

Probabilities as extensions of logic

A implies B

What does B say
about A?

A: it is raining

B: There are clouds

If A is true, then B is true



If B is true, my assessment about the
plausibility of A should change?

How much should it change?

Cox showed that the correct tool for this
type of reasoning was probabilities!

Likelihood of an observation

- The Likelihood asks us to imagine a possible world, and in that world, figure out what could happen
- Think of the likelihood in a story. It is not how plausible it is that it really happened in the real world, but how consistent the events of the story are with the world in which it happens

$$P(\text{Events} \mid \text{Assumed World})$$

- Mathematically, the Likelihood is just a count of how many ways something could happen under some hypothesis about the world
- The more ways to produce a data set under a hypothesis, the higher the likelihood attributed to a data set under that hypothesis

$$P(y \mid \theta)$$