

UNIT - II

Data Visualization Through Their Graph Representations, Graph-theoretic Graphics, High-dimensional Data Visualization, Multivariate Data Glyphs: Principles and Practice, Linked Views for Visual Exploration, Linked Data Views, Visualizing Trees and Forests.

1. Data Visualization Through Their Graph Representations

Data visualization through graph representations means **displaying data using graphs to make patterns, trends, and relationships easy to understand.**

Graphs convert numerical data into visual form.

Common Graph Representations

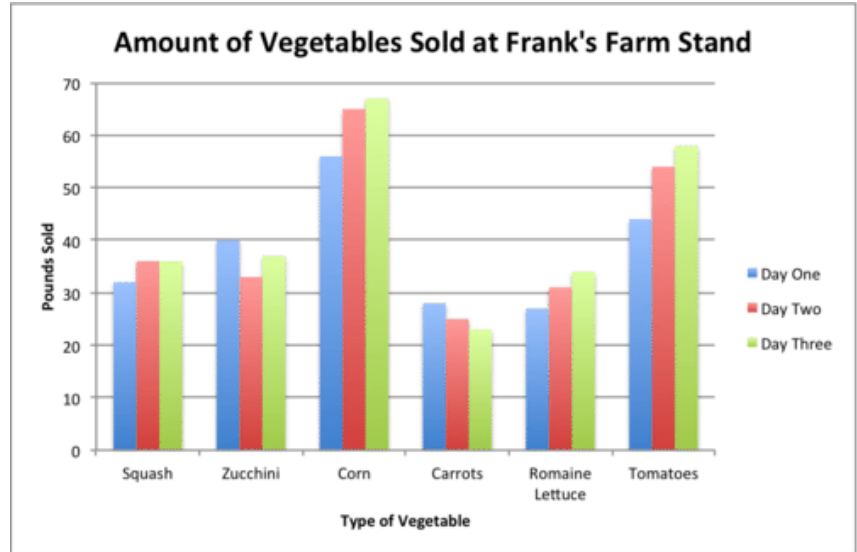
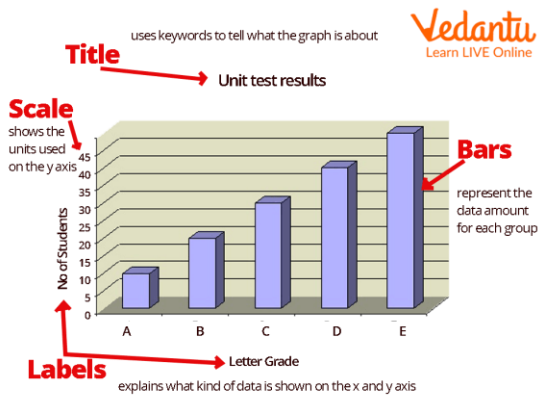
- Bar graph
- Line graph
- Pie chart
- Histogram
- Scatter plot

Example

A **line graph** can show temperature changes over time, making trends easy to see.

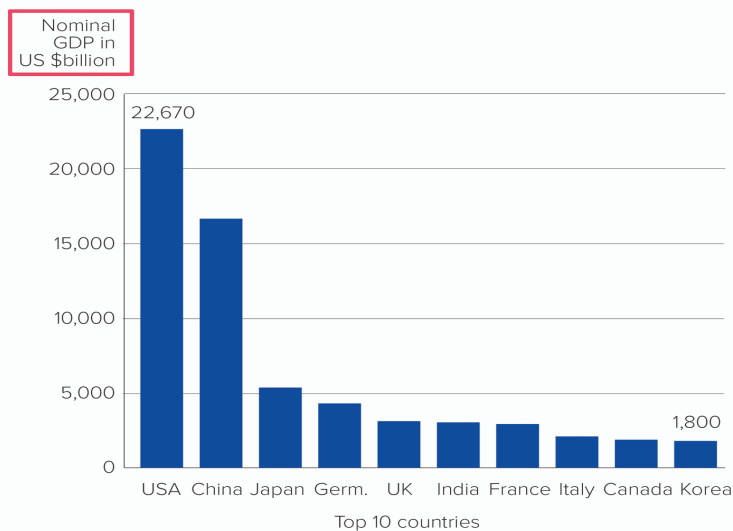
Advantages

- Easy comparison
- Quick understanding
- Detect patterns
- Better decision-making

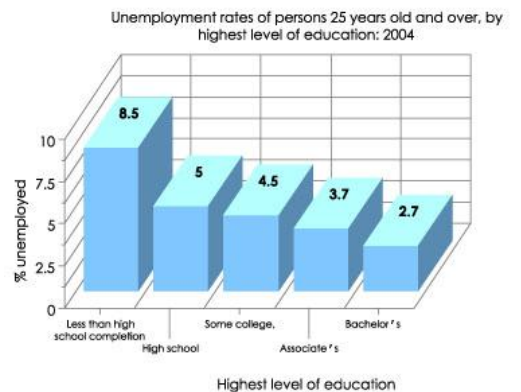


The rich list

Countries with the highest nominal GDP, 2021



? No particular place to go



U.S. Department of Labor, Bureau of Labor Statistics, Office of Employment and Unemployment Statistics, Current Population Survey (CPS), 2004.

