

# PHIL 105 Bayes Theorem

## Bayes Theorem

Fire alarm rings.

We think that it is a false alarm.

We aren't concerned about this because we must assign the probability of a fire given an alarm a low chance.

$P(\text{Fire}|\text{Alarm})$

$P(\text{Fire}|\text{Alarm}) = \text{Alarms with fire} / \text{Alarm}$

// note that the denominator can be written as a sum

//  $\text{Alarms with fire} + \text{Alarms without fire}$

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Hypothesis (GC): My girlfriend is cheating on me.

New Evidence (TWL): She texts me that she's working late.

What's the chance that she's cheating on me.

1. How likely was GC before the new evidence.  $P(\text{GC})$  // Prior probability

2. How strong is the new evidence: // a ratio

$P(\text{TWL} | \text{GC}) / P(\text{TWL} | \sim \text{GC})$  // ratio of being right vs being wrong

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$P(A \text{ and } B) = P(A|B)P(B) = P(B|A)P(A)$

$P(B|G) = (P(G|B)*P(B)) / P(G)$

$P(\text{Hypothesis} | \text{Evidence}) = (P(E|H) * P(H)) / P(E)$

$P(H)$  - Prior probability

Base rate or plausibility

$P(H|E)$  - Updated probability (Posterior probability)

We update our beliefs or Hypothesis based on evidence

$P(G) = (\text{Green Animals}) / (\text{Green Animals and non-green Animals})$

$P(H|E) = (P(E|H)P(H)) / (P(E|H)P(H) + P(E|\sim H)*P(\sim H))$

If the probability goes up then it is confirmed. Is supported, it is confirmed.