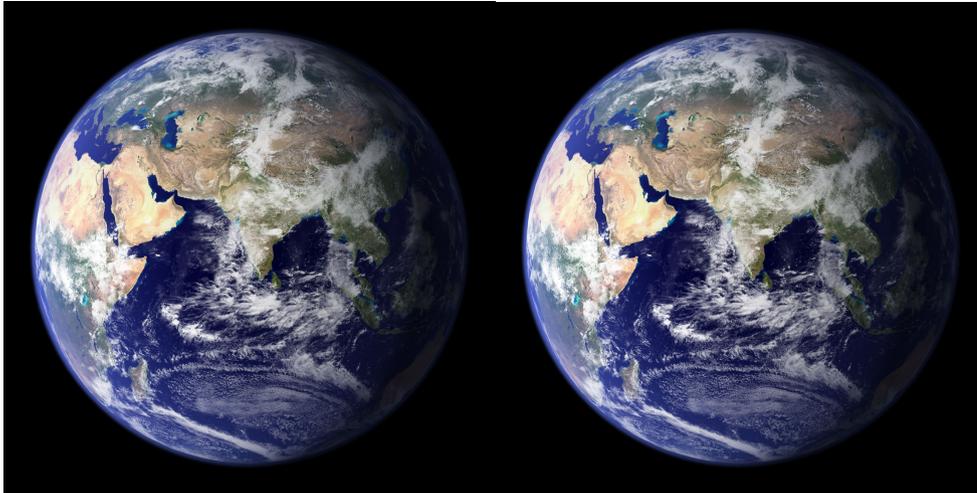
Thought experiments



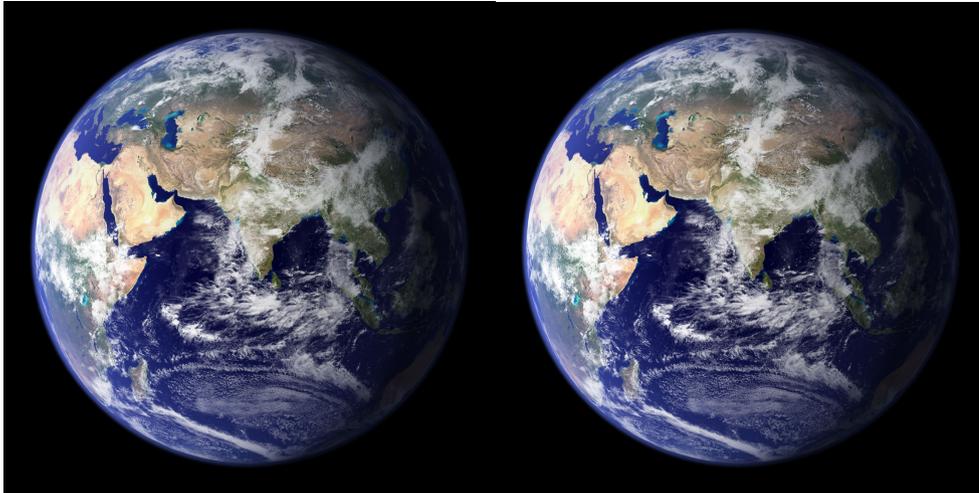
Thought experiments



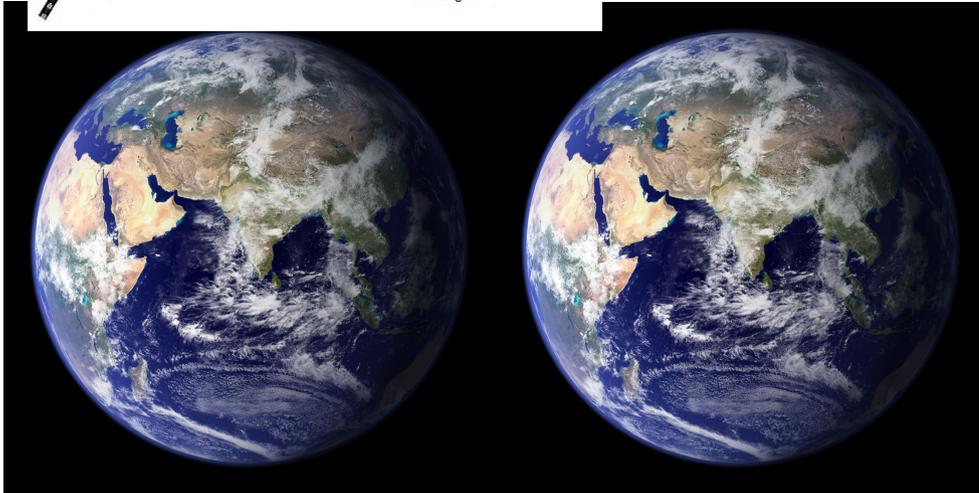
Thought experiments



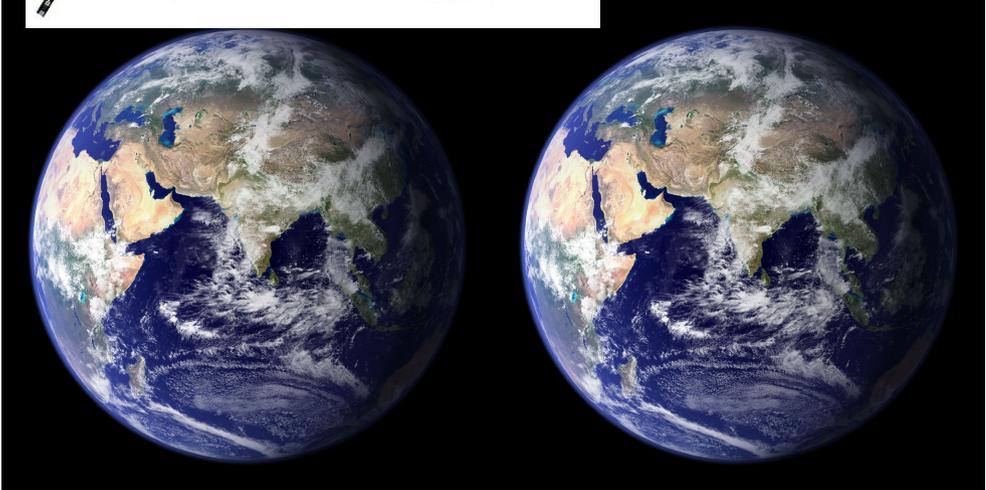
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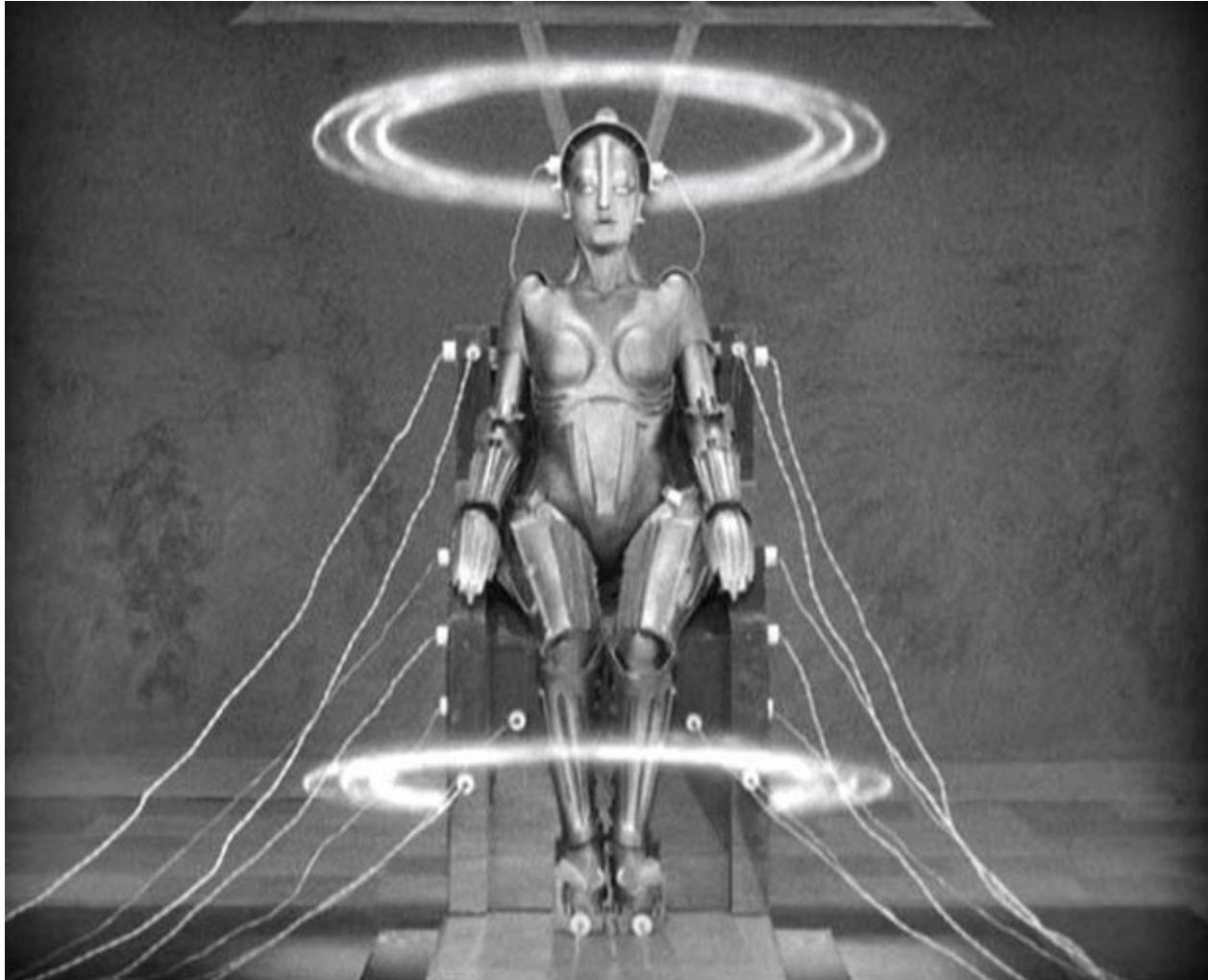
Thought experiments



Thought experiments



Thought experiments



Simulation as thought experiment

The first question that arises frequently—sometimes innocently and sometimes not—is simply, "Why model?" ... my favorite retort is, "You are a modeler." Anyone who ventures a projection, or imagines how a social dynamic—an epidemic, war, or migration—would unfold is running some model.

But typically, it is an implicit model in which the assumptions are hidden, their internal consistency is untested, their logical consequences are unknown, and their relation