DATA VISUALIZATION

Course: Impact of COVID-19 to financial markets

Professor Nabijon Holov

ABOUT ME

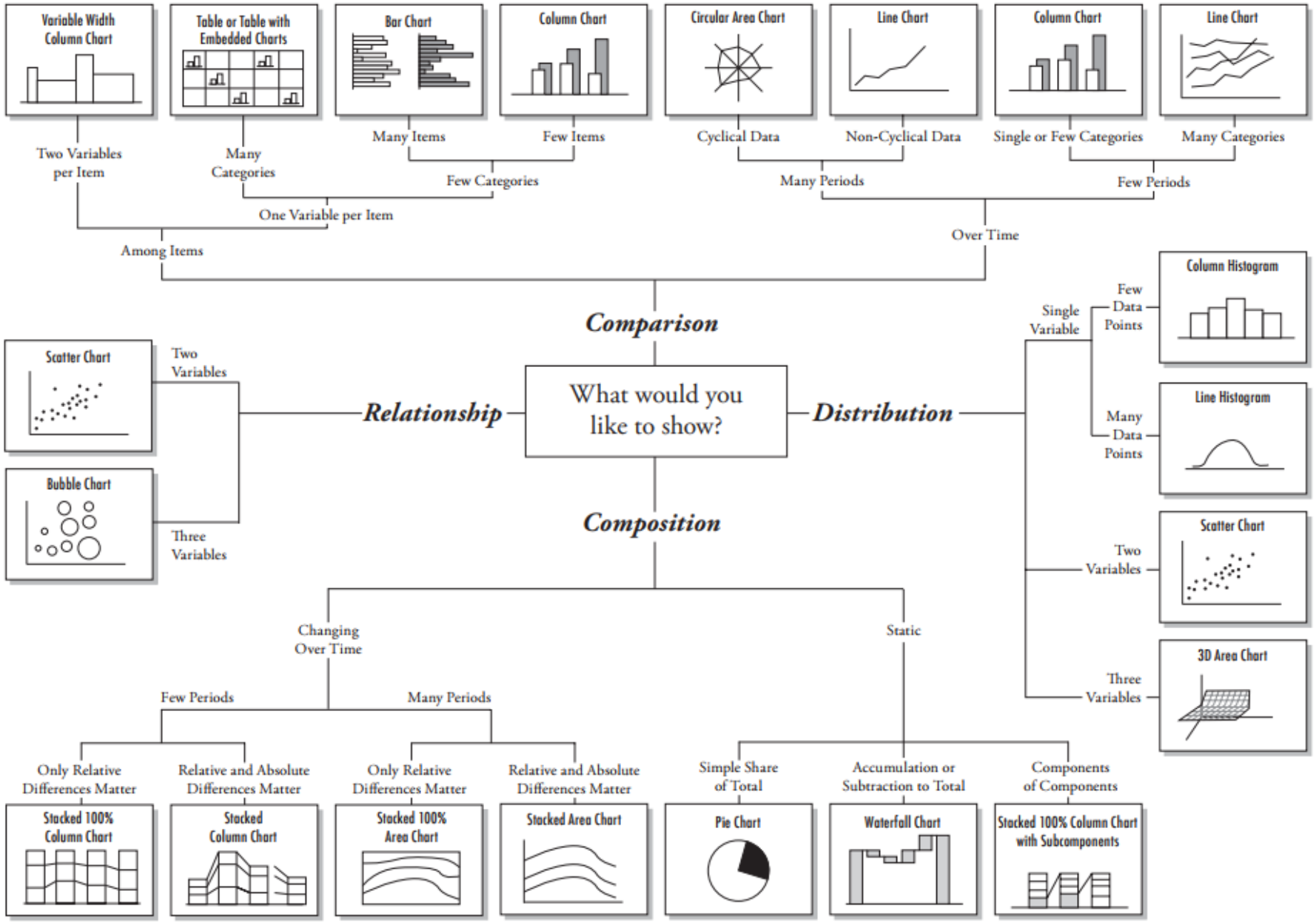
- Senior Analytics Consultant, DataBrains
- Former SSEF, ISEF, STS Finalist
- Science Fair Judge (regional, SSEF, ISEF)

- Data Visualization is my day-to-day job

FOUR QUESTIONS

- 1. What data is **important to show**?
- 2. What do I want to **emphasize** in the data?
- 3. What **options** do I have for displaying this data?
- 4. Which option is **most effective** in communicating the data?

