

CHAPTER 4

# **Data Visualization Techniques**

Exploring types of data, core visualization methods, and the science of effective data storytelling.

# WHY DATA VISUALIZATION MATTERS



## Rapid Processing

Helps humans understand complex data significantly faster than text-based tables.



## Reveal Insights

Easily reveals hidden patterns, emerging trends, and critical outliers.



## Reduce Load

Reduces cognitive load by organizing info visually for better decision-making.

# WHAT IS DATA VISUALIZATION?

## Bridging Raw Data and Insight

Data visualization is the visual representation of data through charts, graphs, maps, and diagrams.

It transforms raw, often overwhelming datasets into clear, actionable insights that tell a compelling narrative.



# FOUNDATIONAL DATA TYPES

- 👉 **Categorical (Nominal):** Grouped by labels or categories with no inherent order.
- ↓📄 **Ordinal:** Data with a meaningful order (e.g., rankings, satisfaction).
- 📊 **Quantitative:** Numerical data that can be measured (Continuous) or counted (Discrete).
- 🕒 **Temporal:** Time-series data collected over specific intervals.
- 🌐 **Spatial:** Data tied to geographical locations or regions.

# CATEGORICAL DATA (NOMINAL)

Nominal data is grouped by specific labels or categories that lack a natural order or ranking.

**Examples:** Gender, Product Type, Department.

## Optimal Visuals:

- Bar Charts (Comparison)
- Pie Charts (Proportion)



# ORDINAL DATA VISUALIZATION

## Ordinal Data

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## Understanding Hierarchy

Ordinal data possesses a meaningful order, though the differences between values may not be equal.

**Use Case:** Rankings (1st, 2nd, 3rd) and satisfaction levels (Likert scale).

**Requirement: Must use an Ordered Bar Chart to maintain sequence.**



# Quantitative Data

Measuring and Counting the Numerical World

# DISCRETE VS. CONTINUOUS DATA

## Discrete Data

Data that consists of countable, distinct values.

### Best Visuals:

- Bar Charts
- Dot Plots

## Continuous Data

Data that consists of measurable values within a range.

### Best Visuals:

- Line Charts
- Histograms

# TEMPORAL (TIME-SERIES) DATA



## Charting Change

Temporal data shows trends and changes over time (e.g., Stock prices, Weather patterns).