to data is unknown. But, when you close your eyes and imagine an epidemic spreading, or any other social dynamic, you are running some model or other. It is just an implicit model that you haven't written down

Epstein, J.M. (2008) "Why Model?" JASSS

Simulation as thought experiment

- Forces precision in assumptions, theories, and results
- Often illuminates hidden biases and missing details

An example from testimony

[W]hen I ask a stranger on the street for directions to the Empire State Building, do I have enough information about her to justify my accepting her testimony that it is six blocks north? Or, traveling to London for the first time, do I have enough evidence about a random British newspaper to adequately justify the beliefs I acquire while reading it?

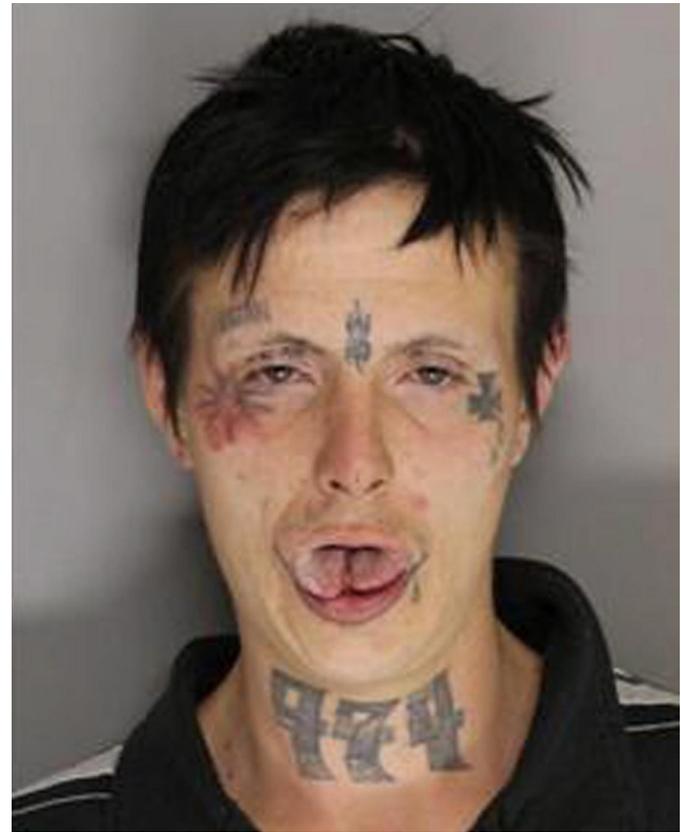
This, to my mind, is a very compelling objection to reductionism.

