

# Data Visualization in the Online Newspaper: Efficacy and Multidimensionalities

Sabahudin Hadžialić<sup>1</sup>, Phuong V Thi<sup>2</sup>, Monira Begum<sup>3</sup>

Received on: 03 June 2024; Accepted on: 06 July 2024; Published on: 17 July 2024

## ABSTRACT

Talking about data journalism means talking about data visualization with charts and infographics. Data visualization combined with journalistic analysis capabilities in data journalism works is attractive compared to conventional articles. Data visualization is one of the media's reporting tools capable of turning huge volumes of data into graphic images on any information topic of public interest. It can not only serve as a supplement but can also stand alone as a complete article. Data visualization is a product of creativity, expressing the visual view of its designer. This factor requires graphic designers to have not only journalistic expertise but also technical and artistic qualities. Data visualizations often promote more brainstorming because they appeal to both the visual and cognitive hemispheres. The impression of data visualization in journalism is that it integrates many forms of information transmission from images, numbers, and text, to audio, comments, and video. This helps to convey information quickly and neatly to help readers visualize the message more easily. From 10 years of experience in journalism, especially in online journalism, the authors provide a case study that makes it clear that the influence of data visualization on journalism has drastically changed the way stories are told in modern journalism. This article will help readers realize the important role data plays in journalism and understand how to build data-driven content. Journalists will use learning how to build news articles based on facts and case studies to visualize data in the news.

**Keywords:** Data visualizations, Digital journalism, Digital storytelling productions, Journalism, Multimedia journalists, Multimedia storytelling, Online newspaper.

*Science, Art and Religion* (2024): 10.5005/jp-journals-11005-0081

## INTRODUCTION

Data can be used to provide more detailed information about what is happening and the effects of information in society. From telling the public what happened, data can help journalists analyze the information they need to make sense of the day's important issues. Investing in data journalism is considered a necessary long-term and strategic investment for news agencies. Since USA Today (United States) began using numerous large charts, graphs, and images on its pages in the 1980s, data visualization is no longer seen as a foreign idea by the international press, with vibrant hues to improve the information's appeal in comparison to the drab, wordy newspapers of the day. Later, the use of graphics to communicate information spread to nations in Europe like England, Germany, France, and Spain (1986). Vietnam is one of the countries applying data visualization in the press. Vietnam's online newspaper VietnamPlus has cooperated with Agence France-Presse news agency on static graphics as well as interactive graphics about the World Cup since June 2010.<sup>1,2</sup> In 2014, VietnamPlus started buying graphic video services from AFP. In addition to news agencies with graphic news services, some major French daily newspapers such as Le Monde and Le Figaro have their own graphic production rooms at the newsroom. The combination of words and images in a story has an important impact on capturing the reader's

<sup>1</sup>Communication Science Faculty, International Telematic University UNINETTUNO, Rome, Italy

<sup>2</sup>Faculty of Journalism, Communication and Literature, Thai Nguyen University of Sciences, Thái Nguyên, Vietnam

<sup>3</sup>School of Media and Communication, The University of Southern Mississippi, Hattiesburg, Mississippi, United States of America

**Corresponding Author:** Sabahudin Hadžialić, Communication Sciences Faculty, International Telematic University UNINETTUNO, Rome, Italy, Phone: +38761196707, e-mail: sabahudin.hadzialic@uninettunouniversity.net

**How to cite this article:** Hadžialić S, Thi PV, Begum M. Data Visualization in the Online Newspaper: Efficacy and Multidimensionalities. *Sci Arts Relig* 2024;3(3-4):105-114.

**Source of support:** Nil

**Conflict of interest:** None

attention, keeping them engaged, and even ensuring that they retain the information longer when the story is given in the narrative form.

In Vietnam, data visualization has been noticed by VietnamPlus e-newspaper since 2005. Up to now, in addition to VietnamPlus, VnExpress, Tuoi Tre Online, Dan Tri, etc., have also exploited the use of graphics in the transmission of information and attracted many followers. Graphical

information has the greatest ability to quickly affect the human brain through visual illustrations (based on research by Kissmetrics Company, which shows that 65% of the population remembers information with their eyes) and 90% of information transmitted to the brain *via* visual cues) is likely to dominate future coverage for both traditional and social media. The study of how to report and tell stories graphically in electronic newspapers to see the advantages of exploiting this visual reporting method. From there, give some suggestions to improve the quality of the image and data production for online newspapers.

## OBJECTIVES OF THE STUDY

This research aims to clarify what data content is, and what value does data add to journalism? How will journalists ask questions about the data package, and learn and analyze the data? Theories and practices of data construction; online tools to help journalists build data. The main objective of the study is to show how data visualization is best used in newsrooms. On the theoretical basis related to online newspapers, a survey of the current status of data visualization used in online newspapers, analyzing and summarizing lessons learned, this research aims to point out the successes, limitations, and trends in the development of graphics and visualization in online newspapers worldwide. From there, give some suggestions to improve the efficiency of the use of graphic information in data journalism in general. This research also aims to help journalists incorporate metadata journalism into embedded journalism with multidimensional perspectives that create an appeal to the public.

