

# Foundations of Mechanistic Reasoning

PhDs in the Humanities PhD project

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# Glyphosate







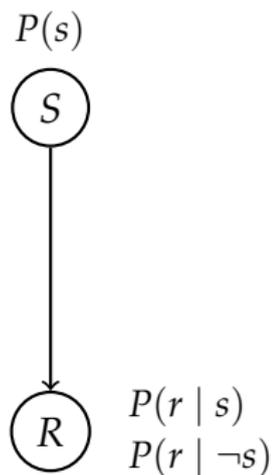
## European Chemicals Agency

- Only statistical evidence is valid
  - Epidemiological data
  - Studies on animals
  - Mostly conducted by industry itself

## World Health Organisation

- “The mechanistic data provide strong evidence” that glyphosate causes cancer
- But what is *mechanistic evidence*?

# Bayes net



The rooster's crow does not cause sunrise

# Is causality all just probability?

- Given binary variables  $X$  and  $Y$ , say  
 $X$  raises the probability of  $Y$  just in case  $P(y | x) > P(y)$ .

Fact. Probability-raising is symmetric

$X$  raises the probability of  $Y$  iff  $Y$  raises the probability of  $X$ .

Proof.

$$\begin{aligned} P(y | x) &> P(y) \\ \frac{P(x | y)P(y)}{P(x)} &> P(y) && \text{Bayes rule} \\ P(x | y) &> P(x) && \times \frac{P(x)}{P(y)} \end{aligned}$$

□

∴ Probability-raising does not represent causal **asymmetry**

Example

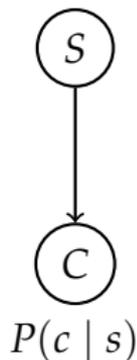
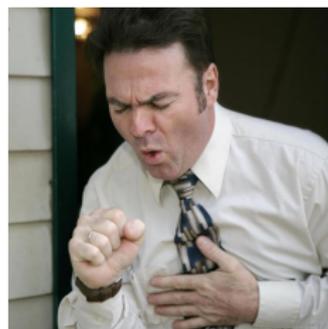
Seeing someone smoke raising the probability that they cough

is equivalent to

Seeing someone cough raising the probability that they smoke

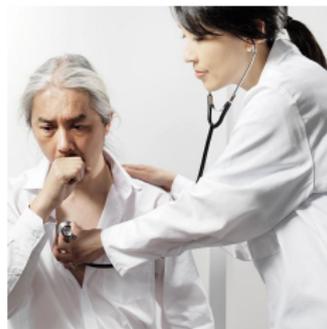
# Asymmetry by intervention

## Observation

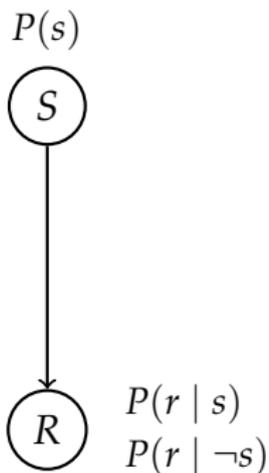


**Seeing** someone cough  
raises one's credence that  
they smoke

## Intervention



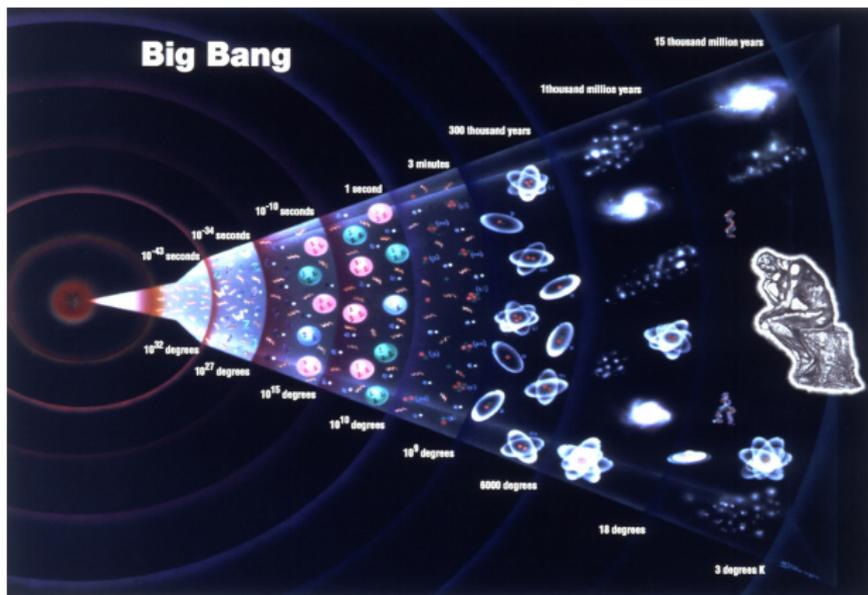
**Making** someone cough  
does *not* raise one's credence  
that they smoke



