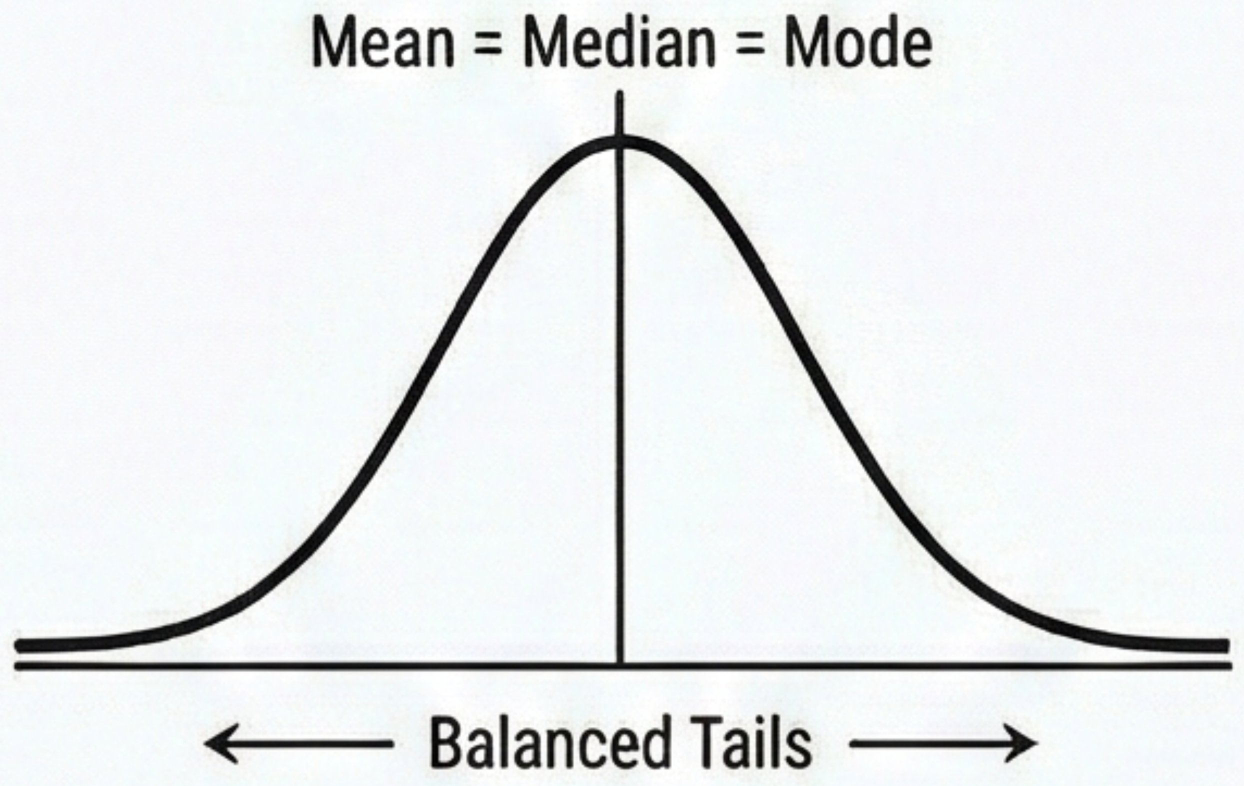
SKEWNESS: ASYMMETRY IN DATA DISTRIBUTION

A measure of the lack of symmetry in a probability distribution. It quantifies the 'tail' behavior.

