International Journal of Information Movement *Vol.2 Issue IX January 2018)*

Website: www.ijim.in *ISSN: 2456-0553 (online)* **Pages 118-121**

INFOGRAPHICS A BACKBONE FOR EFFECTIVE COMMUNICATION

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Abstract : The writing about the historical roles of visual and verbal methods of communication, Lester (1995) notes that "words and pictures have been locked in a struggle for dominance, with words being the clear-cut leader". Indeed few would contest the written or spoken word's communicative power, flexibility, or historical relevance. Despite this however, there are certain types of information for which exclusively textual communication is not the most optimal solution. Certain information needs call for a combined presentation of visual and verbal communication. This article covers the strengths and weaknesses of both textual and graphical communication, as well as the manner in which the two can be combined to produce more effective artifacts. Infographics have been around for many years and recently the increase of a number of easy-to-use, free tools have made the creation of infographics available to a large segment of the population. Infographics are widely used in the age of short attention span.

Keywords: Infographics, Effective Communication, Information Graphics, Visual Representation

1.0 Introduction

A picture is worth a thousand words. An infographic (short for information graphic) is a type of picture that blends data with design, helping individuals and organizations concisely communicate messages to their audience. Infographics is a clipped compound of "information" and "graphics". In fact it is a graphic visual representations of information, data or knowledge intended to present information quickly and clearly. They can improve cognition by utilizing graphics to enhance the human visual system's ability to see patterns and trends. Similar pursuits are information visualization, data visualization, statistical graphics, information design, or information architecture. Infographics have evolved in recent years to be for mass communication, and thus are designed with fewer assumptions about the readers' knowledge base than other types of visualizations. Isotypes are an early example of infographics conveying information quickly and easily to the masses.

2.0 History of Infographics

In 1626, Christoph Scheiner published the Rosa Ursina sive Sol, a book that revealed his research about the rotation of the sun. Infographics appeared in the form of illustrations demonstrating the Sun's rotation patterns. In 1786, William Playfair, an engineer and political economist, published the first data graphs in his book 'The Commercial and Political Atlas'. To represent the economy of 18th Century England, Playfair used statistical graphs, bar charts, line graphs, area charts, and histograms. In his work, Statistical Breviary, he is credited with introducing the first pie chart. Around 1820, modern geography was established by Carl Ritter. His maps included shared frames, agreed map legends, scales, repeatability, and fidelity. Such a map can be considered a "supersign" which combines sign systems as defined by Charles Sanders Peirce consisting of symbols, icons,

indexes as representations. Other examples can be seen in the works of geographers Ritter and Alexander von Humboldt.

In 1857, English nurse Florence Nightingale used information graphics to persuade Queen Victoria to improve conditions in military hospitals. The principal one she used was the Coxcomb chart, a combination of stacked bar and pie charts, depicting the number and causes of deaths during each month of the Crimean War. 1861 saw the release of an influential information graphic on the subject of Napoleon's disastrous march on Moscow. The graphic's creator, Charles Joseph Minard, captured four different changing variables that contributed to Napoleon's downfall in a single two-dimensional image: the army's direction as they traveled, the location the troops passed through, the size of the army as troops died from hunger and wounds, and the freezing temperatures they experienced. James Joseph Sylvester introduced the term "graph" in 1878 in the scientific magazine Nature and published a set of diagrams showing the relationship between chemical bonds and mathematical properties. In 1958 Stephen Toulmin proposed a graphical argument model, called The Toulmin Model of Argumentation. The diagram contained six interrelated components used for analyzing arguments, and was considered Toulmin's most influential work, particularly in the field of rhetoric, communication, and computer science. The Toulmin Model of Argumentation became influential in argumentation theory and its applications.

The infographics created by Peter Sullivan for 'The Sunday Times' in the 1970s, 1980s, and 1990s were some of the key factors in encouraging newspapers to use more infographics. Sullivan is also one of the few authors who have written about information graphics in newspapers. Likewise the staff artists at USA Today, the United States newspaper that debuted in 1982, established the goal of using graphics to make information easier to comprehend. However, the paper has received criticism for oversimplifying news stories and for creating infographics that some find emphasize entertainment over content and data. Tufte coined the term chart junk to refer to graphics that are visually appealing to the point of losing the information contained within them. With vector graphics and raster graphics becoming ubiquitous in computing in the 21st Century, data visualizations have been applied to commonly used computer systems, including desktop publishing and Geographic Information Systems (GIS).The closely related to the field of information graphics is information design, which is the creation of infographics.

