2. Conditional Probability and Bayes' Rule

$$P(A|B) \neq P(B|A)$$

How should we update our beliefs in light of the evidence we observe? *Bayes' rule* is an extremely useful theorem that helps us perform such updates.

Together, Bayes' rule and the law of total probability can be used to solve a very wide variety of problems.

2.1 The importance of thinking conditionally

A useful perspective is that all probabilities are *conditional*

A and B events, $P(B) > 0$, then *conditional probability* of A given B:

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

A is the event whose uncertainty we want to update, and B is the evidence we observe.

$P(A)$ is called *prior probability* of A.

$P(A|B)$ is called *posterior probability* of A.

$P(A|B)$ is the probability of A given the evidence B, **not** the probability of some weird entity called $A|B$.