**Line and Area charts are the standard.**

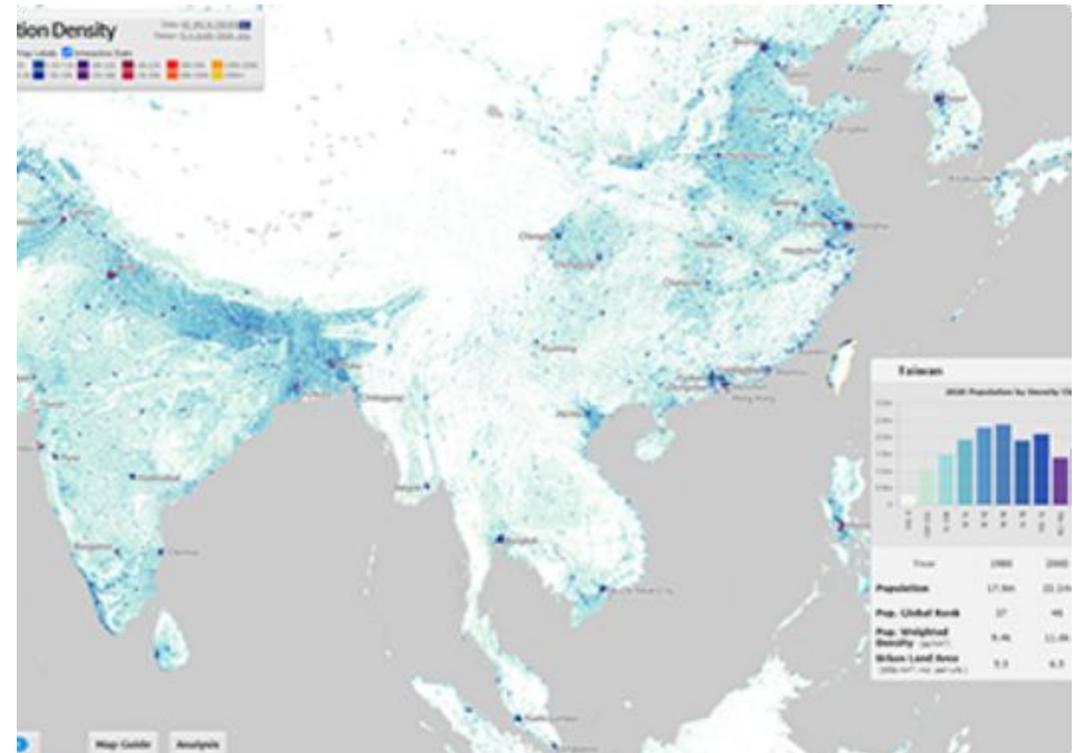
# SPATIAL DATA & CONTEXT

## The Power of Location

Spatial data relates to specific geographical points or regions.

**Example:** Population density by region, store performance by city.

**Use Choropleth maps to provide immediate geographic context and comparison.**



# | THE FOUNDATION OF CLARITY

# #1

**Priority**

## Matching Data to Visualization

The type of data you possess determines the chart choice. Selecting the wrong chart can mislead your audience and obscure the truth.

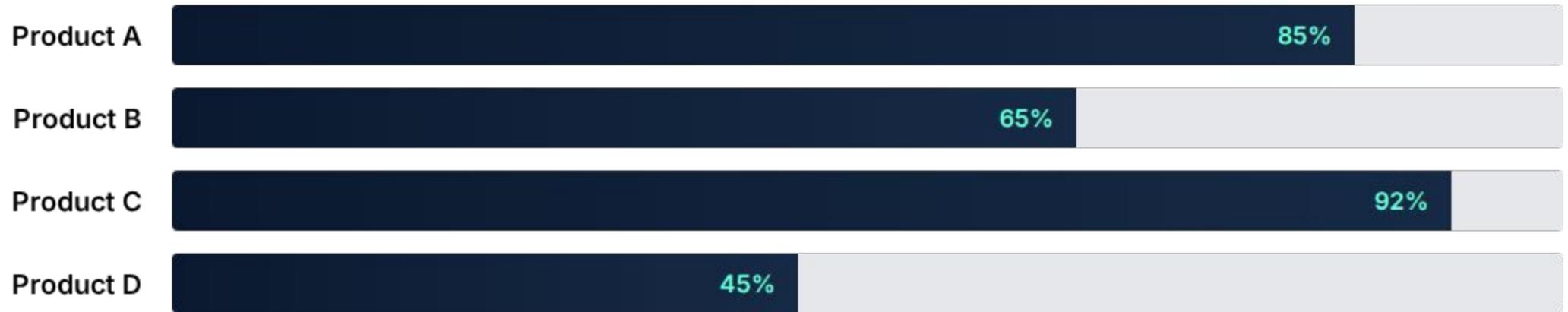
*"Visual clarity is the absolute priority. If a chart requires extensive explanation, it has failed its purpose."*

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# CHARTS AND GRAPHS

Transforming Metrics into Meaningful Narratives

# BAR CHARTS



## Strategic Comparison

Bar charts are simple, effective, and best for comparing values across distinct categories. They can be oriented vertically or horizontally to fit the data labels.

