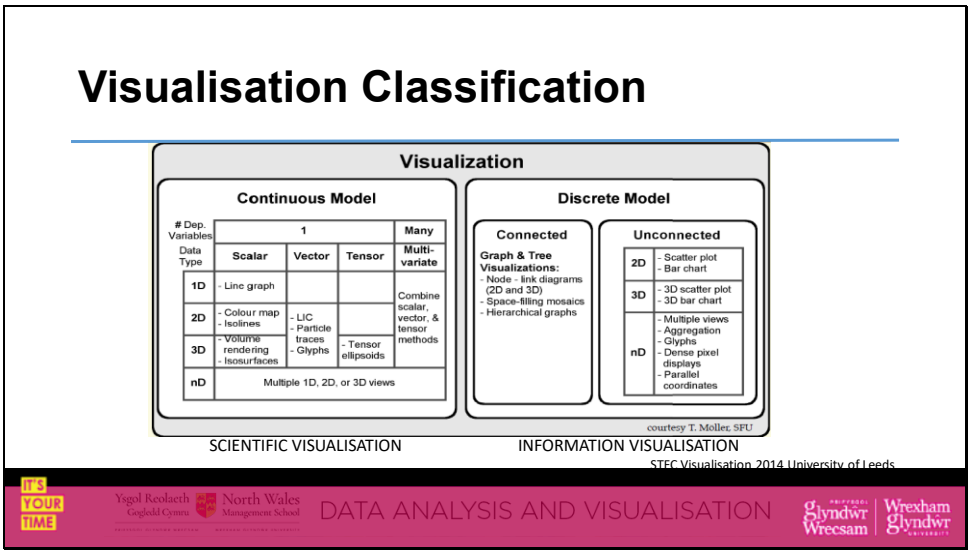
Slide 1

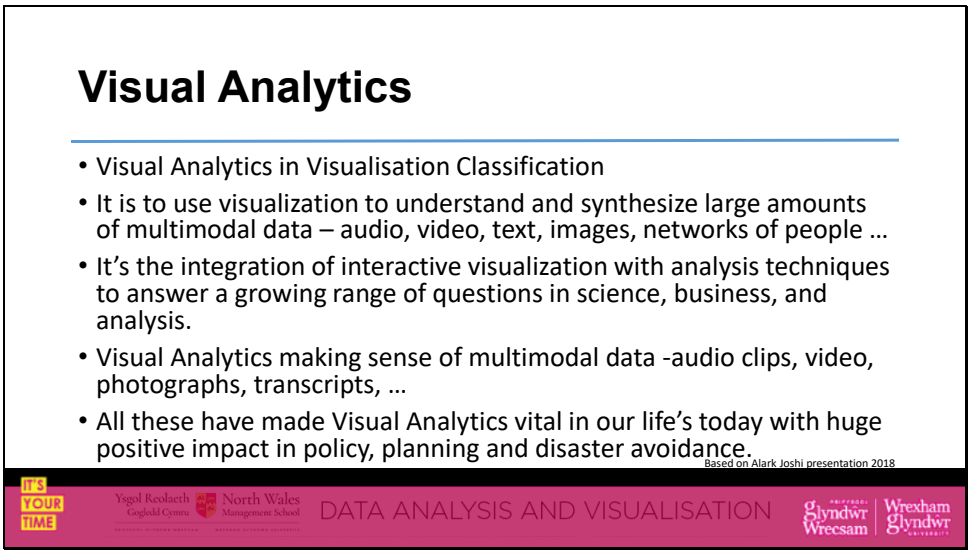
Welcome to Lecture 4 of week 6 Visual Analytics and design principles

Slide 2



We're back to our discussion on Visualization classification with a focus on Visual Analytics

Slide 3



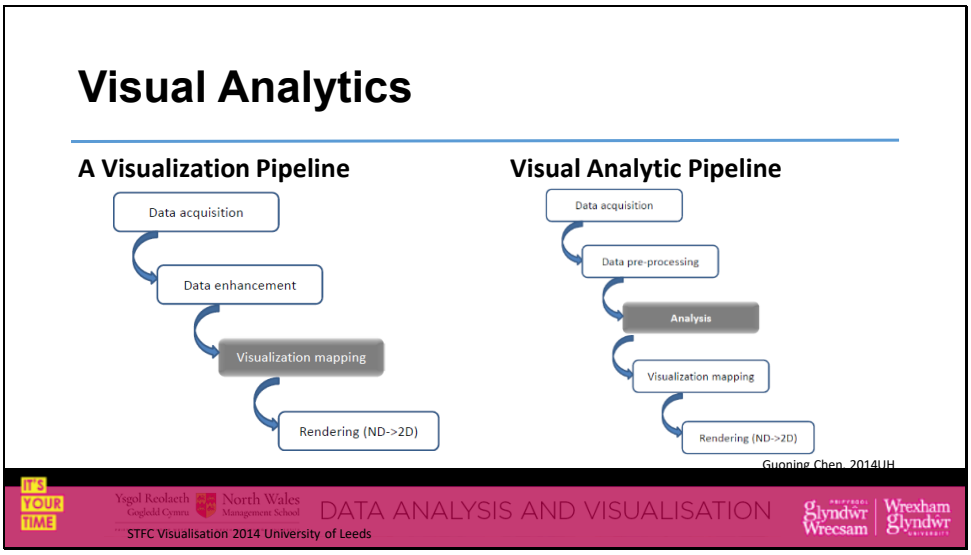
As one of the aims of visulaisation is analysis, Visual Analytics can be considered also as part of Visualisation Classification.
Where it is to use visualization to understand and synthesize large amounts of multimodal data – audio, video, text, images, networks of people …