## Research Methods

This study uses the following research methods: (1) Survey, statistical, and evaluation methods are the main research methods to clarify the current situation of using data visualization on online newspapers surveyed, and at the same time, the advantages and limitations were presented as a basis for proposing some suggestions to improve the quality of using visualization on domestic online newspapers; (2) In-depth interview method: Conducted with experts and journalists who produce images and data directly in newspapers to have research materials; (3) This method of comparison and meta-analysis is used to compare the current situation of using data and the form of representation in press images in online newspapers of Vietnam and other countries and analyze the results, investigate, and draw scientific arguments.

## Findings

### *The Special Appeal of Data Journalism*

Data visualization is a crucial tool for creating journalism-related goods. A photograph, as they say, is worth a thousand words. Visual media's efficacy and multidimensionality give them cognitive power.<sup>3</sup> The difference in data journalism is its ability to provide visual information compared to traditional types of journalism. In addition, data journalism

demonstrates the ability to tell a compelling story with a wide range of information brought about by digital media to modern journalism, embodied in the following main contents.

Firstly, the method of organizing information is scientific. Industry 4.0 is the era of big data, in which data becomes the key for journalism products, helping data journalism to grow more and more. Thanks to the support of artificial intelligence, data analysis is becoming quicker and more convenient, and reporters can obtain detailed comparison results, thereby telling the story in their own way.<sup>4</sup> In data journalism, data is no longer just a statistical tool; reporters will use data to write topical stories. When dealing with raw data sources, reporters need to find the big questions, assumptions, and doubts from the data sources and look for data sources that support the predictions; then data journalism will create curiosity for readers.

Second, the information tool is transparent against fake news. Journalism plays a significant part in information orientation and debunking fake news in the fight against it. Data is the determining factor in the 4.0 age when determining what events are real and what are made up. Data journalism plays a significant role in the fight against fake news when information is transparent with specific figures. This is because readers always place confidence in information with specific figures and a clear source.<sup>5</sup> Industry 4.0 facilitates public access to raw data sources by linking to a big data platform, making it verifiable by the public assumptions that reporters make in data journalism or make their own analyses and predictions.<sup>6</sup>

Third, visualize the figures. Data journalism provides readers with an overview by presenting information graphically. Vivid infographic works help the public just "click" on an area on the image, and information about that area will appear. This is a way of data compression to help readers find the data of their interest instead of all the data spread out in the newspaper.

Besides, presenting graphic news becomes much easier with internet design programs and service packages specifically for press agencies. In addition, the trend of embedded journalism is growing in the world. Some press agencies currently are incorporating mega story works into embedded journalism with multidimensional perspectives to create an appeal to the public.<sup>7</sup> How data visualization is best used in newsrooms. We present some highlights from our research here.

## DRAMATICALLY CHANGING THE WAY JOURNALISM STORIES ARE TOLD

A change from writing being the semi-primary mode to data and visualization being the main components of journalistic storytelling is being brought about by the increasing use of data visualization in journalism. Even if it's just a straightforward graphic or diagram, many respondents claim that data visualization is the inspiration behind a narrative.

According to reader statistics, when we include straightforward data visualization in a narrative, readers stay on the website a little bit longer. The emergence of multiskilled teams of experts with data skills in newsrooms coincides with these shifts. The newsroom staff must also adjust to learning new internal and commercial tools as new structures emerge to suit this changing visual form to develop new skills, understand how to communicate across teams and areas of expertise, and produce effective data stories. As a result, certain chart kinds, like bar and line charts, have become more popular, and scroll telling—stories that unfold as a user scrolls down the page and in which images embedded in the text appear to correspond to the passage of time—has also become more common.

How does the viewer interact with and interpret the pictures they view in the media? Data journalists are frequently too occupied to address this issue. Although data visualization researchers do not have this justification, they rarely pay heed to what viewers of the images think of them. The study project “Enter Seeing Data” investigates how people interact with the data images they come across on a daily basis, frequently in the media. It investigates the elements that affect engagement and what this implies for how we consider what constitutes an effective image (Fig. 1).<sup>6</sup>

As a result of the fact that both the newspapers and the visual images frequently reflect the participants’ views of the world, the participants’ trust in these newspapers and the images therein demonstrates the significance of beliefs and opinions in determining how and whether people choose to spend time interacting with particular images. Some participants stated that they enjoyed having their views and opinions visually supported.

Engaging in visualization is regarded a difficult task for those who do it. The timing of this “work” is critical in determining whether people are ready to do it. Most of the female participants stated that they did not have time for visual viewing and did not prioritize jobs, family, and family commitments.<sup>8</sup> One working mother described how her combined pay and domestic labor were so exhausting that when she got home from work, she didn’t want to watch the news, which included gazing into her imagination. Such



Fig. 1: Data Visualization: Census Migration, produced for the Migration Observatory, University of Oxford

activities felt like “work” to her, and she was too tired at the conclusion of a long day to do them.

Data visualization is similar to putting together a jigsaw puzzle. There are a few things you should keep in mind in order to be successful: the scene revealed by the works is the story you want the data graphic to communicate. You must also comprehend what you have at your disposal—the puzzle parts are the data set in front of you. Then it’s up to you to assemble puzzles or groups of elements in your graphics to convey the story of your data.<sup>5</sup>

The various storytelling points discussed above are readily recognized by the mind. In the text, knowledge is delivered one nugget at a time, in a predetermined order. In the image, our eyes wander to look for information in numerous dimensions at the same time. Design components such as reference lines, legends, data labels, and captions influence perception. Notably, the richness of the visual medium enables complicated relationships to emerge, which would otherwise result in long, heavy, squiggly sentences when expressed verbally.