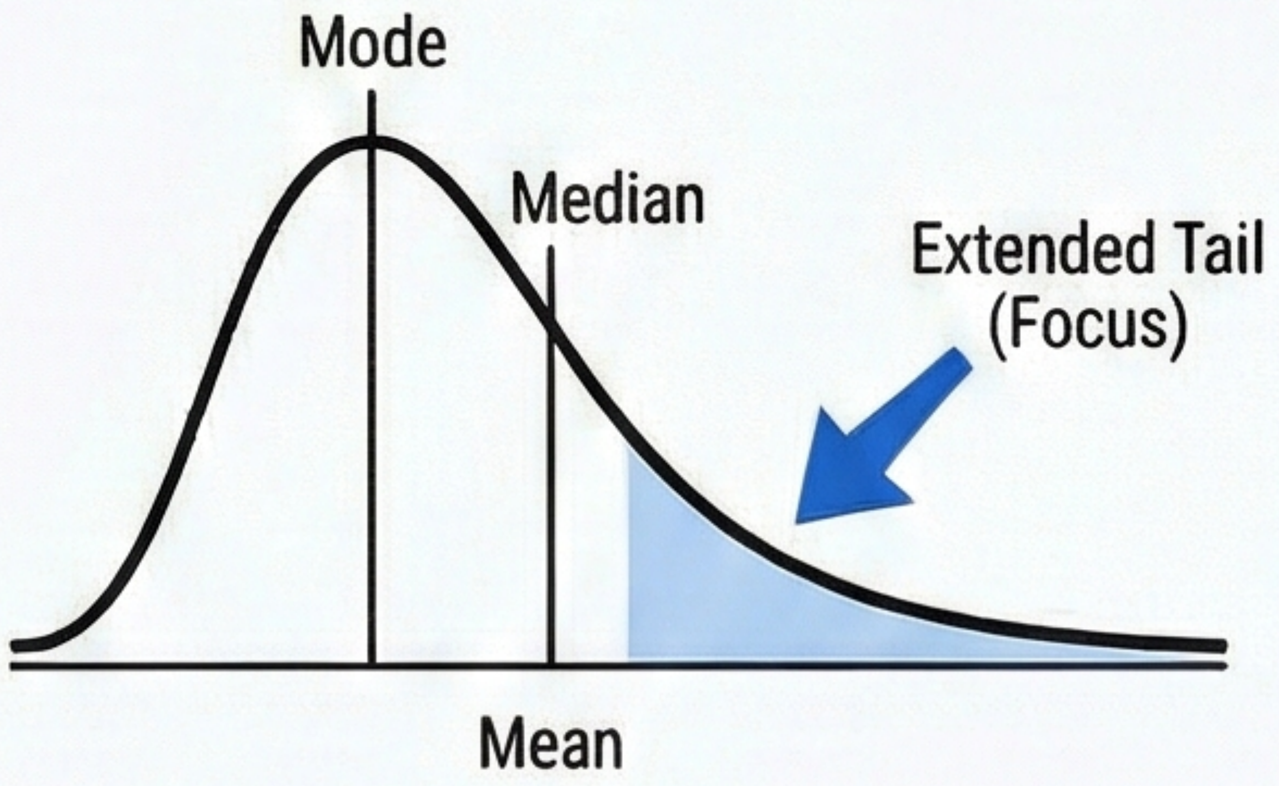
MODULE 1: THE FOUNDATION (Symmetry vs. Asymmetry)

CORE CONCEPT: DEVIATION FROM NORMALITY

SYMMETRICAL DISTRIBUTION
(Normal)



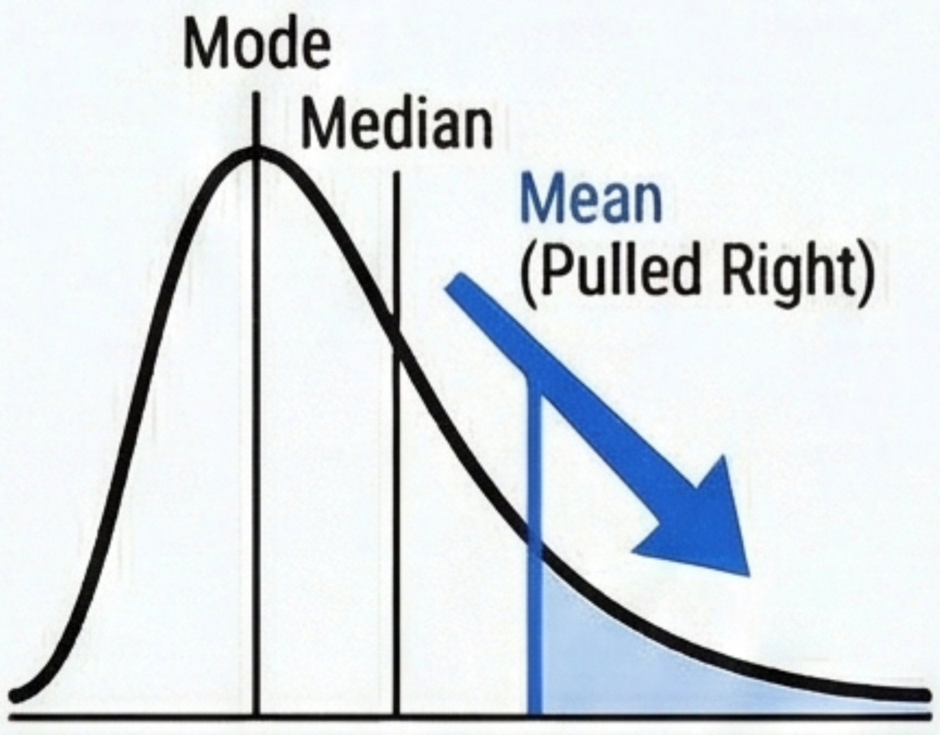
ASYMMETRICAL DISTRIBUTION
(Skewed)



