Artificial Intelligence & Data Science (Sem VI)

ADC 601 : Data Analytics & Visualization

Module - 4 : Introduction to Data Visualization
(8 Hours)

Instructor : Mrs. Lifna C S

*Department of Artificial Intelligence & Data Science*

Topics to be covered

- Acquiring and Visualizing Data,
- Simultaneous acquisition and visualization
- Applications of Data Visualization
- Keys factors of Data Visualization
- Exploring the Visual Data Spectrum
  - Charting Primitives
  - Data Points,
  - Line Charts,
  - Bar Charts,
  - Pie Charts,
  - Area Charts

- Exploring advanced Visualizations
  - Candlestick Charts,
  - Bubble Charts,
  - Surface Charts,
  - Map Charts
- Narrative visualization
  - Digital storytelling
  - Infographics
  - Interactive dashboards

Data Visualization

- [graphical representation of information and data](#).

- provide an [accessible way to see and understand trends, outliers, and patterns](#) in data.

- provides an excellent way for employees or business owners [to present data to non-technical audiences without confusion.](#)

- In the world of Big Data, data visualization tools and technologies are [essential to analyze massive amounts of information and make data-driven decisions](#).

7 Stages involved in Visualizing Data

acquire → parse → filter → mine → represent → refine → interact
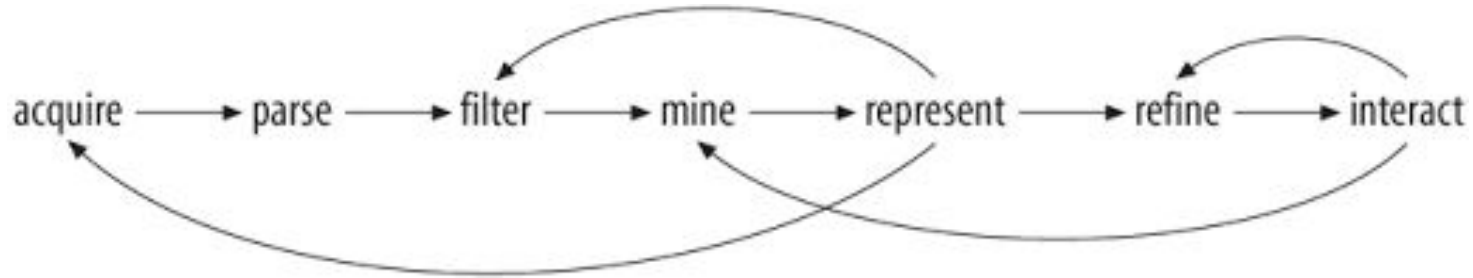
1. **Acquire :** Obtain the data, whether from a file on a disk or a source over a network.

2. **Parse :** Provide some structure for the data's meaning, and order it into categories.

3. **Filter :** Remove all but the data of interest.

4. **Mine :** Apply methods from statistics or data mining as a way to discern patterns or place the data in mathematical context.

5. **Represent :** Choose a basic visual model, such as a bar graph, list, or tree.

6. **Refine :** Improve the basic representation to make it clearer and more visually engaging.

7. **Interact :** Add methods for manipulating the data or controlling what features are visible.

Key Factors of Data Visualization

1. **Purpose and Audience:**

2. **Data Accuracy and Integrity:**

3. **Simplicity and Clarity:**

4. **Visualization Type:**

5. **Color and Contrast**

6. **Interactivity:**

7. **Consistency**

8. **Storytelling:**

9. **Annotations and Context:**

10. **Responsive Design:**

11. **Accessibility:**

12. **Feedback and Iteration:**

13. **Performance:**

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Courtesy : Tableau

Key Factors of Data Visualization

1. **Purpose and Audience:**

   ○ Clearly define the purpose of the visualization – whether it's to inform, persuade, or explore data.

   ○ Consider the knowledge level and interests of the audience to tailor the visualization appropriately.

2. **Data Accuracy and Integrity:**

   ○ Ensure that the data used in the visualization is accurate, reliable, and up-to-date.

   ○ Maintain the integrity of data to avoid misinterpretations or misleading conclusions.

3. **Simplicity and Clarity:**

   ○ Keep visualizations simple and focused on the main message.

   ○ Avoid unnecessary clutter, complex designs, or excessive detail that may distract from the core insights.

4. **Visualization Type:**

   ○ Choose the right type of visualization for the data and the message you want to convey

     ■ (e.g., bar charts, line charts, pie charts, scatter plots).

   ○ Consider the context and the nature of the data (e.g., categorical, numerical, time-series).

Key Factors of Data Visualization

5. **Color and Contrast:**

    ○ Use colors purposefully to highlight important elements or groupings.

    ○ Ensure sufficient contrast for readability and accessibility.

6. **Interactivity:**

    ○ Incorporate interactive elements when applicable to allow users to explore the data further.

    ○ Interactive features can enhance engagement and facilitate deeper understanding.

7. **Consistency:**

    ○ Maintain consistency in design elements, such as color schemes, fonts, and labeling.

    ○ Consistency helps create a cohesive and professional-looking visualization.

8. **Storytelling:**

    ○ Develop a narrative within the visualization to guide viewers through the data.

    ○ Tell a compelling story that aligns with the objectives of the visualization

Key Factors of Data Visualization

9. **Annotations and Context:**

   ○ Add annotations to highlight key points, trends, or outliers.

   ○ Provide context through captions, labels, and explanatory notes.

10. **Responsive Design:**

    ○ Ensure that visualizations are responsive to different devices and screen sizes.

    ○ Optimize for both desktop and mobile viewing experiences.

11. **Accessibility:**

    ○ Design visualizations that are accessible to a diverse audience, including individuals with disabilities.

    ○ Consider using alternative text, color contrasts, and other accessibility features.

12. **Feedback and Iteration:**

    ○ Seek feedback from users or stakeholders to improve the effectiveness of the visualization.

    ○ Iterate on the design based on feedback and changing requirements.

13. . **Performance:**

    ○ Optimize the performance of interactive visualizations, especially when dealing with large datasets.

    ○ Ensure that the visualization loads quickly and responds efficiently to user interactions.

Data Visualization - Advantages

1. **Clarity and Simplicity:** simplify complex data, making it easier to understand and interpret.

2. **Effective Communication:** by providing a clear and concise way to convey insights, trends, and patterns.

3. **Decision-Making:** visualizations highlight key aspects of the data.

4. **Identifying Patterns:** make it easier to identify trends, correlations, and outliers within the data.

5. **Audience Engagement:** Interactive visualizations engage users, encouraging exploration and deeper understanding.

6. **Universal Understanding:** overcoming language barriers and reaching a diverse audience.

7. **Memorability:** more memorable than text, aiding in long-term retention of information.

8. **Time Efficiency:** enable quick data analysis, saving time compared to parsing through raw data.

9. **Enhanced Data Exploration:** uncovering hidden insights and gaining a deeper understanding.

10. **Effective for Presentations:** compelling and engaging manner.

Data Visualization - Disadvantages

1. **Misinterpretation:** Poorly designed visualizations can lead to misinterpretation and incorrect conclusions.
2. **Complexity:** Creating effective visualizations can be complex, when dealing with large and diverse datasets.
3. **Overemphasis on Aesthetics:** without considering the accuracy and relevance of the data can be a pitfall.
4. **Limited Context:** Visualizations may not provide the complete context of the data ⇒ oversimplification of complex issues.
5. **Technical Expertise:** Creating advanced or customized visualizations ⇒ limits accessibility for non-technical users.
6. **Data Overload:** Too many visual elements or complex visualizations can overwhelm users,
7. **Data Quality:**. Poor data quality can result in misleading visualizations.
8. **Subjectivity:** Interpretation of visualizations can be subjective, leading to different conclusions based on individual perspectives.
9. **Potential Bias:** Visualizations can unintentionally introduce bias, especially if the designer has preconceived notions or biases.
10. **Technology Dependency:** Reliance on specific tools or technologies ⇒ challenges if these tools become obsolete or inaccessible.

How Data Visualization addresses Big Data Challenges ?

1. Handling Complexity

2. Insights Discovery

3. Real-Time Monitoring

4. Interactivity

5. Communication of Insights

6. Identifying Trends and Anomalies

7. Scalability

8. Data Preparation and Cleaning

9. Decision Support

How Data Visualization addresses Big Data Challenges ?

1. **Handling Complexity:**

   ○ Handling massive volumes of data that may be too large and complex for traditional data processing systems to manage.

   ○ Data visualization <u>simplifies the representation</u> of complex data, allowing users <u>to understand patterns, trends, and outliers</u> in large datasets more easily.

2. **Insights Discovery:**

   ○ <u>Extracting meaningful insights</u> from large datasets is a challenge due to the sheer volume and variety of data.

   ○ Visualization tools enable users <u>to explore and discover insights</u> within big data, <u>providing a clear representation of trends and patterns.</u>

3. **Real-Time Monitoring:**

   ○ Big data often involves real-time data streams that need continuous monitoring.

   ○ Real-time visualizations allow for <u>immediate monitoring and analysis of data streams,</u> facilitating quick decision-making and response to changing conditions.

How Data Visualization addresses Big Data Challenges ?

4. **Interactivity:**

   ○ Analyzing large datasets may require interactive exploration to drill down into specific details.