Lackey, J. (1990) *Learning from Words*

An example from testimony



An example from testimony

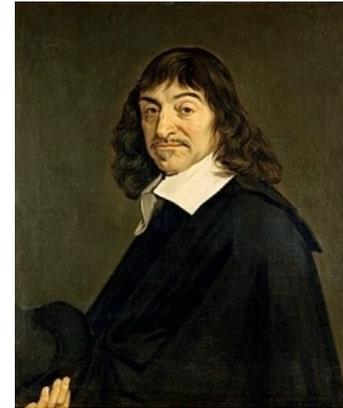


Kenyon, T. (2013) "The informational richness of testimonial contexts"
Philosophy Quarterly

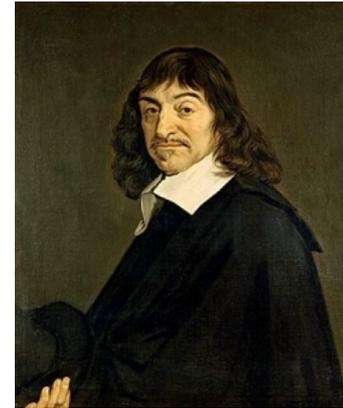
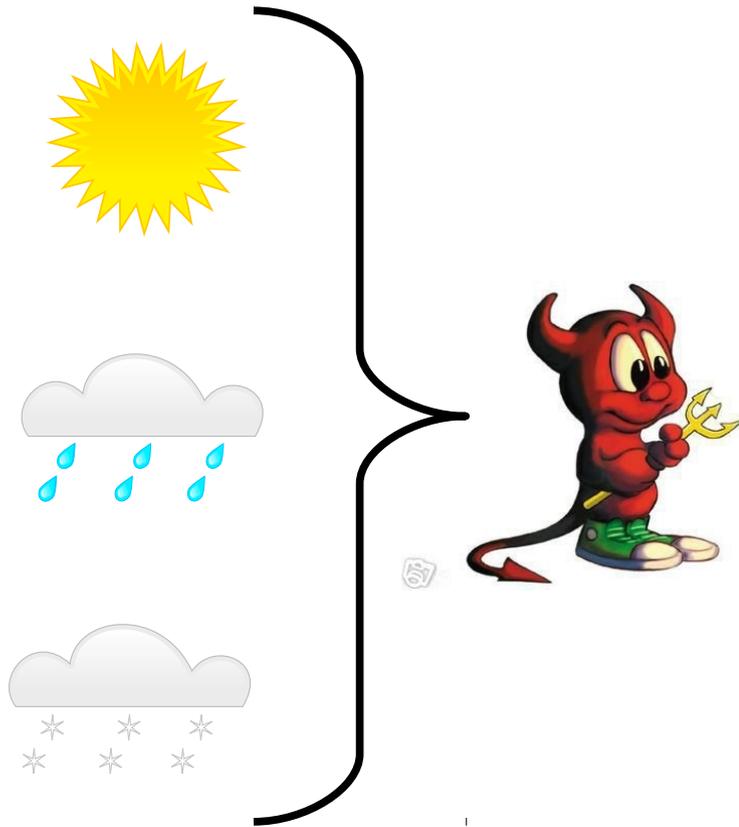
Simulation as thought experiment

- Forces precision in assumptions, theories, and results
- Often illuminates hidden biases and missing details
- Can handle complex systems