MODULE 2: TYPES OF SKEWNESS (A Comparative Analysis)

THREE TYPES: VISUALIZING THE SHIFT

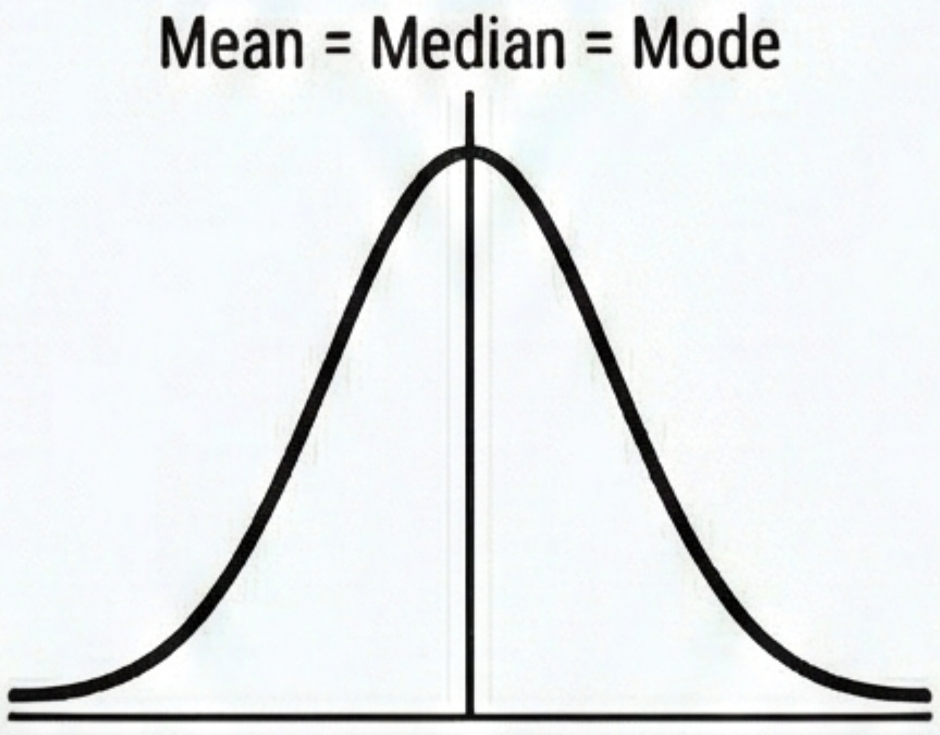
POSITIVE SKEW
(Right-Skewed)



Mode < Median < Mean

Example: Income Distribution (Few High Eamers, Long Right Tail).

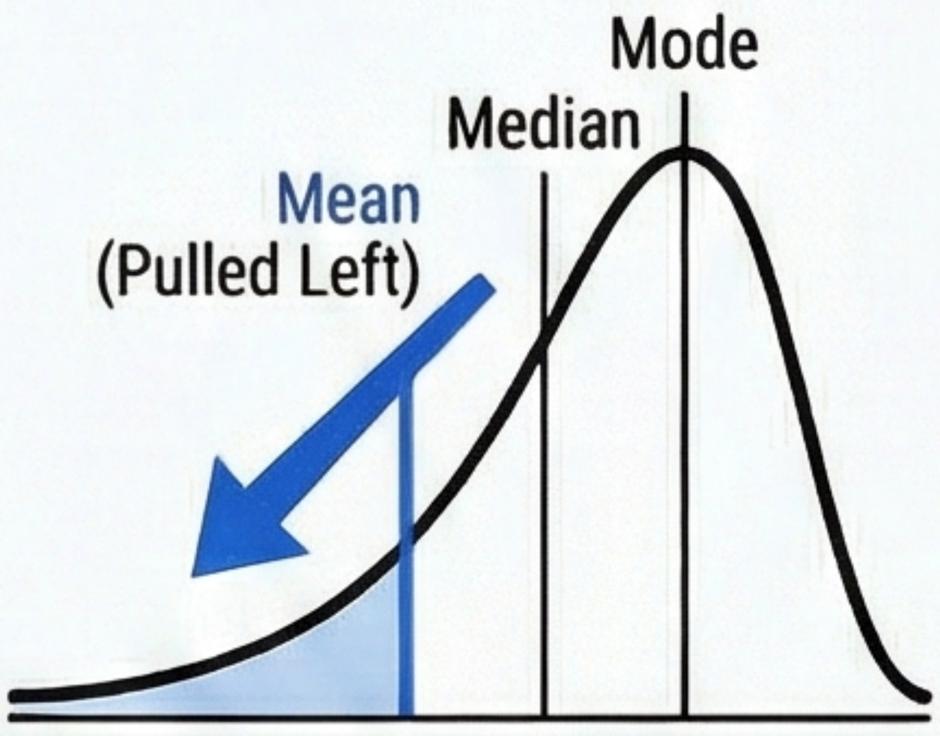
NORMAL DISTRIBUTION
(Symmetrical)