Chart Suggestions—A Thought-Starter



Time Series

Ranking

Part-To-Whole

Deviation

Distribution

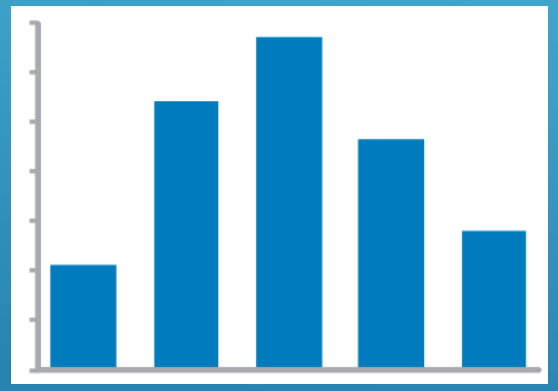
Correlation

Comparison

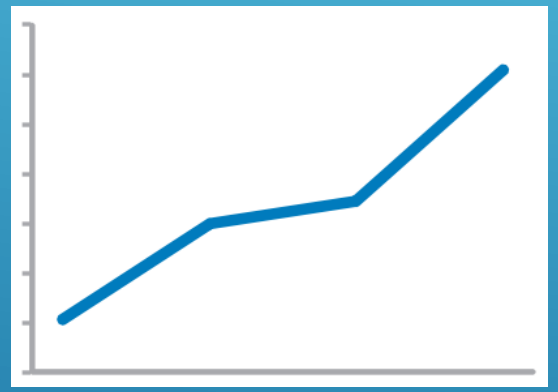
WHAT DO YOU WANT TO SHOW WITH YOUR DATA?

TIME SERIES

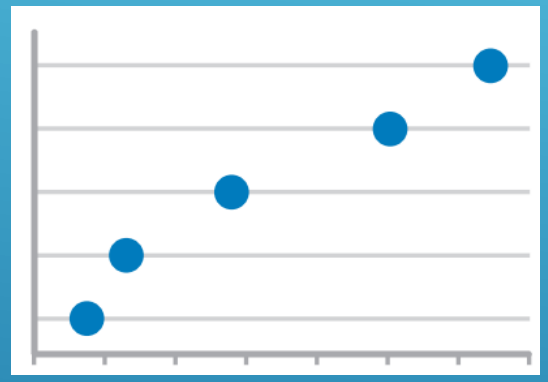
VALUES DISPLAY HOW SOMETHING CHANGED OVER TIME



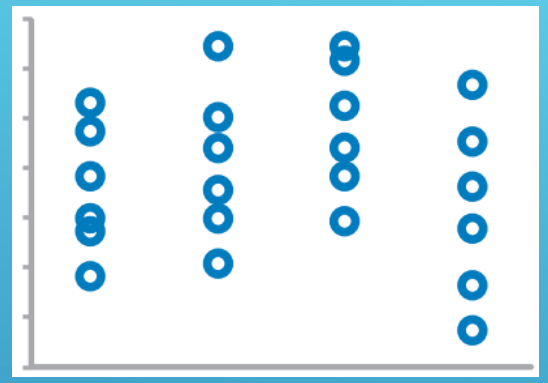
Bar Graph (vertical)
To feature individual values and support their comparisons. Quantitative scale must begin at zero.



Line Graph
To feature overall trends and patterns and support their comparisons

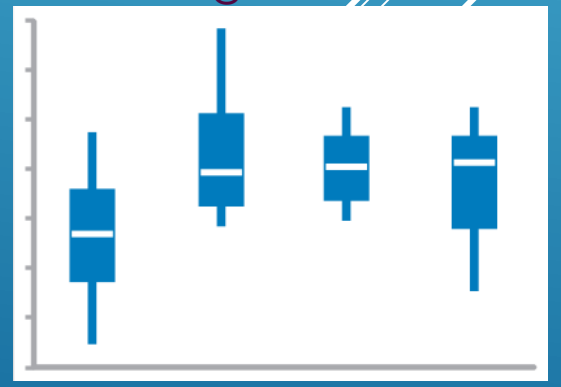


Dot Plot (vertical)
When you do not have a value for every interval of time



Strip Plot (multiple)

Only when also featuring distributions



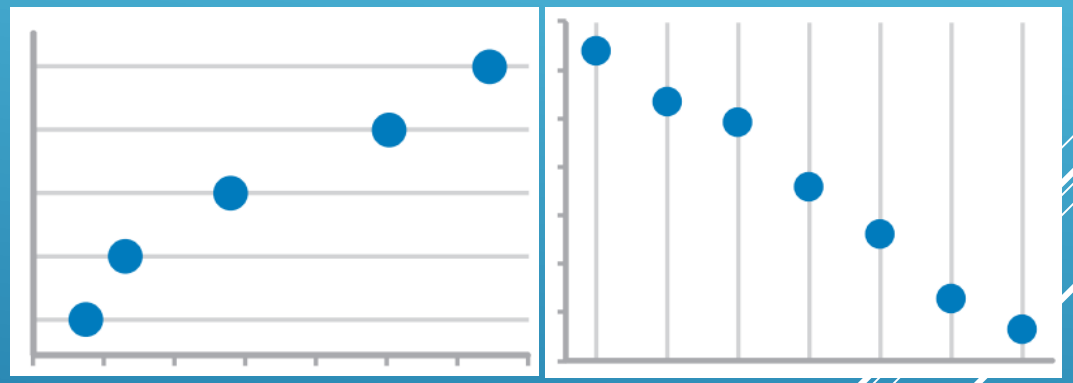
Box Plot (vertical)