2. Graph-theoretic Graphics

Graph-theoretic graphics visualize **relationships between objects using nodes and edges**.

- **Nodes (vertices)** represent objects
- **Edges (links)** represent connections

Examples

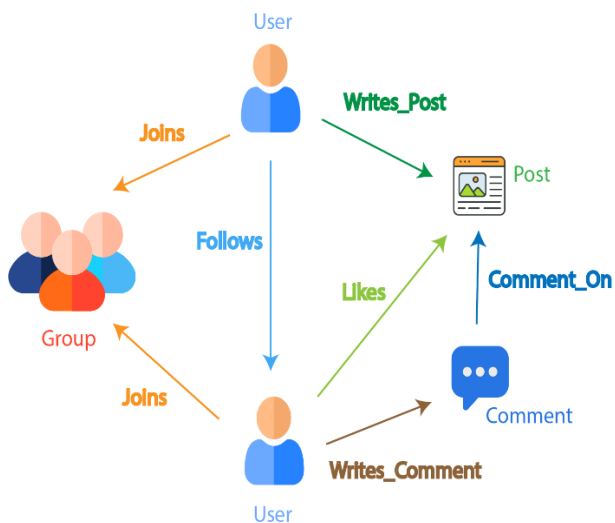
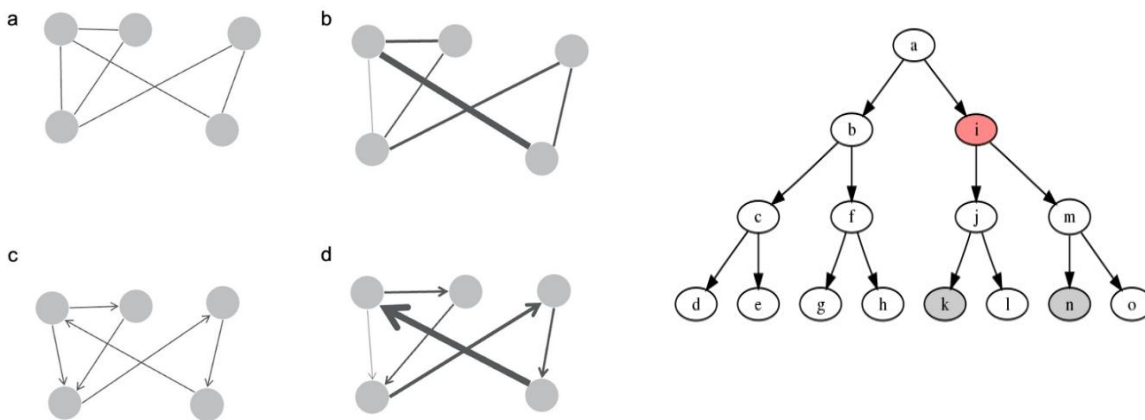
- Social network visualization

- Computer network diagrams
- Transportation route maps

Example: In a **social network graph**, people are nodes and friendships are edges.

Applications

- Network analysis
- Web link analysis
- Communication systems



3. High-dimensional Data Visualization

High-dimensional data visualization represents data with **many variables (dimensions)**.

Since humans cannot easily visualize more than 3 dimensions, special techniques are used.

Techniques

- Parallel coordinates
- Heat maps
- Scatter plot matrix
- Dimensionality reduction

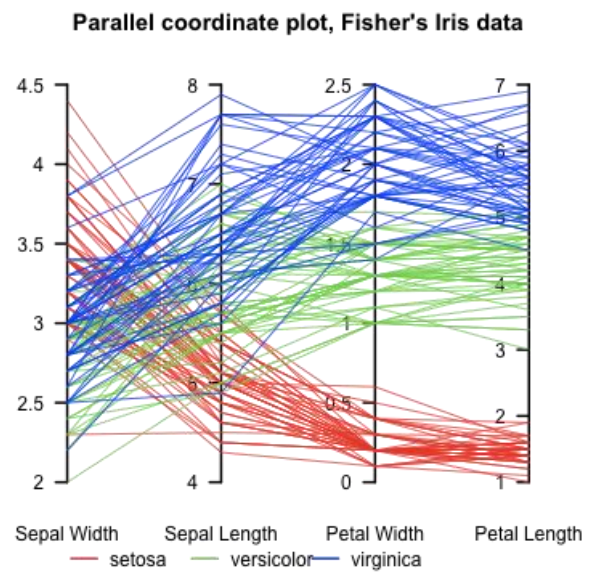
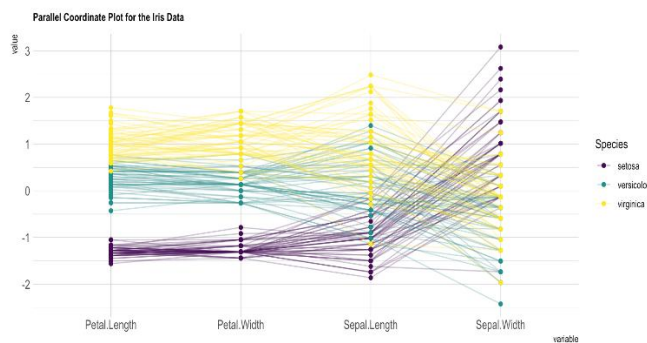
Example

