

# ISA 401/501: Business Intelligence & Data Visualization

## 20: Charts for High Dimensional Data

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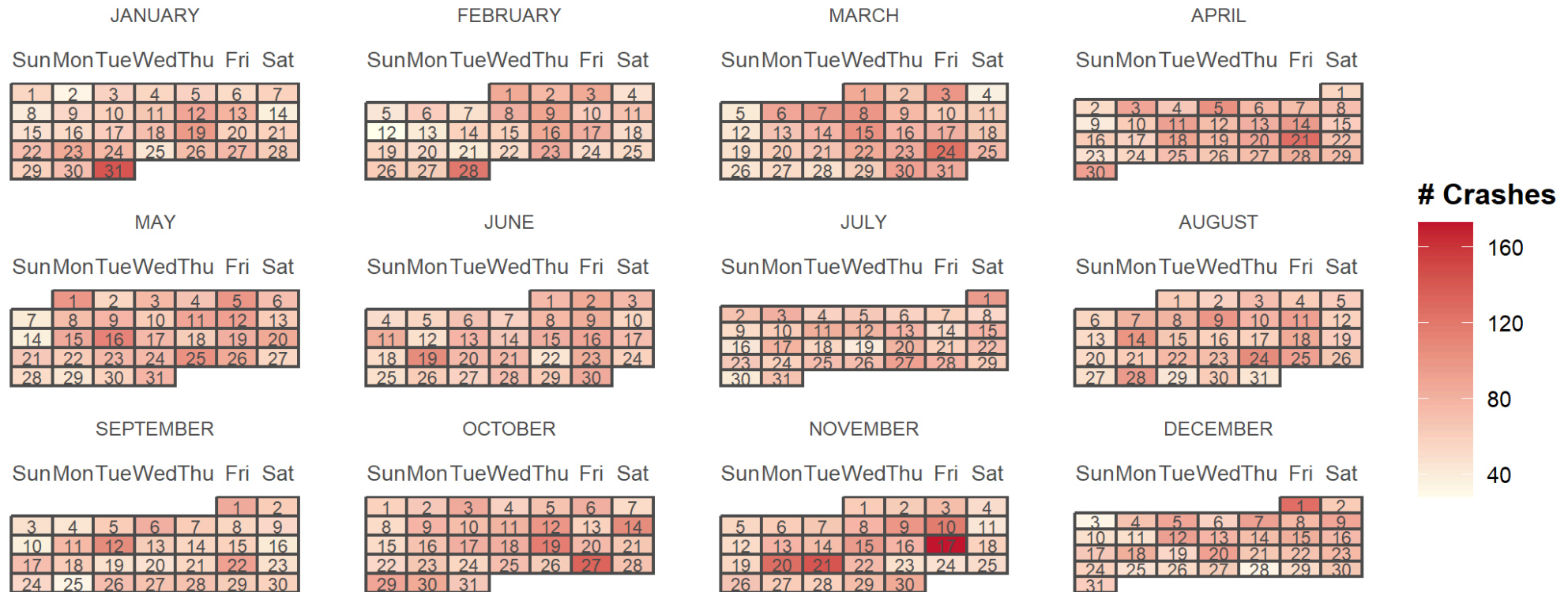
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 Automated Scheduler for Office Hours

Spring 2024

# Warm-up/Non-graded Activity: A Calendar Plot

Let us use  inside Power BI to create this based on [cincy\\_daily\\_crashes.csv](https://data.cincinnatiopen.com/dataset/cincy-daily-crashes).



Created by: Fadel Megahed | Data source: City of Cincy Open Data Portal (rvmt-pkmq)

# Learning Objectives for Today's Class

- Describe what is high dimensional data.
- Provide some examples for graphs used for high dimensional datasets.
- Construct these graphs using software

# High Dimensional Data

03:00

# What Do we Mean by High Dimensional Data.

**Activity**

Your Solution

In 3 minutes, define the terms in next tab in the context of this table.

Order ID ♦	Order Date ♦	Order Priority ♦	Product Container ♦	Product Cost ♦	Ship Date ♦
1	1/1/2022	5 - low	Large box	25	1/5/2022
2	1/4/2022	4 - not specified	Small Box	36	1/7/2022
3	1/15/2022	2- high	Small Box	38	1/17/2022
3	1/15/2022	2- high	Small Box	41	1/17/2022
3	1/15/2022	2- high	Jumbo Box	44	1/17/2022
3	1/15/2022	2- high	Wrap Bag	33	1/17/2022
4	1/18/2022	1- urgent	Small Box	33	1/19/2022

Showing 1 to 7 of 11 entries

Previous

1

2

Next

# What Do we Mean by High Dimensional Data.

Activity

Your Solution

**Data Types:** (Edit below)

- Multivariate data: \_\_
- Big Data: \_\_
- Tall Data: \_\_
- Wide Data: \_\_
- High Dimensional Data: \_\_

# Taxonomy

## Based on the number of attributes:

- 1: Univariate
- 2: Bivariate
- 3: Trivariate
- 4+: Multivariate

## Things to Think about:

- What is the problem with visualizing multivariate (especially when  $p > 6 - 7$  dimensions) data? \_\_
- Any ideas about what to do? \_\_

# Examples of High Dimensional Charts



# Hans Rosling: The Best Stats You Have Seen

Activity

Your Solution

While watching this video, please answer the questions in the next tab!!



