

The Relation between Online and Print Information Graphics for Newspapers

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Abstract. In this article we make a critical assessment of the relation between online and print design, focusing on the graphic language of newspaper infographics. A lot of the work done in this area consists in adapting print newspaper infographics to online versions. The problem with many of these adaptations is that there are losses in reading strategy and structure of their online versions, offering readers a mainly linear reading experience. To understand this fact, we compare print infographics and their digital versions through the analysis of layout and cognitive load. In a time when the knowledge of computer programming seems to be crucial to editorial design, we reflect on the importance of layout, which is the principle design structure to help readers access and understand information.

Keywords: Information graphics, information design.

1 Introduction

Newspaper design is a specialized field that, with the aid of technological advances, was included in the wider area of graphic design. Gradually, journalists became aware of the need to have a more effective typographic structure in newspaper layout. The traditional formula of newspaper layouts, with text and pictures (including photography) presented separately, was not enough to explain to the general public complex facts and processes, therefore graphical structures that could integrate both became necessary. In a parallel process, information graphics, or infographics, also developed from simple diagrams to complex non-linear graphic narratives. Technological innovation was an important factor in the inclusion of infographics in news design. When the North American newspaper USA Today came into existence in 1982, a four color printing process was chosen because popular journalism valued color pictures and infographics (Moraes, 2013). Although infographics is not a new

way of communication, it has aroused great interest in recent years with the development of online information technology. With the current dissemination of information, infographics have helped readers to understand and process information quickly. This occurs, in part, by the varied means of symbolization available in an infographic, which makes it more adaptable to new contexts of information communication than other forms of traditional journalism (Lima, 2009).

Journalistic infographics is not a traditional form of iconography like illustration (including photography) it is in fact a kind of news story in which text and iconography are interdependent (Lima, 2009). Unlike traditional journalism, the written text is not necessarily the preferred source of information. Furthermore, the reading strategy may develop in a non-linear manner. That is, the reader can choose the order in which he reads, something that is somewhat problematic in a traditional linear text. Michael Twyman (1979, 1985) proposed that graphic language was composed of different modes of symbolization that are pictorial, verbal and schematic. Infographics integrates all of them through a non-linear layout structure, not only this but recently, online journalism made sound available to designers, bringing new possibilities for graphic language.

In this article, we show the problems faced in print infographics when they are adapted to online newspapers. In many cases, the principal strategy of the adapted infographics is the use of a sequential narrative. The infographic is divided into screens that can be accessed by the reader, one at a time. The problem with this strategy is that it conditions the reading process, creating a poor notion of the whole narrative, with limited choices of interaction. To understand this process we discuss the relevance of layout in the theory of graphic language proposed by Rob Waller (1985, 2012), problem of cognitive load in learning experience from the work of Mayer (2005) and Sweller et al. (1998).

2 Layout and Infographics

Rob Waller (2012) discusses the problems that graphic designers have been facing with the transition to online platforms and how layout has affected in this process. Waller was influenced by Michael Twyman (1979), who proposed that a page is diagrammatic, which means that readers understands text not only as words but as a structure of different forms of graphic language. Waller (1985) suggests that the linear structure of a traditional textbook tends to be that of prose, such as a transcript in graphic communication, verbal language. However, this can present miscommunication for certain types of information in certain contexts. Waller (1985) suggests that specialized scientific texts are not the norm when it comes to understanding documents. Newspapers and magazines are perhaps better examples, because they are developed taking into account the graphical structure of their content. Other good examples of texts that recognize the need to clarify its content graphically are reference Books and technical manuals (Waller, 1985:107).

To meet these varied reading strategies, Waller (1985) proposes the concept of text as diagram, i.e., a structure of non-linear text with a diagrammatic quality. When the

text is placed in the form of a diagram, the structure becomes more accessible to a less linear reading, enabling readers to choose ways to understand the text and create their own reading strategy. Therefore, these texts have multiple columns and complex typographic grids. Waller's focus is on the linearity of typographical texts (verbal graphic language) and its structure. However, the author does not neglect the role of pictorial images in the process. For Twyman (1985) the problem with pictorial language, is that it does not follow a well-defined grammar in the same way words do. Pictorial language is characteristically nonlinear. Twyman suggests (1985) that sequential images (graphic novels) or infographics can fuse the pictorial to the words graphically.