RANKING

VALUES ARE ORDERED BY SIZE (DESCENDING OR ASCENDING)

Bar Graphs

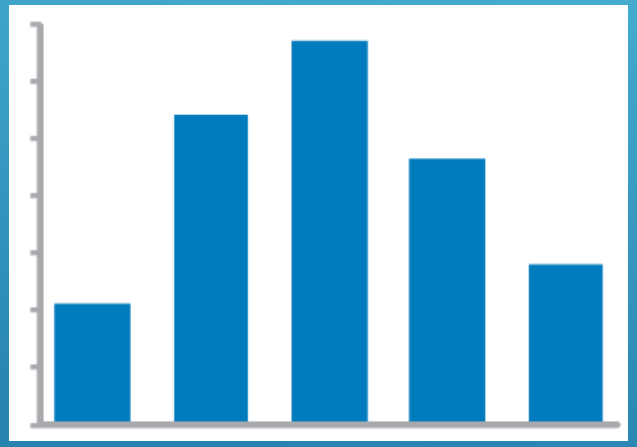
Quantitative scale must begin at zero

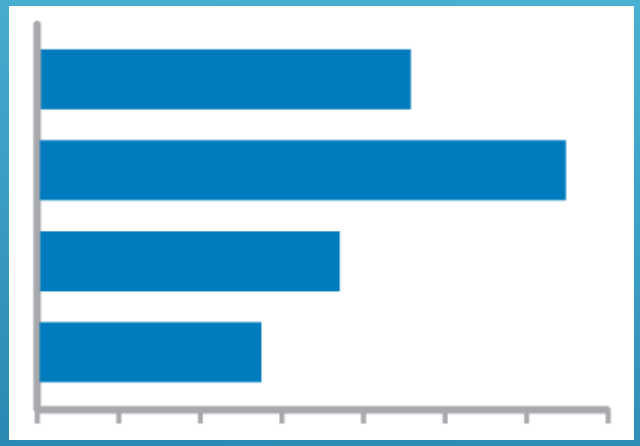


Dot Plots

PART-TO-WHOLE

VALUES REPRESENT PARTS (RATIOS) OF A WHOLE



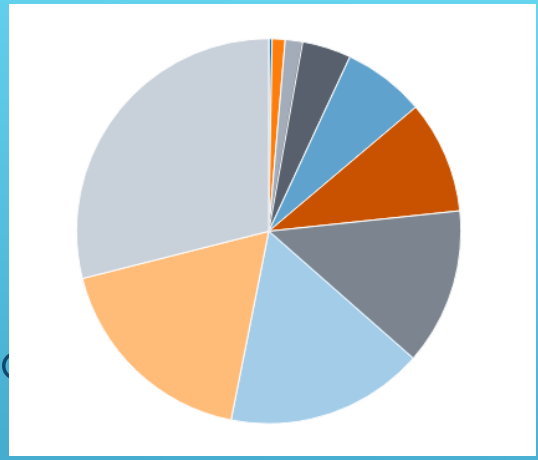


Bar Graphs

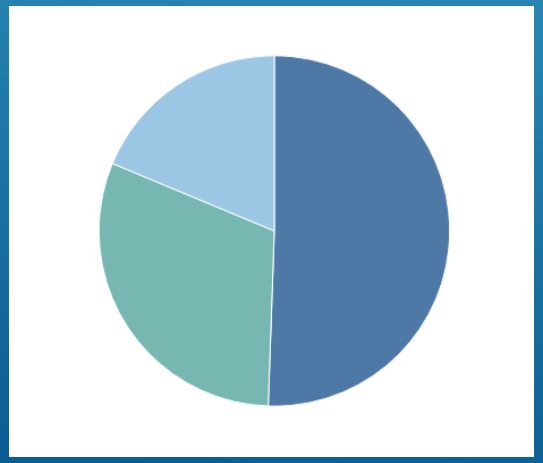
Quantitative scale must begin at zero

WHAT ABOUT PIE CHARTS?