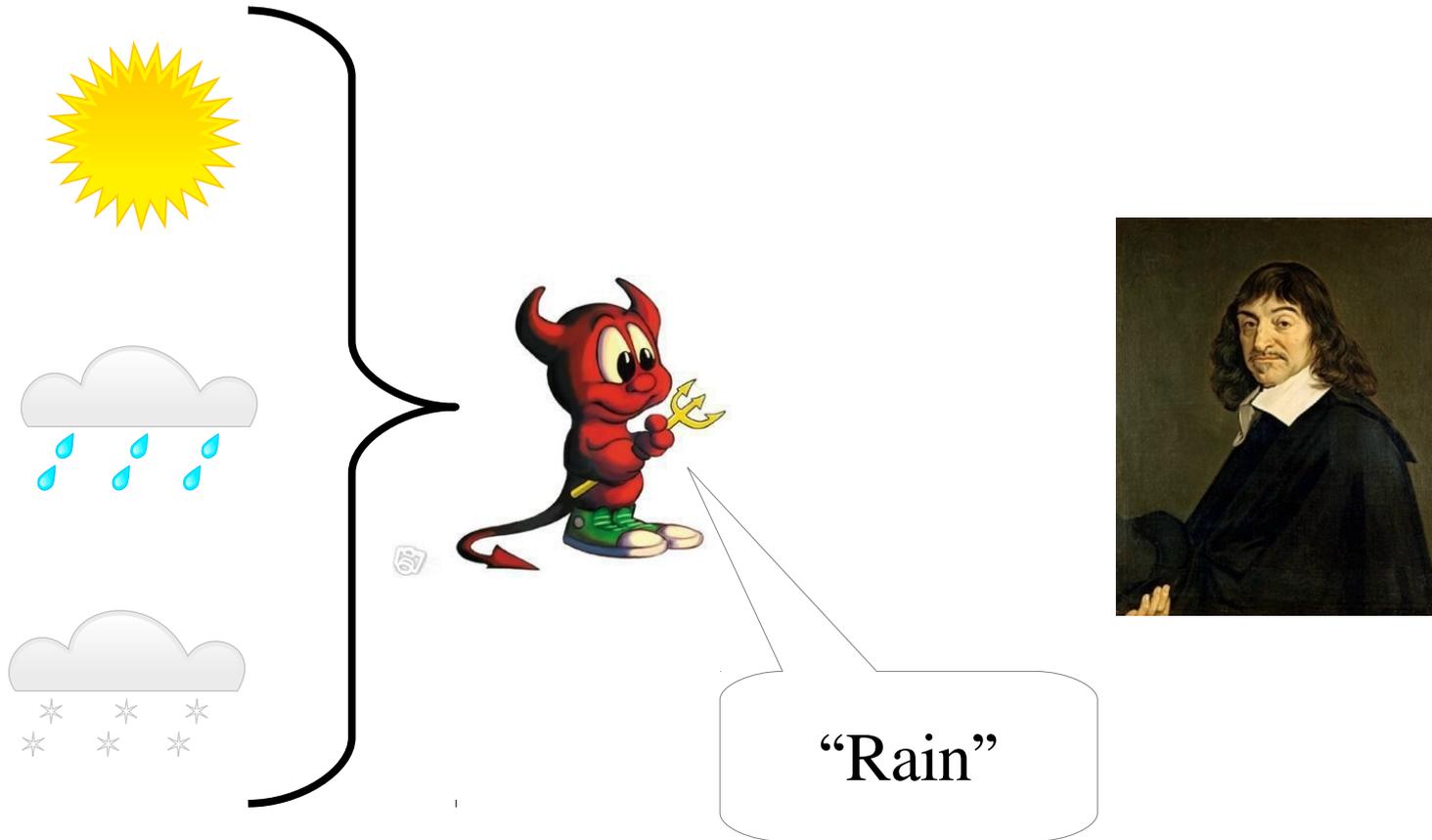
An example



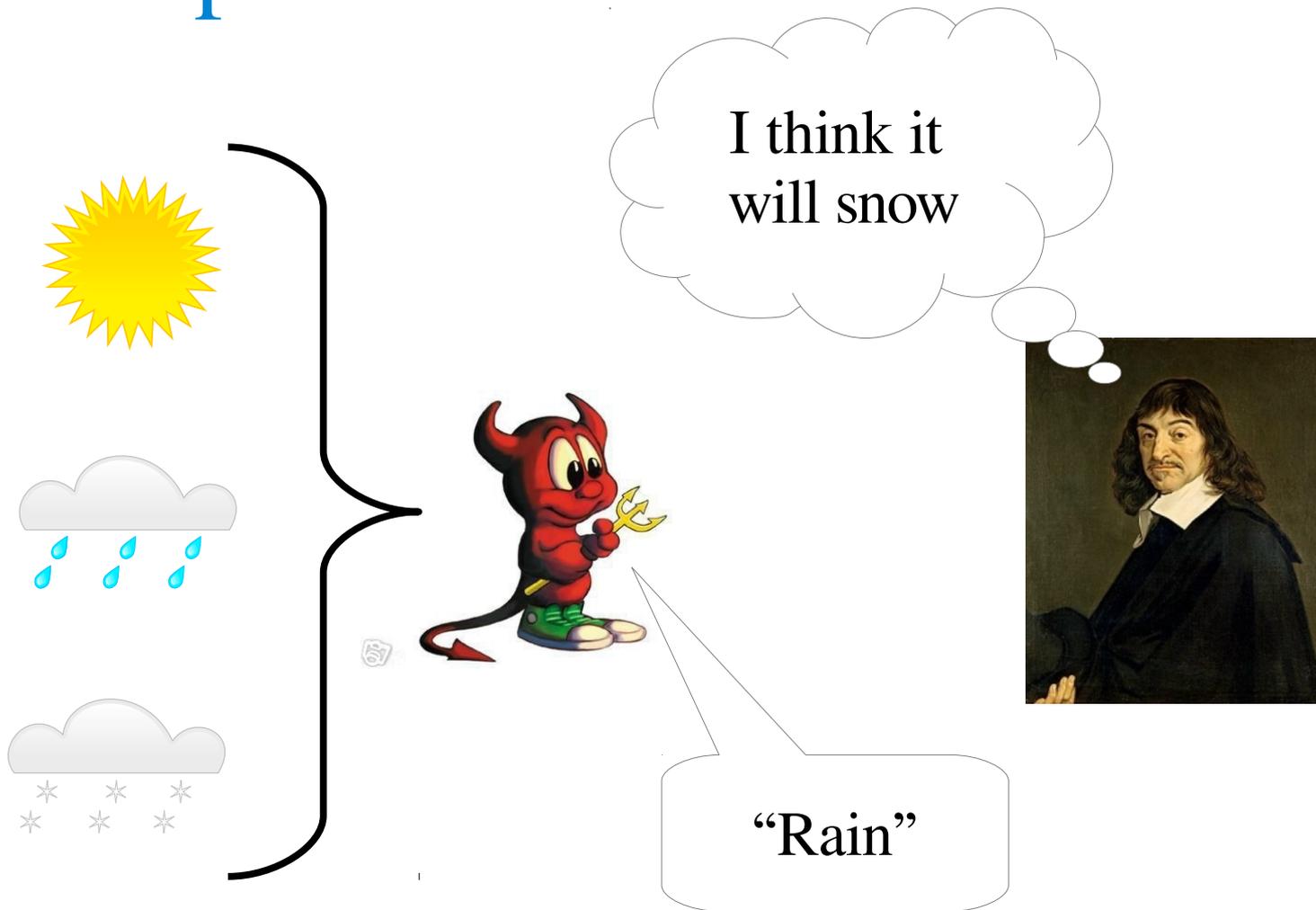
An example



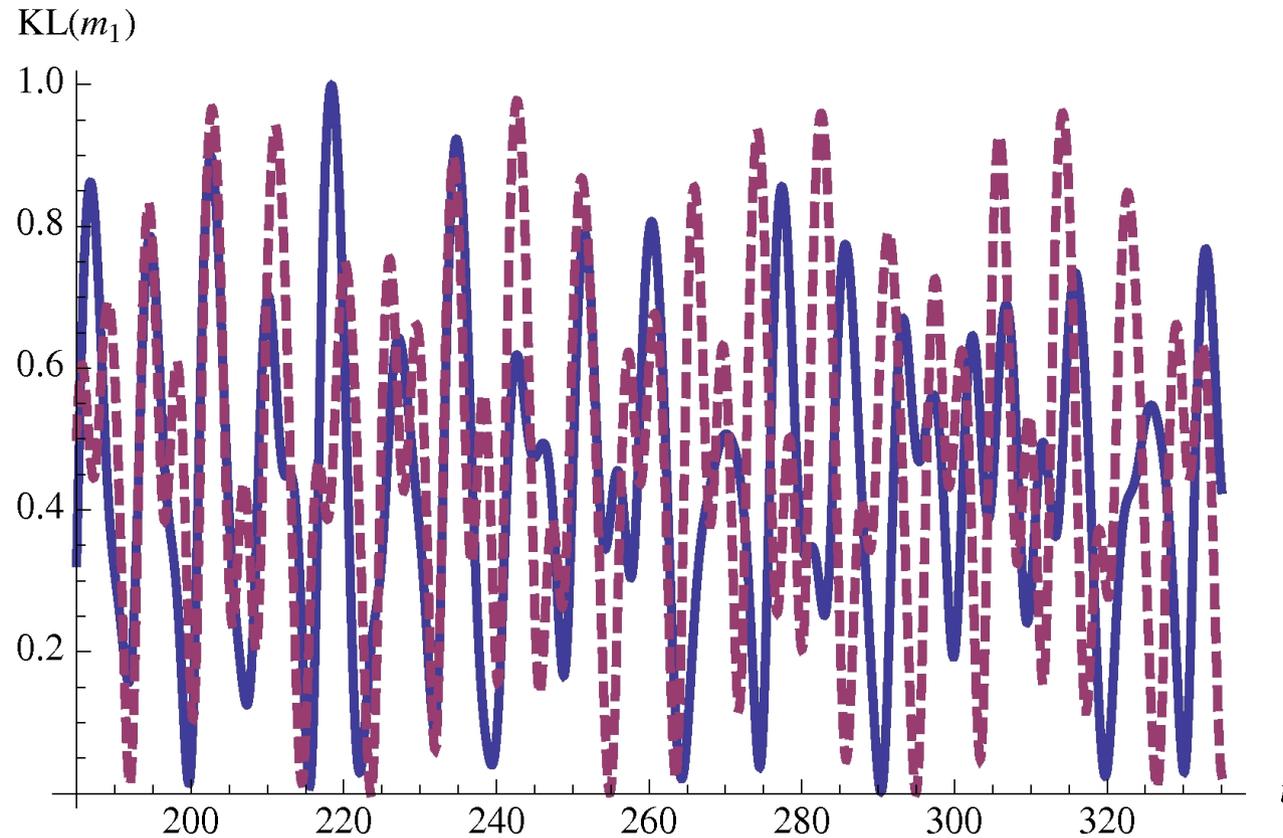
An example



An example