   ○ Interactive visualizations enable users to interact with the data dynamically, exploring details and gaining deeper insights as needed.

5. **Communication of Insights:**

   ○ Communicating insights derived from big data to a diverse audience can be challenging.

   ○ Visualizations provide a means of effectively communicating complex findings to stakeholders, making it easier for non-technical users to understand and act on the information.

6. **Identifying Trends and Anomalies:**

   ○ Identifying trends or anomalies within massive datasets requires effective data analysis.

   ○ Visualization tools help in identifying and highlighting trends, outliers, and irregularities, making it easier to understand and act on them.

How Data Visualization addresses Big Data Challenges ?

7. **Scalability:**

   ○ <u>key consideration</u> when dealing with big data processing and visualization.

   ○ Visualization tools designed for scalability can <u>handle large datasets and ensure smooth performance,</u> even as data volumes grow.

8. **Data Preparation and Cleaning:**

   ○ Preparing and cleaning large datasets for analysis is a <u>time-consuming process.</u>

   ○ Visualization tools can <u>assist in identifying and addressing data quality issues,</u> helping users understand and clean the data more effectively.

9. **Decision Support:**

   ○ Making informed decisions based on vast amounts of <u>data requires effective analysis and presentation.</u>

   ○ Data visualizations serve as decision support tools, <u>providing a clear and visual representation of information that aids decision-makers.</u>

Applications of Data Visualization

1. **Business Intelligence:**

2. **Finance:**

3. **Healthcare:**

4. **Marketing and Sales:**

5. **Education:**

6. **Government and Public Policy:**

7. **Supply Chain and Logistics:**

8. **Research and Development**

9. **Human Resources:**

10. **Sports Analytics:**

11. **Cybersecurity:**

12. **Environmental Science:**

13. **Manufacturing and Quality Control:**

14. **Real Estate:**

15. **Customer Service:**

Applications of Data Visualization

1. **Business Intelligence:**

   ○ Visualizing key performance indicators (KPIs) and business metrics for quick insights.

   ○ Creating dashboards to monitor sales, revenue, and other business metrics in real-time.

2. **Finance:**

   ○ Analyzing financial data trends, market performance, and investment portfolios.

   ○ Visualizing budget allocations, expenditures, and financial forecasts.

3. **Healthcare:**

   ○ Displaying patient data, medical records, and treatment outcomes for better decision-making.

   ○ Visualizing disease patterns, epidemiological trends, and public health data.

4. **Marketing and Sales:**

   ○ Creating visualizations to understand customer behavior and preferences.

   ○ Analyzing sales trends, conversion rates, and marketing campaign performance.

Applications of Data Visualization

5. **Education:**

   ○ Visualizing student performance, learning outcomes, and assessment results.

   ○ Creating interactive educational content and visual aids for teaching.

6. **Government and Public Policy:**

   ○ Displaying demographic data, census information, and geographic trends.

   ○ Visualizing public opinion, election results, and policy impacts.

7. **Supply Chain and Logistics:**

   ○ Monitoring inventory levels, order fulfillment, and supply chain efficiency.

   ○ Analyzing transportation routes, delivery times, and logistics data.

8. **Research and Development:**

   ○ Visualizing scientific data, experimental results, and research findings.

   ○ Creating interactive visualizations for data exploration in research.

Applications of Data Visualization

9. **Human Resources:**

   ○ Visualizing employee performance, turnover rates, and HR metrics.

   ○ Designing organizational charts and workforce planning visualizations.

10. **Sports Analytics:**

    ○ Analyzing player performance, game statistics, and team strategies.

    ○ Creating visualizations for sports fans, coaches, and analysts.

11. **Cybersecurity:**

    ○ Visualizing network traffic, identifying anomalies, and monitoring security events.

    ○ Creating dashboards for cybersecurity professionals to analyze threats.

12. **Environmental Science:**

    ○ Displaying climate data, environmental changes, and ecological patterns.

    ○ Visualizing the impact of human activities on the environment.

Applications of Data Visualization

13. Manufacturing and Quality Control:

- Monitoring production processes, defect rates, and quality control metrics.

- Visualizing equipment performance and optimizing manufacturing workflows.

14. Real Estate:

- Visualizing property values, market trends, and geographic features.

- Creating interactive property maps and market analysis visualizations.
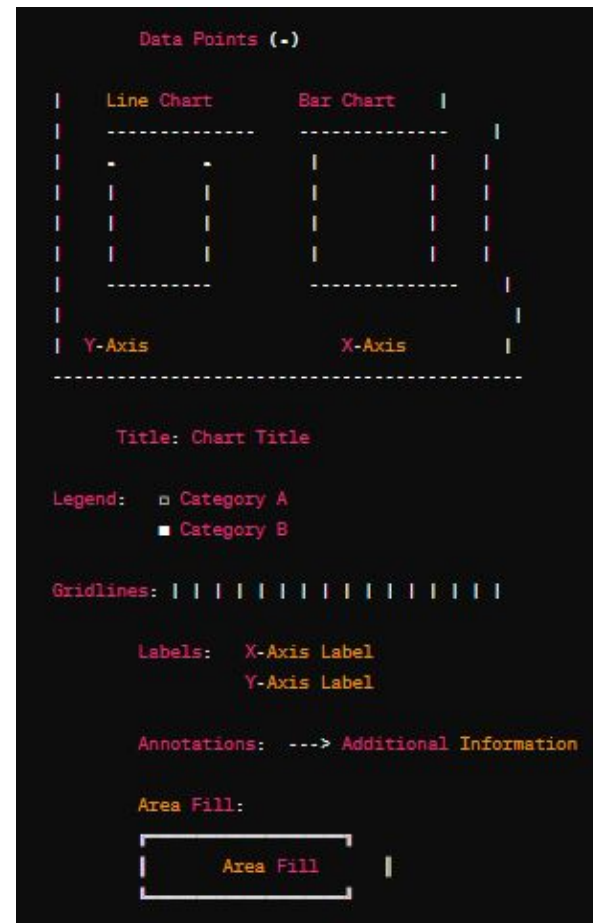
15. Customer Service:

- Visualizing customer feedback, support ticket trends, and service performance.

- Analyzing customer satisfaction scores and improving service quality.

Charting Primitives

1. **Data Points:**

2. **Lines:**

3. **Bars:**

4. **Axes**

5. **Labels:**

6. **Title:**

7. **Legends:**

8. **Gridlines:**

9. **Markers:**

10. **Area Fill:**

11. **Annotations:**

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Charting Primitives

1. **Data Points:**

   ○ represent individual values or observations in a dataset.

   ○ They are plotted on the chart to visually depict the values of the variables.

2. **Lines:**

   ○ connect data points, forming line charts. They can represent trends, relationships, or patterns in the data.

   ○ Line charts are effective for <u>displaying trends over a continuous axis.</u>

3. **Bars:**

   ○ used in bar charts to represent the values of different categories or groups.

   ○ suitable for comparing discrete categories or showing the distribution of data.

4. **Axes:**

   ○ provide a reference framework for the chart. They include the x-axis (horizontal) and y-axis (vertical).

   ○ define the scale and units of measurement, facilitating the interpretation of data points.

Charting Primitives

5. Labels:

- provide textual information about data points, axes, or other chart elements.

- enhance the clarity of the chart by providing context and explanations.

6. Title:

- is a text element that summarizes the purpose or main message of the chart.

- help users understand the chart's focus and context.

7. Legends:

- provide a key to interpreting colors, symbols, or patterns used in the chart.

- are crucial for understanding the representation of different variables or categories.

8. Gridlines:

- form a grid across the chart, aiding in reading values and making comparisons.

- assist in visually aligning data points and understanding the scale of the chart.

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Charting Primitives

9. **Markers:**

   ○ symbols or shapes placed at data points, enhancing visibility.

   ○ can differentiate between data points or highlight specific values.

10. **Area Fill:**

    ○ used to shade the region between lines or curves on a chart, indicating a range or distribution.

    ○ is effective in visualizing uncertainty or the relationship between two variables.

11. **Annotations:**

    ○ additional notes, arrows, or shapes added to the chart to provide supplementary information.

