What is probability?

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Event: Observing a T-rex running a marathon.

Random

Event: A coin toss resulting in either heads or tails.

Probability = 0 = 0 % (impossibility)

Probability = 1 = 100% (certainty)

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Classical Probability

When we have a finite set of outcomes, and each outcome is equally likely, the probability is the proportion of outcomes that make up the event.

Example: Flipping a coin.

$$\mathrm{P}(\text{Tails}) = 0.5 = 50\%$$

$$\frac{1}{2}$$

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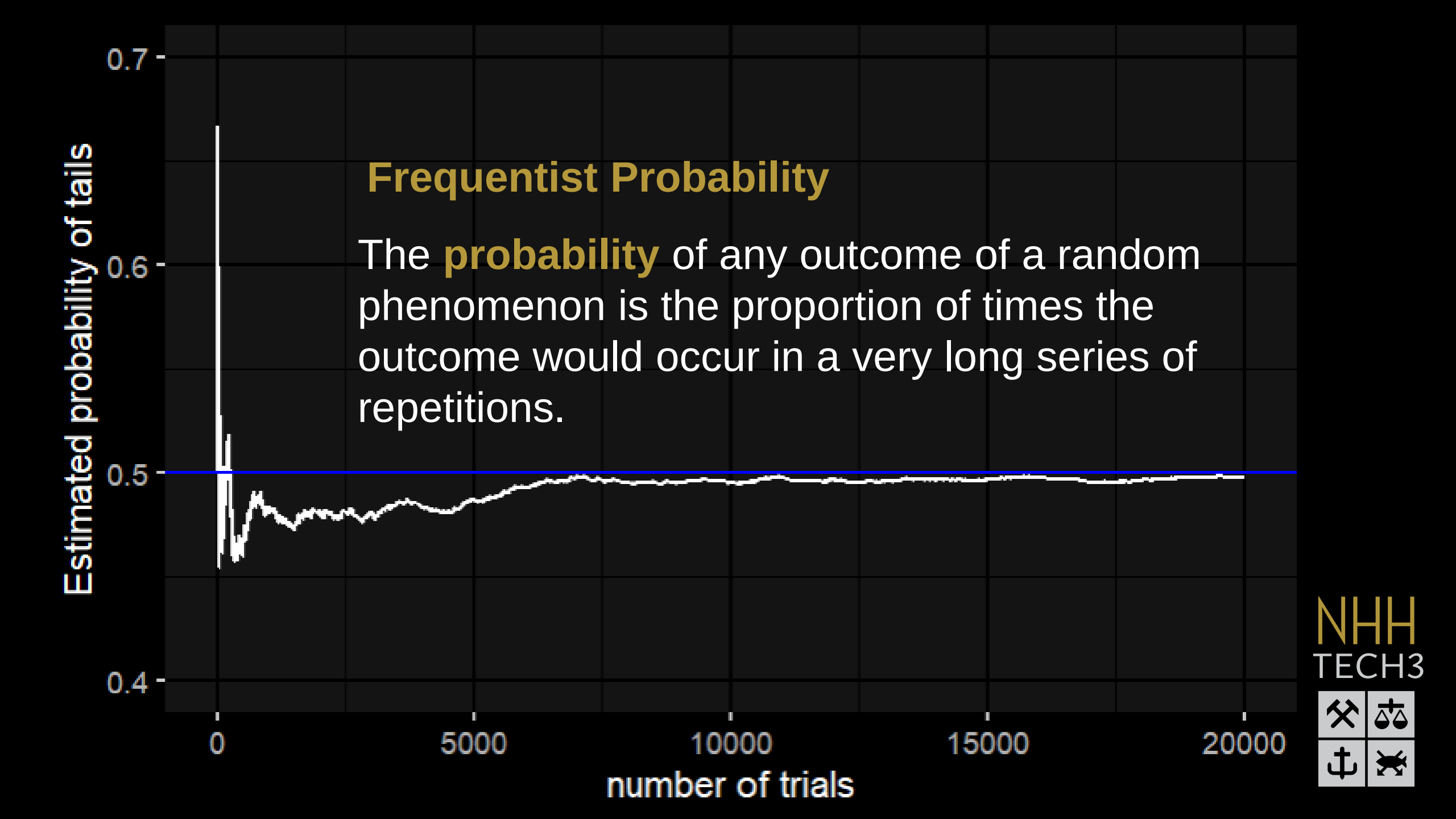

Frequentist Probability

The **probability** of any outcome of a random phenomenon is the proportion of times the outcome would occur in a very long series of repetitions.

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Subjective Probability (Personal belief)

In many cases personal knowledge and/or opinion is the only guide we have in determining the probability of an event.

Example: What is the probability that a particular startup will become a unicorn (valued at over $1 billion) in 5 years?

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Bayesian probability

Bayesian probability interprets probability as a **degree of belief** that gets updated as new data becomes available.

Example: You start with a prior belief that a coin is fair (50% tails).

Do you still have the same belief after flipping it 100 times and observing 80 tails?

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Interpretation	Meaning	Key Question	Example
Classical	Based on equally likely outcomes	"What proportion of outcomes are favorable?"	Rolling a fair die, P(4) = 1/6
Frequentist	Based on long-run relative frequency	"How often does the event occur over many trials?"	Rain occurred 30% of the time historically.
Subjective	Based on personal belief or judgment	"How confident am I that this event will occur?"	You think your team has a 10% chance of placing top 4 in the league.
Bayesian	Combines belief and evidence	"How does new evidence change my belief?"	Updating beliefs about a biased coin.

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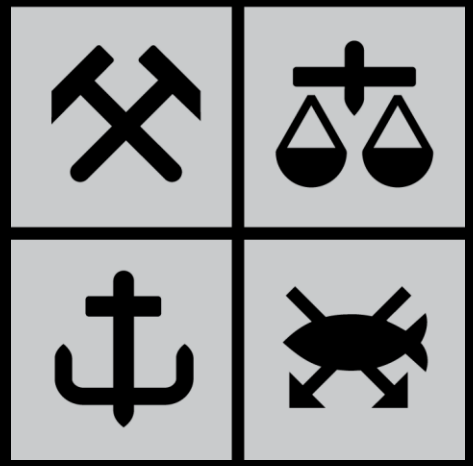

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