Skewness = 0

Example: Height, Standardized Test Scores (Most People Average).

NEGATIVE SKEW
(Left-Skewed)



Mean < Median < Mode

Example: Age at Retirement, Exam Scores in an Easy Test (Few Low Scores, Long Left Tail).

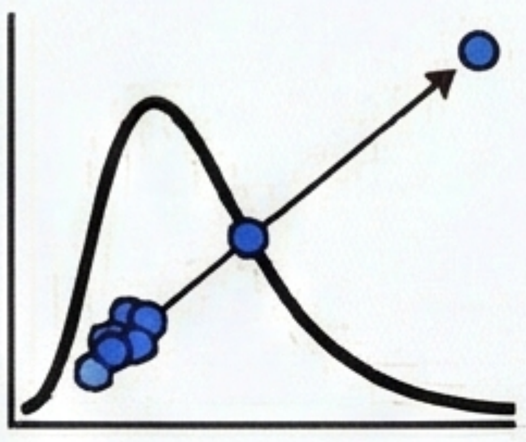
MODULE 3: IMPLICATIONS FOR DECISION-MAKING (Interpreting the Shift)

MANAGEMENT INSIGHT: IMPACT ON CENTRAL TENDENCY

MEAN vs. MEDIAN
(Focus on Robustness)

The **Cobalt Blue Mean** is highly sensitive to the skewed tail (outliers).

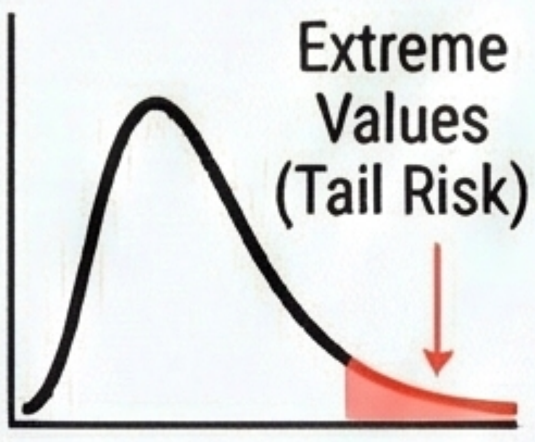
In skewed data, the **Median** is often a more robust and representative messure of the "typical" value for.



TAIL RISK
(Alert on Extremes)

The extended tail, indicated in **Vermilion**, represents extreme values or outliers.

Ignoring the tail can lead to underestimating risks or opportunities, especially in financial or operational.



