Visual communication
in digital
infographics

La comunicación visual en la infografía

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◈ Abstract

The intention of this article is to reflect by appreciating graphic composition as the main factor that regulates the relationship between design and communication. Microreactions can give us guidance on the user's acceptance of the content of digital infographics, as well as help us evaluate the coherence of the infographic with its name, its objective, and the authorship or the institution that is responsible for the content.

This study explores the process of visual communication in digital infographics, considered as a semiotic process through which meaning is produced. The objective is to analyze infographics published on the Internet as case studies, to identify if they comply with the elements of visual communication that, in turn, lead to the understanding of information. A qualitative method and three data collection techniques were used: case study analysis, observation of microreactions in 10 users in an Eye Tracking laboratory and focus groups for the identification of visual communication vectors and design in digital infographics. It is concluded that visual communication, in the production of graphic objects that are aimed at specific audience groups, must be strictly intentional to achieve the purpose for which they have been designed, even when a percentage of information transmission is presented in those that do not have an adequate graphic composition.

Keywords: Visual communication, graphic design, digital infographics

◈ Resumen

La intención de este artículo es reflexionar apreciando la composición gráfica como el principal factor que regula la relación entre el diseño y la comunicación. Las microrreacciones pueden darnos una orientación sobre la aceptación que tiene el usuario de los contenidos de infografías digitales, así como evaluar la coherencia de la infografía con su nombre, su objetivo, y la autoría o la institución que se responsabiliza del contenido.

En este estudio se explora el proceso de comunicación visual en la infografía digital, considerado como proceso semiótico mediante el cual se produce significado. El objetivo es analizar infografías publicadas en internet como casos de estudio, para identificar si cumplen con los elementos de comunicación visual que, a su vez, deriven en la comprensión de información. Se emplea un método cualitativo y tres técnicas de recolección de datos: análisis de casos de estudio, observación de microrreacciones en 10 usuarios en un laboratorio de Eye Tracking y grupos de enfoque para la identificación de vectores de comunicación visual y diseño en infografías digitales. Se concluye que la comunicación visual, en la producción de objetos gráficos que se dirigen a grupos específicos de audiencia, debe ser estrictamente intencional para alcanzar el propósito para el que éstos han sido diseñados, aun cuando se presenta un porcentaje de transmisión de información en aquellos que no poseen una composición gráfica adecuada.

Palabras clave: Comunicación visual, diseño gráfico, infografía digital

◈ Introduction

The objective of this study is to analyze the visual communication process that occurs during the perception of a digital info-graphic. Although visual communication is an activity that has existed since prehistory, the discipline of graphic design emerged in the modern era with the dissemination of graphic reproduction methods at the beginning of the 20th century (Meggs and Purvis, 2016). Modern graphic design has focused its efforts on the aesthetic and harmonious composition of the elements, as well as the functionality of their visual communication. In the current era, digital technologies have facilitated abundant availability of data, thus information design has gained greater importance (Uyan Dur, 2014).

Visual communication, as defined by Bruno Munari (2016, p. 63), "is everything our eyes see." Munari (2016) distinguishes between two types of visual communication: casual and intentional. Casual visual communication is free perception and interpretation, accumulated daily in everyday life, it is of common order without directed intention. It happens in everyday life, during the encounters that people have with different objects and visual discourses, some of which are directed towards different types of users or audiences, although not all. In this way it is inevitable to encounter messages when perceiving the context that surrounds us. On the other hand, intentional visual communication covers two aspects: "that of aesthetic information and that of practice" (Munari, 2016, p. 63). The aspect of aesthetic information, to which Munari (2016) refers, is related to the visual messages that communicate through their spatial dimensions (for example, volume in architecture) and temporal dimensions (the succession of images in video and television). Donis A. Dondis (2017) writes about visual elements:

> They are the basic ingredients that we use for the development of thinking and visual communication. They have the spectacular ability to transmit information in an easy and direct way, messages that are effortlessly understandable to anyone who sees them. (p.80)

In the present research, the observations of these authors have been considered to analyze a graphic product derived from information design, a discipline that has become increasingly important in visual media to regulate the flow of data and optimize the understanding and retention of information in the user (Uyan Dur, 2014).