    ○ help highlight specific points or events and offer additional context to the audience.
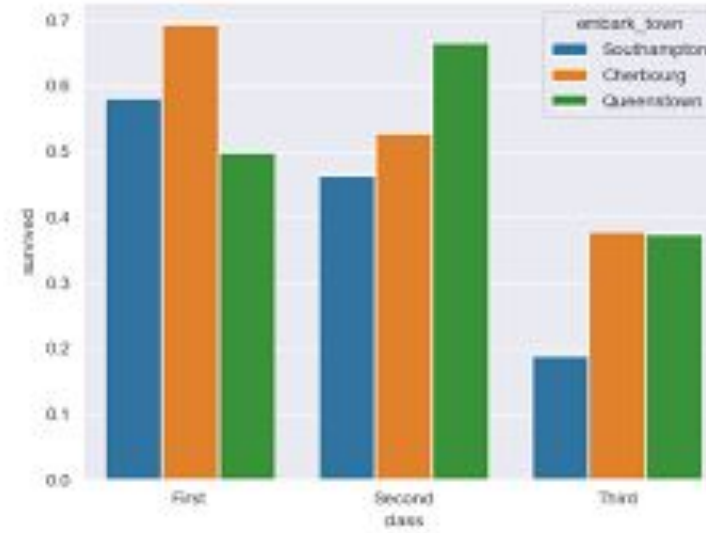
Types of Data Visualization Techniques

1. Bar Charts

2. Line Charts:

3. Pie Charts:

4. Scatter Plots:

5. Heatmaps:

6. Histograms:

7. Bubble Charts:

8. Box Plots (Box-and-Whisker Plots):

9. Treemaps:

10. Radar Charts

11. Area Charts

12. Candlestick Charts

13. Surface Charts

14. Map Charts
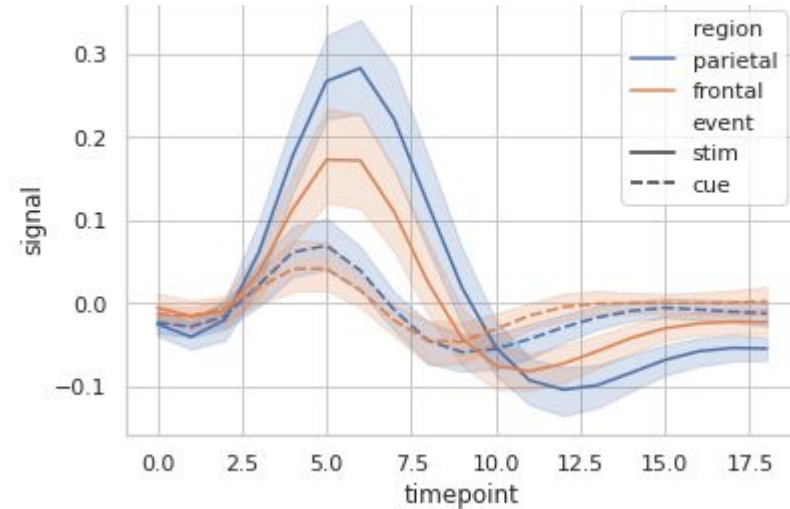
Types of Data Visualization Techniques

1. Bar Charts:

- represent data using rectangular bars of varying lengths.

- suitable for comparing discrete categories or showing the distribution of a single variable.

- Purpose: Highlighting differences or similarities in values.

- Features:

    - Can be vertical (column chart) or horizontal (bar chart).

    - Useful for displaying categorical data.

- Pros:

    - Easy to understand.

    - Effective for comparing values across categories.

- Cons:

    - Limited in representing complex relationships.

Types of Data Visualization Techniques

2. Line Charts:

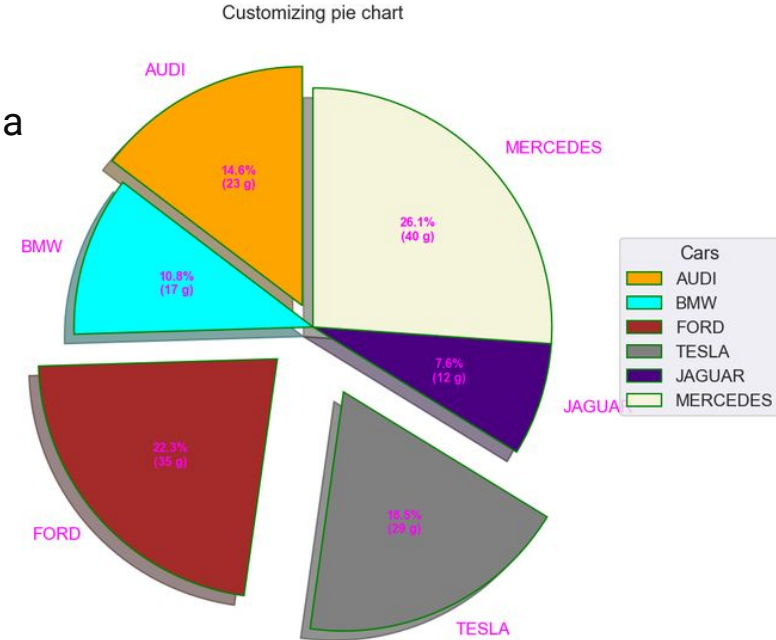- display data points connected by straight lines.

- effective for showing trends and patterns over time or continuous data.

- <u>Features</u>:

    - Suitable for time-series data.

    - Can display multiple lines for comparisons.

- <u>Pros</u>:

    - Clearly shows trends and patterns.

    - Useful for displaying data changes over time.

- <u>Cons</u>:

    - May not be suitable for discrete or categorical data.

Types of Data Visualization Techniques

3. Pie Charts:

- represent data in a circular graph,

- where each slice represents a proportion of the whole

- Purpose: Representing percentages or proportions in a visually intuitive way..

- Features:
  - Suitable for displaying parts of a whole.

- Pros:
  - Intuitive for displaying proportions.
  - Useful for small datasets with clear categories.

- Cons:
  - Less effective for comparing multiple categories.
  - Challenging to interpret with many slices.

Customizing pie chart

Cars	
	AUDI
	BMW
	FORD
	TESLA
	JAGUAR
	MERCEDES

AUDI 14.6% (23 g)
MERCEDES 26.1% (40 g)
BMW 10.8% (17 g)
JAGUAR 7.6% (12 g)
FORD 22.3% (35 g)
TESLA 18.5% (29 g)

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Types of Data Visualization Techniques

4. Scatter Plots:

- display individual data points on a two-dimensional graph, with one variable on each axis.

- Features:

  - Useful for identifying relationships between two continuous variables.

  - Each point represents a data point.

- Pros:

  - Effective for visualizing correlations.

  - Useful for identifying clusters, outliers.

- Cons:

  - Limited in displaying categorical data.

  - May become cluttered with a large number of points
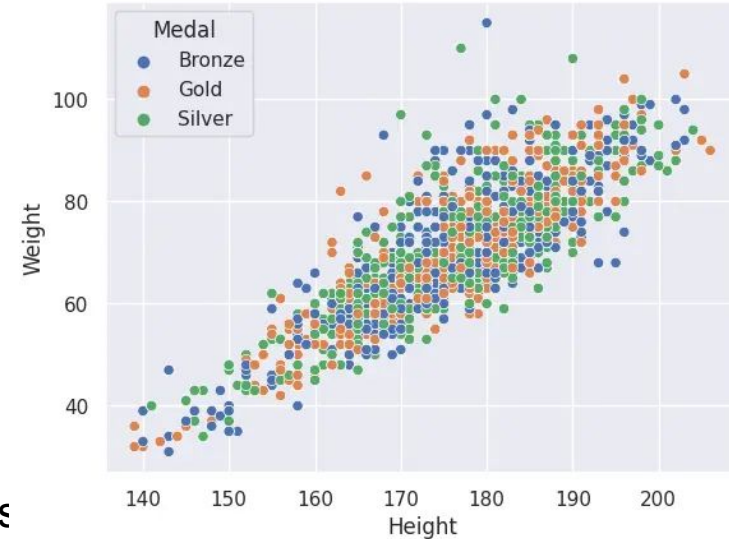
5. Heatmaps:

- represent data in a matrix, where colors indicate the magnitude of values.

- <u>Features</u>:
  - Effective for visualizing large datasets.
  - Useful for identifying patterns and trends.

- <u>Pros:</u>
  - Provides a visual overview of data density.
 - Suitable for displaying relationships in a matrix.

- <u>Cons</u>:
  - Interpretation can be subjective.
  - May not be suitable for small datasets.

Types of Data Visualization Techniques

6. Histograms:

- display the distribution of a single variable by dividing it into bins

- representing the frequency of values in each bin.

- Features:
    - Provides insights into the data distribution.
    - Suitable for continuous data.

- Pros:
    - Effective for visualizing the shape of a distribution.
    - Helps in identifying patterns and outliers.

- Cons:
    - Bin size selection can impact interpretation.
    - Limited in displaying relationships between variables.

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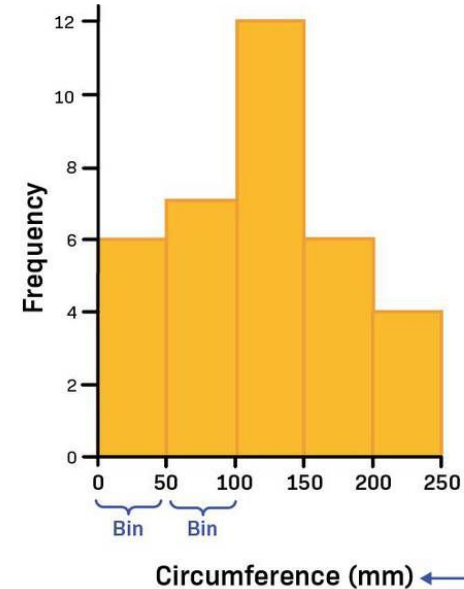
Types of Data Visualization Techniques

7. Bubble Charts:

- represent three-dimensional data, where each point has x, y coordinates and a third variable is represented by the size of the bubble.

- <u>Features:</u>
  - Useful for visualizing relationships between three variables.

- <u>Pros:</u>
  - Provides a visual representation of 3D
  - Useful for highlighting specific data points.

- <u>Cons</u>:
  - May become cluttered with too many bubbles.
  - Limited in representing additional dimensions.