It is the integration of interactive visualization with analysis techniques to answer a growing range of questions in science, business, and analysis.

Visual Analytics is making sense of multimodal data -audio clips, video, photographs, transcripts, …

All these have made Visual Analytics vital in our life's today with huge positive impact in policy, planning and disaster avoidance.

Slide 4



Here, to high light visual analytic we are comparing it with a visualization pipeline as part of big data lifecycle
A Visualization Pipeline has got following element usually.
In Data acquisition, Data are generated/collected.
In Data enhancement, Data are processed.
In Visualization mapping Data are mapped to visual primitives, e.g. colors, geometry, etc.
In Rendering (ND->2D) Images are generated.

In a Data Visual Analytic Pipeline, similar to A Visualization Pipeline we have most of its stages, i.e.,
In Data acquisition, Data are generated/collected.
In Data enhancement, Data are processed.
In Analysis it performs Feature detection Structure extraction Statistical analysis etc

In Visualization mapping Data are mapped to visual primitives, e.g. colors, geometry, etc.

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Design Principles for Visual Analytics

- Tufte's Design Principles
  - Above all else show the data
    - Use Decomposition or Hierarchical Display
    - Show the Context especially for comparison
    - Avoid Chartjunk or extraneous visual elements that distract viewer from context

Images from Alark Joshi presentation 2018 based on G.Reynolds

Showing the data in your visulisation is most important task.
Use Decomposition i.e., put related graphs together or show them in Hierarchical display.
Show the Context as the heart of your visulaisation especially with comparison of other data vislisation.
Avoid Chart junk or extraneous visual elements that distract viewer from context.

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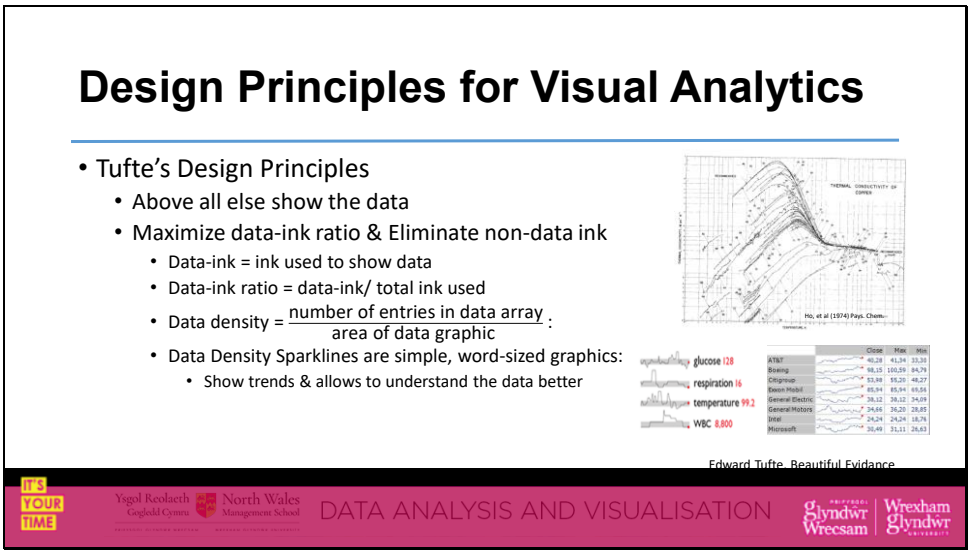

You have to Maximize data-ink ratio & Eliminate non-data ink & Eliminate redundant data ink.
Data-ink is the ink used to show data.
Data-ink ratio is defined as data-ink/ total ink used.
Data density = number of entries in data array *divided by* area of data graphic

Use these quantities to Maximize data-ink ratio & Eliminate non-data ink & Eliminate redundant data ink.

Data Density Sparklines are simple, word-sized graphics show trends and allows us to understand the data better.