Composition is the main vector between design and visual communication, this can be evidenced through the recording of the perception of the graphic composition characteristics of digital infographics. As a method of evidence, these characteristics have been identified through the use of observation of microreactions.

On the other hand, the lack of knowledge of what a digital infographic is in virtual environments is also evident, since this name is given to graphic products that are not such. It is considered important that the graphic product that is the object of study be appropriately distinguished, as part of the promotion of digital culture that allows improving the transmission of online messages. This can give users the security of appropriately citing what has been their source of information.

◈ Infographics design

Infographics are data visualization tools that can improve understanding of information and retention of complex concepts. They are characterized by presenting information in an understandable, attractive, aesthetic, clear and simple way (Gallagher et al., 2017). According to Hernández-Fernández and Morera-Vidal (2022), infographics are descriptive or narrative visual stories that are used as an alternative to simple text or audio and that propose effective ways for communication; they are especially suitable for digital platforms. The narrative aspect of the infographic refers to the explanation it displays, while the visual aspect refers to the descriptive or graphic elements (Hernández-Fernández and Morera-Vidal, 2022).

Abraham Moles (1991) argues that the image has a clear intention for which it is created, proposing functional communication that in its beginning is between human beings, now observed between the human being and the image (graphic object). In his approach, he presents another perspective to observe the fulfillment of the communication aim in graphic materials, indicating that it can be evaluated through the manifestation of microreactions, which are experienced by the human being and are reflected in brief facial expressions at a cognitive, emotional, temporal, economic and psychological level. These microreactions can be so brief that they become imperceptible to the untrained eye, but the user can recognize the microacts or microreactions that they have identified once they reflect on their experience (Costa, 1987).

Infographic design is a means for visual communication, it fulfills a social function oriented towards informative and educational purposes. Infographics transcend the aesthetic function of graphic design with its informative vocation, aimed at data visualization. The visual design of infographics aims to express thinking with the support of visual language, which can communicate information in a clearer, faster and more effective way (Shangguan, 2022). Infographic design includes planning the user's interaction with language, interpreting the cultural context, as

well as innovation in visual design (Shangguan, 2022). The creative process begins in the conceptualization of the design, where strategies are proposed for the communication of a message, which can be factors for decision-making or for the user's reception of information. The design can be oriented towards styles such as maps or diagrams related to spatial perception, the expression of an action or behavior, the illustration of an object and its components, a story told on a timeline, among others.

It is necessary to talk about graphic composition as the interpretive means of the visual message sent to the receivers. The message must be coherent and formulated appropriately for the fulfillment of a specific function, so it can achieve its communication objective. Good infographic design involves aspects such as visibility, content management and usefulness, which are tools to persuade, direct and mobilize audiences. Information visualization in infographics ensures the user's ability to see and connect data, revealing patterns and categories, so that they significantly impact users' mindsets, beliefs, and behaviors (Uyan Dur, 2014). In explaining the relationship between form and content, Dondis (1985, p. 83) indicates "the interaction that exists between the forces of content (message-meaning) and form (design-medium-arrangement); and, secondly, between the reciprocal effect of the articulator (designer-artist-craftsman) and the receiver (audience)." This relationship between form and content explains the appeal of infographics: they deliver the maximum amount of content in the smallest possible space, while maintaining clarity and precision (Jaleniauskiene and Kasperiuniene, 2022).

