

# RUTGERS

Rutgers Business School  
Newark and New Brunswick

## Data Visualization

“My particular ability does not lie in mathematical calculation, but rather in visualizing effects, possibilities, and consequences.”

- Albert Einstein

# Evolution of Visualization

- Visualization is **not new**. Throughout recorded history, drawings and other visually oriented representations have been an **integral part** of man's investigation of the world
- What is new on the other hand, is the **computational** and **visual display capabilities** of computers
- Furthermore, ERP systems among other evolving technologies are increasing the **stream of data** and their **parameters**, resulting in multidimensional data with a **high dimensionality**, where finding **valuable** information **hidden** in them, is like searching a pin in a haystack

# What is Data Visualization

- The idea of visualization is to **present** the data in some **visual form** (e.g. charts, graphs, maps) allowing the human to get **insight** into the data, **draw conclusions**, and come up with **hypotheses**
- Data visualization aims at **integrating** individuals in the data analysis process, applying their **perceptual abilities**, **flexibility**, **creativity**, and **general knowledge** to the large data sets available in today's systems

# Stages of Data Visualization

- The **four stages** of Data Visualization consist of:
  - The **collection** and **storage** of data
  - The **preprocessing** designed to **transform** the data into something we can **understand**
  - The **display hardware** and the **graphics algorithms** that produce an image on the screen
  - The human **perceptual** and **cognitive system**

# The Theory of Cognitive fit

- The **theory of cognitive fit** proposed by Vessey (1991) provides a **basis** for the **outcome** of visual or graphical presentation
- This theory proposes that a **problem** may be represented either **spatially** (Visually) or **symbolically** (Tabular form), and the **task required** of the decision-maker may also be **described similarly**
- It suggests that the **correspondence** between task and information presentation format **leads to superior** task performance whereby if the **type of presentation** matches the **type of task**, decision makers will be both **more efficient** and **more effective** in decision making

# Why Data Visualization?

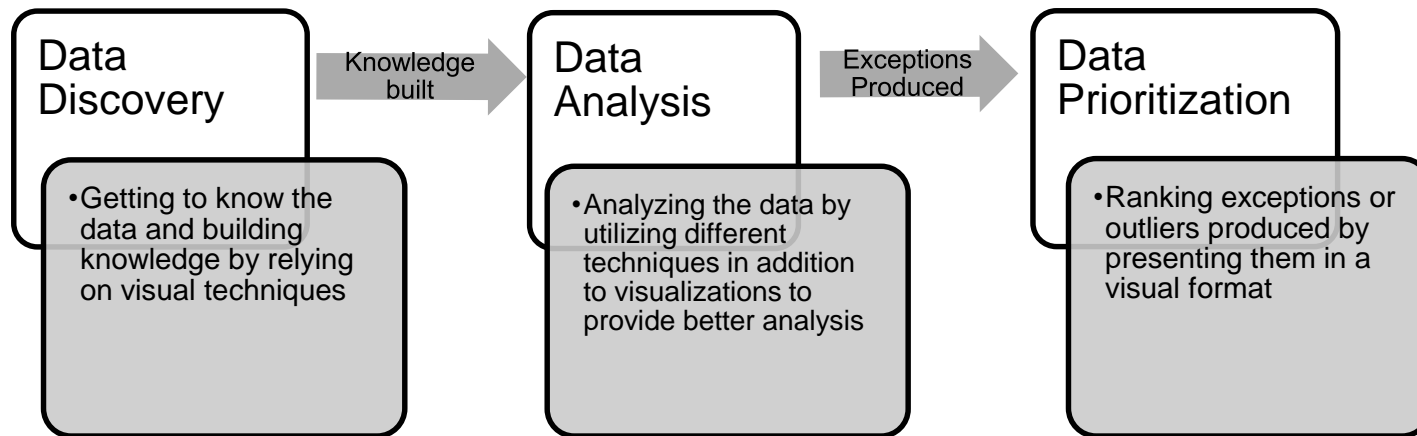
- It is well known that **Decision-making** is **a cognitive process** and involves reliance on the **nature** and content of information being inputted and how the information is being **presented**
- Additionally, presentation format has been used to support decision-making processes and
- **Numerous studies** have also suggested the use of such format to minimize human information processing limitations and **improve ways of thinking**

# Why Data Visualization?

- Furthermore, the 20 billion plus neurons of the brain that are devoted to analyzing visual information provide a powerful but **flexible pattern finder**
- Coupled with **computational power**, we can go one step further and recognize that people with machines are much **more cognitively** powerful than a single person or machine alone
- Therefore, what better way to **present** and **analyze** data than to apply **data visualization** techniques

# Benefits of Data Visualization

- Data visualization can **benefit** the **different stages** of data analytics, from discovery to ranking/prioritizing outliers.