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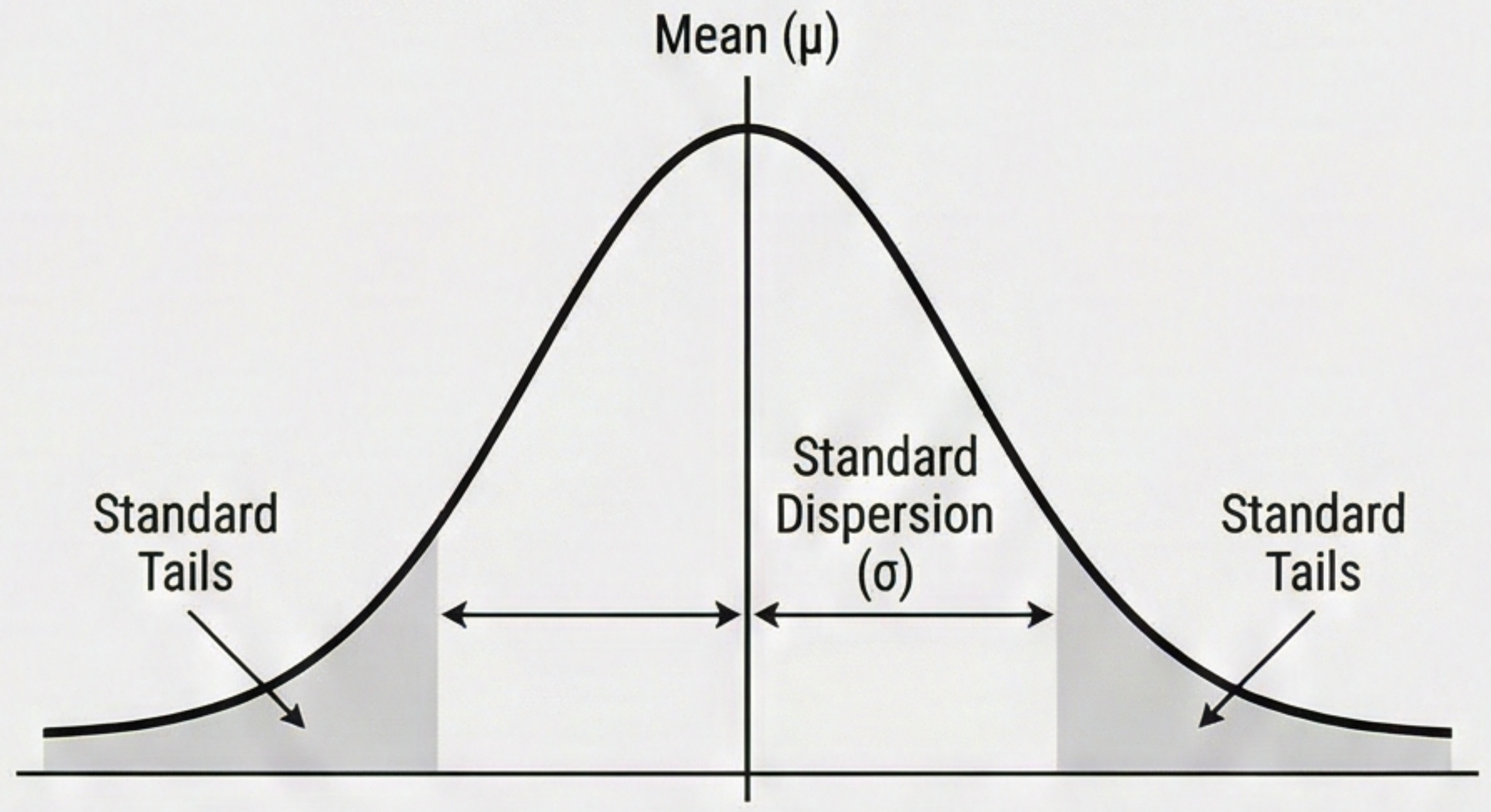
KURTOSIS: PEAKEDNESS & TAIL BEHAVIOR

Quantifying the frequency of extreme events relative to a Normal distribution.
A measure of distribution shape, not variation.

MODULE 1: THE BENCHMARK & CONCEPT

CORE CONCEPT: THE NORMAL BASELINE

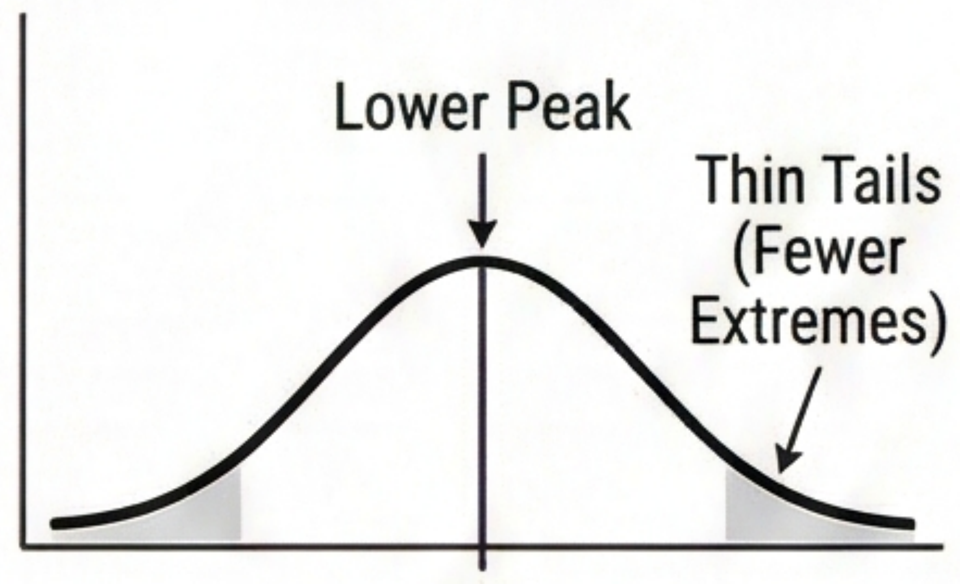


The Normal (Mesokurtic) Distribution is the reference standard.
Excess Kurtosis ≈ 0. It represents a baseline balance of peak and tails.