The perception of data in infographics

The structure of the visual message is key to understanding, because the reader tends to follow visual paths or trajectories (Hernández-Fernández and Morera-Vidal, 2022). When looking at an infographic, bottom-up and top-down processing is used, something that occurs in the understanding of visual information (Carrillo Quiroga, 2022; Hernández-Fernández and Morera-Vidal, 2022). The ascending process begins with the focus of attention towards sensory stimuli, selecting the most relevant or salient, for example: the light that arrives as electrochemical information to the visual cortex of the brain is interpreted and identified as a perceptual object (Carrillo Quiroga , 2022). On the other hand, top-down processing uses memory and previously acquired knowledge for understanding that "descends" towards the world or reality, and thus shapes perception (Carrillo Quiroga, 2022). As visual elements, infographics use two types of components: context (texts, data, facts and knowledge) and visual elements (graphs, colors, icons and signs) (Jaleniauskiene and Kasperiuniene, 2023). This combination improves the learning process, as well as the retention of information, enhancing the educational aspect of infographics (Alqudah et al., 2019). In fact, experiments carried out with graduate students have shown that the use of infographics has positive effects on learning (Alqudah et al., 2019).

Microreactions

In the field of Psychology, the work of Paul Ekman and Wallace V. Friesen (1969, 1972, 1986) on facial expressions of emotions stands out. Ekman (1992, 1999) is the author of the Theory of Microexpressions and a pioneer in studies of cognition, emotion and facial expressions, while Ekman, Friesen and Hager (2002) create a tool called Facial Coding System (in English: Facial Action Coding System [FACS]), which allows the unification of a readable and useful code in the identification of emotions in facial expressions, as well as empathizing with the recipient and improving communication. For his part, Abraham Moles (1983) is interested in actions that are motivated by small acts that a person performs when encountering objects in their daily life, which he calls microacts, and which are the product of his Theory of Acts.

Microreactions or microacts are studied by Micropsychology and are manifested in a recipient when faced with an object with which they interact in daily life. These microacts have a short duration, hence their name (Moles and Rohmer, 1983). According to Moles (1991), they are the reason for people's final decision making and are key in the decision process to make, buy and use objects. Microreactions arise from the encounter between a person and perceptual objects. If the interaction with the object is satisfactory, that is, if functional communication is developed, it is said that it has fulfilled the objective for which it was designed (Moles and Rohmer, 1983).

Costa's proposal (1987, p. 118), called "generalized economy," is the opposite of the concept of "generalized cost" proposed by Moles (1983, p. 67). The generalized economy focuses on saving a series of efforts for the user who is in contact with the graphic signal, as explained by Costa (1987) in his book on signaling. Then, low or no savings in the generalized economy is identified through microreactions and, when it has not been achieved, microacts are triggered that lead to a negative action or action contrary to what was expected, to the fulfillment of the signaling function.

In a more current article, where this phenomenon is discussed, it is mentioned that Micropsychology focuses on the knowledge of generalized cost, that is, "the observation of an action as a product of a sequence of microacts" (Costa, 2014 p. 174). Costa (2014) explains the components of generalized cost, applied to consumption in advertising, which are: temporal cost, psychological cost, financial cost, intellectual cost, energy cost. However, in his proposal for a generalized economy, he redirects reflection towards signaling design.

The interest in the proposal of Moles (1983, 1991) and Costa (2012) is that they ensure that there are microacts derived from the interaction with objects, which when expressed influence the decision to consume the object itself. If this is so, greater assertiveness would be given when

interpreting these microreactions, as Moles (1983) named them in his Theory of Acts, and they would be useful to understand the recipient of the communication. The approaches of Moles (1983, 1991) and Costa (2012) link these studies with communication in design objects, such as signaling and advertising.

With the intention of contributing to the discussion on the assessment of the consumption of graphic objects other than those analyzed by Moles and Costa, in this article we investigate the graphic object: digital infographics, in order to provide other possible applications of the observation of the microacts or microreactions. In this research we are inclined to use the term microreactions, since we consider that it is closer to the user's behavior when interacting with a digital infographic.