# Hans Rosling: The Best Stats You Have Seen

Activity

Your Solution

- What data is represented in this visualization? Be specific. \_\_
- How is each data type visually encoded? \_
- Do you think the encodings are appropriate? \_

# So What is the Motion Bubble Chart?

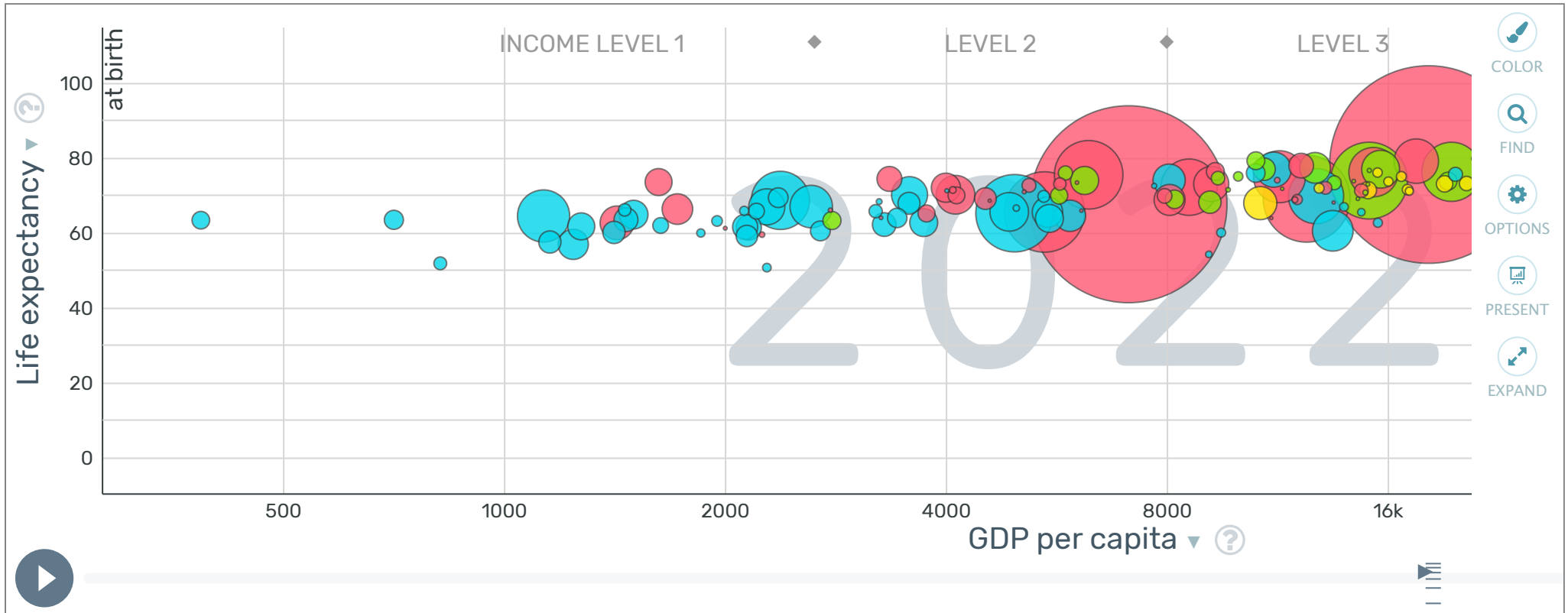
Motion charts are essentially **animated bubble charts**. A bubble chart shows data using the **x-axis**, **y-axis**, and the **size** and **color** of the bubble. A motion chart displays **changes over time by showing movement within the two-dimensional space and changes in the size and color of the bubbles**. -- Juice Analytics

## Encoding mechanisms:

- **x-axis** is typically used to encode a **numeric variable**
- **y-axis** is also used to encode a **numeric variable**
- **area** is used to encode a **numeric/ordinal variable**
- **color** is typically used to encode a **nominal variable**
- **motion/animation** is typically used to encode **time**