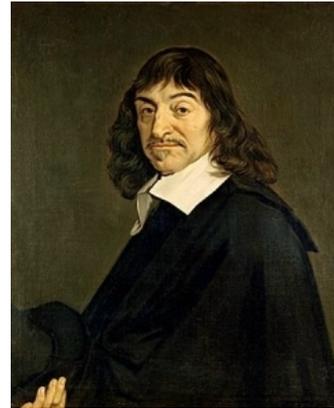


Chaos

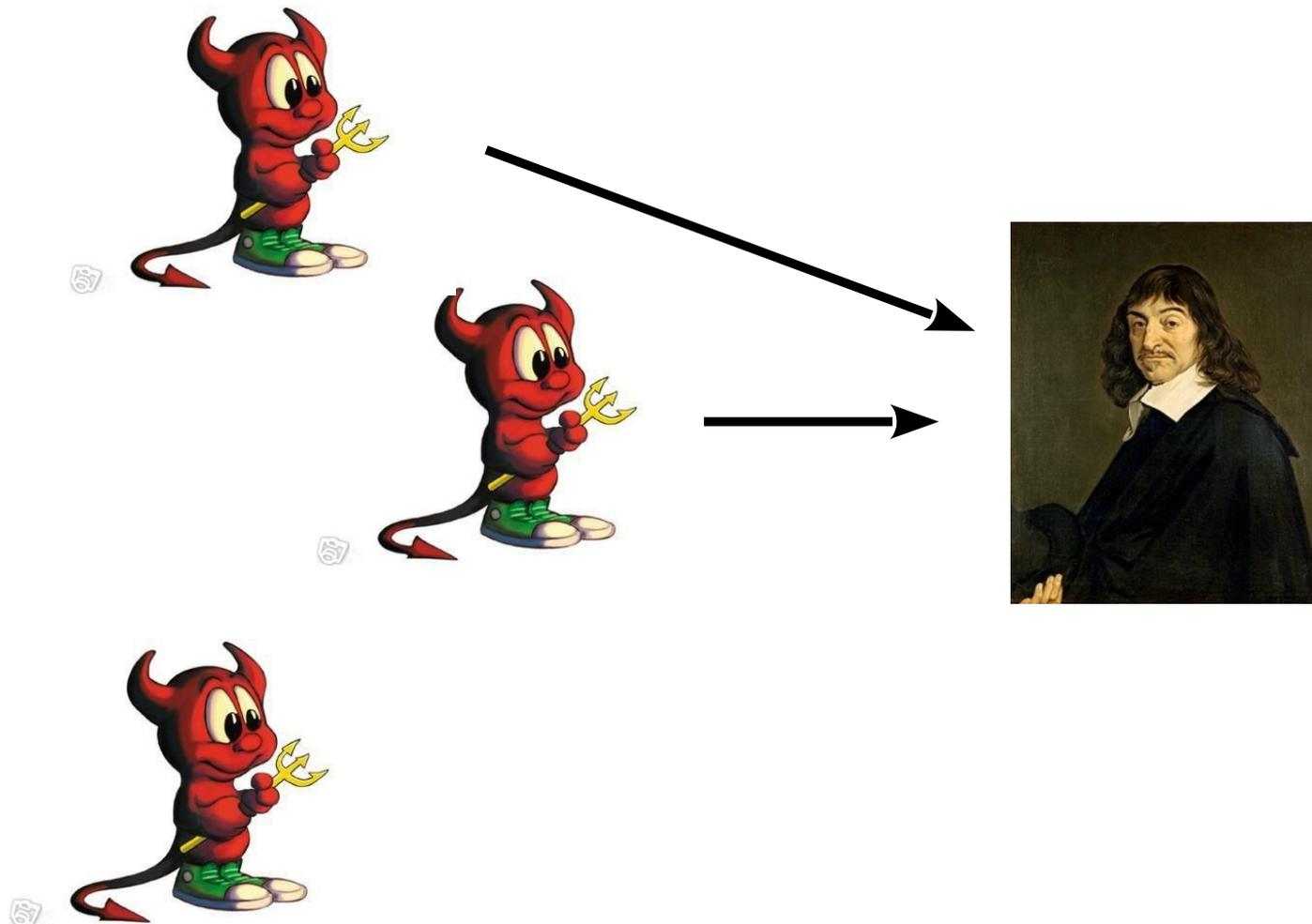


Wagner, E. (2011). Deterministic Chaos and the Evolution of Meaning.
British Journal for the Philosophy of Science.