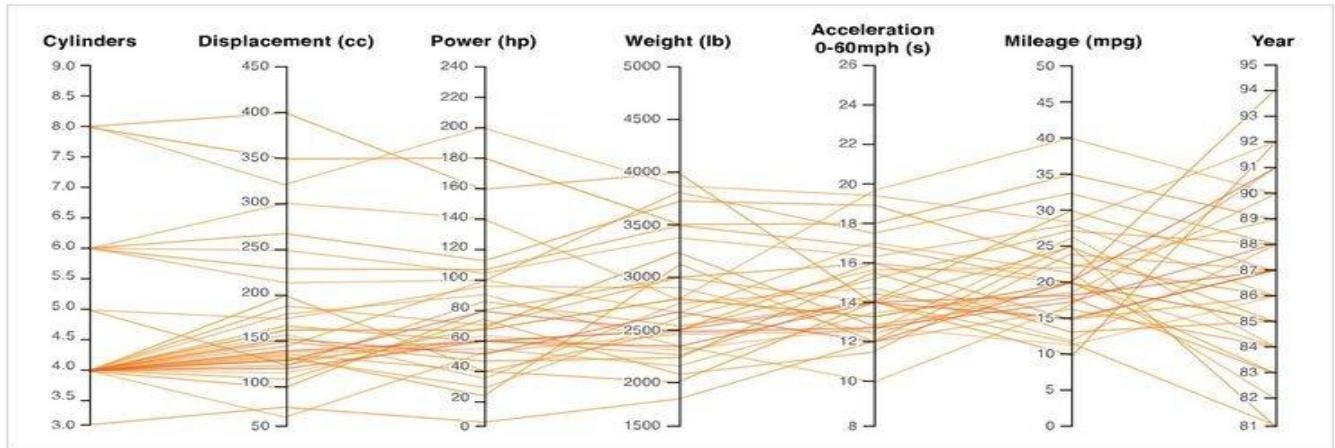
A dataset with **height, weight, age, salary, and education level** is high-dimensional data.

A **parallel coordinate plot** can visualize it.