The efficiency and multiple perspectives of visual media are the result of a set of conventions and rules, which are frequently shared between data visualization producers and consumers.

## DATA VISUALIZATION

According to the author, Nguyen Thanh Loi, in the book titled “Press Operations in the Modern Media Environment,” data visualization is called “using images to present information, data, or knowledge that form accurate, specific, and clear statistics to help readers easily follow, read, and understand.”<sup>2</sup>

According to Jennifer George-Palilonis in “A Practical Guide to Graphics Reporting: Information Graphics for Print, Web and Broadcast,” data visualizations in online journalism often promote more brainstorming because they are more engaging with both visual and cognitive hemispheres. Visuals can tell stories with a level of detail that normally wouldn’t be possible. It provides the public with an amazingly rich “reading” experience and gives journalists a powerful tool to tell different types of stories.

Thus, data visualization is one of the media’s reporting tools capable of turning huge amounts of data into graphic images on all information topics of public interest. It can not only serve as a supplement but can also stand alone as a complete article.

A visualization is also a form of nontextual language, visual information. Journalistic language is a way of expressing the content of a journalistic work for readers to receive. There are two types of journalistic language: textual language and nontextual language. In particular, nontextual language is a special type of language that does not use words to express content but uses symbols, tables, images.<sup>9</sup>

In Vietnam, the term “nontextual information” first appeared in 1988 to collectively refer to information in the press that is not published in text form but in graphical form

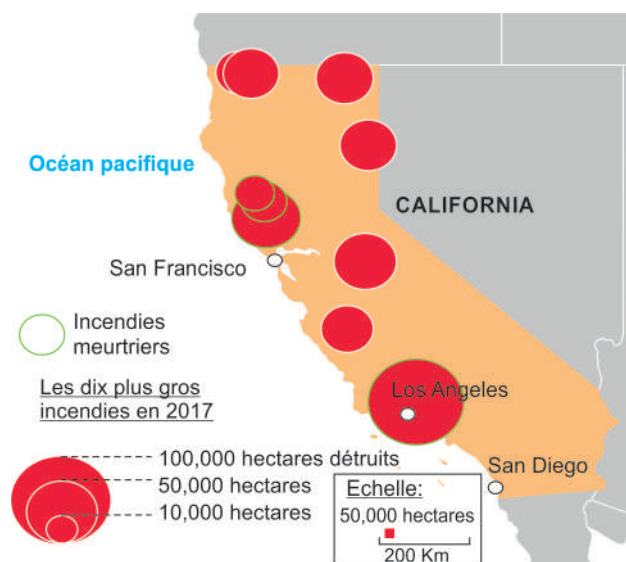
such as images (moving, static), illustrations, tables, graphs, diagrams, maps. Data visualization is a product of creativity, which expresses the visual view of its designer. This factor requires graphic designers to have not only journalistic expertise but also technical and artistic qualities.<sup>1,2</sup>

The public is receptive to visualizing data. According to author Jennifer George-Palilonis, the combination of words and images in a story has an important impact on capturing the reader's attention, keeping them engaged, and even ensuring that they retain the information longer when the story is given in narrative form. Data visualizations often promote more brainstorming because they appeal to both the visual and cognitive hemispheres. This is because text information is still dependent on the decoding of the information; the readers must be literate to read the text.

The impression of data visualization in journalism is that it integrates many forms of information transmission from images, numbers, and text to audio, comments, and video. This helps to convey information quickly and neatly to help readers visualize the message more easily. Even in online journalism, there are many data visualizations appearing in one space at the same time.<sup>10</sup>

Not just numbers, letters, or conventional shapes, data visualization contains certain contents. Looking at the graphics, the public not only receives information but also stimulates the ability to compare, contrast, and feel. This means that the public no longer plays a passive role in receiving information but also can analyze and find the content that data visualization has not or does not mention (Fig. 2).

With the circles showing burned forest areas ranging from 10,000 to 100,000 ha, readers can easily identify the locations where forest fires often occur, and at the same time compare the level of loss of forests and people caused by fires in California state. Journalists use red with the connotation



**Fig. 2:** Visualize data in the form of statistical maps and compare wildfire areas in the US state of California

of fire, heat, and danger, making the reception of readers' messages even stronger and more impressive.

## FEATURES OF DATA VISUALIZATION

Journalism visuals can serve all sorts of information. The job of graphic designers is first to find out the news that reporters send; they will choose works that are able to convert part of the contents from text to graphic form. Most of the information exploited by the reporters can use graphics to show, especially information about politics, the economy, finance, etc. This is the type of information with many suitable numbers and data and is the strength to perform graphics.<sup>8</sup>

Like printed newspapers and television, data visualization is one of the tools for online journalism to bring a lot of appeal to the public through information visualization. With its own strengths, especially in terms of transmission capacity, multimedia capabilities, and interoperability, data visualization on this mass media becomes more diverse and vivid.

Online journalism covers all three forms of data visualization—traditional, interactive, and video. Due to the diversity and completeness of this graphic format, it is difficult for any mass media to compete with online newspapers in terms of visual appeal.

