**Visual Encoding:**

Visual encoding refers to the techniques and methods used to represent data visually. Different visual encodings are used to map data attributes (e.g., values, categories) to visual properties (e.g., position, size, color) in a visualization. Common visual encodings include:

**1. Position:** The position of visual elements (e.g., points or bars) along scales (e.g., x-axis and y-axis) can be used to represent numerical or ordinal data. For example, a bar chart encodes data using the height of bars.

**2. Length and Size:** The length or size of visual elements, such as bars or data points, can represent numerical values. Longer bars can represent larger values, and smaller points can represent smaller values.

**3.Color:** Color can be used to encode both categorical and numerical data. For categorical data, different colors represent different categories. For numerical data, color can be used as a gradient to represent values, with darker shades typically indicating higher values.

**4.Shape:** Different shapes, such as circles, squares, and triangles, can be used to represent different categories or groups within the data.

**5.Texture and Pattern:** These visual properties can be used to distinguish between categories or data groups in situations where color is not suitable, such as in black-and-white printing.

**6.Angle and Direction:** These visual properties can represent data when dealing with circular or radial data, such as pie charts or radial bar charts.

**Data Types in Tableau**

Tableau expresses fields and assigns data types automatically. If the data source appoints the data type, Tableau will use that data type. If the data source doesn't individually assign a data type, Tableau will assign one. Tableau consist of the following data types:

o Date values

o Text values

o Numerical values

o Date and time values

o Boolean values (True or False conditions )

o Geographic values (longitude and latitude used for maps)

**String Data Type:**

• Text Data type

• Characters are enclosed in single or double quotes

“Shiksha Online” or ‘Shiksha Online’

• String values are of two types:- Char and Varchar

• Char Data Type

• The length of the string is pre-defined or fixed

i.e. if you enter the value greater than defined it will show error

• Stores alpha-numeric values

• Varchar Data type

• Varchar stands for Variable character

• The length of the string is variable

• i.e. you can enter as many values as you want

• Stores alpha-numeric values

**Date and Date & Time Data Type:**

• Tableau support all date formats like

• dd-mm-yy, dd-mm-yyyy, mm-dd-yyyy etc.

• Date and time data type is an extension of Date data type

• Time data values can be

• Seconds, minutes, hours, days, months, years, decades etc.

• If you want to add date value in the form of a string, add # symbol before,

• Example: # 11 March 2022

**Numeric Data Type:**

• Numeric values can be either:- Integer or Floating

• Integer: 10, -5, 0

• Floating (decimal): 2.536, 0.6667, -3.14

• Integer are preferred over floating values as it’s difficult to accumulate decimal point after a certain limit.

Round( ) is used to round the float values

**Geographical Data Type:**

• Data values are used in Maps

• Associates each value in a field with latitude and longitude value

• Includes values such as postal code, region, city, state, country etc.

**Cluster or Mixed Data Types:**

• Tableau is capable of identifying the data type but sometimes the data field doesn’t match the data type.

• Mix values create a problem while analyzing the data.

• In such a situation, users have the option either to handle it manually or allow Tableau to operate on it.

**Encoding mark in tableau**

in Tableau, encoding marks refers to the process of mapping data attributes to visual properties (marks) in your visualization to create meaningful and informative charts and graphs. Marks in Tableau represent individual data points, and encoding them correctly is crucial for effective data visualization. Here are some common visual encodings and how to use them in Tableau:

**1.Color Encoding:**

• Use Case: Color encoding is effective for highlighting categorical differences or showing variations in a single measure.

• How to Encode Marks: To encode marks with color in Tableau, you can drag and drop a dimension or a measure onto the "Color" shelf in the Marks card. You can then choose color palettes, customize colors, and set legends to make the encoding clear and meaningful.

**2.Size Encoding:**

• Use Case: Size encoding is useful for representing a measure's magnitude or emphasizing specific data points.

