Data Visualization and Big Data Analytics

Unit-1 introduction to visualization

- CONCEPT: Importance of data visualization
- choosing appropriate visual encodings
- ordering of items
- number of distinct values
- Structure of visualization

POSTIONING:

- Placement and proximity
- Graphs and layouts
- Colors
- Size
- Text and typography
- Shape
- Lines

Data visualization

- Data visualization is the process of translating large data sets and metrics into charts, graphs and other visuals. The resulting visual representation of data makes it easier to identify and share real-time trends, outliers, and new insights about the information represented in the data.
- To communicate information clearly and efficiently, data visualization uses <u>statistical graphics</u>, <u>plots</u>, <u>information</u> <u>graphics</u> and other tools.
- Numerical data may be encoded using dots, lines, or bars, to visually communicate a quantitative message.
- Effective visualization helps users analyze and reason about data and evidence.

DATA VISUALIZATION?



- Data visualization refers to the techniques used to communicate data or information by encoding it as visual objects (e.g., points, lines, or bars) contained in graphics.
- The goal is to communicate information clearly and efficiently to users

Data visualization

- WHAT?
- WHY?
- HOW?

Data Visualization





You are a Sales Manager in a leading global organization. The organization plans to study the sales details of each product across all regions and countries. This is to identify the product which has the highest sales in a particular region and up the production. This research will enable the organization to increase the manufacturing of that product in the particular region.

Data Visualization



Data Visualization Considerations

Three major considerations for data visualization are:







Clarity

Accuracy

Efficiency

Ensure the dataset is complete and relevant. This enables the Data Scientist to use the new patterns yield from the data in the relevant places.

Data Visualization Considerations

Three major considerations for data visualization are:







Accuracy

Efficiency

Ensure using appropriate graphical representation to convey the right message.

Data Visualization Considerations

Three major considerations for data visualization are:







Efficiency

Use efficient visualization technique which highlights all the data points.

Why is Data Visualization Important?

- What business or career you've chosen, data visualization can help by delivering data in the most efficient way possible.
- As one of the essential steps in the business intelligence process, data visualization takes the raw data, models it, and delivers the data so that conclusions can be reached.
- In advanced analytics, data scientists are creating machine learning algorithms to better compile essential data into visualizations that are easier to understand and interpret.
- Data visualization uses visual data to communicate information in a manner that is universal, fast, and effective.
- Visualized data gives stakeholders, business owners, and decision-makers a better prediction of sales volumes and future growth.

What Are The Benefits of Data Visualization?

- Data visualization positively affects an organization's decisionmaking process with interactive visual representations of data.
- Businesses can now recognize patterns more quickly because they can interpret data in graphical or pictorial forms.
- Here are some more specific ways that data visualization can benefit an organization:
- 1. Correlations in Relationships:
- 2. Trends Over Time:
- 3.Frequency:
- 4. Examining the Market:
- 5. Risk and Reward:
- 6. Reacting to the Market:

Which Data Visualization Techniques are Used?

- There are many different methods of putting together information in a way that the data can be visualized.
- Depending on the data being modeled, and what its intended purpose is, a
 variety of different graphs and tables may be utilized to create an easy to
 interpret dashboard.
- Some visualizations are manually created, while others are automated.
- Either way, there are many types to meet your visualization needs.
- 1. Infographics:
- 2. Heatmap Visualization:
- 3. Fever Charts:
- 4. Area Chart (or Graph):
- 5. Histogram:

• RESULT:

- We need data visualization because the human brain is not well equipped to devour so much raw, unorganized information and turn it into something usable and understandable.
- We need graphs and charts to communicate data findings so that we can identify patterns and trends to gain insight and make better decisions faster.