MODULE 2: THE THREE TYPES (COMPARATIVE ANALYSIS)

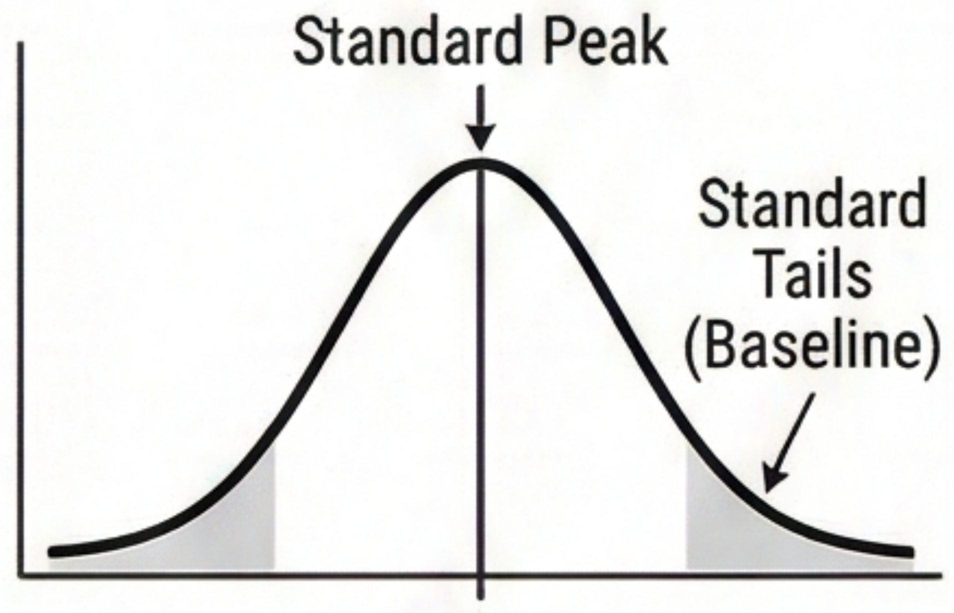
THREE DISTRIBUTION SHAPES: TAILS & PEAKS

PLATYKURTIC
(Low Kurtosis)



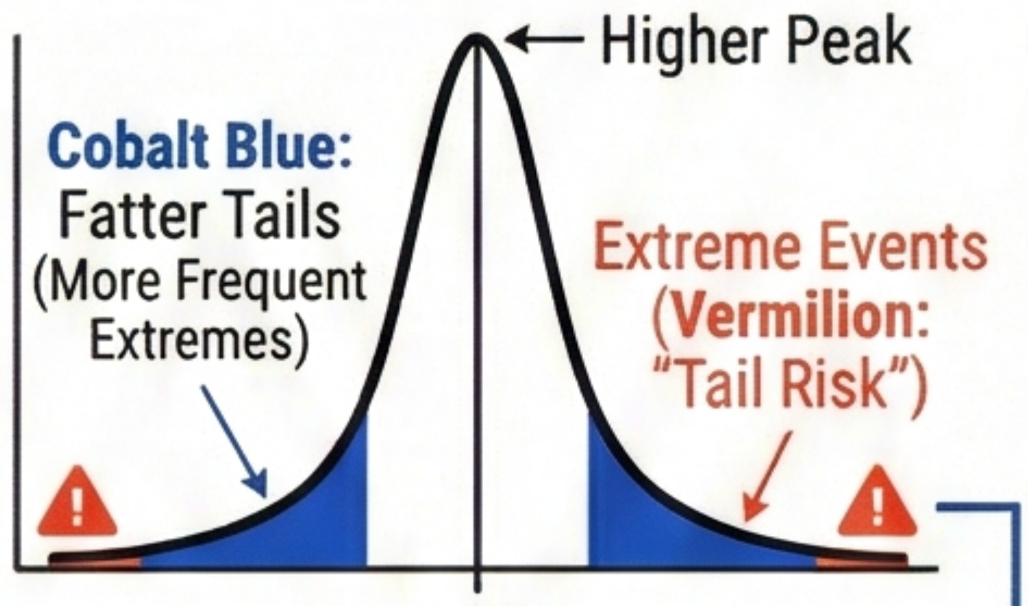
Excess Kurtosis < 0.
Data is less concentrated around the mean and has fewer outliers.

MESOKURTIC
(Normal)



Excess Kurtosis ≈ 0.
The reference distribution.