The structure of the diagram, the most typical form of an infographic, is perhaps the key to understanding how an infographic is configured. Infographics are essentially diagrams in the way that pictures, words and schematics are arranged in a layout. These multimodal structures are conceived with a nonlinear reading strategy in mind, providing more freedom to the reader (Lima, 2009). Each infographic is arranged according to certain rules of use compatible to its genre, as Waller (2012) points out:

The graphic layout of such genres effectively contains the rules or affordances for their use: Engaging layouts and large headings invite the magazine reader to browse; the orderly layout of a user guide invites systematic reading, referencing a task outside of the text through diagrams, and providing large numerals as a visual target to the returning reader (Waller, 2012:13).

Waller (2012) proposes that readers know (or find out) how to read a 'text' depending on access structures (the 'rules for use') of each document genre. A printed newspaper article is not read in the same way as its web counterpart. This is partially a technological matter, the Internet and print are simply not the same medium, they have different 'natures' and, therefore, should have different layouts configurations. What Waller points out is that, when print newspaper article is adapted to their online versions, there are many losses in reading strategy and structure. Online texts tend to be more constrained, in many cases, presented in single columns, offering little variety in its layout structure. If compared with their print counterparts, these online texts have fewer possibilities for interaction, offering readers a mainly linear reading experience, which is ironic because nonlinearity is considered one of the main characteristics of online texts.

This transition adaptation can be compared to problems with the transition between medieval manuscripts to the printed book. The illuminated manuscript, through the nature of its manufacturing methods, offered a close integration with the pictorial and verbal graphic content. The same could not be said of the printed book. Typography and iconography were separated with the invention of the movable type. Only later, through the development of new printing methods and mass media, could text and pictorial images be integrated once again.

What crucial is that the way a reader understands a online document genre is determined, in many ways, by paradigms shaped through older genres. For many online document their access structures are originally determined in print. And as Waller (2012) mentions, each new technology goes through a period of adaptation, but that the new medium does not render old ones completely extinct.



Fig. 1. A comparison between the online and print versions of a news story for the daily newspaper Folha de São Paulo. As we can see, the varied of layout structure of the print version (right) is reduced to a one column linear text without the aid of illustration (left).

3 Cognitive Theory of Multimedia Learning and Infographics

In most adaptations to online articles and infographics, much of the layout structure is lost, and with it most of the graphic content originally proposed. To better understand these 'losses' in many online layouts, we can look from the point of view of cognitive psychology. Some studies of cognitive psychology investigate how individuals learn through multimedia materials using different modes of presentation. One of the most cited is the cognitive theory of multimedia learning (CTML). Mayer (2002, 2005) formulates suggestions for the development of multimedia learning materials. The term multimedia is generally used to refer to varied uses of media (video, music, animation, etc.) but for Mayer the term has to do with multimodality, i.e., the set of different modes in which information is presented.

Mayer bases his theory on three assumptions:

1. The visual and verbal information are processed in different channels, derived from theories by Baddley (1974) and Paivio (1986);
2. Each channel has a limited capacity for information processing that originated from the cognitive load theory proposed by Sweller et al. (1998).
3. The processing of information in different channels actively promotes the construction of coherent mental representations, derived from the theory of active processing by Wittrock and SOI model, by Mayer (1996) himself.

These assumptions propose a better use of visual and verbal channels, adapting the cognitive load resources, resulting in a more meaningful learning process. The cognitive load is connected to the information processing capacity of current memory (or working memory), according to Sweller et. al (1998) there are three types of load (Sweller et al, 1998): intrinsic load, extraneous load and germane load. For a

significant learning experience the intrinsic and extraneous loads should be minimal, because the focus of the cognitive resources should be on germane load, which is connected to the construction of learning.

From Sweller's perspective, the intrinsic load is related to the complexity of the information. The number of relationships between its components defines this complexity. Certain types of information are more complex. For example, learning a foreign grammar is inevitably more complex than learning a new vocabulary, i.e., the translation of individual words. The intrinsic cognitive load is produced by the complexity of the system. This load can not be fully minimized without compromising the complexity inherent to certain systems. The solution proposed by the authors is to divide the information into parts. Thus the reader only has to grasp part of the information each time, without covering the whole complexity at once. In this way the reader can experience the intrinsic load gradually. When reading an infographic, complexity is an important factor because of its multimodal, non-linear layout.