Visual Encoding

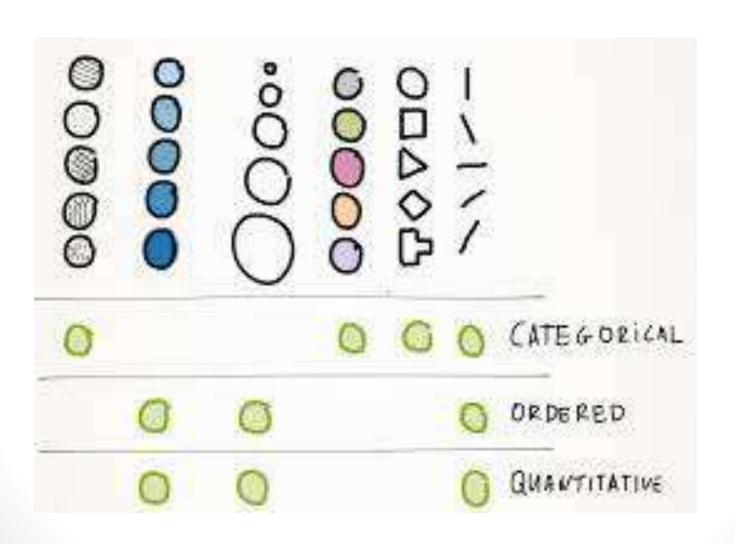
- The visual encoding is the way in which data is mapped into visual structures, upon which we build the images on a screen.
- There are two types of visual encoding variables:
- planar and retinal.
- Humans are sensitive to the retinal variables.
- They easily differentiate between various colors, shapes, sizes and other properties.
- Retinal variables were introduced by Bertin (→) about 40 years ago, and this concept has become quite popular recently. While there's some critique about the effectiveness of retinal variables (→), most specialists find them useful.

- Data, once you know the "shape" of your data, you can encode its various dimensions with appropriate visual properties. Different visual properties vary—or may be modified—in different ways, which makes them good for encoding different types of data.
- Two key factors are whether a visual property is <u>naturally</u> ordered, and how many distinct values of this property the reader can easily differentiate.
- Natural ordering and number of distinct values will indicate whether a visual property is best suited to one of the main data types: quantitative, ordinal, categorical, or relational data. (Spatial data is another common data type, and is usually best represented with some kind of map.)

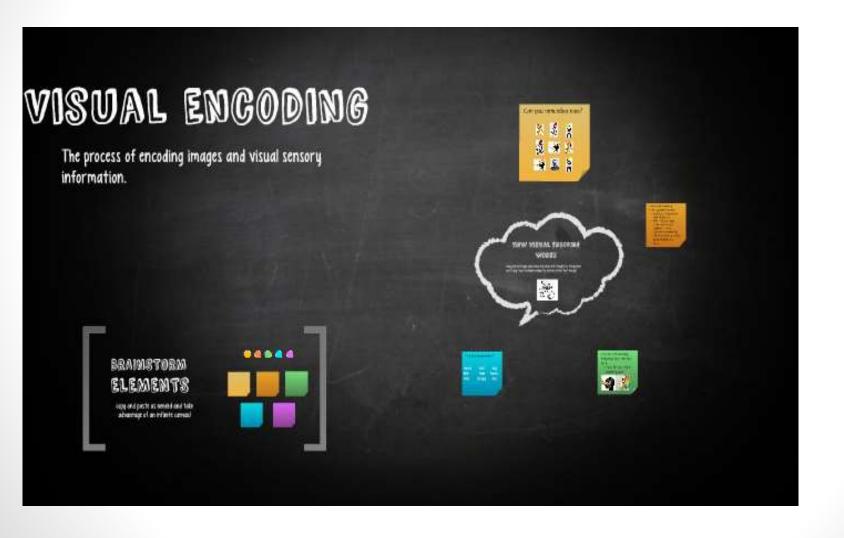
Natural Ordering

- A visual property has a natural ordering is determined by whether the mechanics of our visual system and the "software" in our brains automatically—unintentionally—assign an order, or ranking, to different values of that property.
- The "software" that makes these judgments is deeply embedded in our brains and evaluates relative order independent of language, culture, convention, or other learned factors; it's not optional and you can't design around it.

Example visual encoding



Example visual encoding



Examples

- For example:
- 1.position has a natural ordering; but shape doesn't.
- 2. Length has a natural ordering; texture doesn't (but pattern density does).
- 3.Line thickness or weight has a natural ordering; line style (solid, dotted, dashed) doesn't.
- Depending on the specifics of the visual property, its natural ordering may be well suited to representing quantitative differences (27, 33, 41), or ordinal differences (small, medium, large, enormous).