• How to Encode Marks: To encode marks with size in Tableau, drag and drop a measure onto the "Size" shelf in the Marks card. You can adjust the size range and scaling options to control how data points are sized based on the measure.

**3.Shape Encoding:**

• Use Case: Shape encoding is suitable for distinguishing between categories or groups within your data.

• How to Encode Marks: To encode marks with shape in Tableau, drag and drop a dimension onto the "Shape" shelf in the Marks card. You can choose from a variety of predefined shapes or use custom shapes to represent different categories.

**4.Label Encoding:**

• Use Case: Label encoding adds textual labels to individual data points, providing additional information or context.

• How to Encode Marks: To encode marks with labels in Tableau, you can drag and drop a dimension or measure onto the "Label" shelf in the Marks card. You can customize the label text, format, and positioning.

**5.Tooltip Encoding:**

• Use Case: Tooltip encoding allows you to display additional information when users hover over data points.

• How to Encode Marks: To encode marks with tooltips in Tableau, drag and drop the desired dimensions or measures onto the "Tooltip" shelf in the Marks card. When users hover over marks, they will see the specified information in a tooltip.

**6.Detail Encoding:**

• Use Case: Detail encoding is used to provide additional granularity in the visualization or to drill down into specific data points.

• How to Encode Marks: To encode marks with detail in Tableau, you can drag dimensions or measures onto the "Detail" shelf in the Marks card. This adds more detail to the view without changing the primary encoding.

**7.Path Encoding (for line charts):**

• Use Case: Path encoding is specifically used for line charts and represents the order or sequence of data points.

• How to Encode Marks: To create a line chart in Tableau, place a dimension with a temporal aspect (e.g., date) on the "Columns" shelf and a measure on the "Rows" shelf. Tableau will automatically connect data points to create a line.

**8.Angle Encoding (for radial charts):**

• Use Case: Angle encoding is used in radial charts like pie charts to represent proportions or percentages.

• How to Encode Marks: To create a pie chart in Tableau, drag a dimension or measure onto the "Angle" shelf in the Marks card. This will determine the size of each pie slice based on the data.

**GESTALT**

In germanit says **configuration** and **pattern**

Principles

**1-Figure – Ground** :- This rule states that, people when they see a figure they either see the foreground or background.

We naturally separate visual stimuli into a figure (the object of focus) and a ground (the background or context). Effective use of figure-ground relationships can help direct attention and create visual interest.

**2-Similarity** :- In simple words it means that when we see similar things we usually group them together(shape,siza,color)

Elements that share visual similarities, such as color, shape, size, or orientation, are perceived as belonging to the same group or category. Similarity can be used to create emphasis or differentiate elements.

**3-Proximity or Common Region** :- This rules states that, things which are placed closely yogether looks more related to each other, than things placed far apart

This rule very similar to rule of proximity. It states that when object are placed in a closed region, we perceive them as related.

Elements that are close to each other in space are perceived as being related or belonging together. Proximity is a fundamental principle for creating

**4-Continuity** :- This rule states that, elements or things which are places on line or curve seems to be more related, than the element which are places randomly.

When elements are aligned in a straight line or a smooth curve, they are perceived as forming a continuous path or pattern. Continuity is often used in design to guide the viewer's eye.

**5-Closure** :- This rule states that, when we looks at the complex arrangement of element , we tend to look for single or recognizable pattern.

When presented with incomplete or fragmented information, our brains tend to fill in the missing parts to perceive a whole or complete object. Closure is essential for recognizing shapes and patterns.

**6-Symmetry & Order** :- This rule state that, element which are symmentrical to each other are perceived as a same group or related to each other.

Symmetrical arrangements are perceived as more stable, balanced, and harmonious. Symmetry is a useful principle in creating aesthetically pleasing designs.

**How does visual perception affect data visualization?**

The main purpose of data visualization is to aid in good decision making. To make good decisions, we need to be able to understand trends, patterns, and relationships from a visual. This is also known as drawing insights from data. Now here is the tricky part, we don’t see images with our eyes; we see them with our brains. The experience of visual perception is in fact what goes on inside our brains when we see a visual.