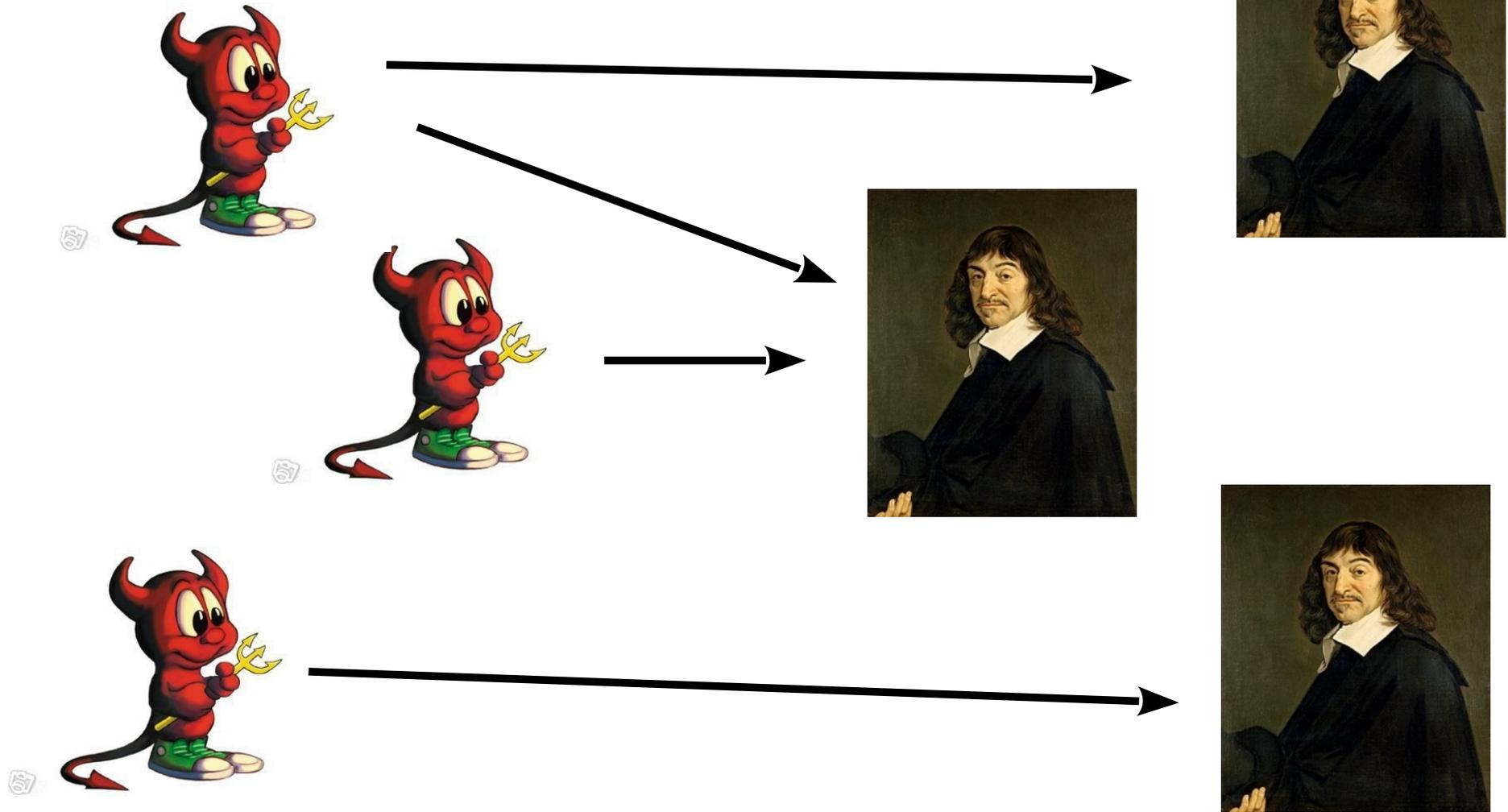
More...



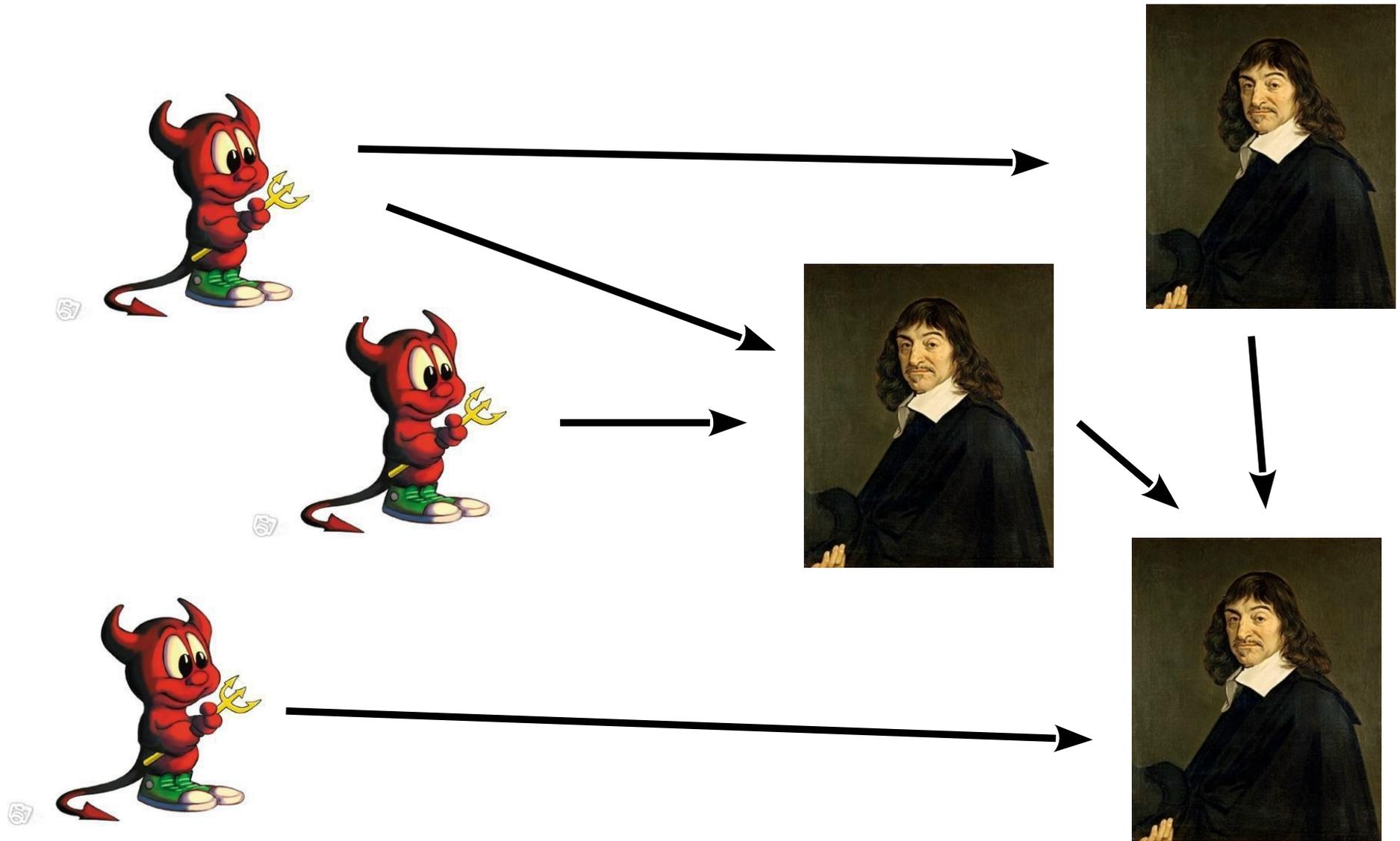
More...



... and more ...



... and more.