- Commonly used to show parts of a whole
- However…
  - Hard to judge relative size of pie slices – **better at differentiating length**
  - Take up a lot of space to **present little information**
  - **Require labels and good color contrast** to even be us (often difficult)



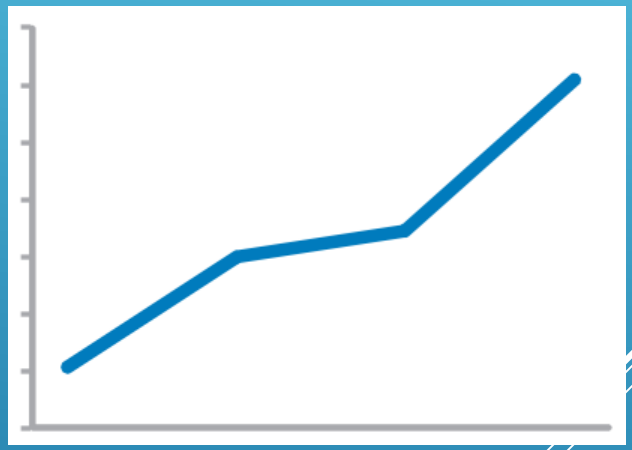
Best use is when one overwhelmingly larger value than the rest – no need to focus on actual values



DEVIATION

DIFFERENCE BETWEEN TWO SETS OF VALUES

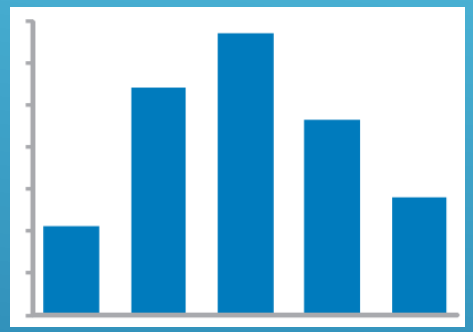
Bar Graphs
Quantitative scale must being at zero

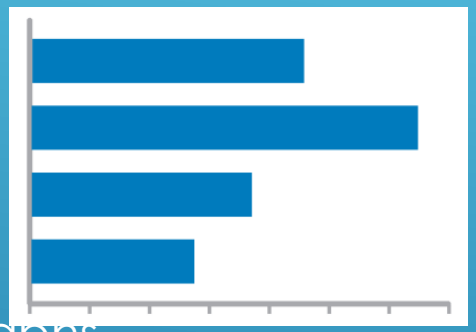


Line Graph
Only when also featuring time series or single distribution

DISTRIBUTION

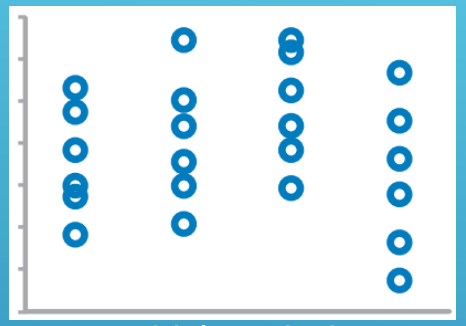
COUNT OF VALUES PER INTERVAL ALONG QUANTITATIVE SCALE



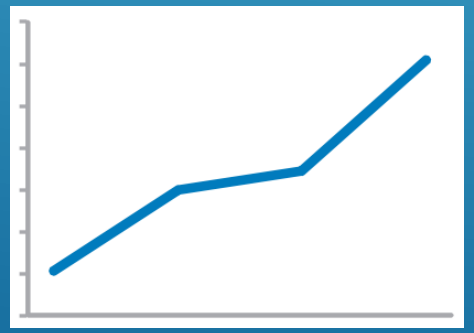


Bar Graphs
Quantitative Scale, must begin at zero

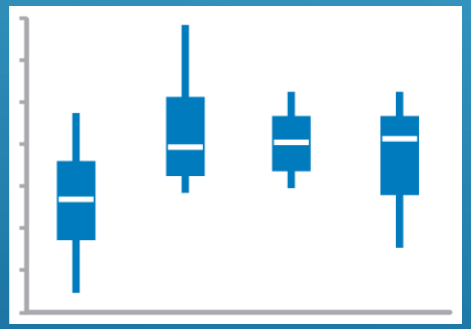
Strip Plot (single)
When you want to see each value

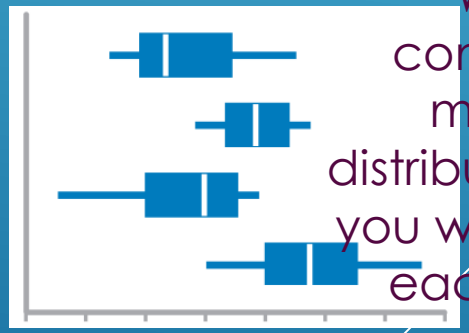


Strip Plot (multiple)
When comparing multiple distributions AND you want to see each value