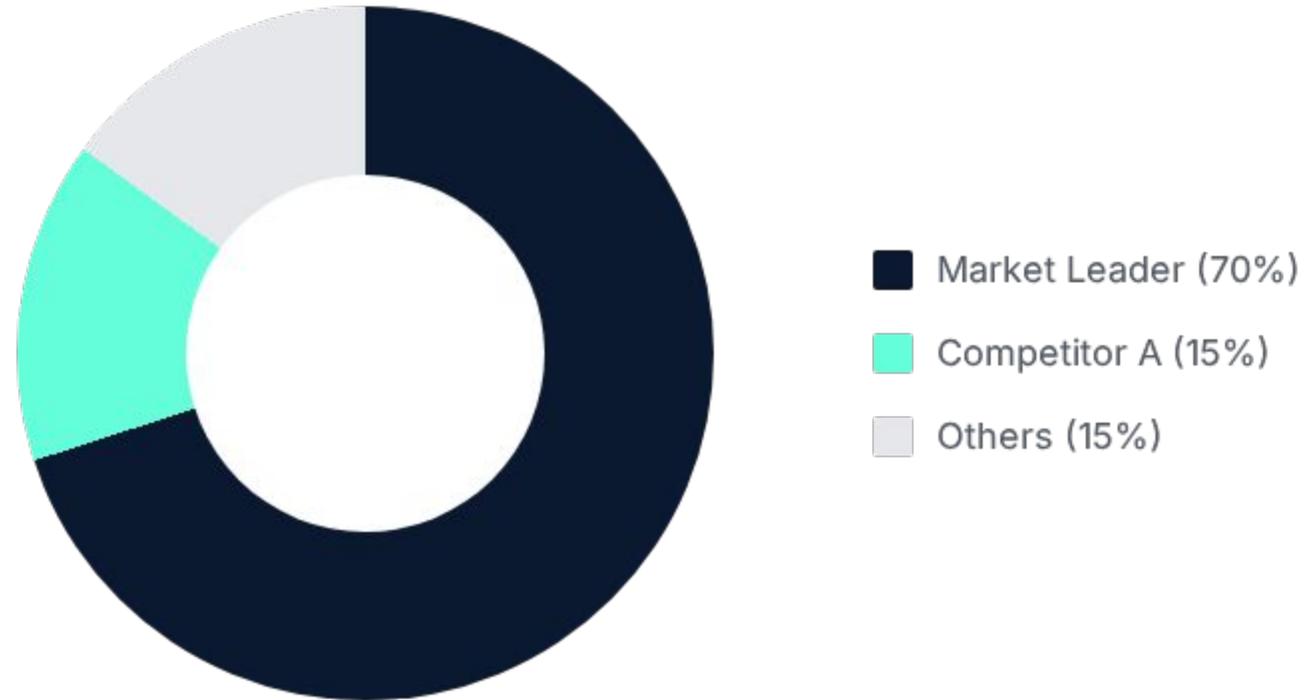
# LINE CHARTS



## Analyzing Continuity

Ideal for showing trends over time and highlighting increases or decreases in continuous data. Line charts allow viewers to predict future trends based on historical patterns.

# PIE CHARTS



Pie charts show proportions as parts of a whole. They are most effective when limited to a small number of categories to maintain clarity.

# HISTOGRAMS



## Visualizing Distribution

Histograms display data distribution by grouping values into "bins." Unlike bar charts, they represent frequency across a continuous numerical range.



## Large Datasets

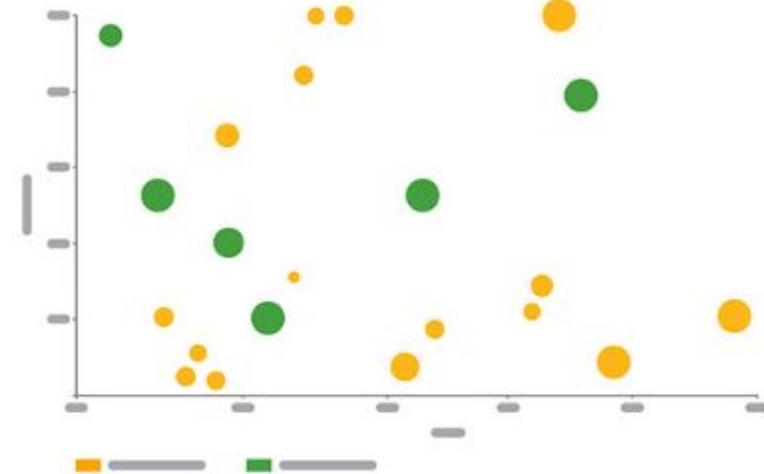
Perfect for summarizing large datasets to identify patterns like skewness, normality, or outliers in the data spread.