Another feature of data visualization in online journalism is the elongation of the graphic because it is not limited in terms of paper size (printed newspaper) and capacity (television). This advantage helps graphic designers of online journalism to be more creative and comfortable about the logic of information because they are not constrained by a certain framework. This is very suitable for storytelling—the way of reporting in data journalism, as readers are more and more interested in receiving and self-analyzing huge information flows by means of data visualization.

Another impressive feature of data visualization in online newspapers is in the form of animation—interactive. Readers can not only see but also manipulate graphic images. This special point makes the visual images in online journalism become more attractive and attracts more and more attention and love from the public.

## EXPRESSION OF VISUAL IMAGES

Most data visualization conventions and rules are not distinct; in some instances, competing, conflicting conventions coexist. As tools develop, the rules, such as how we handle colors, evolve.

## CHART

In the book titled "The Language of Journalism," author Vu Quang Hao defines a chart as "a drawing representing a certain concept, law, or relationship; it visually describes the dependence between quantities." This is a simple visual image that is often used in many articles on economics, finance, banking, and the stock market. If the statistics,

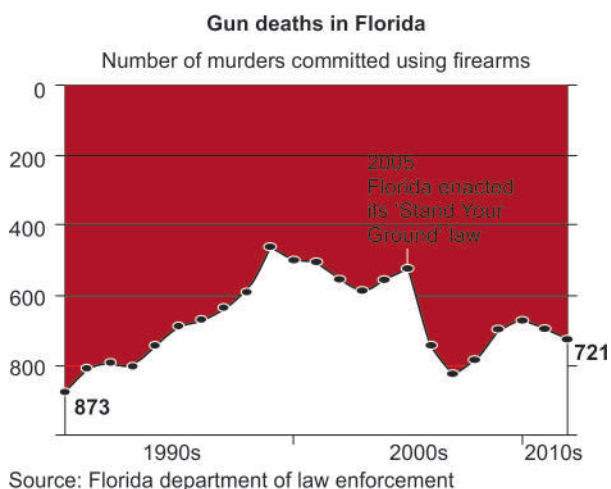
summary, and comparison of output are presented in narrative form, readers will be very reluctant to read such data and often do not understand the information in the article. With such data, information processing is required to present it in the form of a chart or graph to bring better results.

In the press, there are the following types of charts:

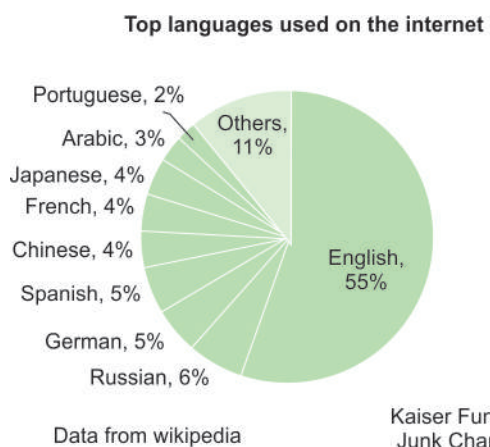
**Column chart:** Vertical column charts and horizontal column charts are the two types, with the vertical column chart being the more prevalent. Which variable goes on which axis is determined by tradition. In this case, the per capita healthcare indicator is regarded a driver of health results. Health indicator (explanatory variable) is recorded as X, and life expectancy (outcome) is encoded as Y. In our divergence case, the X- and Y-axes are reversed. Its visual look is a 45° diagonal reflection of the same data. The regression line is a common scatter chart add-on. Regression analysis measures the relationship between two factors represented by a scatter plot.

**Figure 3** was released by Reuters in 2014, and it quickly sparked a tweetstorm in the data visualization community.

**Pie chart/arc chart:** This type of chart helps to identify and compare the ratio of quantities by the size of the sections. It



**Fig. 3:** A chart showing the effect of Florida's stand-your-ground law on gun homicides



may be horizontal, the slant may be solid, have a hole in the center, or maybe only a semicircle. If it is an arc, the sections can be distinguished by color, and if it is a circle, the outer sections distinguished by color can also be separated from the center of the circle, recede from the circle, and sometimes even be an independent section of the quantity.

**Pie charts** do exist, albeit as a chart type used by certain data visualization professionals (Fig. 4).

**Illustrated chart:** This is essentially an illustration, but it is designed in the form of a chart or a combination of a chart and an illustration or an image.

### Graph

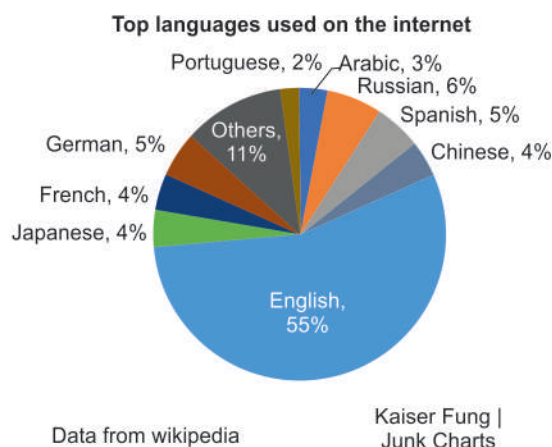
If in mathematics, a graph is a drawing showing the variation of a function depending on the variation of a variable, then for journalism, a graph is a drawing showing the variation of one or more variables by one or more lines connecting points placed on a coordinate axis. If the comparison is expressed in terms of height/low between columns in a vertical column chart, length/shortness between columns in a horizontal column chart, or size between sections in a pie/arc chart, then in the graph each line represents a quantity. The length of the horizontal axis is the variation or development of the quantity, and the comparison is the up-and-down bends of the points on that line relative to each other or to other lines if any.