Simulation as thought experiment

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- Often illuminates hidden biases and missing details
- Can handle complex systems

Objections to modeling

- Your model is not true

Models are false

- Everyone idealizes
- Much of model based reasoning is inductive
- Many forms of scientific reasoning are “false” in a strict sense

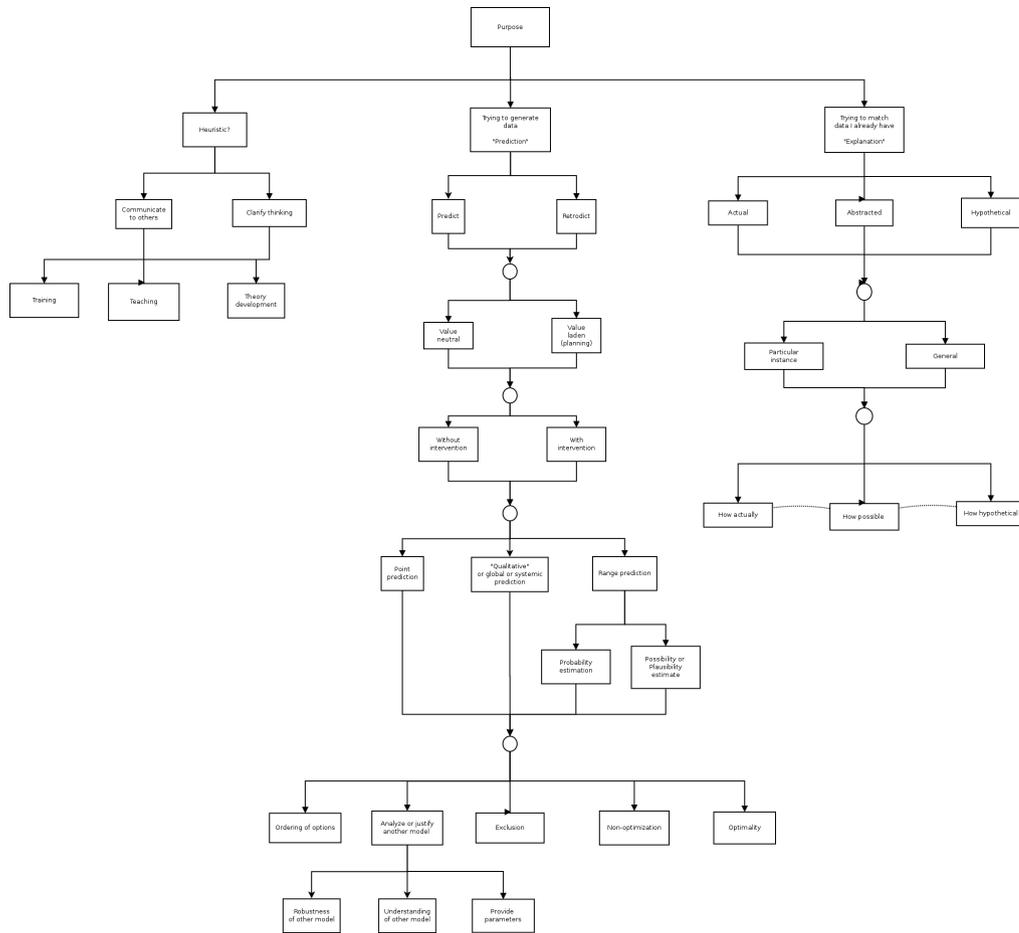
Objections to modeling

- Your model is not true
- Your model is not “validated”

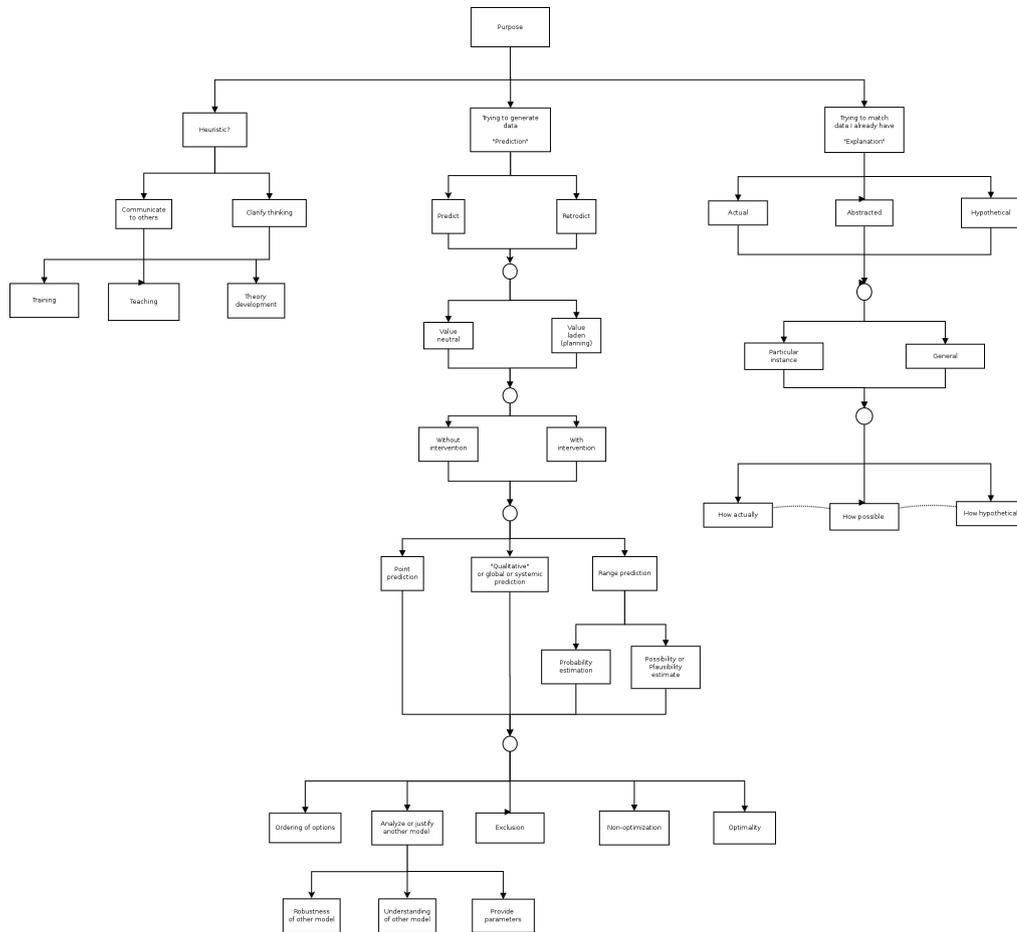
“Validation”

- Means something like: testing predictions or parameter settings against the world or against another “validated” model
- Sometimes it important sometimes not