3.0 Review of Literature

The act of reading, though a common and frequently performed task for most humans, is a rather complex cognitive process (Atkinson et al., 1988). Carr (1988) suggests that while humans' information processing system contains certain characteristics that facilitate auditory language processing, it has no intrinsic strengths at interpreting written language. Written alphabets are essentially symbol systems whose basic characters are abstract representations of phonemes that can be combined in myriad ways to produce an infinite range of meaning (Ware, 2004). While this arbitrary abstraction gives written language its scalability and strength, it also contributes to the cognitive load involved in its comprehension (Carr, 1986). Visual text perceived by the biological processing system is converted to linguistic information in the working memory system; meaning emerges after repeated transfer of the information between the working and long-term memory systems (Atkinson et al., 1988). Thus, the reading process may require significant effort, attention, and motivation on the part of the reader. In certain contexts this effort can be rather rewarding for the reader; research has shown that the cognitive processes involved in reading can allow for deeper and more developed learning (Chin and Brown, 2000). Many use contexts however, don't allow for such effort to be exerted. Tasks involving other additional simultaneous subtasks (e.g., reading instructions while attempting to operate a device) or a quick time to act (e.g., reading diagnostic information in an emergency situation), may not allow readers' the resources required to read through large amounts of text (Wickens et al., 2004). Many times readers will not even bother reading the text if it is not predicted to provide great benefits (Schriver, 1997). Some steps can be taken to simplify the reading process, such as applying visual formatting to help readers detect document structure more easily, but little can be done to limit the verbiage required for communicating complex information (Schriver, 1997). Thus, one can utilize graphical representations of information to create relatively concise messages that would otherwise require large amounts of words.

4.0 Data Visualization

Data visualizations are often used in infographics and may make up the entire infographic. There are many types of visualizations that can be used to represent the same set of data. Therefore, it is crucial to identify the appropriate visualization for the data set and infographic by taking into consideration graphical features such as position, size, shape, and color. There are primarily five types of visualization categories like time series data, statistical distributions, maps, hierarchies, and networking.

4.1 Time Series Data: Time-series data is one of the most common forms of data visualization. It documents sets of values over time. Examples of graphics in this category include index charts, stacked graphs, small multiples, and horizon graphs. Index charts are ideal to use when raw values are less important than relative changes. It is an interactive line chart that shows percentage changes for a collection of time-series data based on a selected index point. For example, stock investors could use this because they are less concerned with the specific price and more concerned with the rate of growth. Stacked graphs are area charts that are stacked on top of each other, and depict aggregate patterns. They allow viewers to see overall patterns and individual patterns. However, they do not support negative numbers and make it difficult to accurately interpret trends. An alternative to stacked graphs is small multiples. Instead of stacking each area chart, each series is individually shown so the overall trends of each sector are more easily interpreted. Horizon graphs are a space efficient method to increase the data density of a time-series while preserving resolution.

4.2 Statistical : Statistical distributions reveal trends based on how numbers are distributed. Common examples include histograms and box-and-whisker plots, which convey statistical features such as mean, median, and outliers. In addition to these common infographics, alternatives include stem-and-leaf plots, Q-Q plots, scatter plot matrices (SPLOM) and parallel coordinates. For assessing a collection of numbers and focusing on frequency distribution, stem-and-leaf plots can be helpful. The numbers are binned based on the first significant digit, and within each stack binned again based on the second significant digit. On the other hand, Q-Q plots compare two probability distributions by graphing quantiles against each other. This allows the viewer to see if the plot values are similar and if the two are linearly related. SPLOM is a technique that represents the relationships among multiple variables. It uses multiple scatter plots to represent a pairwise relation among variables. Another statistical distribution approach to visualize multivariate data is parallel coordinates. Rather than graphing every pair of variables in two dimensions, the data is repeatedly plotted on a parallel axis and corresponding points are then connected with a line. The advantage of parallel coordinates is that they are relatively compact, allowing many variables to be shown simultaneously.