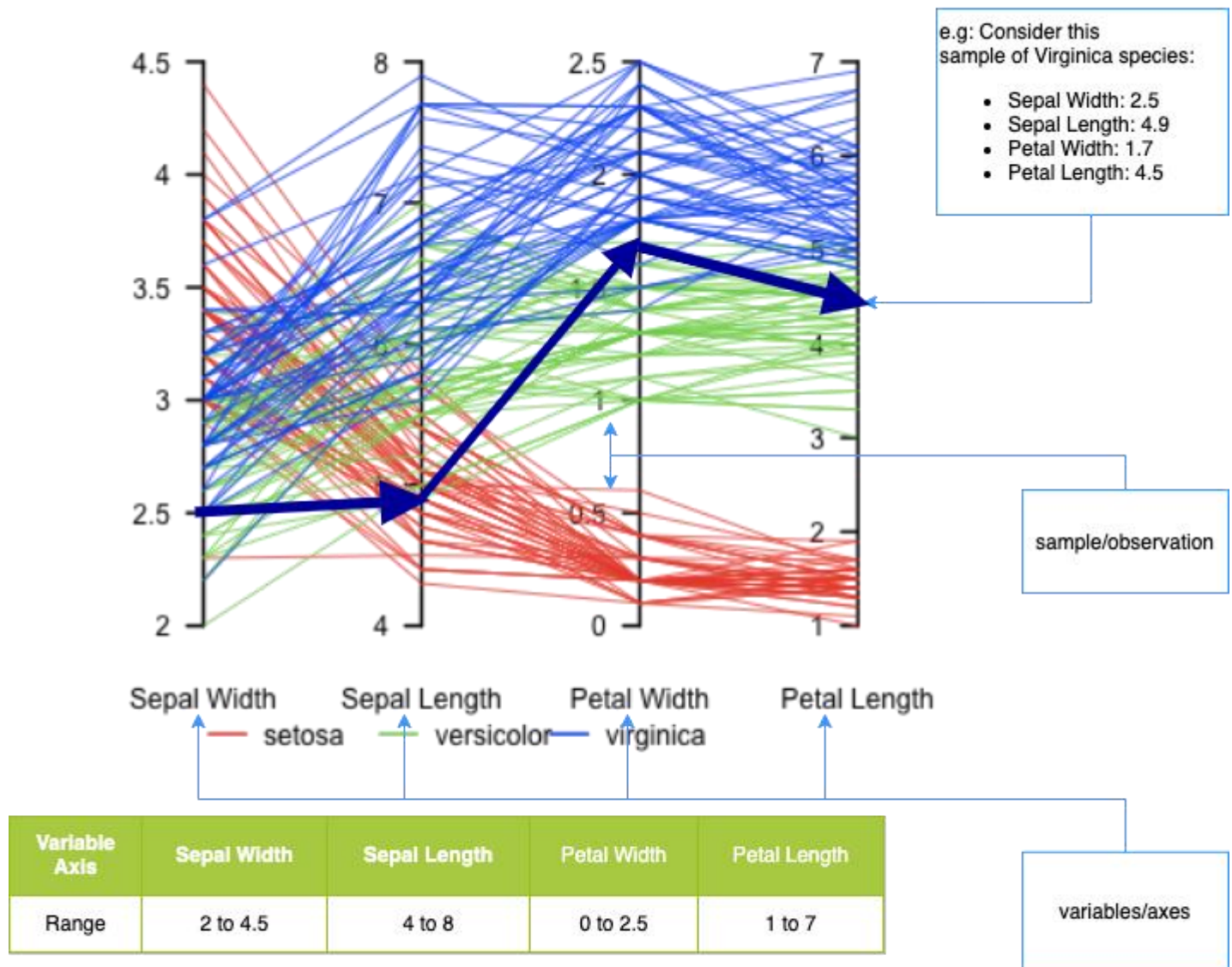
Advantages

- Shows complex relationships
- Helps in machine learning analysis
- Reveals hidden patterns





Parallel coordinate plot, Fisher's Iris data



4. Multivariate Data Glyphs: Principles and Practice

Multivariate data glyphs represent **multiple variables using shapes, symbols, or icons**.

Each visual property represents a different variable.

Example

In a glyph:

- Size → population
- Color → income
- Shape → category
- Orientation → growth rate

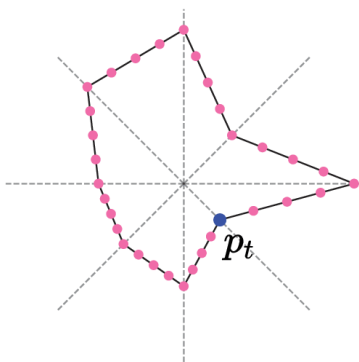
A **star glyph** or **Chernoff face** is commonly used.

Principles

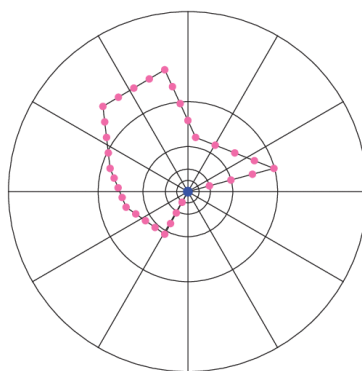
- Maintain clarity
- Use consistent symbols
- Avoid overcrowding
- Ensure readability

Applications

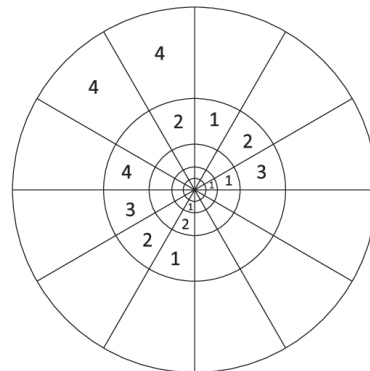
- Scientific visualization
- Data dashboards
- Statistical analysis



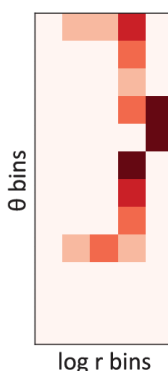
(a)



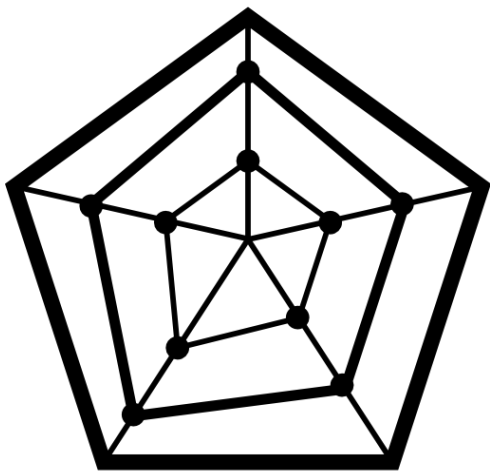
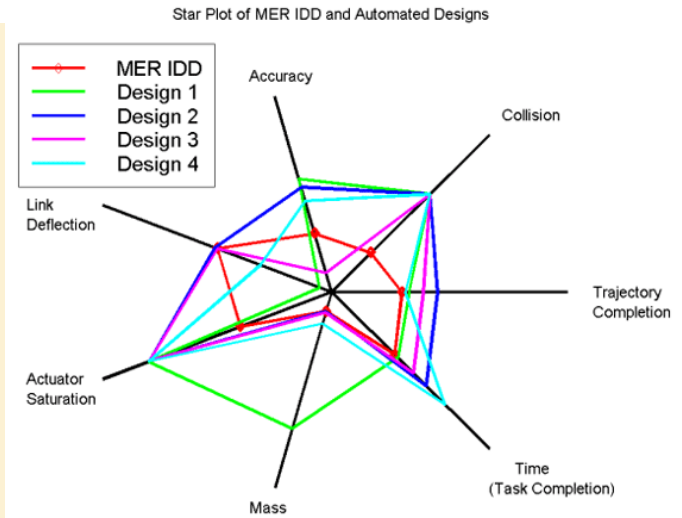
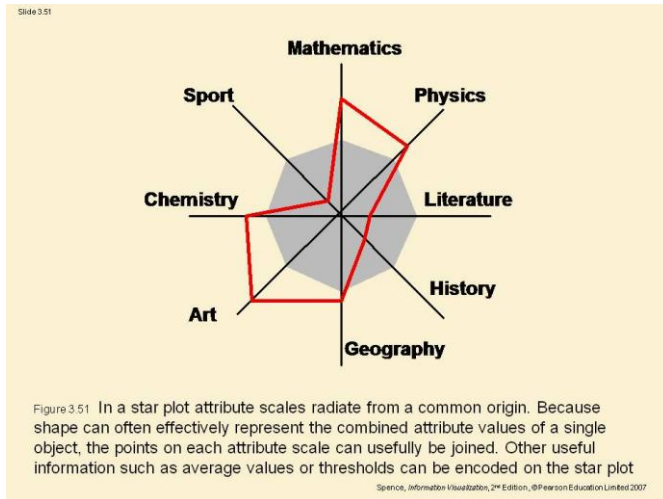
(b)