Thus the suggestions of CTML focuses on strategies to minimize extraneous load and foster the relevant load. The extraneous load is coming from mental activity generated by the multimedia materials that is not related to learning. An example would be a picture that is complementary to a block of text in a layout, but they are presented in a way in which there is no clear correlation between them. This layout taxes the cognitive capacity of the reader because he has to pay more attention to the layout to understand the correlation. This kind of poor design configuration leads to a high amount of extraneous cognitive load. However, when the layout aids a better understanding of the content, this promotes a germane cognitive load.

From this perspective, at first glance, it is possible to consider an infographic as a complex material, which naturally leads to a substantial intrinsic load, because of a high number of relations between elements. However, some common features of infographics are compatible with the strategies recommended by the CTML. For example, the multimedia principle and the principle of contiguity. Mayer (2005) suggests, with the multimedia principle, that explanations that use image and text promote a deeper learning, this relation between image and text is a feature found in many definitions of infographics (Pablos,1999; Rajamanickam, 2005; Colle, 2004; Teixeira, 2010). In the contiguity principle, the author argues that multimedia elements must be spatially proximate so as to minimize an extraneous load.

Waller (2012) reminds us that, in design education, the "visual syntax of the page" is understood through perceptual principles established by the Gestalt psychologists. These principles are independent of specific content and are compatible with the principle of contiguity proposed by Mayer (2005). They are generally known as the proximity principle, "where that things that are physically close on the page are related in some way", and a similarity principle, "that things that look similar are members of the same category" (Waller, 2012:11). So it is widely accepted by designers that formal contiguity helps readers understand graphic relations and to distinguish categories. In infographics we can observe a close integration of elements in their layout, a practice that improves the reader's learning process without an unnecessary extraneous cognitive load.

When Mayer (2005) considers the advantages of contiguity, he only mentions the relation between text and image. He doesn't consider the variety of graphic elements available (such as sequential images, animation, etc.). But the author's scope is limited to learning materials, his theory does not examine the complexity of news and document design. In this sense, Waller (2012) seems to understand more fully the part played by layout in contiguity.

4 Analysis and Conclusion

Below is a brief analysis of the infographic "Tapuiassauo, the new dinosaur from Brazil", published in both online and printed versions of the Brazilian daily newspaper O Estado de São Paulo. Note that in 2011 the online version of this infographic received the gold medal in the online category of Malofiej, most important international award of infographics. The infographic provides information about the paleontological discovery of the dinosaur Tapuiassauo. A pictorial representation of the dinosaur and details of the fossils found.

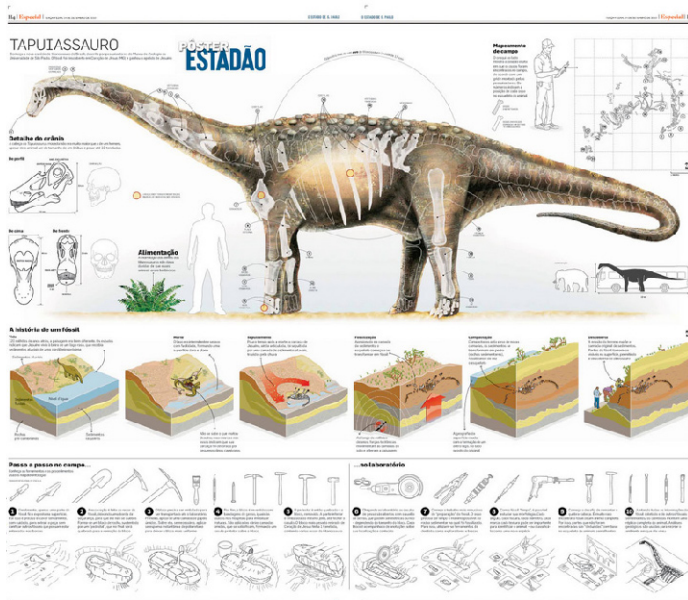


Fig. 2. Infographic "Tapuiassauo, the new dinosaur from Brazil" for the print version of daily newspaper O Estado de São Paulo. Design: Glaucio Lara.