◈ Methodological design

Functional communication observes the acts expressed by the recipient of the message when faced with the stimulus; thus, users' microreactions reflect whether or not the function for which the infographic was created is fulfilled. In this study, digital infographics were analyzed in order to identify the elements necessary for functional communication through infographics.

To do this, a qualitative methodology was employed using the following data collection tools: analysis of 5 digital infographics as case studies, the observation of microreactions in 10 users in an Eye Tracking laboratory and 2 focus groups. The study is qualitative and exploratory. Furthermore, it is based on grounded theory, as it seeks to demonstrate the presence and importance of microreactions in the design of digital infographics. The following research objectives were set: 1) identify the semiotic aspects observed in digital infographics; 2) describe the user's interaction with the digital infographic, based on the microexpressions they present, and 3) describe the relationships between the graphic composition of the digital infographic and functional communication.

Analysis of case studies

The criteria for selecting the case studies were the following: 1) that the infographics were found in digital public information media and 2) that they were called "digital infographics" by the media that published them. The case studies are graphic images published on the Internet as digital infographics, as can be seen in figures 1, 2, 3, 4 and 5.

Figure 1. *Case 1.*
Source: Instituto Nacional de Estadística y Geografía.
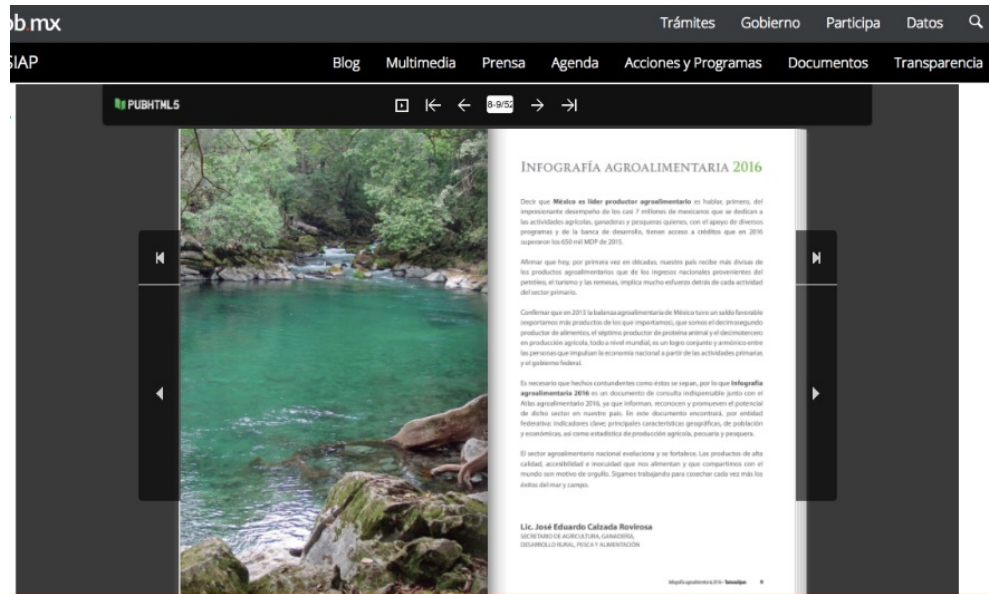

Figure 2. *Case 2.*
Source: SEDESOL.

Figure 3. *Case 3.*
Source: *Gobierno de México.*

Figure 4. *Case 4.*
Source: *Gobierno de México.*

Figure 5. *Case 5.*
Source: Hoy Tamaulipas.

Their characteristics were analyzed to identify if they comply with the elements of functional visual communication that, in turn, lead to the understanding of the information. Three assumptions were stipulated to be answered:

1. Digital infographics are not identified as such by the citizen who observes them.

2. Digital infographics cause micro-reactions in the user that affect the visual communication of information.

3. Functional communication is influenced by the graphic composition of a digital infographic.

Observation of microreactions

To observe microreactions, an experiment was carried out in the Laboratory of Interactive Systems and Eye Tracking of the Division of Sciences and Arts for Design of the Autonomous University of Mexico Azcapotzalco, one of the two laboratories that have the necessary technology for the purposes of this research in our country.