### Map

A map is a miniature and generalized image of a part of the earth's surface on flat paper according to certain mathematical laws. Maps are used to help people locate and determine geographical directions. In journalism, maps are used quite commonly in cases where information needs to be visualized. They are often used in news events such as war, natural disasters, weather forecasts, locations, etc.

Maps used in journalism are often not shown in full detail but only with clear and simple outlines of a generalization nature. In addition, maps are also used as statistical maps.

According to author Tim Harrower, there are three types of maps commonly built in the newsroom, based on his statistics: (1) Location map: A type of map showing the



**Fig. 4:** Matching pie chart (left) and diverging pie chart (right)

location of an important place related to news in journalism; (2) Explanatory maps: They are used to tell a story and explain how an event happened. Usually using step-by-step images, so this type of map is more active than a mere positioning map; (3) Data maps: They inform the public of how data are geographically distributed, such as population, political trends, weather, etc.

### Diagram

If the map answers the question of where it is, the diagram answers the question of what it is and how it is. A diagram is a conventional, sketchy drawing that depicts certain information. Diagrammatic information is a simplification of an event, detailing the problem through modeling, so its accuracy is approximate. However, in journalism, this form is more effective than textual information in helping the public visualize issues and events. Diagrams are widely used in information about sociopolitical, war, land planning, and infrastructure.

There are two common types of diagrams: organizational diagrams to describe relationships and diagrams to describe structure, place, and time. According to author Roger C Parker, "the most complicated relationships can be represented in organizational charts in a very simple way. This type of diagram can replace countless paragraphs of text while still retaining its original content, as well as present a variety of images in the publication, instead of just dense text with the same common spaces."

### TABLE

Tables are the simplest and most basic representation of information among the infographic formats. They are a way to organize and arrange information in rows and columns to help the public quickly grasp the main idea of a topic as well as easily analyze the details and their relationships to each other. Tables can convey information quickly and accurately, as redundant words and phrases can be eliminated to help readers focus only on the most important information. Information presented in tables will be simpler and more vivid than text while still ensuring the main contents.

Tables include data tables and rankings, two of which hold data and are the most classic type of data visualization; it is both a text and a table. In journalism, tables are used to describe information content (event or data) in frames of a certain size. The number of rows and columns must be at least equal to or greater than two, separated by lines.

Unlike a chart, a table mainly represents textual content. In other words, a table is essentially a way of reorganizing textual information to make it easier for readers to recognize. In online journalism, the table is rarely used because its attractiveness is not as high as other forms of data visualization.

### ILLUSTRATIONS

An illustration is a description, such as a drawing, painting, or photograph, created to clarify or enhance information in a story, poem, or article. Its main purpose is to elucidate or partially decorate textual information. It provides an image that emphasizes the topic described in the text.

Illustrations can be used to display a wide range of topics and serve a variety of functions such as creating the expressive faces of characters in a story, showing several examples of an item described in an academic textbook, expressing human ideas through advertising images, or causing humor and satire in articles.

Illustrations can also replace images in situations where it is difficult or impossible to use images. This is also an element to express the creator's personal style through hand-drawn or machine-drawn strokes for the purpose of creating a distinct impression of information. In online journalism, illustrations can also stand alone in the form of graphic news to tell a story or explain a phenomenon or issue in life.

### OUTSTANDING ADVANTAGES OF VISUAL IMAGES

During the research process, it is found that there are three advantages of data visualization: (1) First, the same image contains lots of data; (2) Second, it is presented in different layers; (3) Third, data visualization conveys a lot of messages and information.

According to research, in general, people comprehend images better than language. When people want to understand the same message conveyed through language, they prefer images received by the naked eye. If approached solely by language or other means, it may be difficult to understand.

For journalists, when the media uses data visualization, it not only makes their articles attractive and beautiful but also conveys the message most effectively. For data visualization to be arranged and organized in a proper manner, journalists should avoid using diagrams to illustrate and decorate their articles but use data visualization. Visual images are always easy to understand for the readers. Data visualization helps us to convey data very clearly. Lots of story data are aimed to compare numbers.

Data visualization is easily compared. Data visualization conveys not only knowledge but also emotions to the readers. If the image is done in a correct, professional, beautiful, attractive, and functional way, it will help readers remember longer, and people have more emotions and interactions with the contents we are conveying.

Some trends in world journalism today are participatory journalism, reader participation, and interaction between readers and reporters. The form of presentation is a tool that allows readers to exploit and explore more of the article's contents.



We give out data in different forms of interaction. A good example is the users. The readers can get their age number and see their age among the executioners, and what age-group, majority or minority, has the data interactions with the story that we give.

A special feature is that data visualization is easy to attract the attention of readers. Journalists play an active role throughout this process. To make readers understand and balance both conveying the message and giving information to help readers access it in the most convenient way, the role of a journalist must be primary.