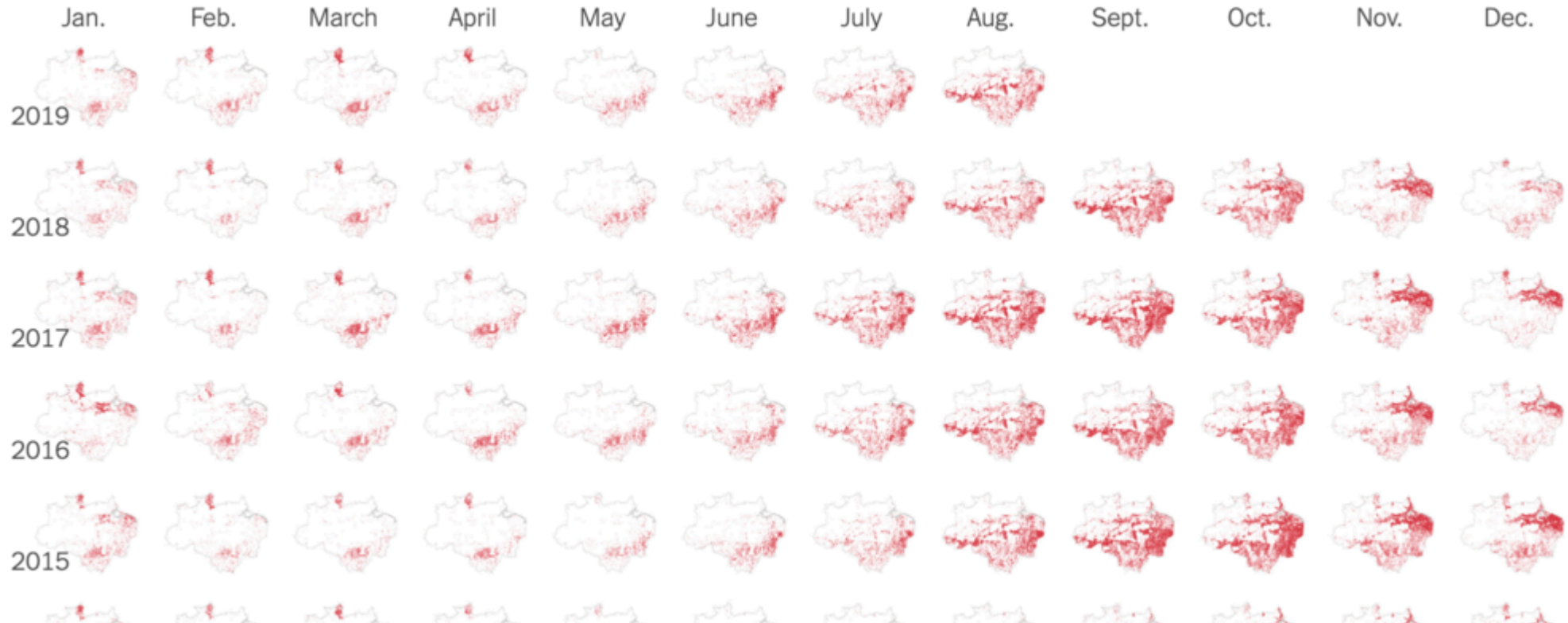
# Live Demo: Creating Bubble Charts in Power BI

Let us use Power BI to create a similar chart to the one created by Hans Rosling. We will be using the [gapminder.csv](#).