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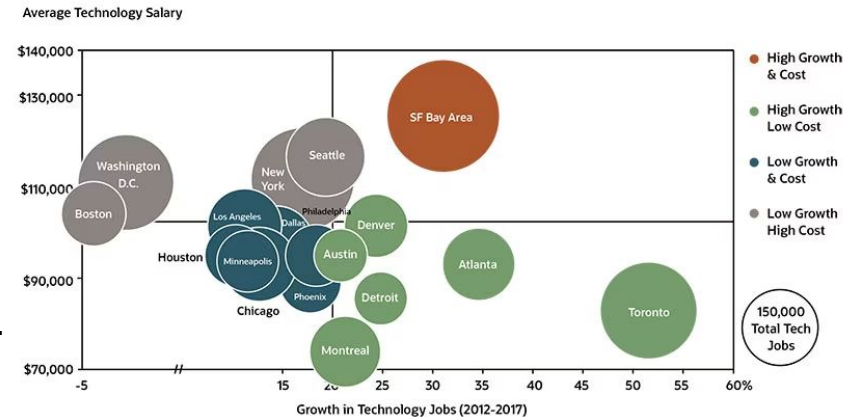
Types of Data Visualization Techniques

8. Box Plots (Box-and-Whisker Plots):

- display the distribution of a dataset, indicating the median, quartiles, and potential outliers.

- Features:

    - Effective for visualizing the spread of data and identifying outliers.

- Pros:

    - Provides a concise summary of data distribution.

    - Useful for comparing multiple datasets.

- Cons:

    - May not show detailed information about the data's shape.

    - Limited in displaying individual data points.

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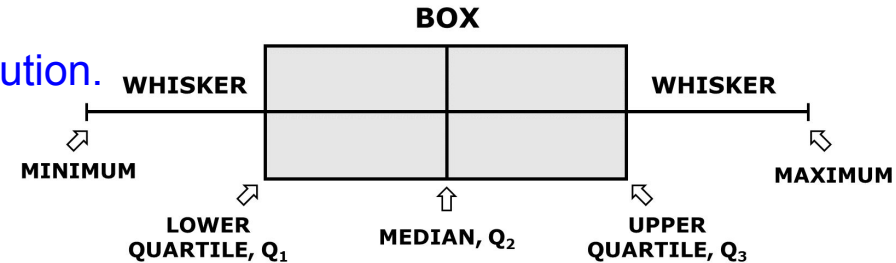
1. **Median**. The middle value of a dataset where 50% of the data is less than the median and 50% of the data is higher than the median.

2. **The upper quartile**. The 75th percentile of a dataset where 75% of the data is less than the upper quartile, and 25% of the data is higher than the upper quartile.

3. **The lower quartile**. The 25th percentile of a dataset where 25% of the data is less than the lower quartile and 75% is higher than the lower quartile.

4. **The interquartile range**. The upper quartile minus the lower quartile

5. **The upper adjacent value**. Or colloquially, the "maximum." It represents the upper quartile plus 1.5 times the interquartile range.

6. **The lower adjacent value**. Or colloquially, the "minimum." It represents the lower quartile minus 1.5 times the interquartile range.

7. **Outliers**. Any values above the "maximum" or below the "minimum."

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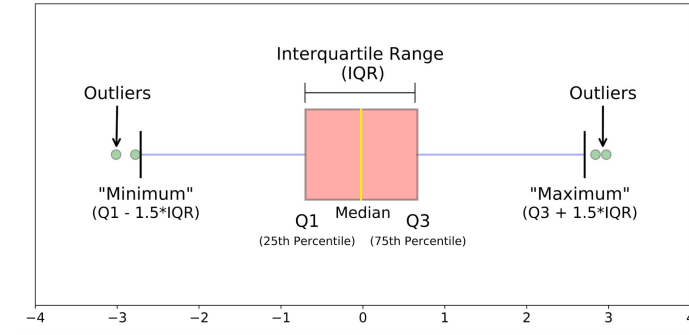
Types of Data Visualization Techniques

9. Treemaps:

- visualize hierarchical data using nested rectangles,

- each rectangle representing a category or subgroup.

- Features:

  - Suitable for displaying hierarchical relationships.

  - Each level is represented by nested rectangles.

- Pros:

  - Efficient for displaying large amounts of hierarchical data.

  - Provides an intuitive overview of data structure.

- Cons:

  - Limited in representing complex hierarchical relationships.

  - May become cluttered with too many levels.

"The Force Awakens" could produce $9.6 billion in revenue from worldwide ticket sales, merchandise, and home entertainment in roughly the first year of release.

$5.0B Merchandise

$500M Disney's Infinity 3.0 Videogame

$214M TV licensing (intl.)

$235M TV licensing (domestic)

$780M Star Wars Battlefront Videogame

$458M DVDs/downloads

$1.65B Box office sales (international)

$734M Box office sales (domestic)

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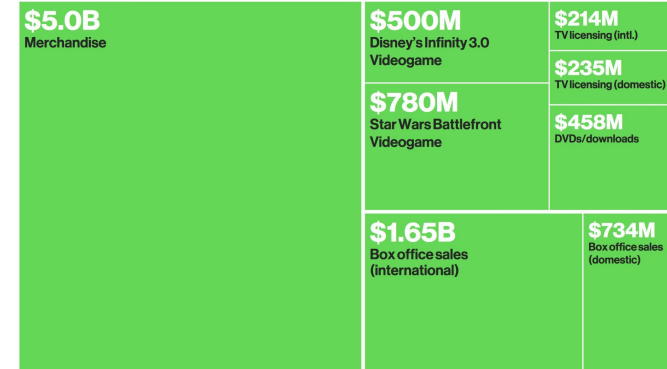
Types of Data Visualization Techniques

10. Radar Charts:

- Features:

  - Useful for visualizing patterns in multivariate data.

  - Each axis represents a different variable.

- Pros:

  - Effective for comparing multiple variables simultaneously.

  - Highlights patterns in data.

- Cons:

  - May be less familiar to some audiences.

  - Challenging to compare complex datasets.

Comparing Cars Across Dimensions
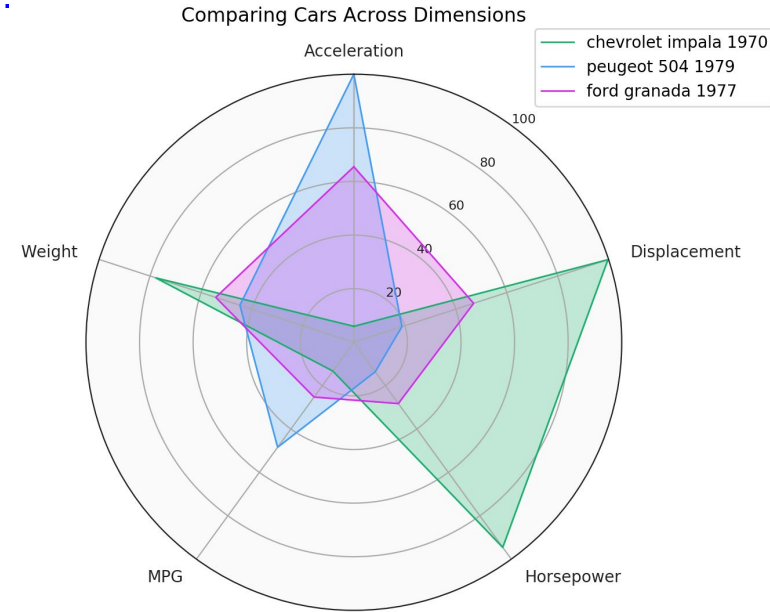
Types of Data Visualization Techniques

11. Area Charts:

- To represent the cumulative magnitude of a dataset over a continuous interval or time.
- Display the trend and distribution of values over a range.

Features:

- Filled area between the line and the axis.
- Suitable for showing total values and their composition.

Pros:

- Clearly illustrates trends and overall patterns.
- Useful for visualizing stacked data series.

Cons:

- May not be suitable for comparing individual data points.
- Interpretation might be challenging for complex datasets

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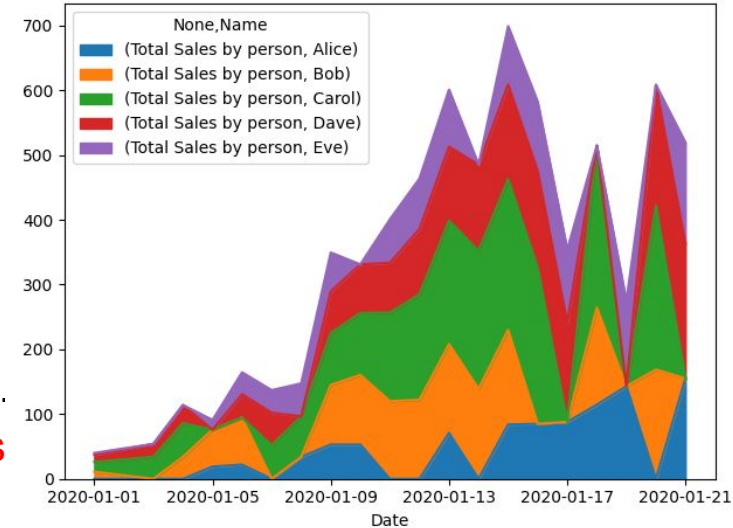
Types of Data Visualization Techniques

12. Candlestick Charts:

- Mainly used in financial markets to represent the <u>open, high, low, and close prices of an asset over a specific time period.</u>
- Provides insights into price movements and trends.