Line Graph
To feature overall shape of distribution

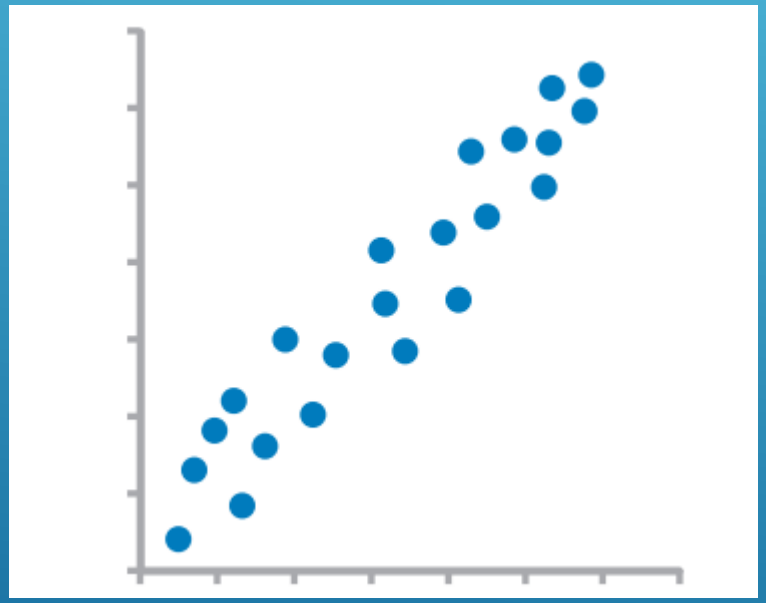




Box Plots
When Comparing Multiple Distributions

CORRELATION

COMPARISON OF TWO PAIRED SETS OF VALUES TO DETERMINE IF THERE IS A RELATIONSHIP BETWEEN THEM



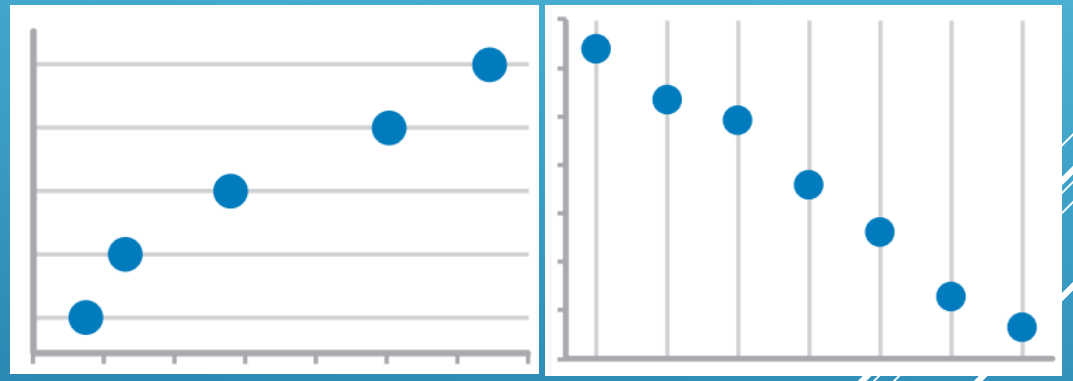
Scatter Plot

NORMAL COMPARISON

SIMPLE COMPARISON OF VALUES FOR A SET OF ORDERED ITEMS

Bar Graphs

Quantitative scale must begin at zero



Dot Plots

OTHER VISUALIZATIONS

A PICTURE IS WORTH A THOUSAND WORDS

- **Schematics**
- **Illustrations**
- **Flow Charts**

Explain how experiment was conducted or design concepts for engineering project

- **Tables**

Raw data or statistical summaries in well-organized manner. Convey important details.

- **Photographs**

Great to show experimental setup, or examples of actual results

ADHERE TO DATA PRESENTATION STANDARDS IN YOUR FIELD

- Judged by those often familiar with research field
- Expected presentations of data in that field
- Review scientific articles – how is data presented?
    - Are there graphs?
    - What kind?
    - What statistics are used?
    - Review schematics – are there specific icons?
    - Does the journal have a style guide?

VISUAL BEST PRACTICES

Emphasize	most important data
Orient	graphs for legibility
Organize	graph/table
Avoid	overloading graphs
Limit	# of colors and shapes
Inform	through important text

DATA ANALYSIS VS DATA VISUALIZATION

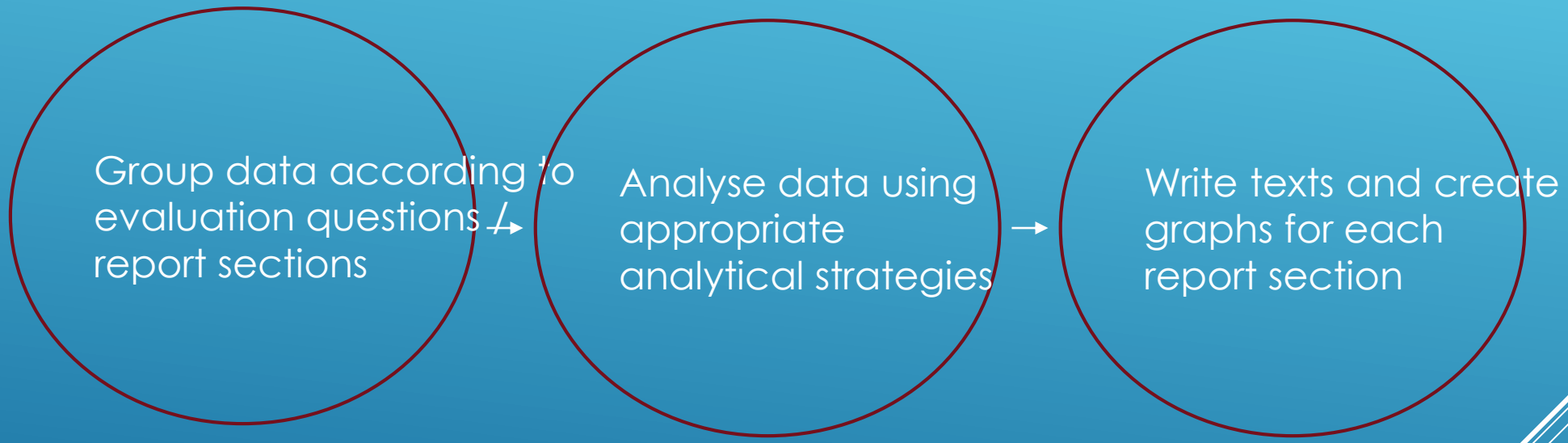
- Traditionally enter data into spreadsheet (Excel)
- Satisfactory, but strengths are in data analysis – not visualization
- Time consuming to create graph variations