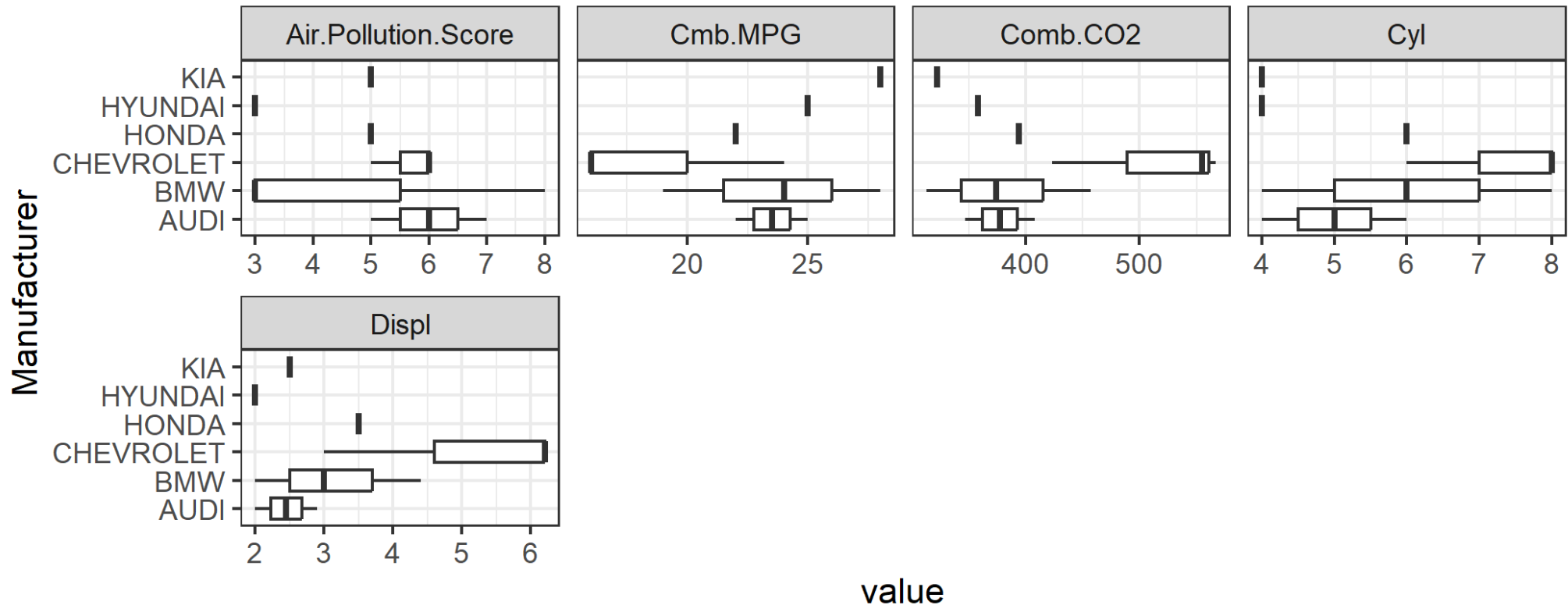
# Small Multiples

Illustrations of postage-stamp size are indexed by category or a label, sequenced over time like the frames of a movie, or ordered by a quantitative variable not used in the single image itself -- [Tuft, E.R.: Envisioning Information, Graphics Press, 1990](#)



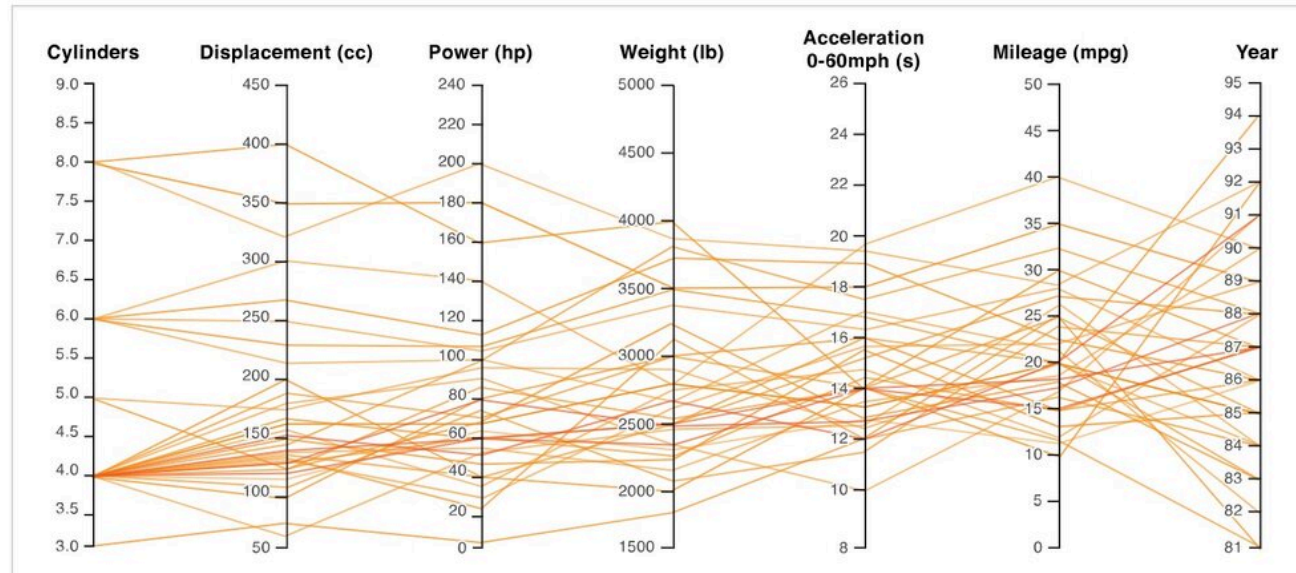
# Small Multiples in Power BI

Let us use Power BI to create a similar chart to the one below. We will be using the [mpg\\_2023\\_large.csv](#).