- Data visualization may also be useful in **quality control**, where with an appropriate visualization, **errors** and **artifacts** in the data often become visible
- Additionally, **patterns**, **trends** and **correlations** that might go undetected in text-based data can be **exposed** and **recognized** easier with data visualization

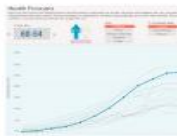


# Benefits of Data Visualization

- **Additional Benefits** of Data Visualization:
  - Data Visualization can easily **deal** with highly **diverse** and **noisy data**
  - Data Visualizations is **intuitive** and requires no understanding of **complex mathematical** or **statistical algorithms** or parameters
  - Data Visualizations usually allows for **faster data** exploration and often provides **better results**

# Types Data Visualization

- There are **many types** Data Visualization techniques
- They may **range** from **static** to **Dynamic**.
  - **Static**: where users select information items and their display format
  - **Dynamic**: where users are allowed a choice of which data to display, how to represent the data, or both



Chart

Quantities,  
Distributions,  
Correlations



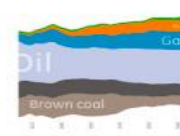
Map

Geography



Network

Interconnections



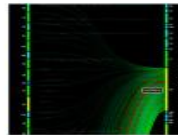
Time Series

Temporality



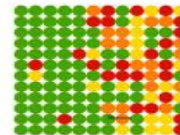
Hierarchy

Tree Structure



Flow

Movement and  
Exchange



Matrix

Composition



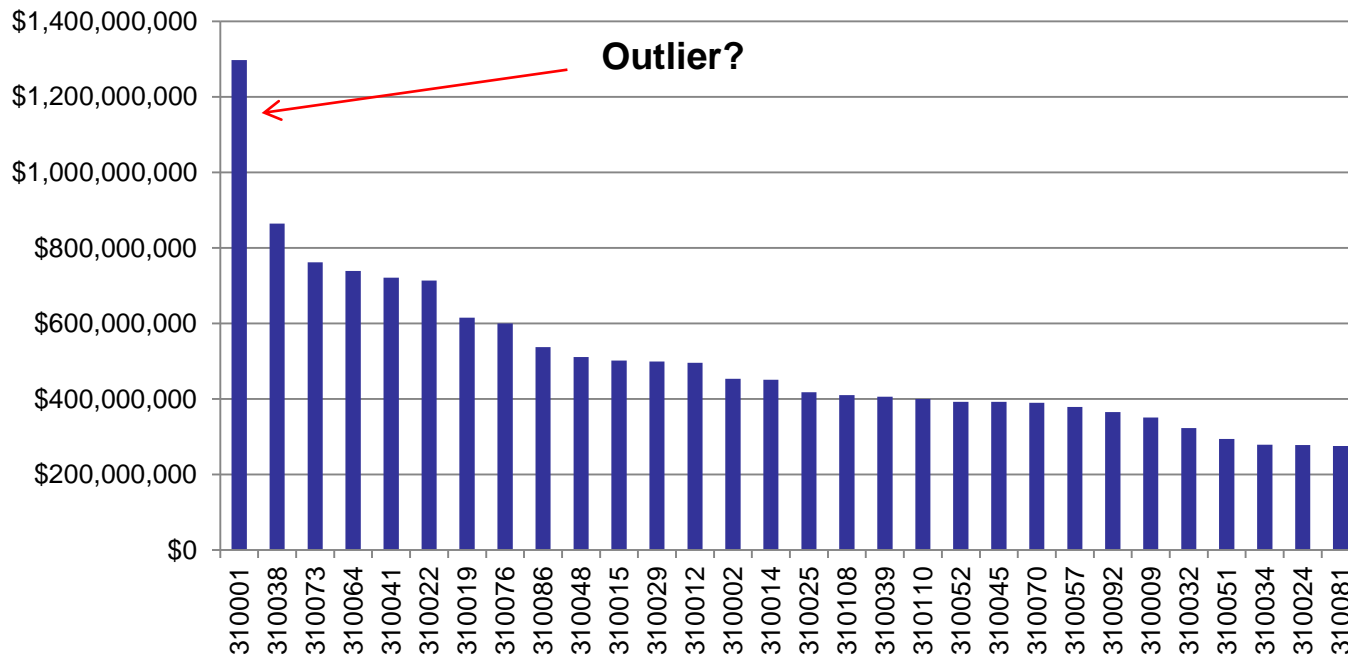
Infographic

Explanation and  
Communication

# Examples of Data Visualization

- **Bar Chart**

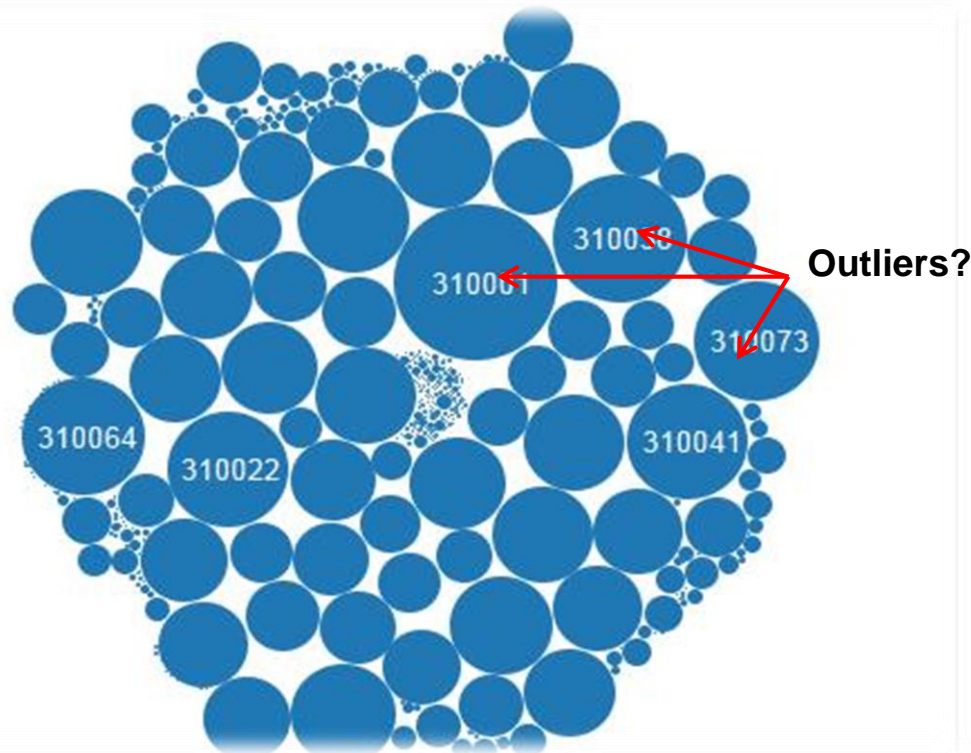
- A bar chart is a simple way to visualize data where they contain rectangular bars with lengths proportional to the values that they represent