A new term is mentioned as "intermediate data," meaning that between the data and the end user, there will be an intermediary to forward, transform, and communicate. The intermediary person does not have to be a journalist; it can be an app programmer. A typical example is an open data user who writes an app that helps patients find the nearest doctor in an emergency. Those people all act as the intermediary person, which means using the available data, analyzing it, and delivering it to the end users. The key in this story is training and education. It is not just training for government agency officials in collecting and storing data in the forms we want; it is also necessary to raise people's awareness about the ability to read and understand data.

Another term from an expert in the field of graphics and data visualization is literacy. The combination of graphics and literacy is the concept of knowing how to read images and diagrams. The process of raising reader awareness will take a long time. A frequently asked question is: Does the data act as primary or secondary in an article (text, data)? Depending on the article, for example, character exploitation in a story related to the character is more important than the main body, not the numbers of that character. It is on a case-by-case basis and of an individual and journalistic nature.

Journalists working in data journalism need to be able to integrate skills in art, technology, and photography, and have their own technology ideas. Since the beginning of data journalism, pioneer journalists must have sufficient knowledge and skills to produce the final product. However, nowadays, it depends on each press agency.

A must-have skill for a data journalist is data analysis. Without data analysis skills to use analytical tools, it is difficult to do data journalism. The data visualization itself is a story. If done professionally and properly, it is a finished product as a given story. Visualize data to help users understand it.

## THE FORM OF DATA VISUALIZATION

Not every form of graphic is suitable for all types of information. A graphic reporter's judgment and classification determine the effectiveness of the visual form in the news.

Author Roger C Parker, in *Design and Layout* (Volume 1), says: "*Choosing an appropriate form of presentation with the information given is a huge determinant of content success that you intend to convey. Each form of presentation has different types of representation suitable for different types*

*of information.*" It is necessary to flexibly combine graphic information and encapsulate cumbersome information with interactive graphics.

Whether in traditional, interactive, or video form, data visualization offers different experiences to the public. Therefore, in addition to taking advantage of the interactive and multimedia features of online journalism in the production of visual images, each newspaper needs to take advantage of each form of data visualization to convey its message effectively.

Journalist Le Quoc Minh, Chairman of the Vietnam Journalists Association, said: "The use of static or dynamic graphics depends on the needs of each article or project, so it cannot be said that one type is superior to the other. There are static graphics, but their production process is very laborious because of a lot of detail, while there are interactive charts that are quite simple and can be produced in a very short time. Or graphic video is quite effective but very laborious and expensive to produce. A flexible combination of graphic information is the most reasonable option."

Sharing the same opinion with journalist Le Quoc Minh, reporter Tien Thanh said: "It is not advisable to distinguish between interactive graphics and static graphics, animation, etc., because each form brings different experiences to the readers. In static graphics, for example, we can see the whole immediately, but for interactive graphics or animations, we must have time to sit and watch each step (like reading the entire text) to get an overview. All forms of graphics within Vietnamese journalism are still groping and learning step by step. In the future, all will still work together to support each other."

However, at present, Vietnam's online journalism mainly focuses on exploiting the traditional graphic form. The number of interactive graphics is very limited. Therefore, newsrooms should be more balanced and flexible in the use of data visualization formats. For interactive graphics, it is not necessary for graphic reporters to have programming skills. Newsrooms can completely equip additional online tools for reporters and editors so that they can create interactive graphics quickly and easily.

Each form of representation, such as charts, maps, diagrams, graphs, illustrations, and tables, provides distinct and effective values for the information to be processed and transformed into a graphic image. Vietnam's online journalism needs to use a variety of different forms of data visualization, not repetitively using relatively simple forms such as column charts, graphs, illustrations, and tables. At the same time, graphic reporters must clearly understand the information transmission characteristics of each type so that they can make an immediate choice of form when receiving "raw" data to avoid errors. Such as:

Column charts are easy to compare and applicable to data not expressed as a percentage. They can be used to represent odd numbers. However, with comparative values that are too close to each other (such as 0.3 with 0.45; 0.92...), the graphic designer needs to choose an appropriate illustrative column type.

Pie/arc charts are used to represent information in a general form. This graphical form is used as a percentage of the data. A pie/arc chart will present the whole while still providing a detailed interpretation. Around 5–6 sections on a pie/arc chart are the ideal number for effective visual reception by the readers.

You can not only use simple and pure diagrams to describe an event but also use organizational charts to show hierarchical relationships, authority, and responsibility. For example, to describe a blood relationship in the family line, using an organizational chart will replace a long and complex piece of text. A map is a rather complex graphic form that can both locate, compare, and analyze data. When using maps, there are a few things you should keep in mind: do not publish maps with any value attached; regions on the map need to be clearly divided; remove any unnecessary information from the traditional map.

When using tables, it is necessary to absolutely avoid the use of abbreviations, not letting the font size be too small, or using too complicated tables with too many small tables in a large table.

## LAYOUT, COLOR, AND ESTHETICS OF INFORMATION GRAPHICS

Graphic designers in journalism in general and in online journalism in particular need to pay attention to seven principles in design.

**Balance:** When the ratio is evenly distributed, we will have the balance. As elements in graphic design have visual ratios, they need to be arranged so that a comfortable sense of balance is achieved. Balance is not necessarily exactly equal.