# Parallel Coordinates

Parallel coordinates is a visualization technique used to plot individual data elements across many performance measures. Each of the measures corresponds to a vertical axis and each data element is displayed as a series of connected points along the measure/axes -- [Juice Analytics' Definition](#)

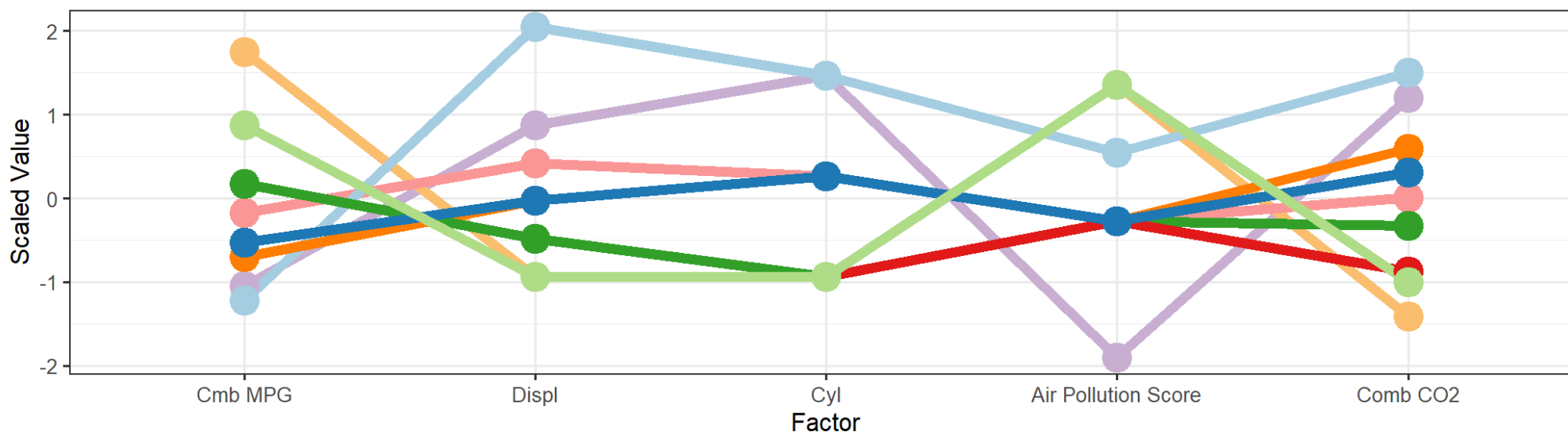


# Parallel Coordinates in Power BI

Let us visualize the [mpg\\_2023\\_sample.csv](#) using a parallel coordinates plot in Power BI.

Some Factors Impacting the Combined MPG for 2023 Vehicles

HEVROLET Silverado 4WD Mud Terrain Tire   HONDA HR-V   KIA Carnival   NISSAN Sentra   PORS  
ORD Explorer   HYUNDAI Santa Fe   MERCEDES-BENZ GLA 250   PORSCHE 911 Carrera GTS Cabriolet



Data source: <https://www.fueleconomy.gov/feg/download.shtml>



# Radar Charts

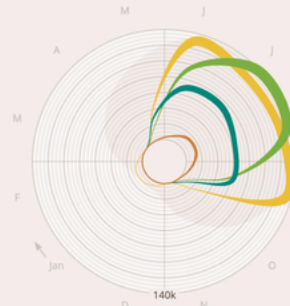
Charts show how individual things perform across multiple measures

## Mountain →

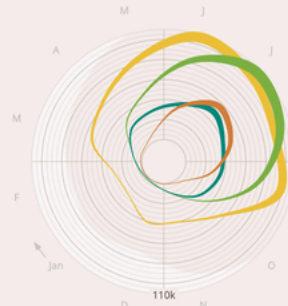
Mountainous parks are known for their snowy winters. Only lodges provide the appropriate shelter during the cold season. They are great camping destination once the snow melts from late spring to early fall.

You will notice a peak of frequentation in the Appalachian Mountains in October when leaves turn yellow.

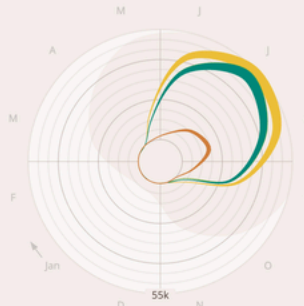
- Lodging
- RV
- Tent
- Backcountry



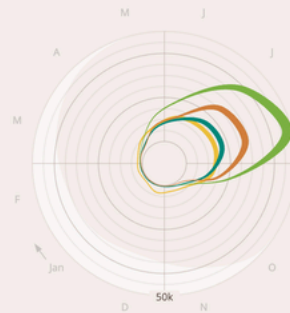
**Yellowstone**  
Wyoming, Montana, Idaho