Features:

- Rectangular "candles" represent price ranges.
- Wick or shadow lines indicate high and low prices.

Pros:

- Offers a clear view of price movements.
- Provides information on market sentiment.

Cons:

- Requires understanding of financial terms.
- May be too detailed for simple trend representation

CandleStick Chart

Types of Data Visualization Techniques

13. Surface Charts:

- Visualizing three-dimensional data, often used in scientific and engineering applications.

- Represent relationships between three continuous variables.

<u>Features:</u>

- Displays data points in a 3D space with a continuous surfa

<u>Pros:</u>

- Excellent for revealing complex patterns in data.

- Suitable for showcasing relationships between multiple var

<u>Cons:</u>

- Can be challenging to interpret for non-technical users.

- May lead to visual clutter with too many data points.
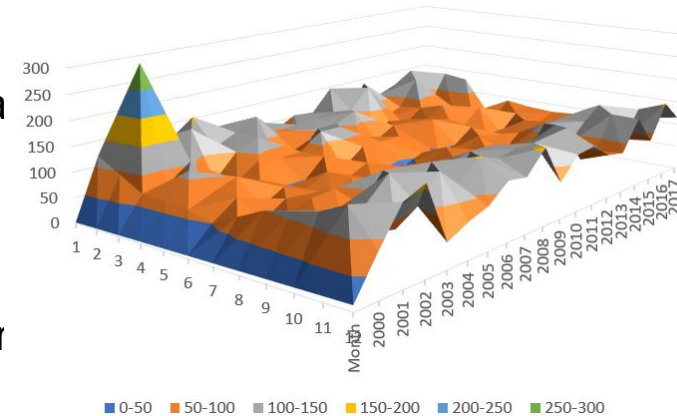
Types of Data Visualization Techniques

14. Map Charts:

- To represent data geographically on a map.

- Visualize spatial patterns and trends.

Features:

- Uses maps with data points or color-coding to represent inform

Pros:

- Effective for showing regional variations.

- Intuitive for viewers familiar with geographical locations.

Cons:

- Requires accurate and up-to-date geographical data.

- Limited to representing information geographically.

Compare : Box Plot Vs Candlestick

Feature	Box Plot	Candlestick Chart
Representation	Presents the distribution of a dataset, showing median, quartiles, and outliers.	Displays open, close, high, and low prices of a financial instrument, such as stocks.
Key Components	- Median (center line)	- Open and close prices (rectangular body)
	- Quartiles (box)	- High and low prices (vertical lines - wicks or shadows)
	- Outliers (individual points)	
Use Case	Commonly used in statistics and data analysis to show the spread and skewness of data.	Primarily used in finance to visualize price movements over time and identify trends.
Interpretation	Provides a concise summary of the data's central tendency and spread.	Offers insights into market sentiment and price dynamics, helping to identify bullish or bearish trends.
Outliers	Outliers are depicted as individual points beyond the whiskers of the box.	Outliers are not explicitly marked but are part of the overall price range.

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Compare : Bar chart Vs Histogram

Feature	Bar Chart	Histogram
Data Type	Typically used for categorical or discrete data.	Primarily used for continuous data.
Data Representation	Represents separate categories or groups with spaces.	Depicts the distribution of a continuous dataset.
X-Axis	Consists of distinct, separate categories or groups.	Represents the range of values in a dataset.
Gaps Between Bars/Bins	Gaps are present between bars to indicate categories.	Bars are adjacent, and the bins represent ranges.
Use Cases	Commonly used to compare discrete categories or groups.	Useful for showing the distribution of a dataset and identifying patterns.

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Compare : Area chart Vs Surface Chart

Feature	Area Chart	Surface Chart
Representation	Represents data points using filled areas between lines or curves.	Represents three-dimensional data points with surfaces or contours.
Dimensionality	Typically used for two-dimensional data over time or categories.	Primarily used for three-dimensional data, adding depth to data representation.
Use Cases	Suitable for displaying trends, patterns, and comparisons within a dataset.	Ideal for visualizing complex relationships in three-dimensional data, such as scientific or engineering data.
Interactivity	Limited interactivity in terms of exploration and manipulation.	Can offer enhanced interactivity, allowing users to rotate and explore the three-dimensional space for deeper insights.
Complexity	Generally simpler to create and interpret, suitable for simpler datasets.	More complex to create and may require specialized tools, better suited for intricate, multidimensional datasets.

Narrative Visualization

- A form of data visualization that <u>combines storytelling elements with visual representations of data to communicate a compelling and coherent narrative.</u>

- It incorporates a <u>structured and meaningful</u> storytelling approach,

- Allows audiences <u>to grasp complex information more effectively.</u>

- Primary goal is <u>to present data in a way that is not only informative</u> but also ***engaging and accessible.***

- <u>Key Features are</u> :

    1. Storytelling Structure:

    2. Engaging Visual Elements:

    3. Contextualization:

    4. Interactivity:.

    5. Emphasis on Insights:

    6. User-Centered Design:

    7. Multimodal Presentation:

Is It Better to Rent or Buy?

By MIKE BOSTOCK, SHAN CARTER and ARCHIE TSE

The choice between buying a home and renting one is among the biggest financial decisions that many adults make. But the costs of buying are more varied and complicated than for renting, making it hard to tell which is a better deal. To help you answer this question, our calculator takes the most important costs associated with buying a house and computes the equivalent monthly rent. **RELATED ARTICLE**

Home Price

A very important factor, but not the only one. Our estimate will improve as you enter more details below.

$250,000

$884

EQUIVALENT RENT

$100K $250K $1M $2M
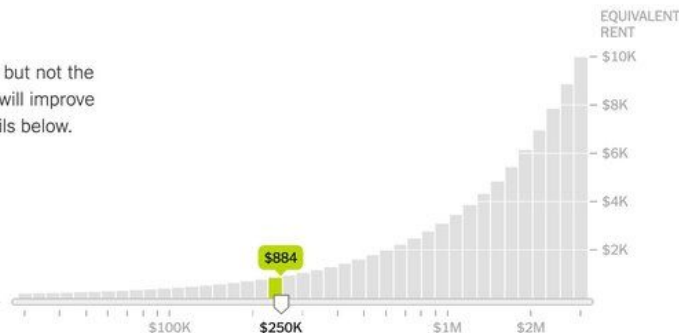
How Long Do You Plan to Stay?

Buying tends to be better the longer you stay because the upfront fees are spread out over many years.

9 years

$884

EQUIV. RENT

9 20 30 40
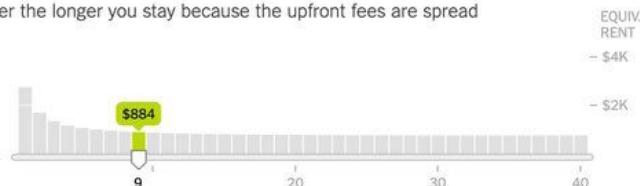
If you can rent a similar home for less than …

$884 PER MONTH

… then renting is better.

Costs after 9 years	Rent	Buy
Initial costs	$884	$60,000
Recurring costs	$106,941	$163,398
Opportunity costs	$15,396	$44,587
Net proceeds	-$884	-$145,649
Total	$122,337	$122,337

How to Read the Charts Charts that are relatively flat indicate factors that are not particularly important to the outcome. Conversely, the factors that have steep slopes have a large impact.

Narrative Visualization - Key Features

1. **Storytelling Structure**:
   - incorporates elements such as an <u>introduction, a main narrative arc, supporting details, and a conclusion</u>.
   - helps guide the audience through the <u>information in a coherent and logical manner</u>.

2. **Engaging Visual Elements:**
   - Visual elements, such as charts, graphs, maps, and images, are <u>used to support and enhance the narrative.</u>
   - These visuals are <u>carefully chosen and designed to complement the story,</u> making the <u>data more understandable and memorable.</u>

3. **Contextualization:**
   - Providing context is crucial in narrative visualization.
   - Story includes <u>background information</u>, <u>explanations of key concepts</u>, and <u>connections between data points</u> to ***help the audience understand the significance of the information presented.***

Narrative Visualization - Key Features

4. **Interactivity:**

   ○ Incorporating interactive elements, <u>allowing users to explore the data on their own</u>.

   ○ Interactive features can include <u>hover-over details, clickable sections for more information, or interactive charts</u> that respond to user input.

5. **Emphasis on Insights**:

   ○ narrative visualization focuses on extracting and emphasizing key insights.

   ○ The story guides the audience to understand the main points and takeaways from the data.

6. **User-Centered Design:**

   ○ The design of the narrative visualization <u>aims to be user-friendly,</u> ensuring that the <u>intended message is conveyed effectively to a diverse audience.</u>

7. **Multimodal Presentation:**

   ○ multiple modes of communication, including text, visuals, and sometimes audio.

   ○ caters <u>to different learning preferences and enhances the overall </u>storytelling experience.