Slight but manageable imbalances can add a lot of esthetic interest to a design. We are frequently interested in two kinds of balance in graphic design: asymmetrical and symmetrical. The balance of a building can be asymmetrical or informal if it is made up of two dissimilar longitudinal halves. Asymmetrical balance is frequently used in data visualization components because it creates a sense of movement and helps direct the eye through information in a rhythmic manner. Stability and unity are conveyed by symmetrical equilibrium. When the message is conservative or calls for a more subdued vintage appearance, symmetrical balance is often used in print design.

**Proportion:** Proportion refers to the size of an element in relation to other elements in a graphic work or in the overall space available. It can be achieved through size, shape, and color, helping create content focus through emphasis. Proportion is crucial in data visualization as it establishes hierarchy and order among elements. For instance, if the title or heading of a graphic is too small, it may get lost among other elements, while if it's too large, it can overshadow more important visual elements. Therefore, the title needs to match the total amount of space available for the graphic work to ensure balance and clarity.

Proportion can also be achieved in a presentation by combining elements of various sizes or shapes. This allows

us to compare and assess their relative size and shape proportionately. Respecting the size and shape relationships results in a more compelling overall illustration effect compared to if all components were the same size. Proportion is also useful in adding dimension; a large, dominant category is often perceived as being nearby or in a prominent position (front), whereas smaller elements are perceived as being further away or in a less essential position (behind).

**Contrast:** Where there is little or no difference between elements, the human eye can discern obvious changes more consistently. A graphic reporter can highlight important information, create visual levels, and help trigger eye movements across a newspaper page by using various levels of visual contrast. Every design should have some degree of contrast, but the amount depends on the nature of the content. Contrast can be produced by using various element sizes and shapes, colors, and a print palette that incorporates different types of fonts. Contrast is extremely essential in the design of visual images.

**Harmony:** Harmony can be achieved through the predominant use of horizontal or vertical shapes in a graphic texture. For instance, if a graphic has a vertical shape, the elements in the layout should repeat the general format to achieve harmony in the design's shape.

**Rhythm:** Visual rhythm is the combination and arrangement of elements that move the eye through the presentation of graphic work. Graphical rhythm can be achieved by repeating similar patterns in size, shape, and color, by arranging contrasting elements one after another in a certain way, or by placing the elements in such a way that translation is possible, for example from small to large, or from light to dark.

When we clearly define a graphic design, the natural path of the eye moves in an A–Z pattern. Rhythm can be achieved in various methods. Asymmetrical balance is most frequently used in graphic design as it is the most effective method to move the eye around a graphic work. Additionally, the repetition of similar or identical elements in a graphic creation can also generate rhythm.

**Focus:** One of the most important rules for any graphic designer is to always establish a focal point, typically the main illustration. This term refers to an object in a design that is larger than the other objects. A good designer can create a focal point or an area to which the eye is most attracted by including a focus. Once the focus has been established, the addition of second and third focal points may be necessary. There are always blocks of explanatory and illustrative text in a visual composition. It's important to note that the focus of a graphic work must be larger than the other components, sometimes even three times larger.

**Unity:** In print design, unity often refers to the overall cohesion of the publication design. Initially, unity may seem synonymous with harmony. However, while harmony pertains to how the components in a specific graphic are in harmony, unity refers to the overall coherence of the product. Consistent print color palettes and a uniform grid system can help achieve unity.





## CREATIVITY IN THE PRODUCTION OF INFORMATION GRAPHICS

Even if a press agency has established standard procedures to simplify the production of data visualizations, “just as a journalist work, photograph or video, a finished work, and a good product are of two different concepts. Although there are certain modules, the data image designers must always be creative and changing to avoid creating boring images because they are relatively similar.”

In the 10-step process illustration above, the graphic designer is shown as a character in a yellow shirt, an editor in a red shirt, and a data analyst in a blue shirt. The roles of graphic designer and editor appear in almost every 10 steps of the process in collaboration. Data analysis only appears in 4 steps: data analysis, looking for form, editing, and proofreading. Only in sketching out ideas and design steps, the appearance of the graphic designer is seen. This process illustrates each step in detail but in practice will have some more focused steps.

In the book titled “Journalism operations in the modern media environment”, author Nguyen Thanh Loi said: “There are three main steps to build a visual image: Interpretation of information, forming a framework, and design of ideas” as follows.

### Interpretation of Information and Forming a Framework

The fact is that the two stages, interpretation of information and forming a framework, are independent of each other, once the information has been thoroughly interpreted, the reporter’s idea is basically clear. In the stage of interpretation of information and forming a framework, it is necessary to pay attention to the following issues: (1) Thoroughly explain the information structure that the reporters want to show, which is the aggregate relationship (a main idea is divided into small ideas) or comparison relationship. This should be as clear as when writing a news story, it is necessary to understand the contents to be shown so that reporters can build a coherent, complete and coherent information framework. (2) The logic within each piece of information is very important, what is the relationship between the contents of each part, the logic of time or the logic of geographical location, mathematical logic? (3) The clarification of the relationship between the contents helps the production team find the most appropriate form of information presentation. For example, if it is mostly mathematical logic, the form of representation is a chart, if it is geographic logic, it is better to use a map.