- Alternative: **Use data visualization software**

DATA ANALYSIS

- A credible amount of data has to be collected to allow for a substantial analysis
- Information collected must now be described, analyzed and interpreted
- You have to look beyond the raw data to ask important questions about what the results mean and whether they are significant
- You have to check the data to ensure that it is “clean” and look
for inconsistencies

DATA ANALYSIS - PROCESS USED



DATA ANALYSIS

Quantitative and qualitative methods produce different types of data

- Quantitative data produces numerical values
- Qualitative data produces narratives

But for both quantitative and qualitative data, the same analytical strategies are used for data interpretation

DATA ANALYSIS

Basic analytical strategies:

Describing
Factoring
Clustering
Comparing
Finding commonalities
Finding covariation
Ruling out rival explanations

Counting
Factoring
Modeling
Examining deviant cases
Telling a story

source: “Evaluation”, by Susan Weiss, (1998)

DATA ANALYSIS

- Often *comparing, clustering* and *finding commonalities* are used in conference evaluation

What is more useful for the conference organiser?

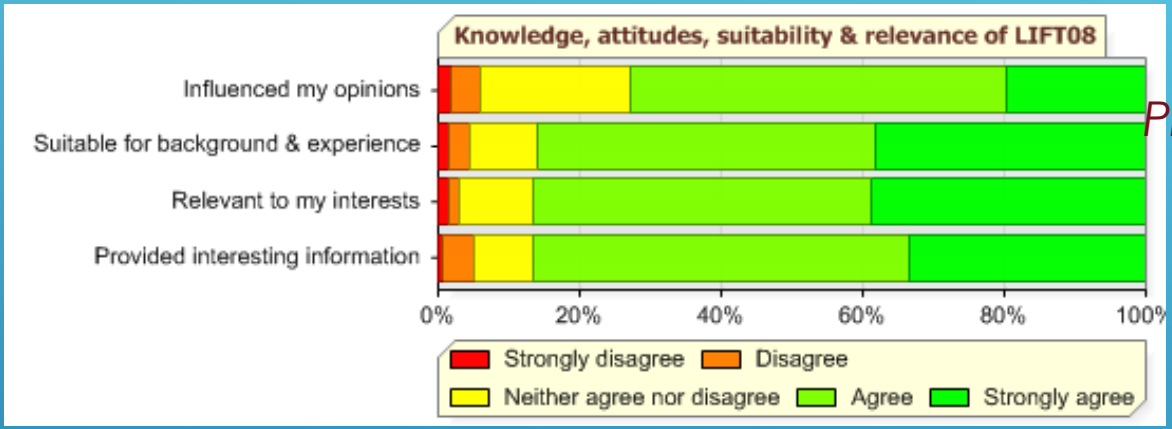
"85% of participants rated positively the conference"

"85% of participants rated positively the conference compared to 92% from the previous year"

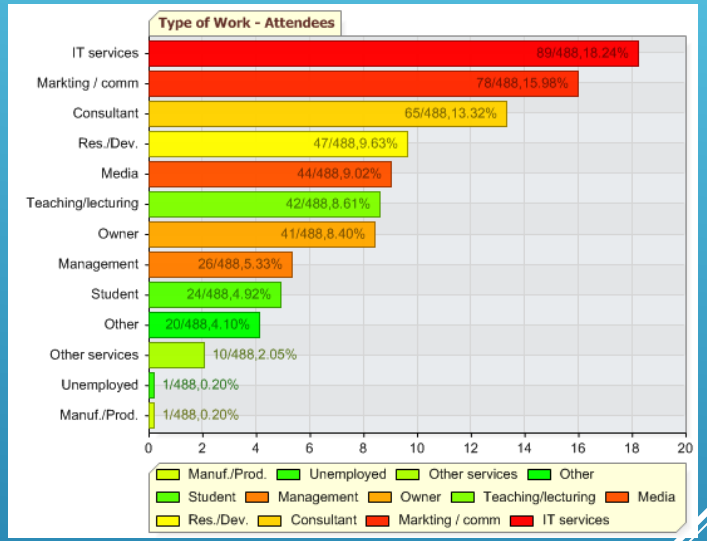
"Scientists rated the conference 10% lower than other groups attending"