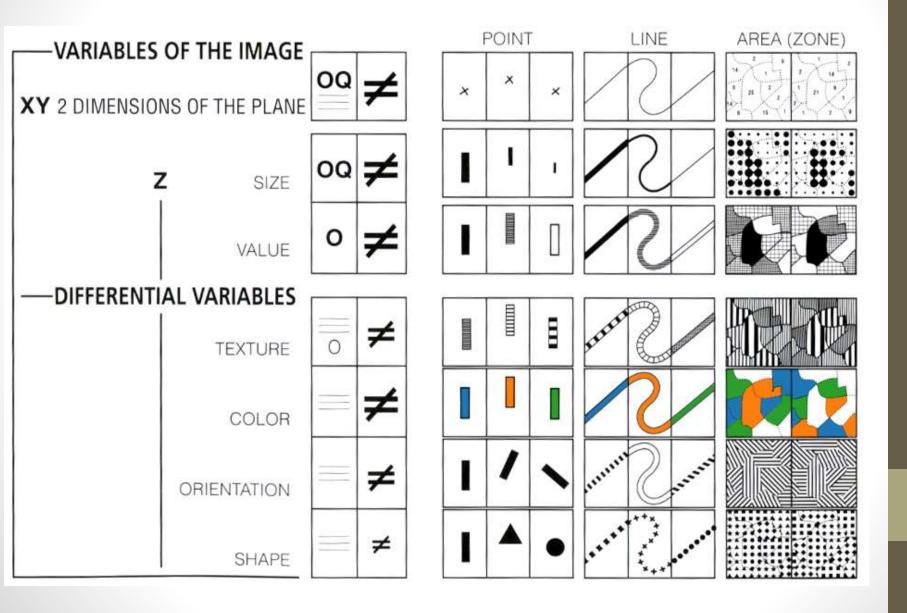
Color is not ordered

• Color (hue) is not naturally ordered in our brains but the Brightness (lightness or luminance, sometimes called tint) and intensity (saturation) are, but color itself is not.

Distinct Values

- The second main factor to consider when choosing a visual property is how many distinct values it has that your reader will be able to perceive, differentiate, and possibly remember.
- For example, there are a lot of colors in the world, but we can't tell
 them apart if they're too similar and We can more easily
 differentiate a large number of shapes, a huge number of positions,
 and an infinite number of numbers while choosing a visual property,
 select one that has a number of useful differentiable values and an
 ordering similar to that of your data

ordering items:

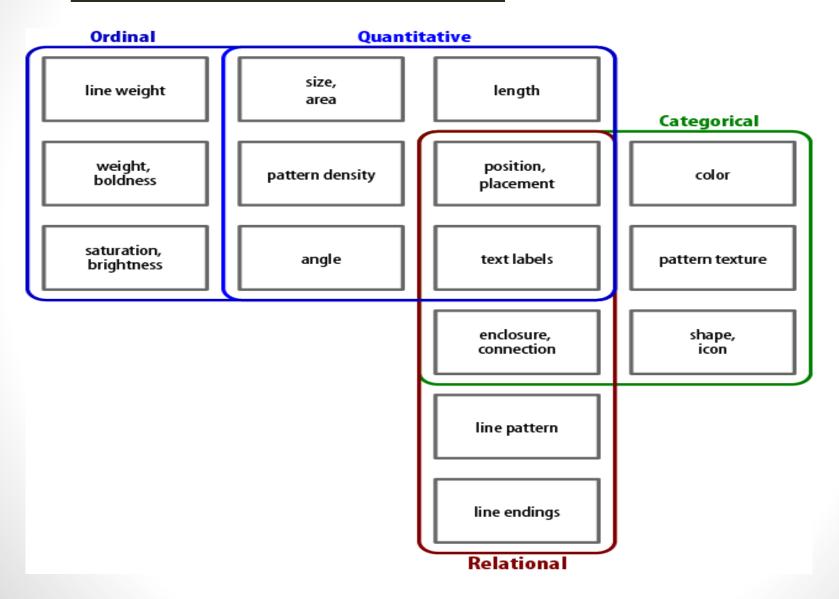


Properties and Best Uses of Visual Encodings

Example	Encoding	Ordered	Useful values	Quantitative	Ordinal	Categorical	Relational
•	position, placement	yes	infinite	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	optional (alphabetical or numbered)	infinite	Good	Good	Good	Good
	length	yes	many	Good	Good		
. • •	size, area	yes	many	Good	Good		
/_	angle	yes	medium/few	Good	Good		
	pattern density	yes	few	Good	Good		
	weight, boldness	yes	few		Good		
	saturation, brightness	yes	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	infinite			Good	Good
======	line pattern	no	few				Good
*	line endings	no	few				Good
	line weight	yes	few		Good		



 Visual properties grouped by the types of data they can be used to encode.



positioning

 Many visual properties may be used to encode multiple data types.

 Position and placement, text, can be used to encode any type of data—which is refeering that why every visualization you design needs to begin with careful considerations.

postioning

To further illustrate this process, check out the GIF below. Your brain sees a dog walking, but it's nothing more than a series of moving dots.