Let’s understand a little bit more about visual perception. There are 3 key points to note:

1. Visual perception is selective. As you can imagine, if we tune our awareness to everything, we will be very soon overwhelmed. So we selectively pay attention to things that catch our attention.

2.Our eyes are drawn to familiar patterns. We see what we expect to see. Hence visualization must take into account what people know and expect.

3.Our working memory is very limited. We will go in depth about memory in a bit, but just understand that we can hold a very limited amount of information in our memory when looking at a visual.

**thyography and text in visualization**

Typography and text play a crucial role in data visualization. They are essential elements for adding context, explanation, and labeling to visualizations, making the information more understandable and actionable for the audience. Here are some key considerations for typography and text in visualization:

**1. Titles and Headings:**

• Use clear and concise titles and headings to provide context for the visualization.

• Titles should convey the main message or purpose of the visualization.

• Consider using larger or bold fonts for titles to make them stand out.

**2. Labels and Annotations:**

• Label data points, axes, and key elements to provide clarity.

• Use descriptive labels that explain what is being represented.

• Ensure that labels are legible and don't overlap, especially in complex visualizations.

**3. Typeface Selection:**

• Choose a typeface (font) that is easy to read and aligns with the tone and purpose of the visualization.

• Sans-serif fonts (e.g., Arial, Helvetica) are often preferred for readability in digital formats.

• Consider the audience's preferences and the brand's style guidelines when selecting a typeface.

**4. Font Size and Hierarchy:**

• Establish a clear hierarchy of font sizes to guide the viewer's attention.

• Use larger fonts for titles, headings, and important labels, and smaller fonts for less important text.

• Ensure that text is legible when the visualization is viewed at various sizes.

**5. Text Color:**

• Choose text colors that have sufficient contrast against the background to ensure readability.

• Consider using high-contrast color combinations for text and background to enhance legibility.

**6. Alignment and Placement:**

• Align text elements consistently to create a clean and organized look.

• Place text strategically to avoid clutter and overlap with data points.

• Use whitespace effectively to separate text from other elements.

**7. Consistency:**

• Maintain a consistent typography style throughout the visualization or dashboard.

• Consistency in font choices, sizes, and formatting helps create a cohesive and professional appearance.

**8. Data-Driven Text:**

• Use dynamic text or annotations to provide context and insights based on the data.

• Incorporate calculated values, data summaries, and statistics as needed.

**9. Interactive Text:**

• In interactive visualizations, use tooltips or pop-ups to display additional information when users hover over or click on data points.

• Interactive text can provide details without cluttering the main view.

**10. Accessibility:** - Ensure that text elements are accessible to all users, including those with visual impairments. - Use descriptive alt text for images and graphics. - Provide alternative ways to access information presented in visual form (e.g., data tables).

**11. Testing and Iteration**: - Test the visualization with potential users to gather feedback on text readability and clarity. - Be open to making improvements based on user feedback and iterative design.

**layout and composition in visual design**

Layout and composition are fundamental principles in visual design that determine how visual elements are organized and arranged within a design, whether it's a webpage, graphic, poster, or any other visual medium. Effective layout and composition are essential for creating aesthetically pleasing, balanced, and visually appealing designs that communicate the intended message clearly. Here are some key concepts and considerations in layout and composition in visual design:

**1. Hierarchy:**

• Establish a clear hierarchy of visual elements to guide the viewer's attention. This hierarchy helps viewers understand the most important information first.

• Use visual cues such as size, color, contrast, and typography to emphasize key elements and create a visual flow.

**2. Alignment:**

• Maintain consistent alignment of elements within the design. Alignment helps create a sense of order and structure.

• Choose from alignment options like left-aligned, right-aligned, centered, or justified text and elements.