SURVEY DATA ANALYSIS - DESCRIPTIVE

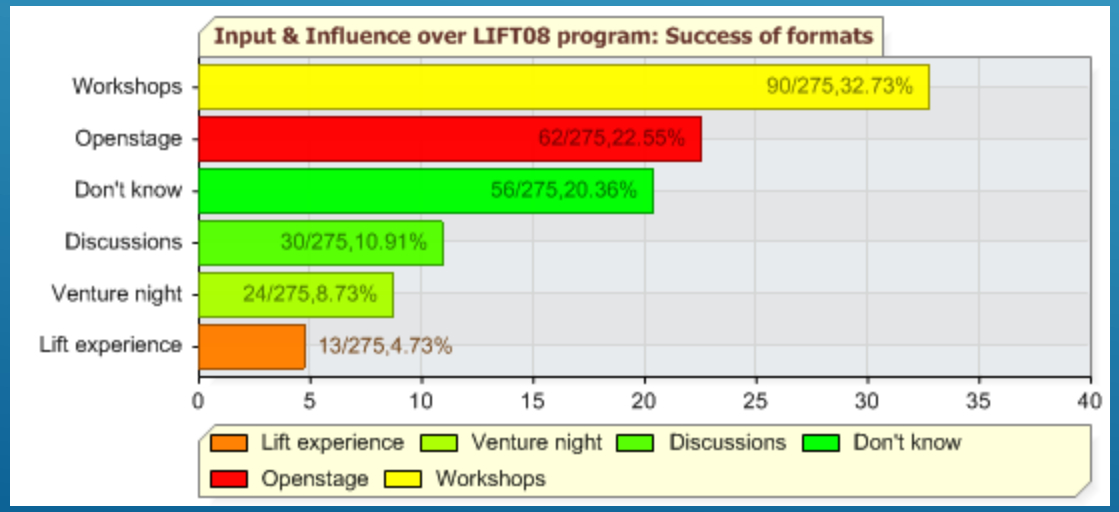
Comparison



Proportions



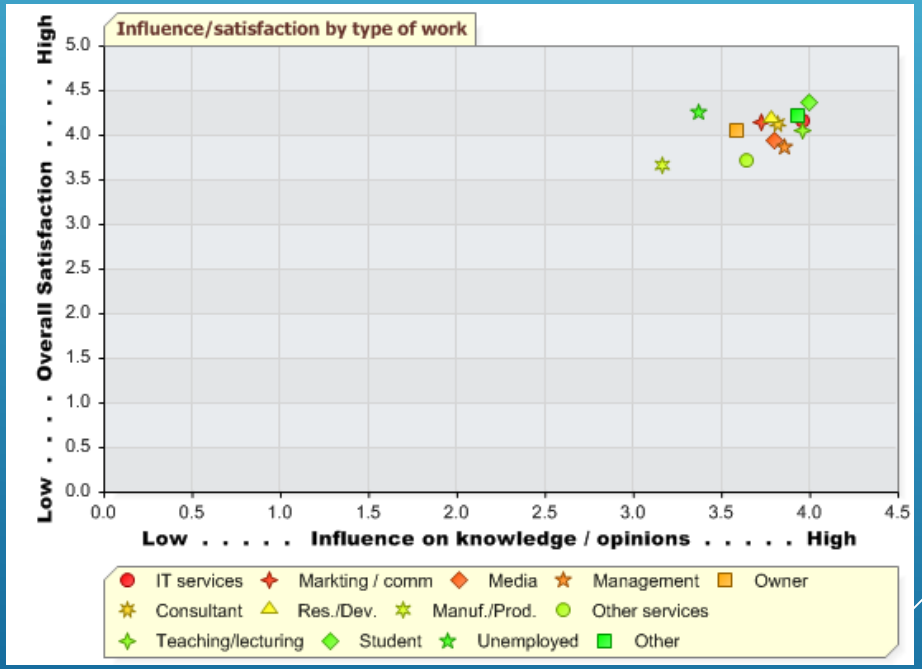
Ranking/priorities



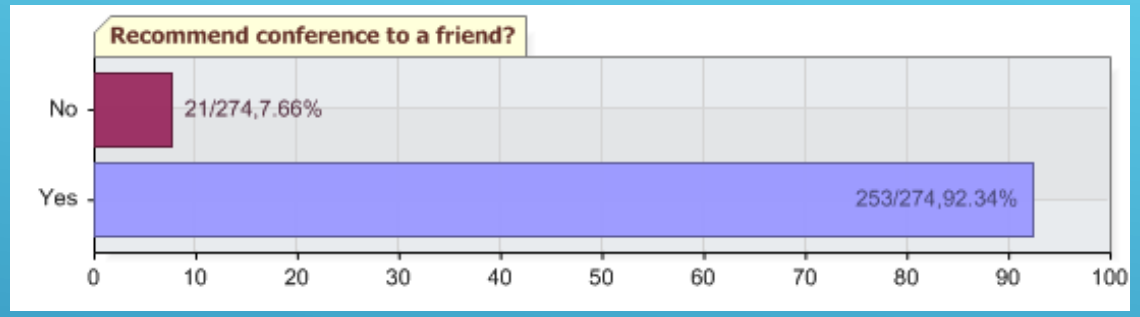
SURVEY DATA ANALYSIS – DESCRIPTIVE

Trends / changes

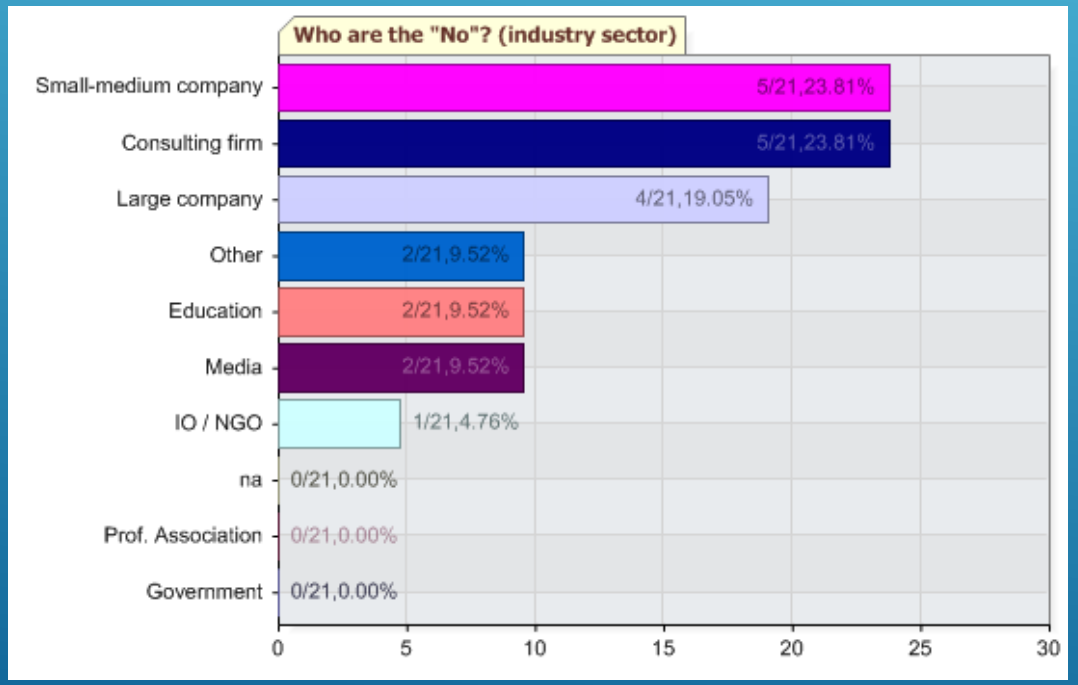
Covariations



SURVEY DATA ANALYSIS – COMMONALITIES



Interested to see who said "No"!



Graph shows from which categories are the "No"

DATA ANALYSIS - QUALITATIVE DATA

Steps for evaluating qualitative data

- 1. Read through the responses.
- 2. Create response categories.
- 3. Label each comment with one or several categories.
- 4. Look at what you have.
- 5. Think what are the responses about?
- 6. Identifying the patterns and trends.

Try and avoid turning qualitative data into quantitative data!

DATA ANALYSIS TO REPORTING

- As you analyse your data, you are arriving at your own assessment of what your findings mean -key questions to ask:
  - Patterns and themes are emerging – do you have enough evidence to justify your conclusions?
  - Have you ruled out other explanations and examined exceptions to the patterns you are seeing?
  - Do you need to run correlation analysis (SPSS) to test if the differences observed are statistically significant?
  - Do you need to have a colleague double-check your findings against your data?
- You should then be ready to move to writing your report

Data Analysis

Process and Clean Data
Filter noise, Detect outliers
Estimate missing values

Explore and Visualize Data
Tabulate, Cross – tabulate,
Correlate, Chart, Summarize

Data Mine
Clustering, Pattern recognition

Build Model
Regression, Decision trees,
Neural networks, Time series

Generate Results & Optimize
Prediction, optimization,
Classification

Validate Results
Test & control, Before & after,
Calculate business metrics

- Conclusion

- Thanks for attention

- **References**

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