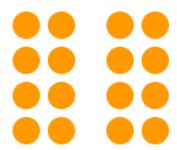
proximity

The principle of proximity states that things that are close together appear to be more related than things that are spaced farther apart.

This is perceived to be one group and the components somehow related to each other.



We perceive two groups here, and understand that there are differences between them.



proximity

Proximity is so powerful that it overrides similarity of color, shape, and other factors that might differentiate a group of objects.

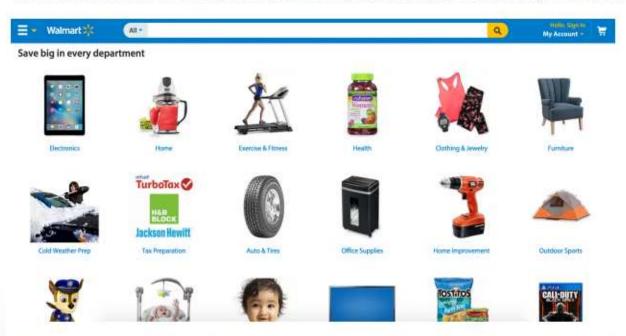


Source: Steven Bradley

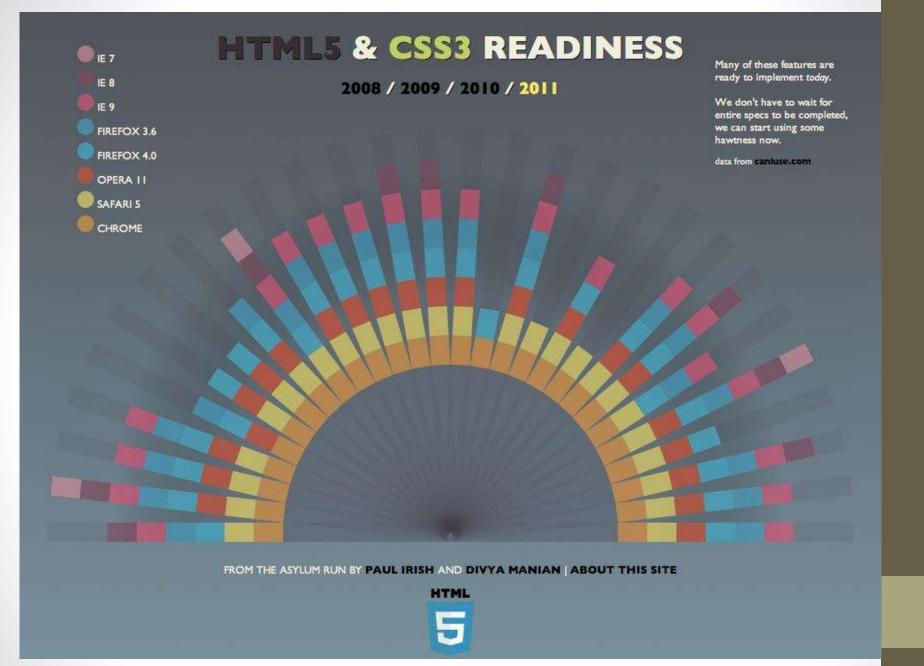
Notice the three groups of black and red dots above? The relative nearness of the objects has an even stronger influence on grouping than color does.

Example of proximity

The nearness of each image and its corresponding text communicates that they're related to one another.

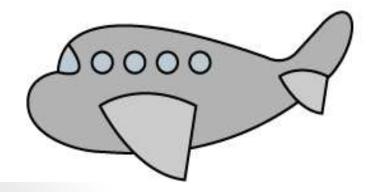


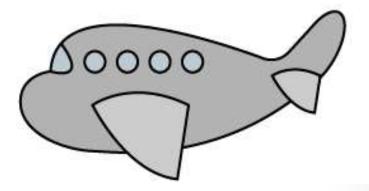
And Vice uses it to distinguish between the images, headlines, descriptions, and other information for each of its stories.