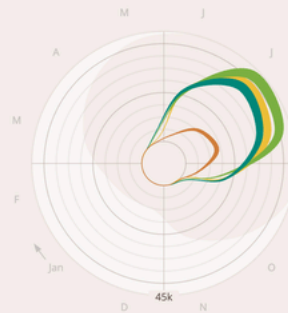
**Yosemite**  
California



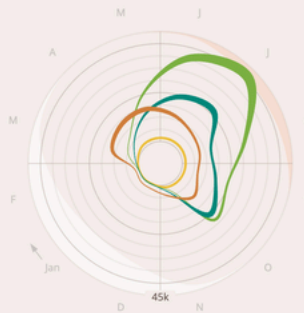
**Grand Teton**  
Wyoming



**Olympic**  
Washington



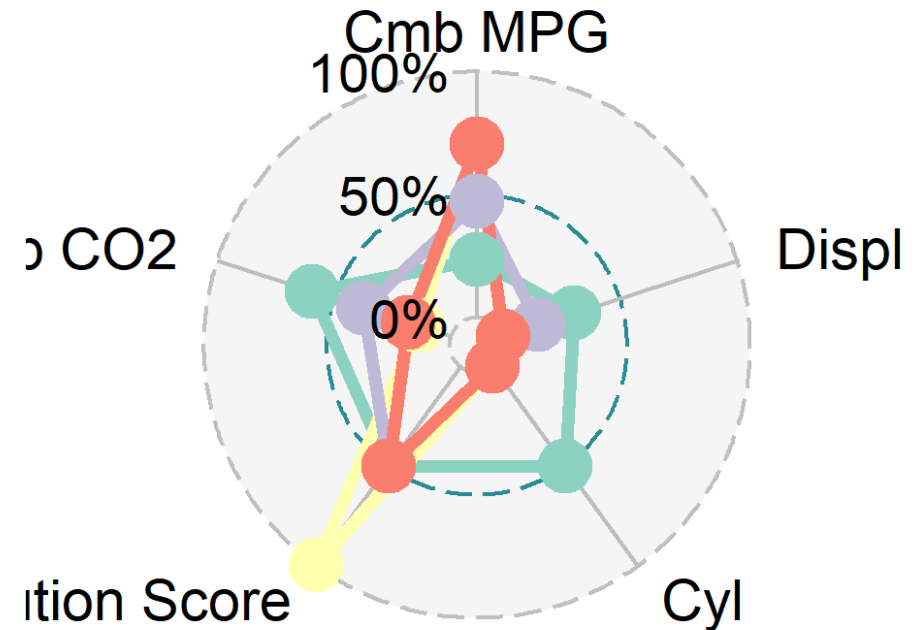
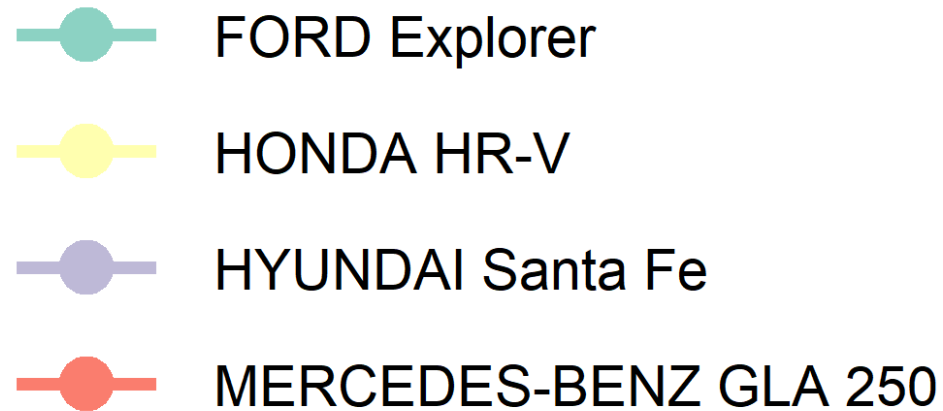
**Glacier**  
Montana



**Great Smoky Mountains**  
Tennessee, North Carolina

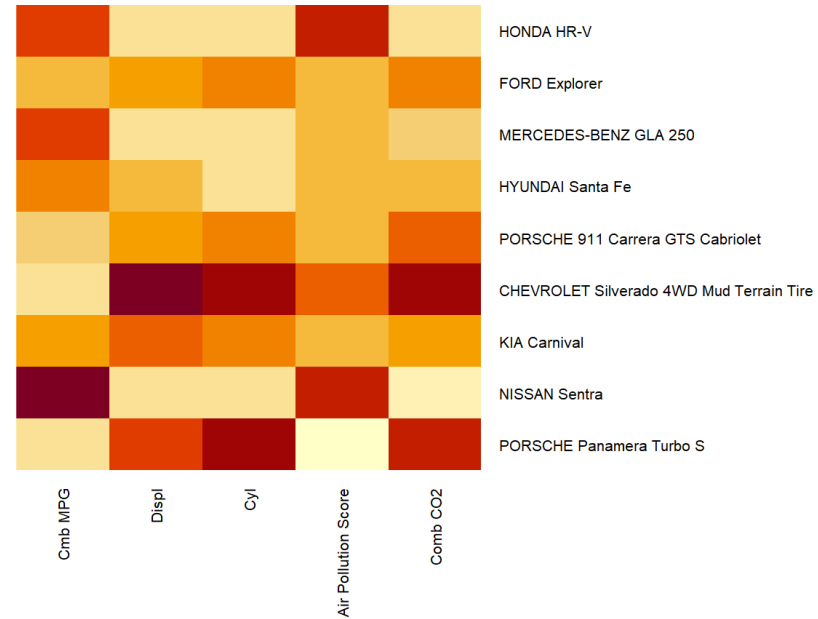
# Radar Charts in Power BI

Let us add the [Radar Chart App](#) to our Power BI and use it to visualize the [mpg\\_2023\\_sample.csv](#).