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Top 10 Tools for Narrative Visualization

Tool Name	Features	Pricing	Pros	Cons
Tableau	Interactive dashboards	Free Public version	User-friendly interface	Expensive for full functionality
Microsoft Power BI	Integration with Microsoft products	Free and paid plans	Strong data connectivity	Learning curve for advanced features
Google Data Studio	Seamless integration with Google products	Free	Collaboration features	Limited data source connections
D3.js	Full customization of visualizations	Open-source	High level of flexibility	Steeper learning curve
Plotly	Support for Python, R, and Julia	Free and paid plans	Interactivity and web-based sharing	Some features require coding skills
Flourish	Storytelling features and templates	Free and paid plans	Easy to create narrative visualizations	Limited customization options

Department of Artificial Intelligence & Data Science Courtesy :Narrative Viz Tools - Upwork

Top 10 Tools for Narrative Visualization

Tool Name	Features	Pricing	Pros	Cons
RAWGraphs	Customizable chart creation	Open-source	Intuitive interface	Limited to basic visualizations
Infogram	Pre-designed templates and themes	Free and paid plans	Easy to use with no coding required	Limited advanced customization
Datawrapper	Simple and responsive charts	Free and paid plans	Quick creation of charts	Limited to basic charts
Qlik Sense	Associative data modeling	Subscription-based pricing	Advanced analytics capabilities	Requires Qlik Server for full features
Looker	Data exploration and discovery	Contact for pricing	Robust data modeling	May be complex for casual users

Department of Artificial Intelligence & Data Science Courtesy :Narrative Viz Tools - Upwork

Benefits of Narrative Visualization

1. **Contextual Understanding**

2. **Enhanced Communication**

3. **Sequential Flow of Information:**

4. **Emphasis on Key Insights:**

5. **User Engagement:**

6. **Effective Communication of Findings:**

7. **Memory Retention:**

8. **Guided Exploration**

9. **Decision Support:**

10. **Cross-Disciplinary Communication:**

Digital Storytelling

- A method of storytelling that utilizes digital media, technology, and multimedia elements <u>to convey narratives.</u>
- It involves combining traditional storytelling techniques with digital tools <u>to create a more engaging and immersive storytelling experience.</u>
- Digital storytelling leverages various forms of media, such as text, images, audio, video, and interactive elements, <u>to communicate stories in a dynamic and interactive way.</u>
- <u>Key elements of digital storytelling include:</u>
  1. **Multimedia Elements:**
  2. **Interactivity:**
  3. **Web-based Platforms:**
  4. **Integration of Technology**
  5. **Nonlinear Narratives:**
  6. **User-generated Content:**
  7. **Educational Applications:**
  8. **Marketing and Branding:**

Digital Storytelling - Key elements

1. **Multimedia Elements:**
   - Digital stories often incorporate a <u>mix of multimedia elements</u>, such as images, videos, sound effects, music, and text.
   - These elements work together <u>to enhance the storytelling experience and convey a richer narrative.</u>

2. **Interactivity:**
   - allows for user interaction.
   - Viewers may have the ability <u>to make choices that influence the direction of the story</u>, click on elements for additional information, or engage with the content in other interactive ways.

3. **Web-based Platforms:**
   - Many digital stories are created for online platforms, <u>taking advantage of the internet's reach and accessibility.</u>
   - Web-based platforms <u>allow for easy sharing, distribution, and engagement </u>with a global audience.

Digital Storytelling - Key elements

4. **Integration of Technology:**
   - Digital storytelling involves the use of digital tools and technologies <u>for creation and presentation.</u>
   - includes <u>multimedia editing software</u>, interactive web platforms, virtual reality (VR), augmented reality (AR), and more.

5. **Nonlinear Narratives:**
   - allows for nonlinear narratives, where users can <u>explore the story in different ways.</u>
   - includes branching storylines or interactive elements that <u>give users control over the narrative progression.</u>

6. **User-generated Content:**
   - involve <u>user-generated content</u>, where individuals contribute their own stories or perspectives.
   - This participatory aspect can create a sense of community and inclusivity.

Digital Storytelling - Key elements

7. **Educational Applications:**

   ○ Digital storytelling is widely used in educational settings as a tool for students to create and share their own stories.

   ○ It enhances digital literacy skills and allows for creative expression.

8. **Marketing and Branding:**

   ○ In the business world, digital storytelling is utilized for marketing and branding purposes.

   ○ Companies use multimedia content to tell their brand story, connect with audiences emotionally, and create a memorable brand identity.

Digital Storytelling Tools

Tool	Features	Pros	Cons	Pricing
Adobe Spark	Multimedia creation (videos, web pages, graphics).	User-friendly interface.	Limited advanced features.	Free, with premium plans available.
StoryMapJS	Create interactive maps and timelines.	Easy to use for beginners.	Limited customization options.	Free
TimelineJS	Build interactive timelines with media.	Simple and intuitive.	Limited to timelines.	Free
Twine	Create interactive, nonlinear stories.	Suitable for branching narratives.	May have a learning curve for non-programmers.	Free
Visme	Design presentations, infographics, and more.	Versatile with various templates.	Some features may be locked behind a paywall.	Free, with premium plans available.

Digital Storytelling Tools

Tool	Features	Pros	Cons	Pricing
Canva	Graphic design tool for presentations, social media, etc.	User-friendly with drag-and-drop interface.	Some advanced features require a subscription.	Free, with premium plans available.
ThingLink	Add interactive elements to images and videos.	Enhances engagement with interactive content.	Limited free features.	Free, with premium plans available.
Prezi	Zoomable canvas for dynamic presentations.	Engaging and non-linear presentations.	Learning curve for some users.	Free, with premium plans available.
Wix	Website builder for creating multimedia-rich sites.	Offers a range of design options.	Complexity for advanced features.	Free, with premium plans available.
Microsoft Sway	Digital storytelling app by Microsoft.	Integrates multimedia elements seamlessly.	Limited control over fine-tuning design.	Free, part of Microsoft 365 subscription.
H5P	Create interactive and multimedia content.	Open-source with a variety of content types.	Requires integration into a compatible platform.	Free

Benefits of Digital Storytelling

1.   **Enhanced Engagement:**

2.   **Multimodal Communication:**

3.   **Emotional Connection:**

4.   **Accessibility and Reach:**

5.   **Interactivity:**

6.   **Flexibility and Adaptability:**

7.   **Data Integration:**

8.   **Real-time Updates:**

9.   **Collaboration:**

10. **Measurable Impact:**

11. **Educational Value:**

12. **Brand Building:**

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Digital Storytelling Process

Digital Storytelling Process

Step One:
Come up with an idea
Write a Proposal

Step Two:
Research/Explore/Learn

Step Three:
Write/Script

Step Four:
Storyboard/Plan

Step Five:
Gather/Create Images
Gather/Create Audio
Gather/Create Video

Step Six:
Put It All Together

Step Seven:
Share

Step Eight:
Feedback and Reflect

Created by Samantha Morra
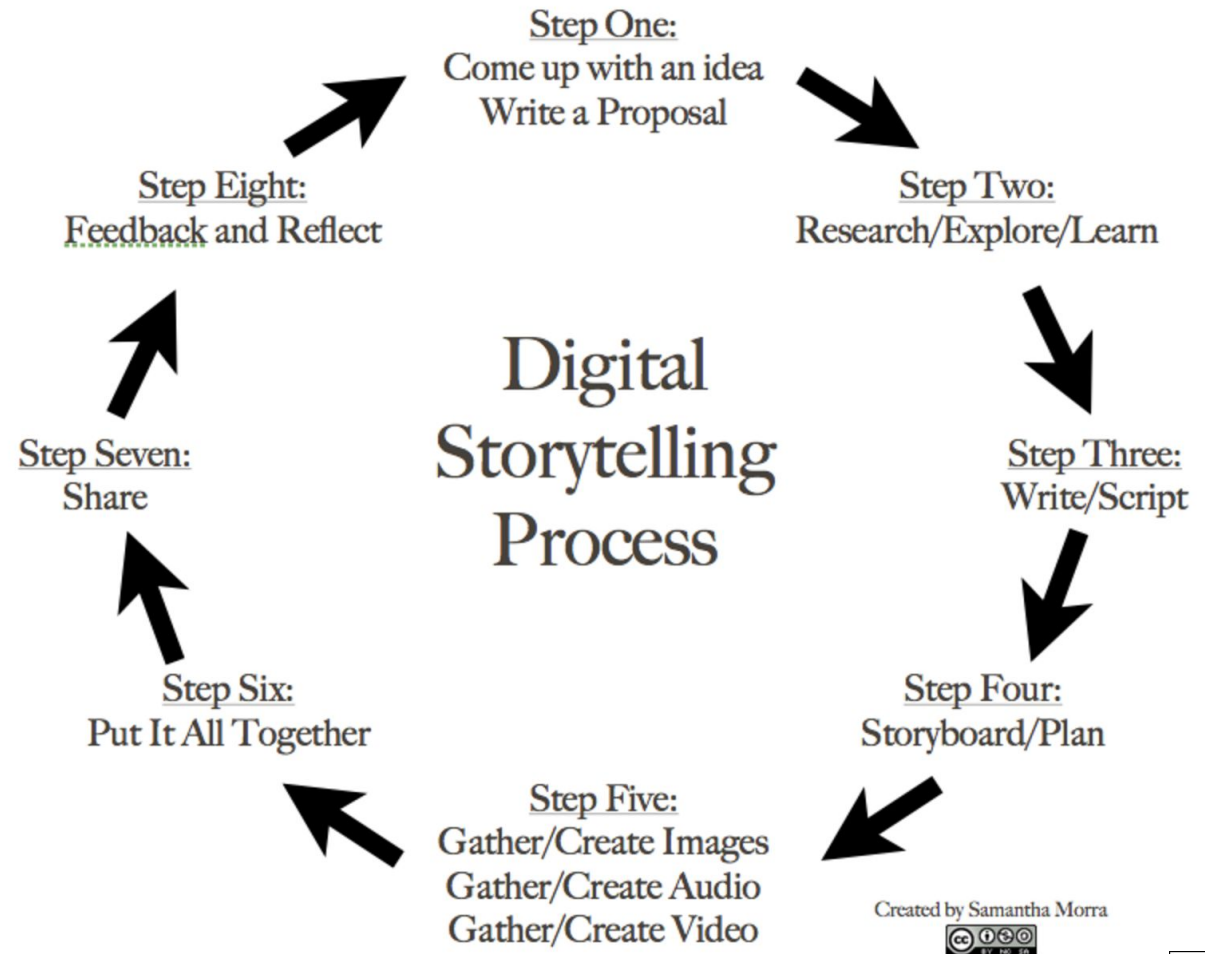
What is Digital Storytelling ?