The print infographic was published in a double page (newspaper standard format). The content is structurally divided into three main parts:

4. A dominant descriptive picture of the dinosaur with sub-items that detail the main description.
5. "The history of the fossil", a sequential representation of the fossilization of the dinosaur.

6. "Step-by-step of the dig", an inventory of instruments and a sequence describing the procedures in a paleontological dig.

The print infographic allows the reader to get a sense of the whole, allowing him to decide his own reading strategies, creating relations between blocks of information. In "Step-by-step of the dig", different categories of information are presented together, in a structure similar to a table, allowing for comparisons between the bones of the skeleton, the tools and the stages of fossilization.

The online version was built using Flash and is divided in four screens that can be accessed through interactive tabs that form a sequence, like chapters: 1. "Tapuiassauro", 2. "dinosaurs in Brazil", 3. "a history of the fossil", 4. "step by step".

The first screen (Fig. 3) has the dominant image of the dinosaur with the sub-items present in print infographic. However, the online version offers interactive objects to reveal the skeleton. By passing the mouse over the dinosaur it is possible to do an x-ray, revealing the bones of the skeleton, with a "magnifying glass". While the reader scans the dinosaur, above the map, he can see where that bone was located in the plan of the dig. This interaction provides a direct observation of the elements, but in relation to the print version it remains compartmentalized, without offering an overall vision of the layout.

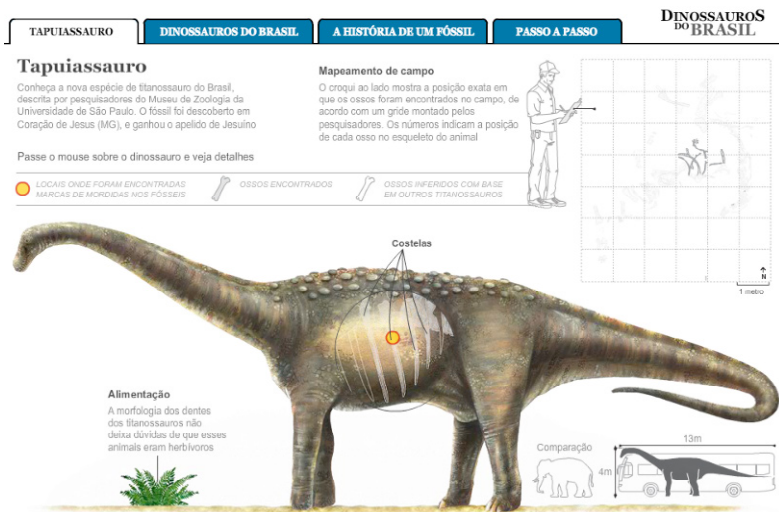


Fig. 3. "Tapuiassauro", first screen of the online version of the infographic

The second screen, "dinosaurs in Brazil" (Fig. 4), allows for a comparison of the scale and other dinosaurs found in Brazil. With mouse-over interaction the reader can select a dinosaur and locate where it was found, on a map of Brazil, and the period it existed. This section is not present in the print infographic because the online medium usually has more space available to offer content, it is not limited to a printed page format.

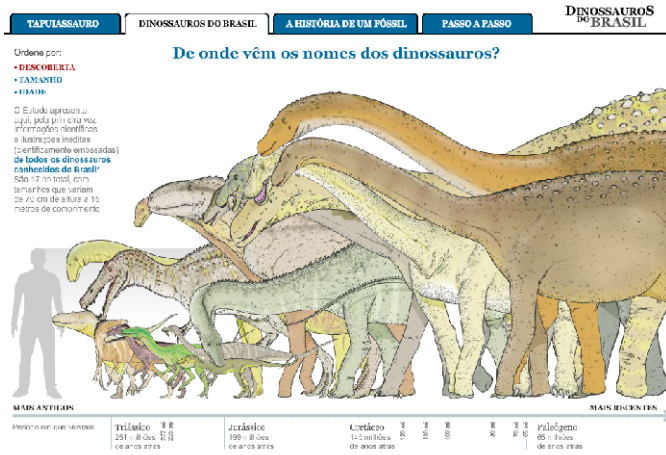


Fig. 4. "Dinosaurs in Brazil", second screen of the online version

The third screen (Fig. 5) provides a step by step representation of the fossilization of the dinosaur in segmented slides. A linear narrative control allows the reader to go forward and back between the slides.