**3. Grid Systems:**

• Grid systems provide a framework for organizing content. They help ensure consistency and alignment in a design.

• Common grid systems include columns and rows, which can be used for text, images, and other elements.

**4. Balance:**

• Achieve visual balance by distributing elements harmoniously throughout the design. Balance can be symmetrical (formal) or asymmetrical (informal).

• Unbalanced designs can be used strategically to create tension or draw attention.

**5. White Space (Negative Space):**

• White space refers to the empty or unoccupied areas in a design. It is essential for preventing visual clutter and allowing elements to breathe.

• Proper use of white space improves readability and enhances the overall aesthetics.

**6. Contrast:**

• Use contrast to create visual interest and emphasize elements. Contrast can be achieved through variations in color, size, shape, and typography.

• High contrast draws attention, while low contrast creates a more subtle effect.

**7. Repetition and Consistency:**

• Repeating design elements (such as colors, fonts, shapes, and icons) creates visual cohesion and a sense of unity.

• Consistency in design elements across multiple pages or screens helps maintain brand identity and recognition.

**8. Focal Point:**

• Establish a focal point in the design to highlight the most critical information or message.

• The focal point should be visually distinct and draw the viewer's attention.

**9. Flow and Direction:**

• Consider the natural flow of reading or viewing, typically from left to right and top to bottom (in Western cultures). Design elements should follow this flow for ease of comprehension.

• Visual cues, such as arrows or lines, can guide the viewer's eye through the design.

**10. Proximity:** -

Group related elements together to convey their relationship or connection. Proximity helps viewers understand how information is organized. - Elements that belong together should be closer to each other than to unrelated elements.

**11. Visual Balance**: - Achieve a sense of equilibrium by evenly distributing visual weight throughout the design. Balance can be achieved through color, size, and placement of elements.

**12. Harmony**: - Create a harmonious composition by ensuring that all design elements work together cohesively. Harmony contributes to a pleasing overall aesthetic.

**Data visualization design principle**

Effective data visualization relies on several key design principles to communicate information clearly and engage the audience. These principles help transform complex data into understandable and meaningful visual representations. Here are some essential data visualization design principles:

**1.Simplify and Clarify:**

• Keep visualizations simple and uncluttered. Remove unnecessary elements that do not contribute to the message.

• Emphasize clarity and readability. Ensure that viewers can quickly grasp the main points without confusion.

**2.Choose the Right Chart Type:**

•Select a chart or graph type that best represents your data and the insights you want to convey. Common types include bar charts, line charts, pie charts, scatter plots, and heatmaps.

•Avoid using overly complex chart types when simpler ones can effectively convey the information.

**3.Data-Ink Ratio:**

• Maximize the data-ink ratio by minimizing non-data ink (gridlines, decorations, etc.). Edward Tufte coined this principle to emphasize that ink in a visualization should primarily represent data.

• Remove or reduce chart elements that don't directly contribute to understanding the data.

**4.Color Usage:**

• Use color purposefully and sparingly. Color should enhance comprehension, not overwhelm the viewer.

• Employ color consistently for similar data categories or groups. Use color scales to represent quantitative data.

**5.Labels and Annotations:**

• Include informative labels, titles, and annotations to provide context and explanation for the data.

• Use labels to identify data points and add units to axes to clarify measurements.

**6.Hierarchy and Emphasis:**

• Create a visual hierarchy to guide viewers' attention. Highlight the most important data and insights prominently.

• Use visual cues such as size, color, and contrast to emphasize key points.

**7.Consistency and Branding:**

• Maintain consistency in design elements, including fonts, colors, and chart styles, across related visualizations or reports.

• Incorporate branding elements (e.g., logos, color schemes) to align with organizational identity.

**8.Interactivity:**

• When appropriate, add interactive elements such as tooltips, filters, and drill-down options to allow viewers to explore the data.

• Ensure that interactivity enhances the user experience and doesn't create confusion.