LEPTOKURTIC
(High Kurtosis)



Excess Kurtosis > 0.
Data is highly concentrated at the mean and in the tails; extreme outliers are more frequent.

MODULE 3: MANAGEMENT IMPLICATION (RISK CONTEXT)

MANAGEMENT IMPLICATION: 'TAIL RISK'

STABLE / PREDICTABLE ENVIRONMENTS

Associated with **Mesokurtic/Platykurtic.**
Operations are generally predictable.
Low probability of shock events.

VOLATILE / HIGH-RISK ENVIRONMENTS

Vermilion Alert: Associated with **Leptokurtic.**
High 'Tail Risk'. Managers must prepare for rare but high-impact events (e.g., financial crashes, supply chain disruptions).

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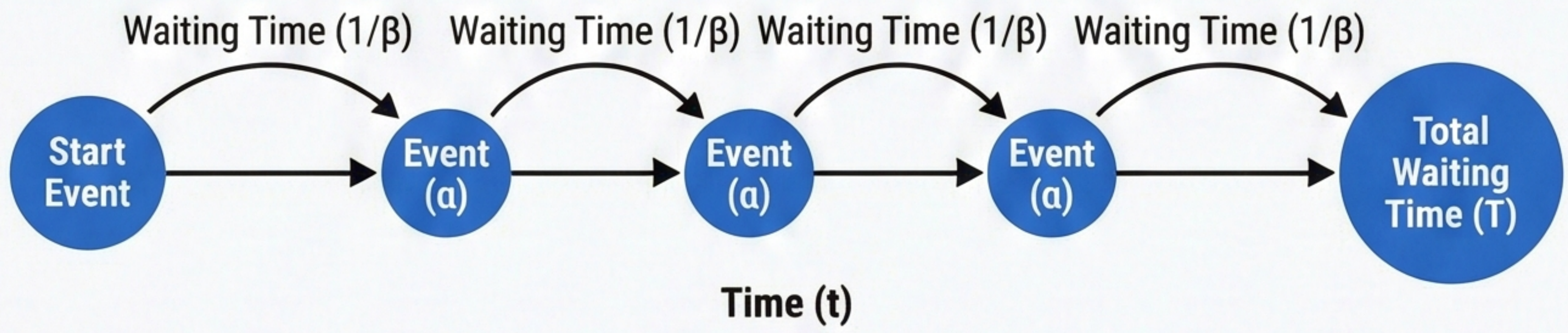
GAMMA DISTRIBUTION

Modeling waiting times for multiple independent events occurring at a constant rate.

MODULE 1: CORE CONCEPT & DEFINITION

THE CONCEPT: ACCUMULATING WAITING TIMES

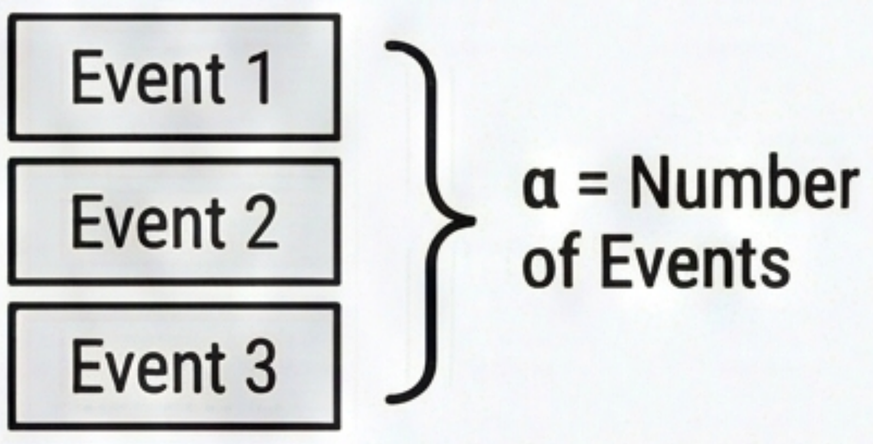


The Gamma Distribution models the time required for “α” independent events to occur, given a constant average rate “β”.

MODULE 2: THE PARAMETERS (Shape & Rate)

TWO KEY PARAMETERS: SHAPE (α) & RATE (β)

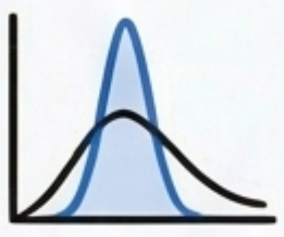
SHAPE PARAMETER (α) - “Count”



Controls the distribution's shape (skewness). If α = 1, it simplifies to the Exponential distribution.