# Examples of Data Visualization

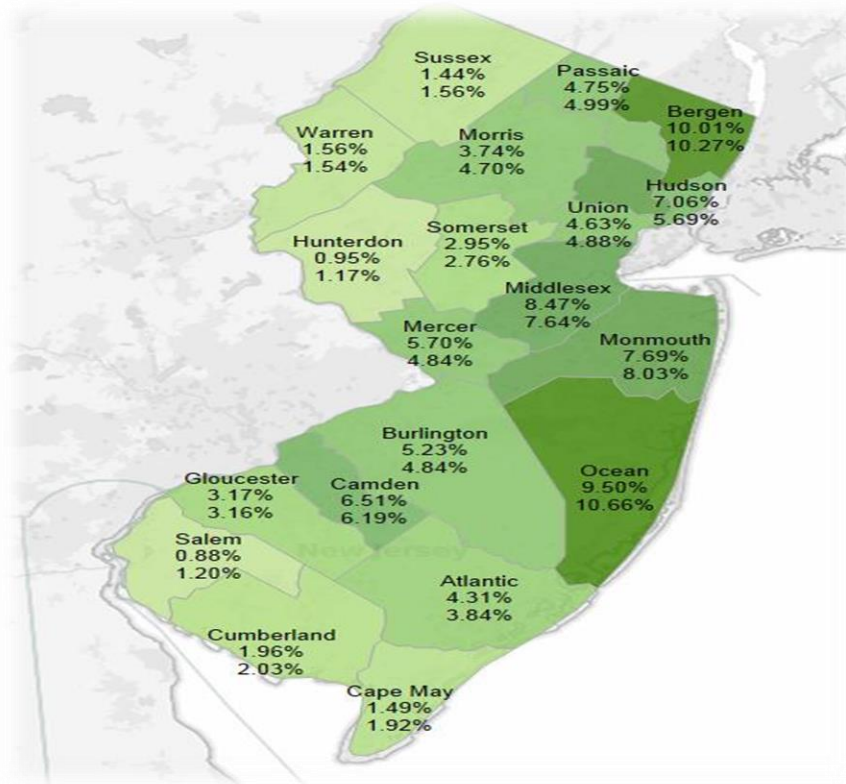
- **Bubble Chart**

- A bubble chart is a variation of a scatter plot where data points are replaced with bubbles, and additional dimensions are represented in terms of bubble size and/or color



## Examples of Data Visualization

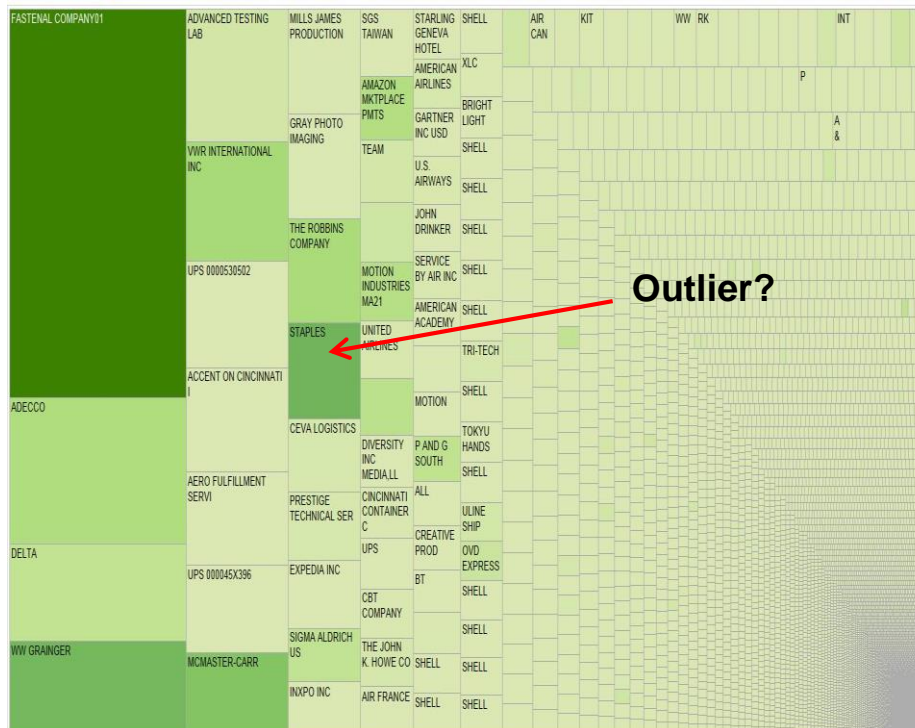
- **Map/Geographic Visuals** (Geovisualization)
  - Geographic visualization refers to a set of tools and techniques supporting geospatial data analysis



# Examples of Data Visualization

- **Heat Maps**

- A heat map is a graphical representation of data where values are presented in a matrix and represented by colors



# Examples of Data Visualization

- Visualization Dashboards**

- Dashboards enables many different visualization formats to be presented to the user simultaneously instead of having to present one at a time



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