What it is not ?
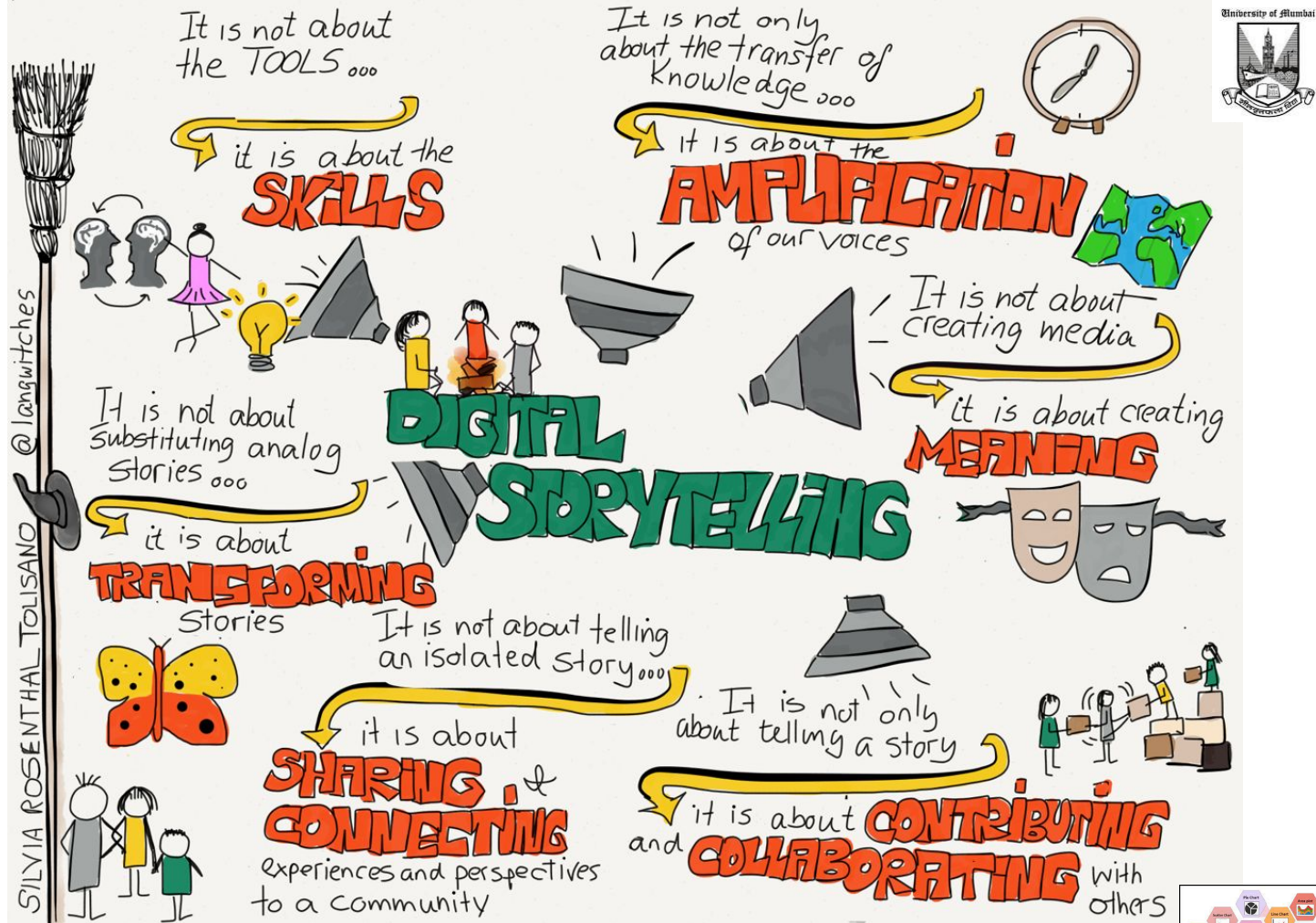
Infographics

- visual representations of information, data, or knowledge designed <u>to convey complex concepts in a clear and easily understandable manner.</u>

- They combine visuals, such as charts, graphs, icons, and illustrations, with concise text<u> to present information quickly and effectively.</u>

- used across various fields<u> to simplify complex ideas, communicate statistics, or tell a story visually.</u>

- <u>Key characteristics of infographics</u>:

  1. Visual Elements:

  2. Concise Text:

  3. Organization:

  4. Color and Design:

  5. Data Visualization:

  6. Engagement:

Infographics Example

PINTEREST

SOCIAL SITE THAT IS ALL ABOUT DISCOVERY

LARGEST OPPORTUNITIES
home, parenting, food, beauty, style

89% USE PINTEREST FOR PURCHASE INSPIRATION

431 MILLION MONTHLY ACTIVE USERS

TWITTER

MICRO BLOGGING SOCIAL SITE THAT LIMITS EACH POST TO 280 CHARACTERS

THERE ARE OVER 77 MILLION TWITTER USERS in the US

6,000 TWEETS ON AVERAGE HAPPEN EVERY SECOND

353 MILLION MONTHLY ACTIVE USERS

FACEBOOK

THE LARGEST SOCIAL MEDIA PLATFORM AROUND THE WORLD

59% OF SOCIAL MEDIA USERS ARE ON FACEBOOK

26% OF U.S. FACEBOOK USERS ARE AGE 25 TO 34

USERS SPEND 19.6+ HOURS A MONTH ON AVERAGE ON FACEBOOK

2.91 BILLION MONTHLY ACTIVE USERS

INSTAGRAM

SOCIAL SHARING APP ALL AROUND PICTURES STORIES AND LIVE VIDEOS

MANY BRANDS ARE PARTICIPATING THROUGH THE USE OF #HASHTAGS AND POSTING PICTURES AND VIDEOS CONSUMERS CAN RELATE TO

MOST FOLLOWED BRAND IS NATIONAL GEOGRAPHIC

1.4 BILLION MONTHLY ACTIVE USERS

TIKTOK

APP FOR MAKING AND WATCHING SHORT FORM VIDEOS

1+ MILLION VIDEO VIEWS DAILY AND

1+ BILLION SOUND USES DAILY

MOST USED SOCIAL PLATFORM AMONG USERS AGES 10-29

1+ BILLION MONTHLY ACTIVE USERS

LINKEDIN

BUSINESS ORIENTED SOCIAL NETWORKING SITE

BRANDS THAT ARE PARTICIPATING ARE CORPORATE BRANDS GIVING POTENTIAL AND CURRENT ASSOCIATES A PLACE TO NETWORK & CONNECT

77%+ USERS ARE OUTSIDE THE U.S.

250 MILLION MONTHLY ACTIVE USERS

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Courtesy : Insightplatforms

Infographics - Key characteristics

1. **Visual Elements:**

   ○ to convey information, making use of charts, graphs, icons, images, and other graphic elements.

   ○ carefully chosen to enhance the message and engage the audience.

2. **Concise Text:**

   ○ The accompanying text in an infographic is kept short and to the point.

   ○ provides just enough information to complement the visuals

   ○ conveys the main message without overwhelming the viewer with excessive text.

3. **Organization:**

   ○ Infographics are organized in a structured and logical manner.

   ○ Information is typically presented in a sequence that guides the viewer through the content, helping them understand the story or message being conveyed.

Infographics - Key characteristics

4. **Color and Design:**

   - A well-designed color scheme and layout contribute to the effectiveness of infographics.

   - Colors are often used to categorize information, create emphasis, and improve overall aesthetics.

   - The design should be visually appealing and easy to follow.

5. **Data Visualization:**

   - Infographics often include data visualization elements, such as bar charts, pie charts, or other graphical representations of numerical information.

   - These visuals help make complex data more accessible and understandable.

6. **Engagement:**

   - Infographics are designed to capture and maintain the viewer's attention.

   - Engaging visuals, a clear narrative, and a visually appealing layout contribute to the overall impact of the infographic.