RATE PARAMETER (β) - “Speed”

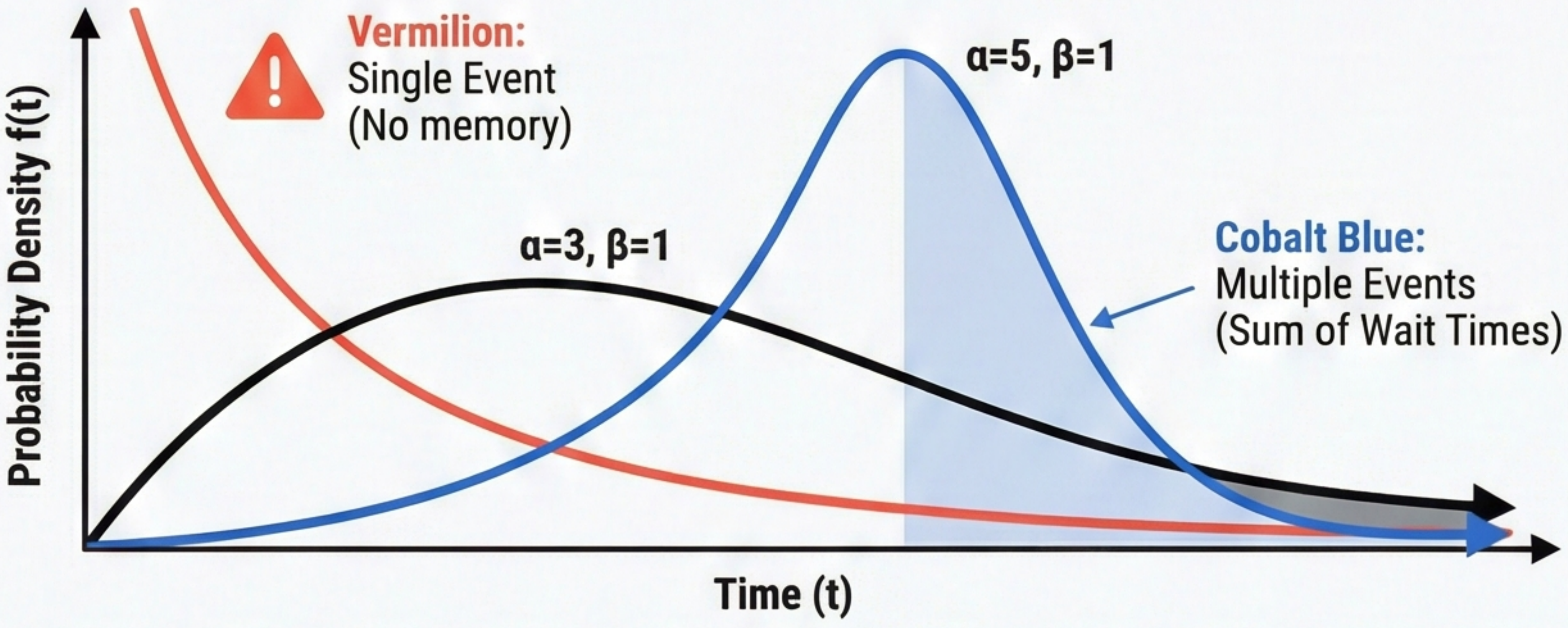
β = Rate of Events (per unit time)



Controls the scale (spread) of the distribution.
Higher β = Faster rate = Less spread.

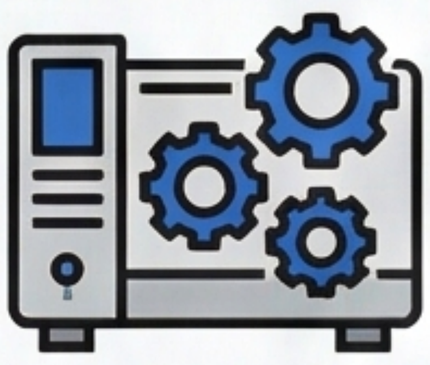
MODULE 3: VISUALIZING THE SHAPE (PDF Curves)

DISTRIBUTION SHAPES: EFFECT OF α & β



MODULE 4: MANAGEMENT APPLICATIONS (Context)

MANAGEMENT APPLICATIONS: MULTI-STAGE PROCESSES



RELIABILITY ENGINEERING
Modeling time to failure for systems with standby components or multi-stage degradation.

Example: Time until 3rd backup generator fails.

SERVICE & QUEUEING
Modeling total service time for a process requiring multiple sequential steps.

Example: Time to complete a 3-stage customer support ticket.

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