**9.Accessibility:**

• Design visualizations with accessibility in mind. Ensure that they are usable by individuals with disabilities, including those who use screen readers.

• Use alt text for images, provide text alternatives for visual content, and ensure sufficient color contrast.

**10.Storytelling:**

• Arrange the visualization elements in a logical order to tell a clear and compelling data-driven story.

• Guide viewers through the narrative, explaining the context, insights, and implications of the data.

**11.Testing and Iteration:**

• Gather feedback from potential users and stakeholders and iteratively refine the visualization based on their input.

• Test the visualization with the target audience to ensure it effectively communicates the intended message.

**12.Ethical Considerations:**

• Be mindful of ethical considerations, such as avoiding misleading visualizations or biased representations of data.

• Present data accurately and transparently, and acknowledge any limitations or uncertainties.

**Typography**

* Typography is the art and technique of arranging text to make it readable, attractive, and effective.

In data visualization, typography plays a crucial role in conveying information, creating hierarchy, and enhancing aesthetics

* **Use contrast and alignment**
* Contrast and alignment are the principles of creating visual distinction and order in typography.
* Contrast refers to the difference between text elements, such as color, size, weight, and style.
* Alignment refers to the position and arrangement of text elements, such as left, right, center, or justify.
* You should use contrast and alignment to highlight the most important and relevant information, and to guide the eye and the flow of the data visualization.
* For example, you can use contrast to emphasize the title, subtitle, labels, and annotations of your data visualization.
* You can use alignment to align the text elements with the data elements, such as axes, bars, lines, and points.
* **Use white space**
* White space, also known as negative space, is the empty area around your text and visuals. White space can help you create balance, harmony, and breathing room in your design. It can also help you highlight important elements and reduce visual noise.
* **Follow the grid and the rule of thirds**

The grid is a system of horizontal and vertical lines that divides your design into columns, rows, and sections. The grid can help you create consistency, proportion, and symmetry in your design. It can also help you align your text and visuals and create hierarchy and contrast. The rule of thirds is a guideline that divides your design into nine equal parts by two horizontal and two vertical lines. The rule of thirds can help you create balance, interest, and focus in your design. It can also help you place your text and visuals along the intersections or along the lines for optimal impact

* **Avoid clutter and confusion**
* Clutter and confusion are the enemies of legibility in typography.
* Clutter refers to the excess and unnecessary text elements that crowd and overwhelm the data visualization.
* Confusion refers to the ambiguous and misleading text elements that confuse and mislead the viewer.
* You should avoid clutter and confusion by using clear and concise language, by reducing and simplifying text elements, and by checking and correcting text elements.
* For example, you can avoid clutter by using abbreviations, acronyms, icons, or symbols instead of long words or phrases. You can avoid confusion by using proper punctuation, capitalization, spelling, and grammar.
* **Test and refine**
* Test and refine are the processes of evaluating and improving typography in data visualization.
* To do so, you should use different methods such as feedback, review, critique, or usability testing.
* Additionally, you should use criteria such as readability, comprehension, accuracy, and aesthetics.
* Ask yourself and others questions like “is the text easy to read and understand?” or “does the text fit the tone, purpose, and context of the data visualization?” to assess your typography.
* By following these tips and guidelines, you can make sure your typography is legible and your data visualization is effective, engaging, and persuasive.

**Data Modelling**

* Data Modeling refers to designing the Entity-Relationship modeling for Database tables to establish the connections between tables. It also involves designing the schema for Data Warehouses. Thus, it shows how tables are connected in schema terms.
* Data Modeling techniques include Entity-Relationship Diagrams (ERDs) to depict the way data has been stored in the Database. The ERDs show the types of relationships between the different tables in the Database, whether one-to-many, many-to-many, etc.
* There are three types of data model:
* Conceptual: It is more at the concept level and it does not have more details.
* Logical: Everything has been mentioned in the detail but nothing has been implemented.
* Physical: It uses logical data model as a base and it finally implements it on the system.