Infographics - Tools

Tool	Features	Pros	Cons	Pricing
Canva	Drag-and-drop interface for easy design.	User-friendly with a wide range of templates.	Some advanced features require a subscription.	Free, with premium plans available.
Piktochart	Customizable templates and an easy-to-use editor.	Offers a library of graphics and icons.	Limited free templates and features.	Free, with premium plans available.
Venngage	Diverse range of infographic templates.	User-friendly interface with customization options.	Some advanced features are available only in paid plans.	Free, with premium plans available.
Visme	Templates for infographics, presentations, and more.	Provides a wide range of design elements.	Some features may be locked behind a paywall.	Free, with premium plans available.
Infogram	Create interactive and visually appealing infographics.	Supports real-time data updates.	Limited design customization in free version.	Free, with premium plans available.

Benefits of Infographics

1. **Visual Appeal:**

2. **Simplification of Complex Data:**

3. **Enhanced Memorization:**

4. **Quick Information Retrieval:**

5. **Increased Engagement on Social Media:**

6. **Cross-Cultural Communication:**

7. **Brand Awareness:**

8. **Increased Website Traffic:**

9. **Storytelling Possibilities:**

10. **Data Visualization:**

11. **Time Efficiency:**

12. **Versatility:**

Interactive Dashboard

- A **user interface** that allows individuals to interact with and explore data visually.

- It provides a dynamic and real-time view of key metrics, performance indicators, and other relevant information, enabling users to gain insights, make data-driven decisions, and customize their viewing experience.

- commonly used in various industries and business contexts **to monitor, analyze, and communicate complex data in a user-friendly manner.**

- Key features of interactive dashboards

    1. **Real-time Data Updates:**
    2. **Visualization of Data:**
    3. **Interactivity:**
    4. **Customization:**
    5. **Data Integration:**
    6. **Alerts and Notifications:**
    7. **Collaboration:**
    8. **Accessibility:**

Interactive Dashboard Example
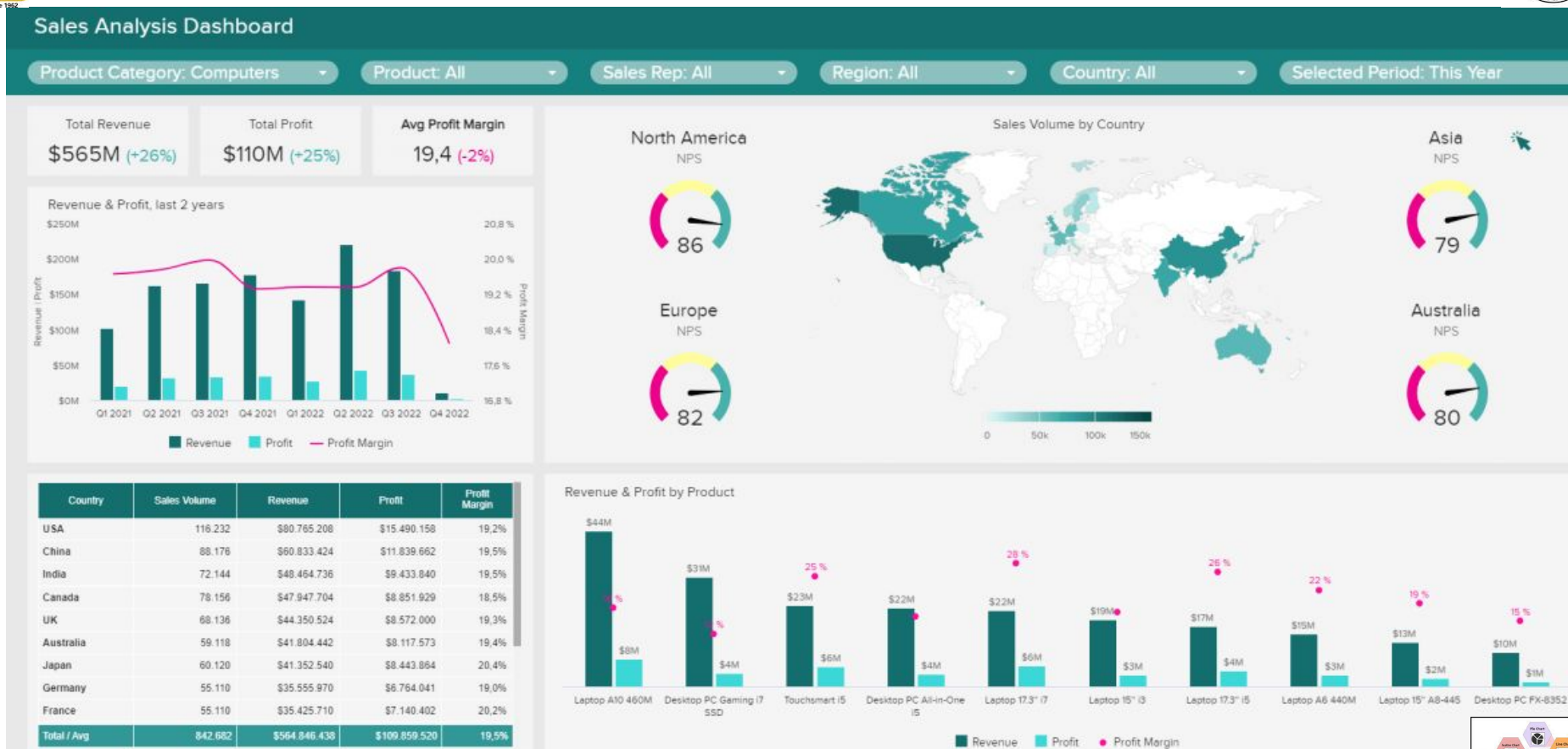
Interactive Dashboard - Key Features

1. **Real-time Data Updates:**

   ○ display data in <u>real-time or near-real-time,</u>

   ○ allows users <u>to access the latest information and respond promptly to changes.</u>

2. **Visualization of Data:**

   ○ Dashboards <u>use visual elements</u> such as charts, graphs, tables, and maps

   ○ to present data in a more <u>comprehensible and visually appealing manner.</u>

   ○ This makes it <u>easier for users to identify trends, patterns, and anomalies.</u>

3. **Interactivity:**

   ○ Users can <u>interact with the dashboard by clicking on elements, applying filters, adjusting parameters, or drilling down</u> into specific details.

   ○ This interactivity <u>enhances the user experience and enables deeper exploration of the data.</u>

Interactive Dashboard - Key Features

4. **Customization:**

   ○ Users can often customize the dashboard layout, choose specific metrics <u>to display, and personalize</u> <u>their view according to their preferences.</u>

   ○ This flexibility <u>caters to different user roles and preferences within an organization.</u>

5. **Data Integration:**

   ○ Dashboards can <u>integrate data from various sources,</u>

   ○ provides <u>a comprehensive view of information</u> from different departments or systems.

   ○ Integration <u>allows for a holistic understanding</u> of organizational performance.

6. **Alerts and Notifications:**

   ○ Some interactive dashboards include <u>alerting features that notify users when certain predefined</u> <u>thresholds or conditions are met</u>.

   ○ This helps <u>users stay informed about critical changes</u> in data.

Interactive Dashboard - Key Features

7. **Collaboration:**

   ○ Dashboards may support collaboration features, <u>allowing multiple users to access and work on the same dashboard simultaneously</u>.

   ○ This <u>promotes teamwork</u> and <u>facilitates data-driven discussions.</u>

8. **Accessibility:**

   ○ Interactive dashboards are often <u>accessible through web browsers or dedicated applications</u>, making them available to users on different devices and platforms.

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Interactive Dashboard Tools

Tool	Features	Pros	Cons	Pricing
Tableau	- Robust data visualization and analytics.	- Rich set of visualization options.	- Higher cost for enterprise solutions.	Free Public version, Paid plans available.
Microsoft Power BI	- Seamless integration with Microsoft products.	- User-friendly interface.	- Some advanced features require a Pro subscription.	Free version, Power BI Pro, Power BI Premium.
Google Data Studio	- Web-based tool for creating interactive reports.	- Integration with various data sources.	- Customization options are limited compared to others.	Free
QlikView/Qlik Sense	- Associative data modeling for data exploration.	- Offers associative data discovery.	- Learning curve for new users.	QlikView: Pricing on request, Qlik Sense: Free, Enterprise plans available.
Domo	- Cloud-based business intelligence and analytics.	- Allows for easy data integration.	- Requires a strong internet connection for optimal use.	Pricing on request

Benefits of Interactive Dashboard

1. **Real-time Insights:**

2. **User Engagement:**

3. **Customization:**

4. **Drill-Down Capabilities:**

5. **Collaboration:**

6. **Data Exploration:**

7. **Visual Storytelling**

8. **Decision-Making Support:**

9. **Adaptability:**

10. **Feedback Loop:**

STATIC REPORTS VS. **INTERACTIVE DASHBOARDS**

STATIC REPORTS	INTERACTIVE DASHBOARDS
Static view of past data	Mix of interactive real-time and past data
Generated to answer specific business questions	Can answer any question that arises during the analysis process
Need to generate multiple reports for different data sources	Centralized view of multiple data sources
Takes time to generate, often with a lot of IT involvement	Anyone can generate and use them within minutes due to their self-service nature