(c)



(d)



5. Linked Views for Visual Exploration

Linked views mean **multiple visualizations connected together**, where interaction in one view affects others.

This helps in **exploring data interactively**.

Example

If you select a region in a scatter plot, the **bar chart updates automatically**.

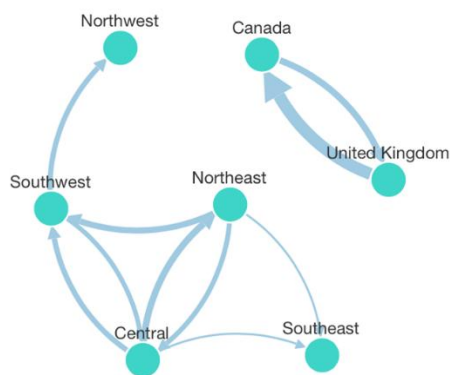
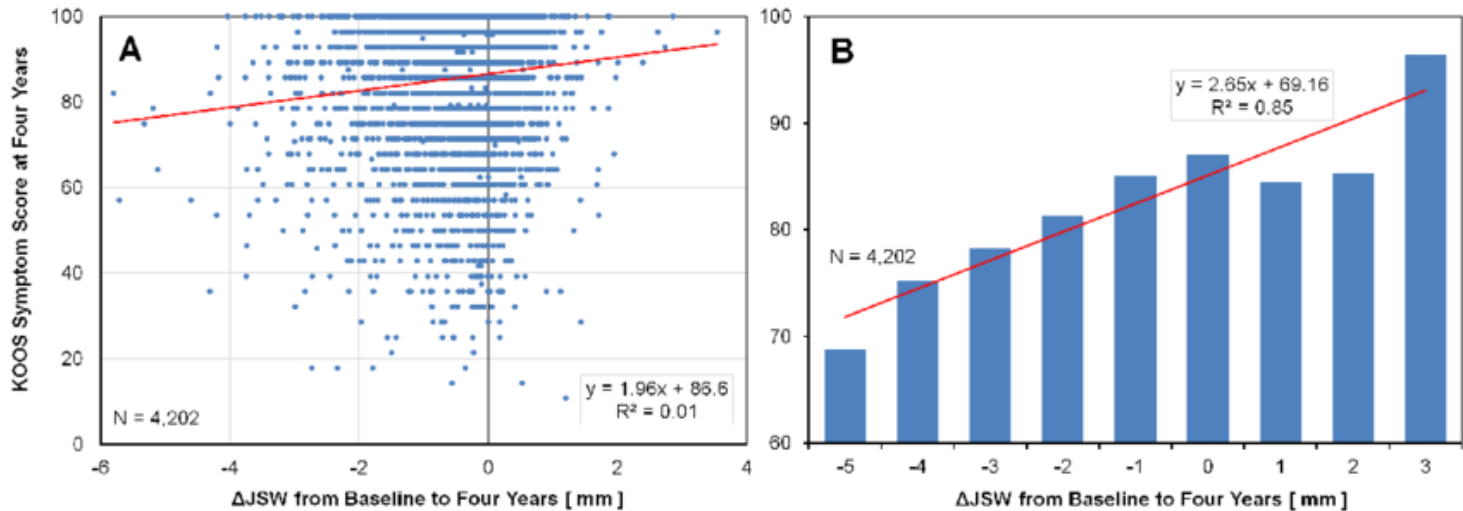
Benefits

- Interactive analysis
- Better understanding
- Compare multiple perspectives

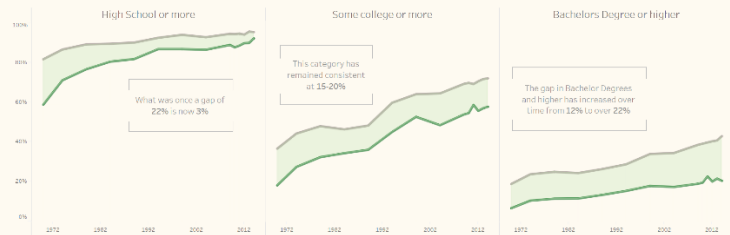
- Detect patterns easily

Tools

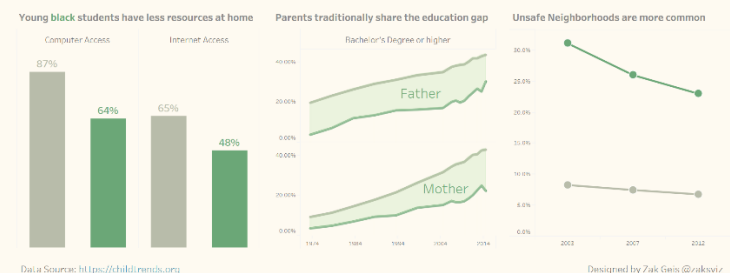
- Tableau
- Power BI
- Python visualization tools