# Other Charts: HeatMap

- each column is a variable
- each obs is a row
- each square is a value;  
closer to yellow the higher



# Other Charts: TreeMaps

Treemaps simultaneously show the big picture, comparisons of related items, and allow easy navigation to the details. [Juice Analytics](#)

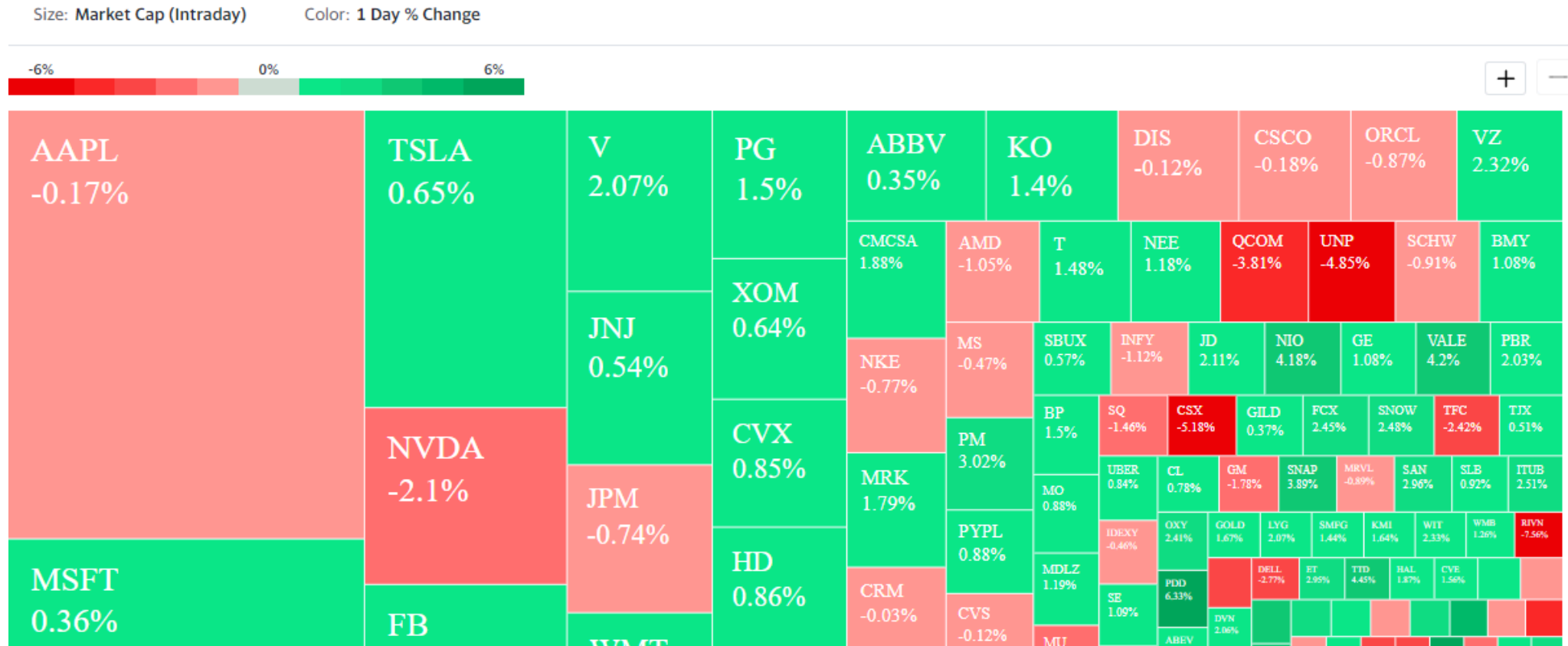
## Encoding mechanisms:

Each box in a treemap can show two measures:

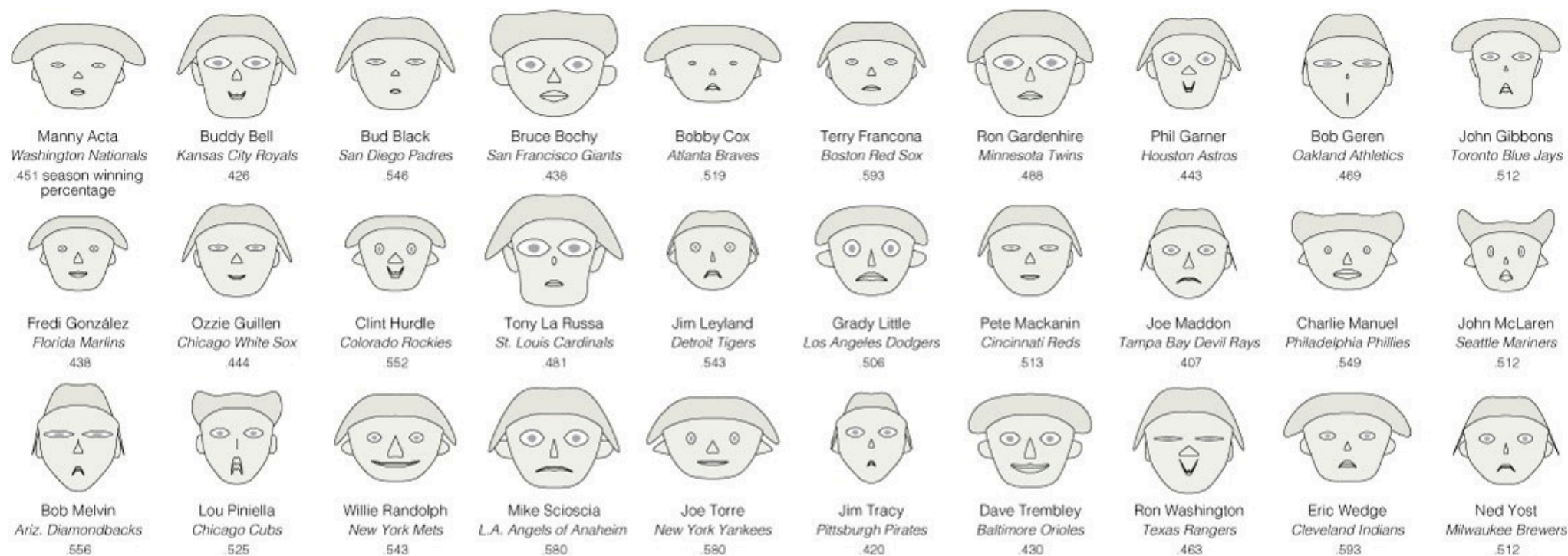
- **area of the boxes** should be a **quantity measure**. The measures should sum up along the hierarchical structure of the data. The sum of all the elements in one branch need to sum to the value of the branch as a whole.
- **Color of the boxes** is best suited to a **measure of performance or change** such as growth over time, average conversion rate, or customer satisfaction.

# Other Charts: TreeMaps

Treemaps simultaneously show the big picture, comparisons of related items, and allow easy navigation to the details. [Juice Analytics](#)

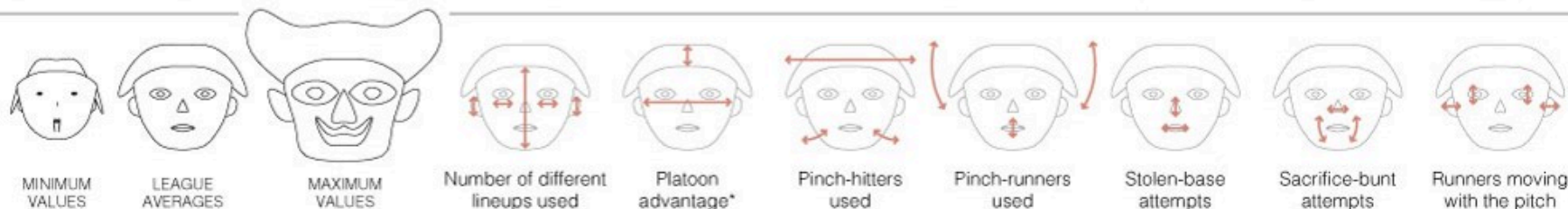


# Other Charts: Chernoff Faces



## SMILE IF YOU BUNT

Steve C. Wang, an associate professor of statistics at Swarthmore College, charted baseball managers from the 2007 season as Chernoff faces, a method of using the heights, widths and angles of facial features to represent different sets of numbers.



\*Percentage of players who had the advantage of batting against an opposite-handed pitcher at the start of the game.

Note: Because different rules cause National League managers to use more pinch-hitters, for example, each manager's rates are compared with his league's average.

# Recap

# Summary of Main Points

- Describe what is high dimensional data.
- Provide some examples for graphs used for high dimensional datasets.
- Construct these graphs using software



# Non-graded Activity: Kahoot

Let us go to Kahoot and compete for a \$10 Starbucks gift card. To evaluate your understanding of the material, please answer the questions correctly and as quickly as possible to get the most points.