What does it mean for this model to describe the actual world?

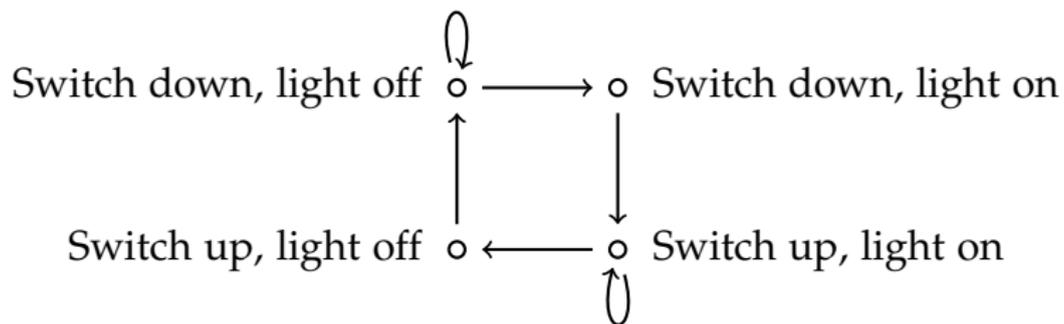
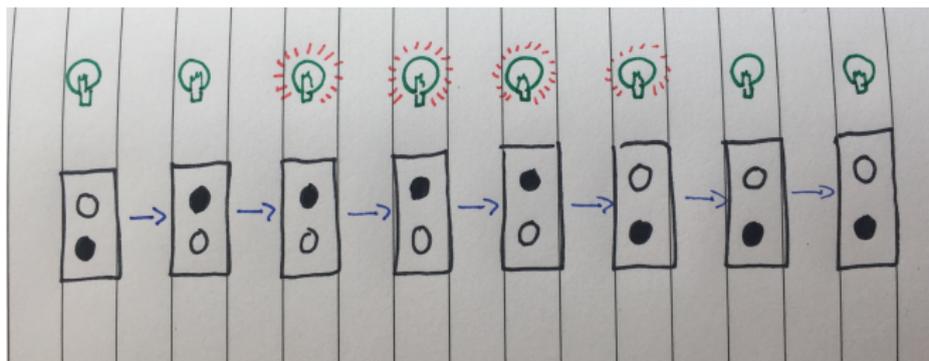
- Probability raising?
- Intervention?
- Temporal modality

# Is causality all just intervention?

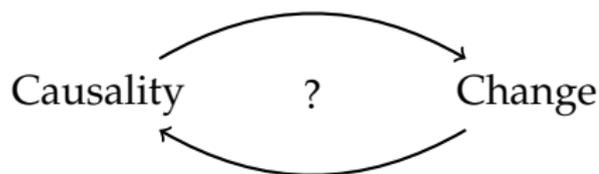


- There are causal relations at the big bang
- But what would it mean to *intervene* in the big bang?
- Intervention is too anthropocentric

# Temporal modality



# Causality and change

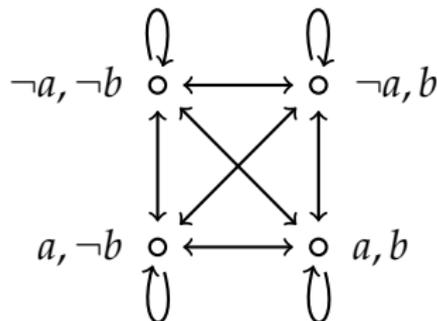


- There's no causality without change,
- But there is **change without causality**

Causality



Change



[...] we are ignorant of those powers and forces, on which [the] regular course and succession of objects totally depends.

Hume, *Enquiry* 4