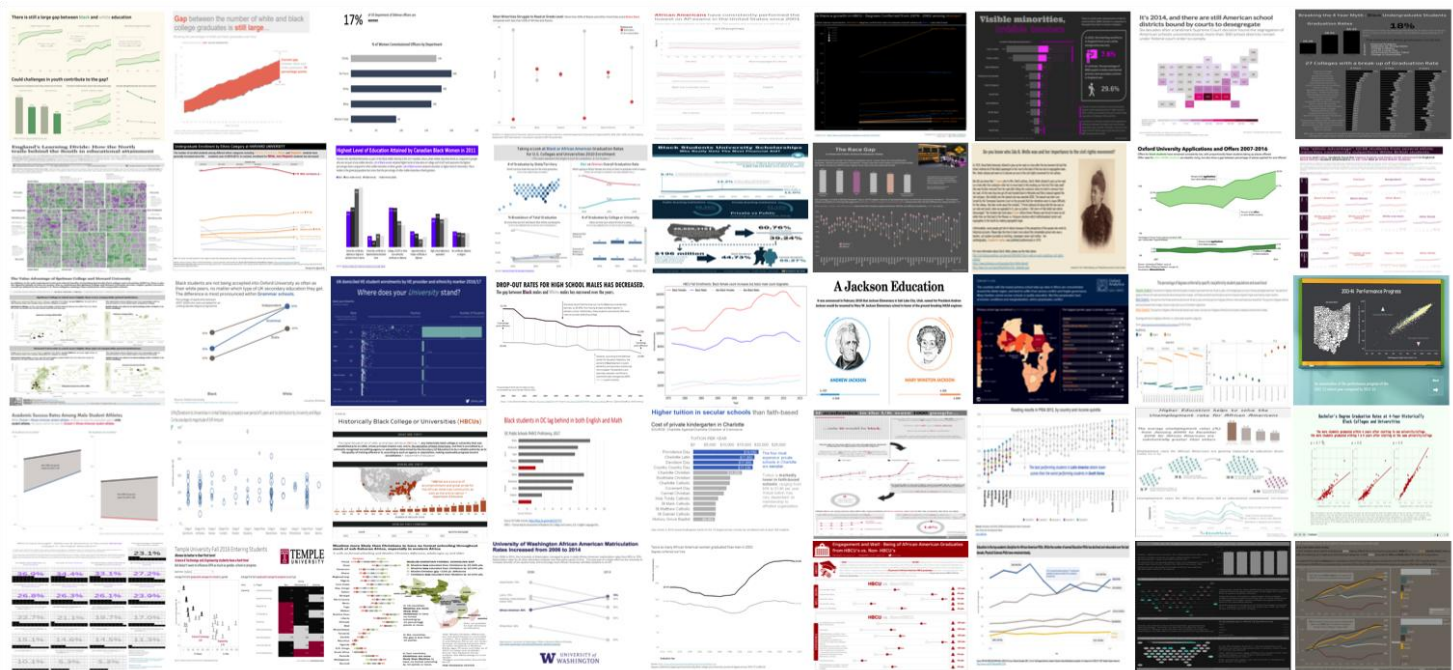


There is still a large gap between black and white education



Could challenges in youth contribute to the gap?





6. Linked Data Views

Linked data views connect **different datasets or visualizations** so they **update together**.

They allow users to **see relationships across datasets**.

Example

A dashboard showing:

- Sales chart
- Region map
- Product table

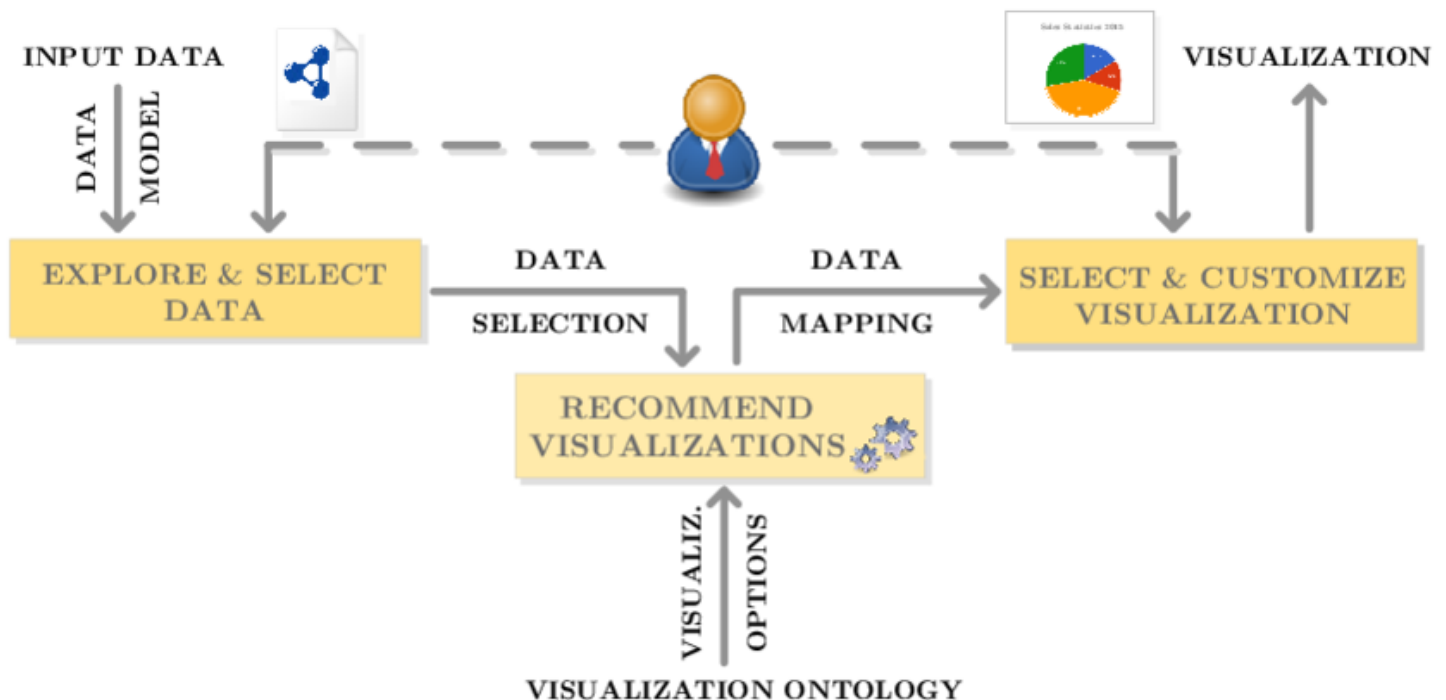
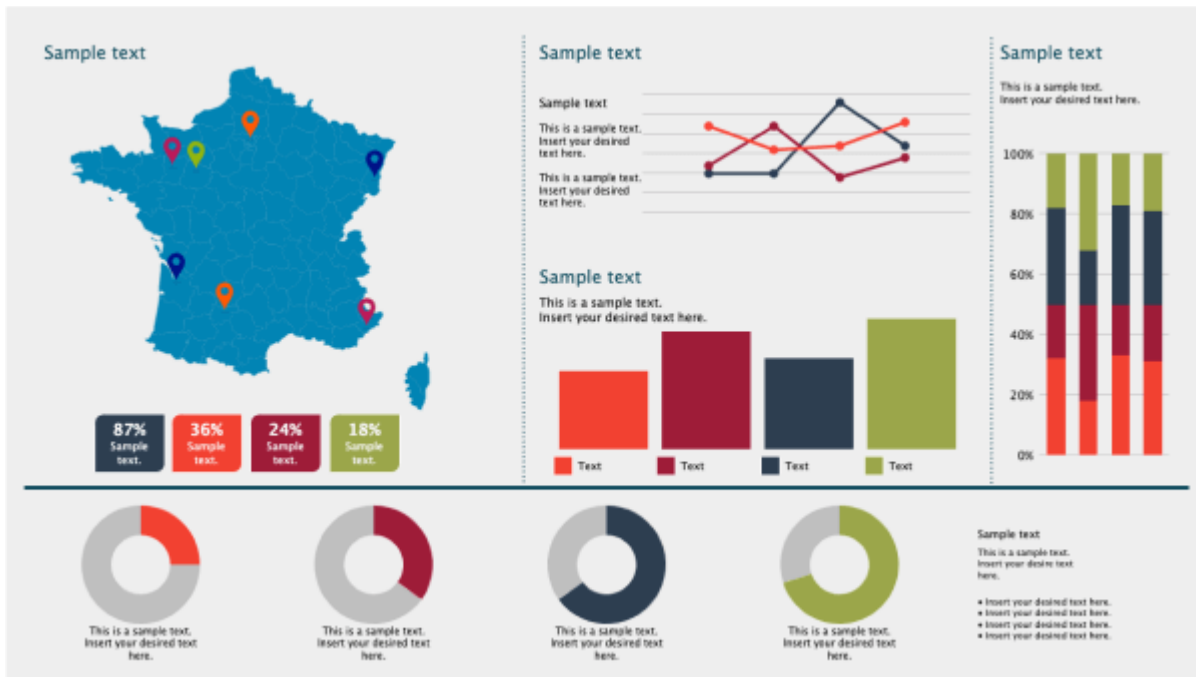
Selecting a region updates all views.