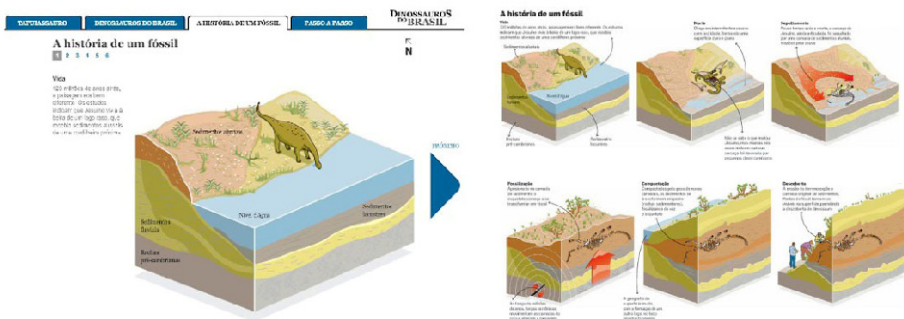


Fig. 5. "A history of the fossil", third screen of the online version

A fourth screen (Fig. 6) has the same inventory of instruments and procedures present in the print version. But the reader cannot see all of them at once, they are divided in two screens, one for fieldwork and another for laboratory work.

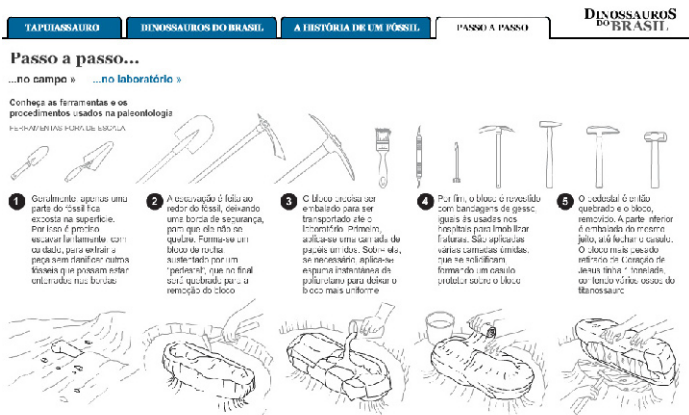


Fig. 6. "Step by step", fourth screen of the online version

Some types of simple controls, such as linear narrative and content selection. These controls seem to condition reading, restricting one of the main characteristics of the infographic, which is its non-linear reading structure, something that helps readers navigate blocks of information in the infographic, creating their own reading strategy.

In the sequence of slides, "a history of the fossil" (fig. 5), the reading process is fragmented into blocks of information, but maintaining a linear narrative. If the reader wishes to make a comparison between the stages of fossilization, he needs to read each one individually. This structure breaks the contiguity between the different stages taxing the reader's capacity to memorize the details of each one, creating a large amount of extraneous load. Something that does not occur in the print version, where a complete overview of the sequence of fossilization is offered.

Linear narrative controls and content controls do not seem to have been specially useful in promoting a better understanding of the content of the online infographic. In part because it is an adaptation of a print infographic. The elements do seem to have been chosen to meet the demands of the informational content, but to solve problems of adaptation between digital and print media.

Infographics published in Brazilian news websites tend to only have simple forms of interactions, such as content selection and linear narrative controls (Miranda, 2013). These interactive resources break the infographic into smaller pieces, as we have seen in the "Tapuiassau" infographic. This could seem beneficial since it would reduce intrinsic load, as proposed by Sweller. However it seems that in the case of infographics, this high complexity has many benefits. The reader is invited to explore and make comparisons between the informational aspects of the infographic. In the online version of the "Tapuiassau" infographic, the major loss occurred in the absence of contiguity between the different parts that structure the layout.

The richness in the complexity of the layout of an infographic is in the relations between the multimodal elements.

Although this tendency towards linear reading strategies is common in online publications some experiments using kinetic and interactive resources, with intention to break with this linearity, have been made. The content adaptation reflects an adjustment phase between print and online content. But the solutions will not necessarily come from advances in technology. Newspapers must invest in design teams that are willing, and have the resources, to experiment with the problems of online graphic language. In a time when the knowledge of computer programming seems to be crucial to editorial design, we must reflect on what must be expected from a designer. We believe that the focus should continue to be in layout, which is the principle design structure to help readers access and understand information.

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