layouts





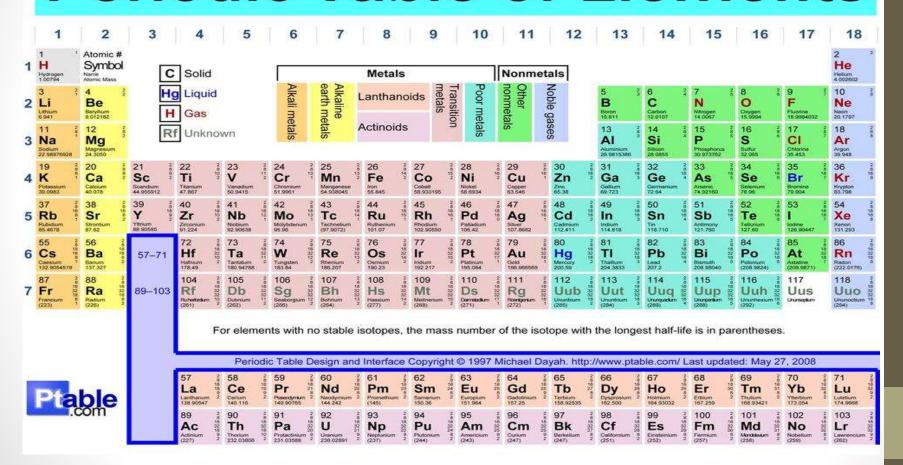


shapes and colors examples

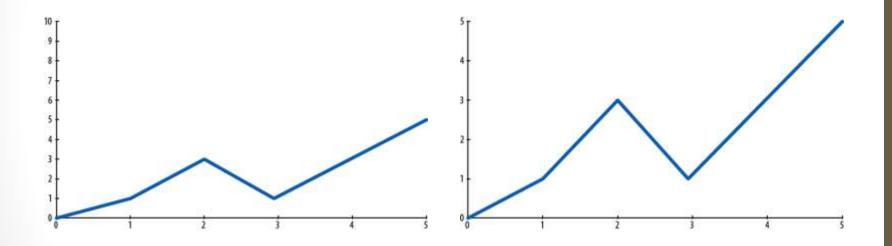
Browser	Existing color	Better color

color -size-text-lines

Periodic Table of Elements



Graphs and layout differentiation



Typograpghy

- Typography is one of the most effective tools for communicating the meaning of data to users.
- When building data visualizations, establishing a clear hierarchy of typographic elements and using easy-to-read font families will help users better understand and interact with your data.
- The term <u>typography</u> is also applied to the style, arrangement, and appearance of the letters, numbers, and symbols created by the process.

- Typography include a broad range, covering all aspects of letter design and application, both mechanical (typesetting, type design, and typefaces) and manual (handwriting and calligraphy). Typographical elements may appear in a wide variety of situations, including:
- Documents
- Presentations
- Display typography (described below)
- Clothing
- Maps and labels
- Vehicle instrument panels
- As a component of industrial design—type on household appliances, pens, and wristwatches, for example
- As a component in modern poetry (see, for example, the poetry of e. e. cummings)
- Since digitization, typographical uses have spread to a wider range of applications, appearing on web pages, LCD mobile phone screens, and hand-held video games.

SPECIMEN

By WILLIAM CASLON, Letter-Founder, in Chifwell-Street, LONDON.

ABCDEFGHIJK ABCDEFGHIJKL ABCDEFGHIKLMN

French Cannon.

Quoulque tandem abutere. Catilina, pati-Quousque tandem adurere, Carilina, patientia nostra?

Two Lines Great Primer.

Quousque tandem abutere, Catilina, patientia nostra? quamdiu nos etiam Quousque tandem abutere, Catilina, patientia nostra? quamdiu nos etiam furor

Two Lines English.

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DOUBLE PICA ROMAN.

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GREAT PRIMER ROMAN.

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ENGLISH ROMAN.

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PICA ROMAN.

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Hebrew without Point

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בראסירים סרא אלדום את הססים את הארץ: הארץ, היתה הדד נבדו החקך עליפני הנחבם היחל אלדיםם פרוזסרים, עליפני הסים! הצבר אלדום אדר היראינו ואיר אלדום ארץ איראור כיסים! הירא אנדום בין האור ובין הדוש אלדום לאור של אחר שחלדוםן

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Display graphics

 Type may be combined with negative space and images, forming relationships and dialog between the words and images for special effects. Display designs are a potent element in graphic design

- Display typography encompasses:
- Advertisements in publications, such as newspapers and magazines
- Magazine and newspaper headline type
- Signs and other large-scale-letter designs, such as information signs and billboards
- Posters
- Brochures and flyers
- Packaging and labeling
- Business communications and advertising
- Book covers
- Typographic logos, trademarks, and word marks

- Typography has long been a vital part of promotional material and advertising. Designers often use typefaces to set a theme and mood in an advertisement (for example, using bold, large text to convey a particular message to the reader).
- Choice of typeface is often used to draw attention to a particular advertisement, combined with efficient use of color, shapes, and images.[50] Today, typography in advertising often reflects a company's brand.

typography adverting video

 https://motioncue.com/best-kinetictypography-videos-to-fire-up-your-artistry/