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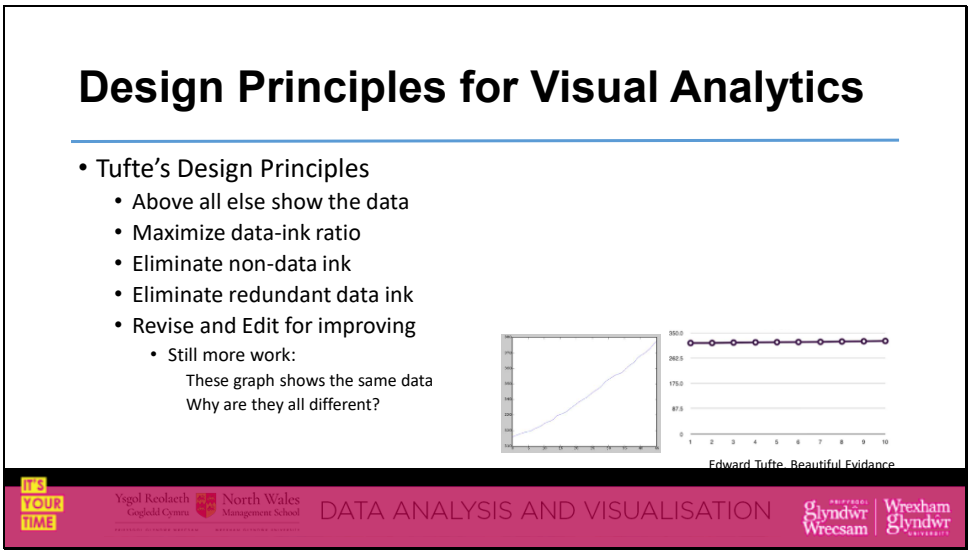

Eliminate redundant data ink is similar to previous stages, i.e. Maximize data-ink ratio & Eliminate non-data ink.

And finally, you have to review, revise and edit your visulaision if possible, to improve it.

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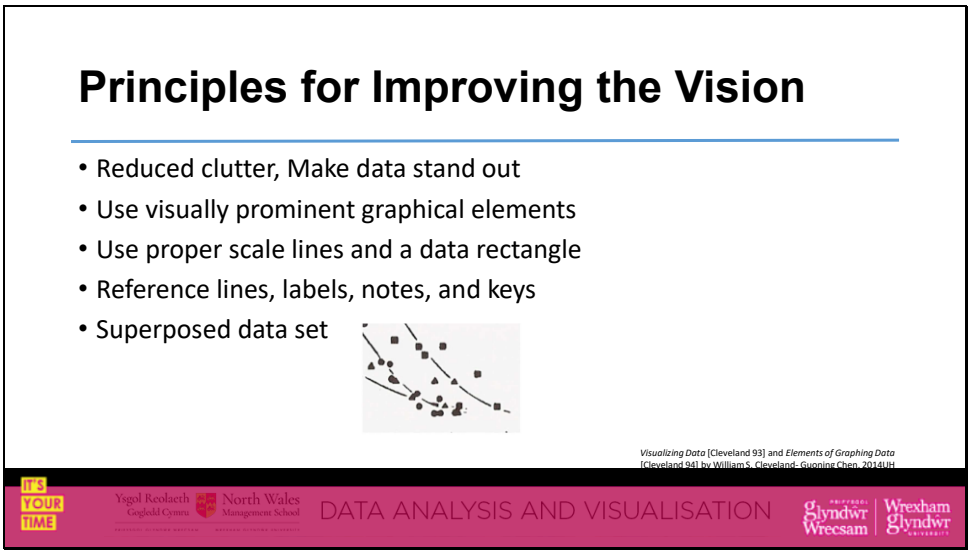

Principle 1: Reduced clutter, make data stand out.

- The main focus of a plot should be on the data itself, any superflous elements of the plot that might obscure or distract the observer from the data needs to be removed.

Principle 2: Use visually prominent graphical elements to show the data.

- Connecting lines should never obscure points and points should not obscure each other.
- If multiple samples overlap, a representation should be chosen for the elements that emphasizes the overlap.
- If multiple data sets are represented in the same plot (superposed data), they must be visually separable.
- If this is not possible due to the data itself, the data can be separated into adjacent plots that share an axis.

Principle 3: Use proper scale lines and a data rectangle.

- Two scale lines should be used on each axis (left and right, top and bottom) to frame to data rectangle completely.
- Add margins for data.
- Tick-marks outs and 3-10 for each axis

Principle 4: Reference lines, labels, notes, and keys.

- Only use them when necessary and don't let them obscure data.

Principle 5: Superposed data set

- Symbols should be separable and data sets should be easily visually assembled.