Advantages

- Data coordination
- Real-time updates
- Better analysis
- Consistent visualization

Applications

- Business dashboards
- Monitoring systems
- Analytics platforms

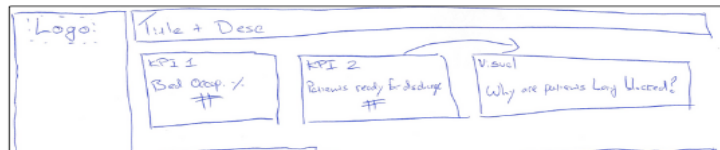


Wireframing for Power BI Dashboards:

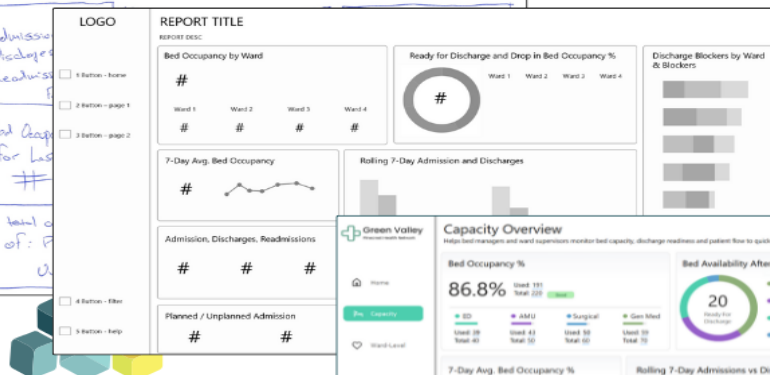
A Guide to Dashboard Wireframes



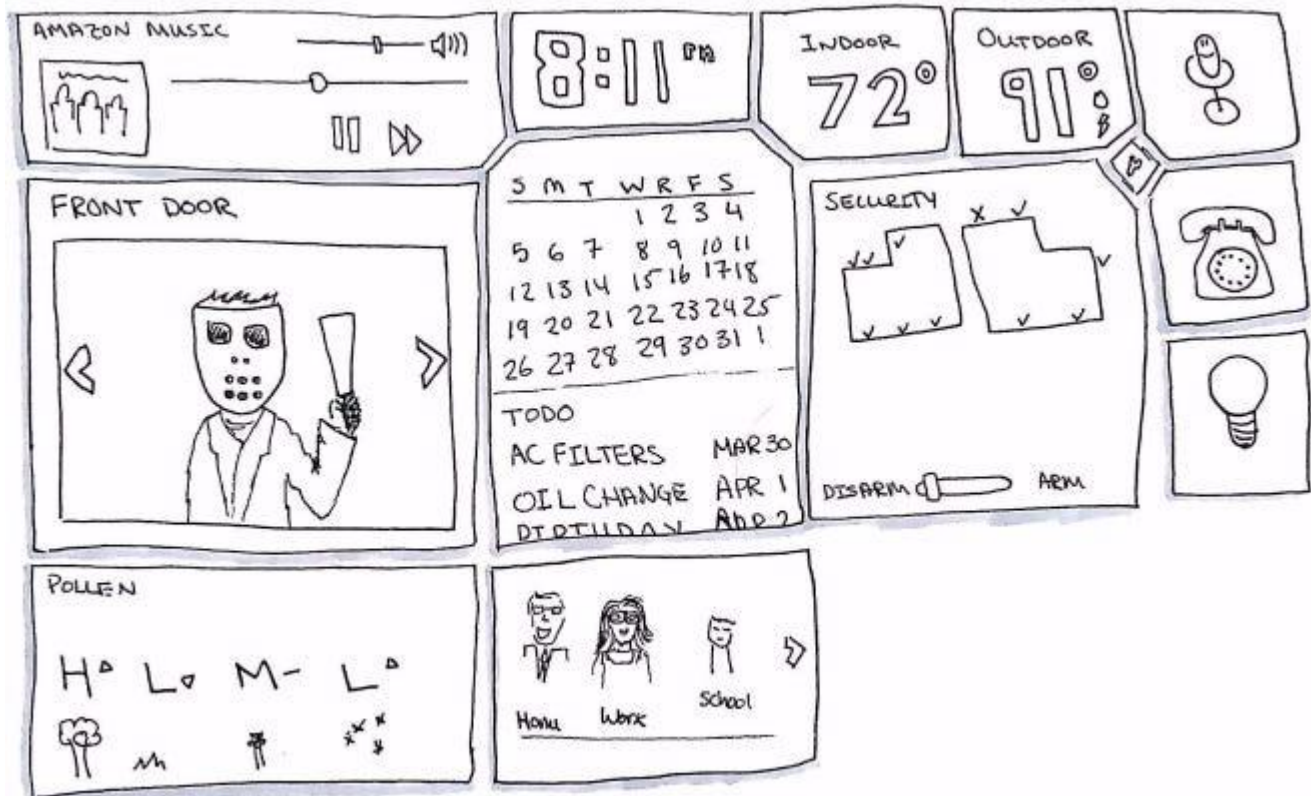
Low-fi



Mid-fi



High-fi



7. Visualizing Trees and Forests

Tree visualization represents **hierarchical data structures**.

A **tree** has:

- Root node
- Parent nodes
- Child nodes

A **forest** is a collection of multiple trees.

Examples

- File system hierarchy
- Organization chart
- Decision tree
- XML/HTML structure

Visualization Types

- Node-link tree diagrams
- Dendrograms
- Treemaps

Example

A **company organization chart** is a tree visualization.

Advantages

- Shows hierarchy clearly
- Easy navigation
- Structured representation