# SCATTER PLOT

## Mapping Relationships

Scatter plots show relationships between two variables to identify correlations. They are essential for detecting outliers and understanding the strength of a relationship.

*"Correlation does not imply causation, but it reveals where to look deeper."*



Scatter Plot: Your Visual Bridge Between Data and Meaning

# | COMMON CHART MISTAKES

- ⚠ **Truncated Axes:** Starting the Y-axis above zero to exaggerate differences.
- ⚠ **Too Many Colors:** Overwhelming the viewer with unnecessary visual noise.
- ⚠ **3D Effects:** Using depth that distorts the perception of data values.
- ⚠ **Misleading Scales:** Inconsistent intervals that hide the true nature of a trend.

# WHAT IS AN INFOGRAPHIC?

## Beyond Simple Charts

Infographics combine data visualization with design elements and text to tell a visual story. They focus on distilling key messages into a single, cohesive narrative.

- ✓ Combines Data & Design
- ✓ Focuses on Narratives
- ✓ Simplifies Complexity



# TYPES OF INFOGRAPHICS



## Statistical

Focuses on data points and metrics.



## Timeline

Explains history or chronologies.



## Process

Shows steps in a workflow.



## Geographic

Displays data on maps.

# GOOD INFOGRAPHIC DESIGN



## Clear Message

A single focused takeaway that the audience understands instantly.



## Visual Hierarchy

Guiding the viewer's eye through the narrative using size and color.



## Consistency

Uniform colors and fonts that build trust and professional appeal.

# POOR INFOGRAPHIC DESIGN



## **Text Heavy**

Overwhelming the visual with paragraphs of text instead of graphics.



## **Low Contrast**

Poor color choices that make the data and text difficult to read.



## **No Flow**

Information scattered randomly without a logical reading path.

# CHARTS VS INFOGRAPHICS

Feature	Charts & Graphs	Infographics
Primary Goal	Data Analysis	Visual Storytelling
Complexity	High Detail / Granular	Simplified / High Level
Key Elements	Axes, Legend, Points	Icons, Text, Narrative
Best Usage	Academic/Business Reports	Marketing/General Public

# | SUMMARY

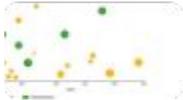
- ✓ **Data First:** Always understand the data type before selecting a method.
- ✓ **Strategic Choice:** Match the visualization to the specific insight goal.
- ✓ **Design Integrity:** Avoid misleading designs and focus on clarity.
- ✓ **Final Focus:** Every element should support the audience's understanding.



# Key Takeaway

Visualization is not decoration. Design must support understanding. Accuracy always precedes beauty.

# IMAGE SOURCES



<https://ppcexpo.com/blog/wp-content/uploads/2025/03/scatter-plot-main.jpg>

Source: [ppcexpo.com](https://ppcexpo.com)



<https://s3.amazonaws.com/thumbnails.venngage.com/template/473e87ec-ceb5-41d8-8ce7-5c01f65cac95.png>

Source: [venngage.com](https://venngage.com)

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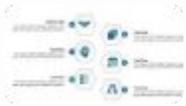
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Source: [www.slideteam.net](https://www.slideteam.net)

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<https://luminocity3d.org/WorldPopDen/WorldPopulationDensityMapSummaryImage.png>

Source: [luminocity3d.org](https://luminocity3d.org)