Idealization in models



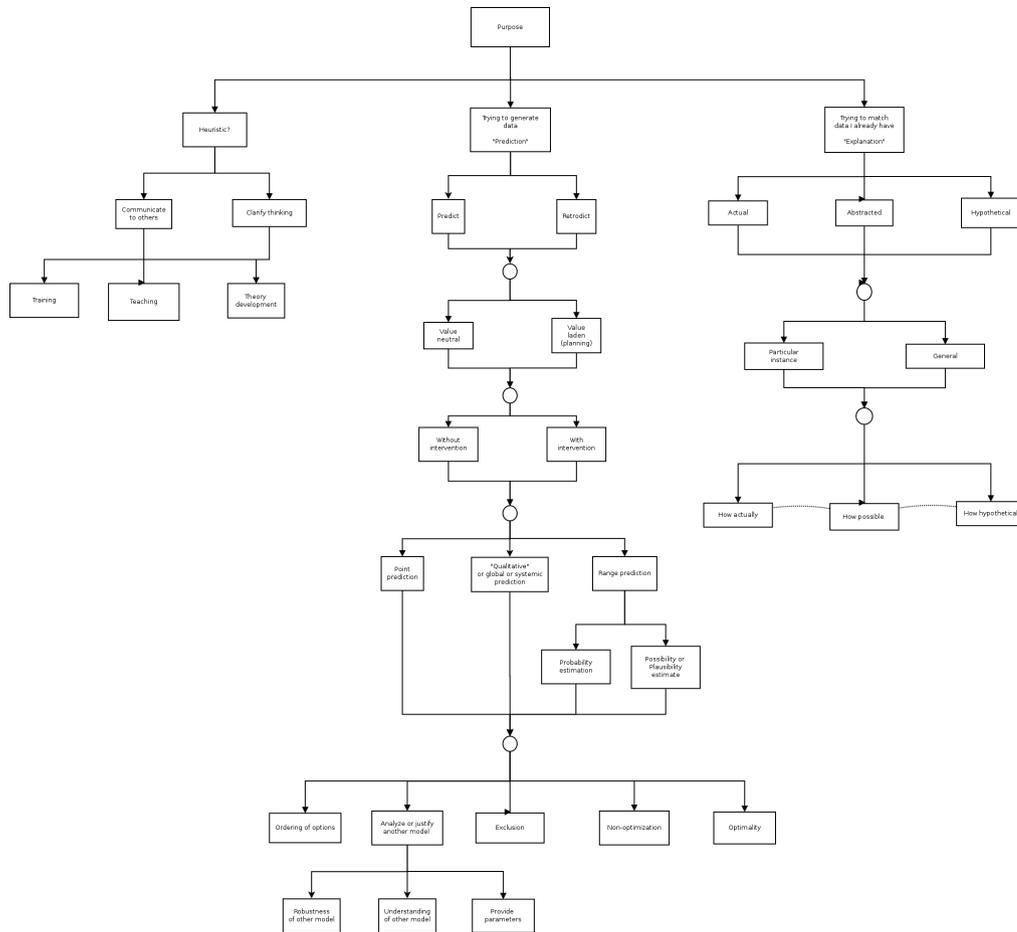
Idealization in models



An example:

How little structure is needed for a collection of small agents to be able to generate arbitrarily complex behavior?

Idealization in models



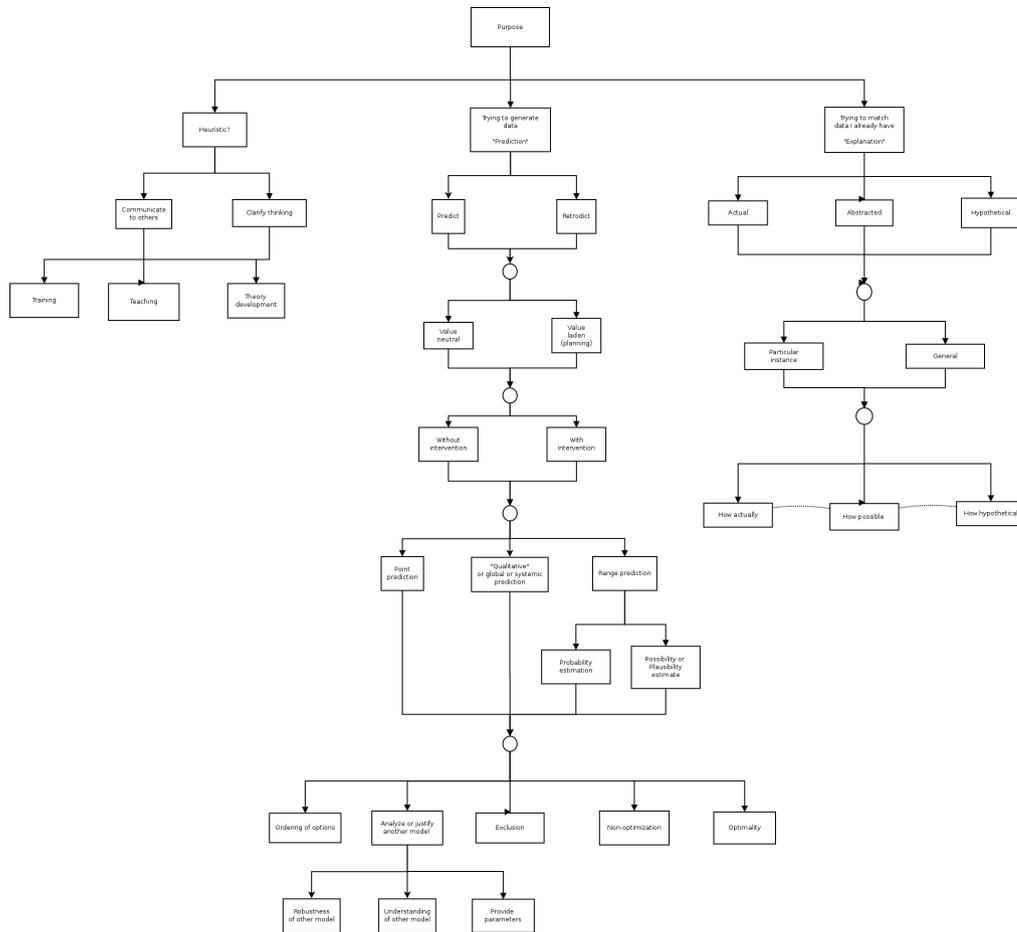
An example:

How little structure is needed for a collection of small agents to be able to generate arbitrarily complex behavior?

Answer: Very, very little

Cook, M. (2004) *Universality in Elementary Cellular Automata*
Complex Systems 15: 1
 (Often, incorrectly, attributed to Wolfram)

Idealization in models



Second example:

How little in terms of cognitive abilities is needed to learn language?

Answer: The simplest “learning” will suffice

Huttegger, H., B. Skyrms, and K. Zollman (2014) “Probe and adjust in information transfer games”
Erkenntnis

“Validation”

- Means something like: testing predictions or parameter settings against the world or against another “validated” model
- Sometimes it important sometimes not
- More critical: do the results depend on the implausible assumptions (robustness)

Robustness replaces validation

Therefore, we attempt to treat the same problem with several alternative models each with different simplification but with a common biological assumption. Then, if these models, despite their different assumptions, lead to similar results we have what we call a robust theorem which is relatively free of the details of the model. Hence, our truth is the intersection of independent lies.

R. Levins (1966) “The Strategy of Model Building in Population Biology” *American Scientist*

Objections to modeling

- Your model is not true
- Your model is not “validated”
- You can't really understand models without proofs

Simulation vs. proof

- It's not about simulation vs. proof
- It's about doing more than reporting results

Conclusions

- Simulations should be seen as a natural part of philosophical method
- Objections to simulations suggest how to best use simulations, but do not eliminate them as a tool for the philosopher