4.3 Maps: Maps are a natural way to represent geographical data. Time and space can be depicted through the use of flow maps. Line strokes are used with various widths and colors to help encode information. Choropleth maps, which encode data through color and geographical region, are also commonly used. Graduated symbol maps are another method to represent geographical data. They are an alternative to choropleth map and use symbols, such as pie charts for each area, over a map. This map allows for more dimensions to be represented using various shapes, size, and color. Cartograms, on the other hand, completely distort the shape of a region and directly encode a data variable. Instead of using a geographic map, regions are redrawn proportionally to the data. For example, each region can be represented by a circle and the size/color is directly proportional to other information, such as population size.

4.4 Hierarchies: Many data sets, such as spatial entities of countries or common structures for governments, can be organized into natural hierarchies. Node-link diagrams, adjacency diagrams, and enclosure diagrams are all types of infographics that effectively communicate hierarchical data. Node-link diagrams are a popular method due to the tidy and space-efficient results. A node-link diagram is similar to a tree, where each node branches off into multiple sub-sections. An alternative is adjacency diagrams, which is a space-filling variant of the node-link diagram. Instead of drawing a link between hierarchies, nodes are drawn as solid areas with sub-sections inside of each section. This method allows for size to be easily represented than in the node-link diagrams. Enclosure diagrams are also a space-filling visualization method. However, they uses containment rather than adjacency to represent the hierarchy. Similar to the adjacency diagram, the size of the node is easily represented in this model.

4.5 Networks: Network visualization explores relationships, such as friendships and cliques. Three common types are force-directed layout, arc diagrams, and matrix view. Force-directed layouts are a common and intuitive approach to network layout. In this system, nodes are similar to charged particles, which repel each other. Links are used to pull related nodes together. Arc diagrams are one-dimensional layouts of nodes with circular arcs linking each node. When used properly, with good order in nodes, cliques and bridges are easily identified in this layout. Alternatively, mathematicians and computer scientists more often use matrix views. Each value has an (x,y) value in the matrix that corresponds to a node. By using color and saturation instead of text, values associated with the links can be perceived rapidly. While this method makes it hard to view the path

of the nodes, there are no line crossings, which in a large and highly connected network can quickly become too cluttered.

While all of these visualizations can be effectively used on their own, many modern infographics combine multiple types into one graphic, along with other features, such as illustrations and text. Some modern infographics do not even contain data visualization, and instead are simply a colorful and succinct ways to present knowledge.

4.6 Infographics Tools

Infographics can be created by hand using simple everyday tools such as graph paper, pencils, markers, and rulers. However, today they are more often created using computer software, which is often both faster and easier. They can be created with general illustration software. Diagrams can be manually created and drawn using software, which can be downloaded for the desktop or used online. Templates can be used to get users started on their diagrams. Additionally, the software allows users to collaborate on diagrams in real time over the Internet. There are also numerous tools to create very specific types of visualizations, such as creating a visualization based on embedded data in the photos on a user's Smartphone. Users can create an infographic of their resume or a "picture of their digital life". The professional infographic designers rely primarily on a core vector graphics software program to create their infographics designs. The main advantage is that all the icons, charts, images, illustrations, and data visualizations are treated as separate objects that can be easily moved, resized, overlapped, and rotated. No matter where you create the individual design elements, the final infographic design is usually put together in a vector graphics program. Now there are readily online tools for creating infographic like Visme, Canva, Easelly, Piktochart, and Infogram.

5.0 Conclusion

As the amount of information in our lives continues to increase, information designers must continue to design solutions that optimally match users' requirements. Thoughtful combinations of text and graphics are one way to optimize communication, but doing so requires designers to be cognizant of the particular ways in which the two interact. Arguably, one could communicate all of this content using either text or graphics alone. Their combination however, produces an infographic that communicates a wide range of information in a cohesive and efficient manner. The readily available online and offline infographics software can be utilized to maximum extent for providing effective communication.

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