Eye Tracking is a method of recording eye tracking that occurs when observing an object and consists of its own software to generate the readings of said tracking. It indicates what attracts a user's attention the most and for how long, allowing inferences to be made. It is done using a device that is placed in front of the eyes, like glasses, or also using an instrument that is like a helmet; It is then calibrated using infrared light with the pupil in order to create a record through the cameras of the ocular reader.

In this exercise, a total of 10 participants were gathered, students of the Graphic Communication Design degree, indistinct semester, indistinct age and sex. The participants answered a questionnaire on a 5-point Likert scale, which inquired about the identification of the infographics, their understanding, the user's bodily reaction, the affective or emotional reaction, and the user's assessment of the aesthetic aspect.

Focus Groups

The sampling for the focus groups was by opportunity, with two groups of students from the degree in Communication Sciences of the Faculty of Law and Social Sciences, at the Autonomous University of Tamaulipas, Tampico-Madero Campus, in Tamaulipas, Mexico. The age and sex of the groups was indistinct. The first group included nine and the second 11 students. The following initial questions were used:

- How do you describe the experience when using digital infographics?

- What feelings do you identify that the exercise generated in you?

- Do you think it is easier to understand any topic through digital infographics? Because?

- Did you experience any sensation related to understanding or not what the infogram said?

- Can you describe your feeling or attitude towards the infographic you manipulated?

Results   Observation of microreactions

Microreactions were observed during the interaction with the aforementioned digital infographics and comments were placed on each table. It is evident that people show reactions when reading a graphic product, and that these allow us to distinguish the perception that is presented at the moment they try to understand the graphic product observed. The understanding of the contents reflects different micro-reactions, being consistent with the comments made during the focus groups and even

in the application of Eye Tracking. It highlights that these microreactions are not intentionally planned or executed, but derived naturally when faced with graphic products, in this case, digital infographics. They show that the design is relevant and coherent in some case studies, while it is absent in others, so that it influences the understanding of the content or messages that are intended to be transmitted.

Focus groups

The results of the focus groups were analyzed qualitatively. When recording the interventions and responses, the similarity of the comments or messages that were issued was sought, according to the development sequence of each exercise. These were grouped with a semantic and syntactic conception to achieve the unification of criteria and offer a sense of sentence for each observation. In this way, the statement includes the total of the comments of each general question that was asked in the group. Regarding the observation of the case studies, the responses were grouped by question and by case of each digital infographic.

The first focus group was made up of four women and four men, who by their own decision were placed alternating by gender around the table. At first, their behavior was serious and distant, but, once the dynamics that would take place were explained, their collaboration became more participatory. Their facial expressions changed according to the infographics they were observing. They were asked to define the concept of digital infographics and only 10% of the participants gave a brief concept, for example: "a tool with text and image that serves to communicate" and "the union of text and image." It is evident that the participants did not initially identify the concept of infographics. They were then asked to identify which of the images they saw was an infographic, and they managed to identify the correct one, which indicates that they do know how to distinguish it, although not define it.

In relation to the visual elements that allow them to know what is or is not an infographic, he highlighted that it should have images and texts together or combined. One participant indicated that she was part of a group of people who worked making these elements for the university, but that they did them with an online program that develops them automatically when entering the data. This program is Canva, an online software that has pre-designed templates or elements with which the user can select and change the characteristics of the elements it provides for the composition, which is also delimited by the templates.

To highlight the presence of microreactions, without mentioning them by name so as not to confuse the participant, he was asked about his feeling when not understanding the content of an infographic, to which he stated: "lost, desperate, stressed, upset." This suggests that a graphic product can create psychological discomfort in the user, related to the

investment of effort and time, which leads them to lose attention and discontinue watching the content.

Therefore, it turns out that functional communication is not generated, which leads to fulfilling the purpose for which a digital infographic was designed.