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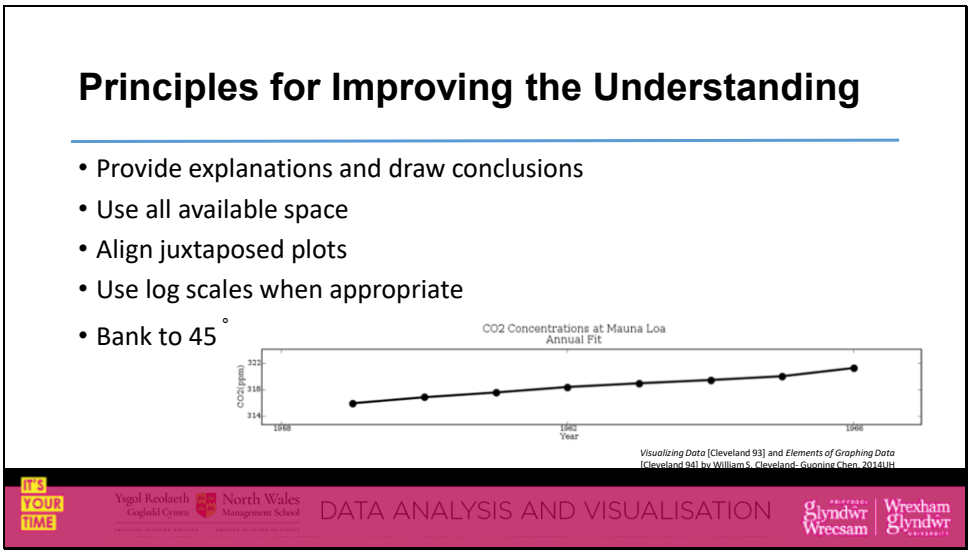

Principle 1: Provide explanations and draw conclusions.

- A graphical representation is often the means in which a hypothesis is confirmed, or results are communicated.
- Describe everything, draw attention to major features, describe Conclusions.

Principle 2: Use all available space.

- Fill the data rectangle, only use zero (the origin) if you need it

Principle 3: Align juxtaposed plots.

- Make sure scales match and graphs are aligned.

Principle 4: Use log scales when appropriate

- Used to show percentage change, multiplicative factors and skewness.

Principle 5: Bank to 45 degree

- Optimize the aspect ratio of the plot by using 45-degree slope.

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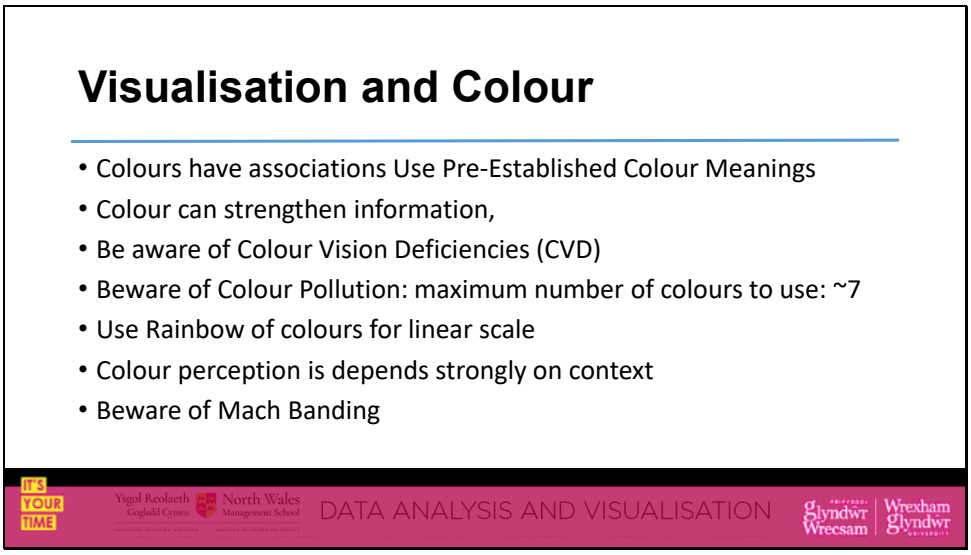

Colour is very important to us.

Examples of Pre-Established Colour Meanings
Red

- Stop
- Off
- Dangerous
- Hot
- High stress
- Oxygen
- Shallow
- Money loss

Green

- On
- Plants
- Carbon
- Moving
- Money

Blue

- Cool
- Safe
- Deep
- Nitrogen

Color can strengthen information,
The maximum number of colors to use: ~7, beware of Color Pollution.

Approximately 50–300 distinguishable colors (different depending on color)

Use Rainbow of colors for linear scale.
Color perception depends strongly on context.
Be aware of Color Vision Deficiencies (CVD) and some users are color blind.

Beware of the Mach-Band Effect
Eyes strengthen boundaries This can introduce mistakes in discretion.
Attention should be paid to colour intensity.