### BUILDING A SPECIALIZED PRODUCTION TEAM

To be more and more perfect in terms of content and presentation of data visualization in online journalism in the coming time, the top priority factors that newsrooms need to obtain are the visual image production workforce, a specific

long-term strategy in development orientation, and constant updating of world trends.<sup>11</sup>

Building a dedicated data visualization production team to research, create, and design different new and vivid graphic formats is the most basic requirement for improving the quality of visual images in national online journalism. The visual image production apparatus must become more and more professional with the participation of reporters, editors, data scientists, data mining experts, graphic designers, and programmers. This is also a necessary trend for domestic online newspapers to catch up with the general development trend of world journalism.

In addition to perfecting and constantly improving human resources to produce visual images, leaders are required to understand and have a clear direction on the issue of using data journalism. Upon implementation, training is extremely important to have knowledgeable graphic designers in journalism. This takes time, so the sooner you get started, the sooner you will have the right team.

At the same time, newsrooms need to develop a standard process to produce visual data images. Although data visualization is an esthetic design activity of a media nature imbued with personal creativity, a standard approach is also required. It will help the newsroom create its own style as well as shorten the production time.

## CONCLUSION

Visual media excels at conveying large amounts of information in multiple dimensions effectively. Such efficiency depends on a set of unwritten rules and conventions implicitly shared between producers and consumers of data graphics. Recognizing these unwritten rules helps avoid unintended misunderstandings.

For data visualization to be used properly, it is necessary to first select the event content with the appropriate information presentation. Not all information is represented graphically. If the selection is not appropriate, the data will not only fail to convey the author’s intentions but also cause resentment among the public, leading to confusion in terms of content, misunderstanding, and misinterpreting the message. In addition, some suggestions below may help online newsrooms to improve and diversify the presentation of data visualization.

The pieces of political information require a new way of conveying through visualization. This not only increases the efficiency in receiving information but also ranks among the top priorities of newsrooms in the Industry 4.0 Era. For example, contents such as announcements, decrees, resolutions, circulars, government and functional agency announcements, or statistics on confidence votes, votes in National Assembly sessions, etc., need more attractive, easier-to-read, and memorable communication methods through visualization.

Simulation of landmarks, places, or information on the results of sociological surveys by geographical area

is conducted through maps. In fact, not everyone knows by heart the geographical locations across the country to be able to imagine where the event is taking place. For sociological surveys by geographical area, maps can identify, compare, and analyze data. Therefore, instead of choosing simple forms of representation like charts or graphs, newsrooms should move toward map graphics to convey information in a smarter and more comprehensive way. This allows for deeper survey angles with certain social issues presented in sociological surveys by geographical area. Moreover, Vietnamese online journalism should learn from French online journalism in how to use maps taken from Google Maps. Categories such as culture, entertainment, and law need to be supplemented with visual reporting methods. Although online journalism has effectively exploited multimedia in these categories, more creativity in graphic reporting is needed. A stand-alone data visualization, like a complete article, can connect data and events into a compelling narrative, possibly even accompanied by interactive video links. This is a very attractive way of reporting to the public in modern times.

## ACKNOWLEDGMENTS

This study received support from the Thai Nguyen University of Sciences, Thái Nguyên, Vietnam, with research project number CS2020-TN06-15, through a fellowship grant. We extend our sincere appreciation to Thai Nguyen University of Sciences for their academic, financial, and moral support. Lastly, we are grateful to our colleagues for their valuable advice and moral support, which contributed to the success of this study.

## REFERENCES

1. Nguyen TT (Ed). Organization and management of online journalism in Vietnam. In: Key grassroots scientific topics. Academy of Journalism and Communication; 2007. Available from: [sagepub.com/journals](http://sagepub.com/journals)
2. Nguyen TTG. Creation of online journalism works. Hanoi: National Political Publishing House; 2014.
3. Lassila-Merisalo M. Story First—Publishing Narrative Digital-Megastory Journalism in Digital Environments. 2014.
4. Lee AM, Lewis SC, Powers M. Audience clicks and news placement: a study of time-lagged influence in online journalism. *Commun Res* 2014;41(4):505–530. DOI: 10.1177/0093650212467031
5. Bradshaw P. "No I'm not abandoning the term 'storytelling', Alberto – just the opposite (and here's why)." *Online Journalism Blog*. 2017.
6. Huang M. Digital transition in Chinese newspaper industry: the case studies of two metropolitan newspaper companies [master's thesis]. Centre for Cultural Policy Research, School of Culture and Creative Arts, University of Glasgow; 2017.
7. Rusbridger A. *Why Journalism Matters*. Media Standards Trust Series. 2010.
8. Coleman R, Wasike B. Visual Elements in Public Journalism Newspapers in an Election: A Content Analysis of the Photographs and Graphics in Campaign 2000. International Communication Association; 2004.
9. Ejaz W, Ittefaq M. Data for understanding trust in varied information sources, use of news media, and perception of misinformation regarding COVID-19 in Pakistan. *Data Brief* 2020;32:106091. DOI: 10.1016/j.dib.2020.106091
10. Salaverría R (Ed). Diversity of Journalisms: Proceedings of the ECREA Journalism Studies Section and 26th International Conference of Communication (CICOM) at University of Navarra, Pamplona, 4-5 July 2011.
11. Many Authors. Tips for writing for online journalism. Hanoi: News Publishing House; 2016.