The last open question in the focus group was to know if they considered that the aspects of graphic design are a vector to perceive the public institution, to which the participants generally indicated yes, that "it provides seriousness, originality, trust and professionalism."

The second focus group consisted of three women and seven men. This group had a slightly more interested attitude towards exercise. Their participation was notable, due to the way they responded relatively faster than the first group. In terms of knowing the definition of a digital infographic, this group could not describe what it was with certainty and remained silent, even when told that there is no right answer and that whatever they knew was fine. From their behavior we consider that they were not sure of the answer and/or that they did not know it, which does not provide us with material that is sufficiently accurate to ensure that they do not know what an infographic is, but it does give us a dubious conception of the term infographic. Once again, the assumption that users do not identify a digital infographic with certainty is proven.

When asked to identify which images are infographics, more than half pointed to the correct one. This suggests that the participants had prior knowledge that allowed them to identify them, although not define them in their own words. Also that the graphic elements that constitute an infographic give rise to its identification.

On the other hand, its manifestations at the level of microreactions are abundant. This group presented greater confusion, although it was more participatory in the use of time for each step within the focus group. Gestures of astonishment, doubt, suspicion and concern were very prominent, compared to the participants in focus group 1.

At that point, each participant was asked how they felt about the infographics they had seen. The responses were similar to group 1: "confusion, it's ugly, it doesn't look clear, I don't understand it", this in relation to figures 2, 3 and 5. Regarding the importance of design in infographics, all participants indicated that It is very important, basic, that cannot be left unattended, and that contributes to identifying the company or the topic of the infographic.

Eye Tracking Laboratory

After observing each infographic, each of the 10 participants answered a Likert scale questionnaire. Figure 6 allows us to observe how the digital

product called online as an infographic is perceived. The reflected position was compared with the image analysis of each case to evaluate the evidence.
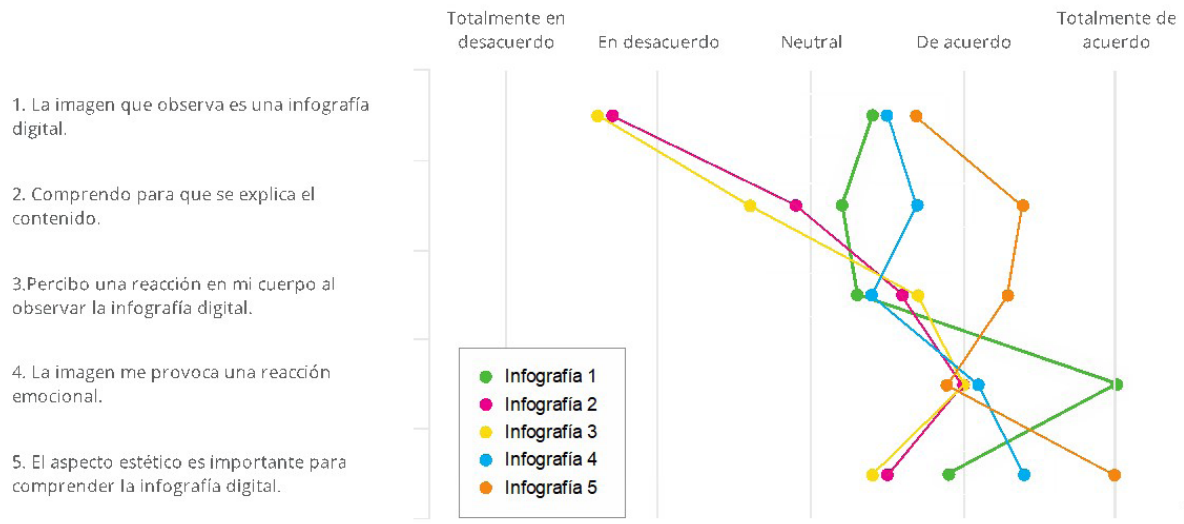

Figure 6. *Comparison of mean response between infographics.*
Source: The authors.

◆ *Conclusions*

We consider that visual communication in the production of digital graphic objects that address specific audience groups must be strictly intentional to achieve its purpose. Even though a percentage of information transmission is presented in those that do not have an adequate graphic composition, the intention is to reflect, appreciating this composition as the main vector between design-communication.

It is relevant to highlight Dondis's (2017) analogy between the verbal and visual literacy of a consumer of graphic products, since for the encoder, the message generates errors from the graphic composition, which impacts the reception of the message. We confirm that among the main causes of visual communication problems is graphic composition. As Dondis (2017, p. 190) states, the fundamental problem in graphic products is composition, that is, "the arrangement of the units of visual and verbal information that gives rise to the intended emphasis and clearly expresses the message."

Regarding micro-reactions, we consider their observation to be an opportunity to conduct evaluations of graphic products, such as digital infographics. On the other hand, regarding the digital environment, it

is important to make it "intelligible through communication design", as indicated by Costa (2014, p. 102), since it must have the same intention of being clear and aesthetically pleasing at the time it is created. shows the information.

In his research, Zhang (2017, p. 30) proposes "three areas that communicators can address when designing infographics in similar contexts: content, usability, and visual appeal." It is this last area where the use of visual design is outlined, which has been proven to contribute to the appropriation of knowledge, hence the importance of the use of infographics in education.

However, when students create this visual material, they do not really develop infographics, but rather prototypes of them, since the content, usability and visual appeal are key and infographics can contribute to making information more accesible in any didactic activity. No work that was reviewed presents the infographics that were used for the investigations, so it cannot be ensured that they are, from a design perspective, visually appropriate. The articles that add them do not present obvious coding of design elements. Furthermore, in the case studies it is noted that the intentions of a harmonious development of graphic elements within the infographics are not visible and, although users manage to recover certain information when viewing them, they also perceive what is poorly done in the images, especially if they lack visibility, an element that implies that all parts of the composition (from typography to color and shape) have the appropriate dimensions.

Regarding the literature that talks about the topic, no recent contributions were found from the study of infographics made in Mexico or Latin America. In fact, for the most part, the research that stands out the most in aesthetic perception and treatment of the visual message is of Chinese, Korean and European origin. What was found were historical research on the matter or on its use in an education context. Therefore, it is necessary to develop more research that argues for the application of graphic design by specialists in the conceptualization of infographic materials, especially in the information that public and private sector intends to present to citizens in general. Definitely, design can contribute with valuable elements to the creation of infographics to bring science closer to citizens.

What was found around the research on infographics made by Mexicans are many efforts to define it, classify it and create typologies, which end up being useless, because there is no typology that rules all infographics.

Moreover, it stands out that 70% of the research carried out about infographics is developed through qualitative studies. This may be because, beyond measurements and numerals, it is necessary to understand the phenomenon of infographics and their capacity to transmit information,

as well as the perceptions and stimuli that users receive, from which they derive their decisions.

The production of infographics as learning material by teachers does help the learning process, especially if it is supported by software for its creation, but it does not ensure that the material meets appropriate aesthetic and communicative criteria. Making an infographic is a process not always suitable for every teacher's skills.

As a conclusion it is relevant that, in the first sensory filter of Munari's (2016) communication scheme, the message can be rejected or accepted, in terms of the visual composition and, as analyzed in this document, that each graphic element adds up so that a message can cross filters found in the receiver's area. This information is very notable because Munari (2016) assures that the external or internal response to the message is derived from this area.

In agreement with Moles (1983), microreactions can give us a guide to understand the user's acceptance of the contents in digital infographics, which adds to the possibility of ensuring that an infographic has or not a consistent appearance with its name, its objective and with the institution that is responsible for the content. Thus, user's experience can also be supported by the first step of the user-centered methodology, due to the analysis of users' microreactions when evaluating a graphic product.

Finally, to respond to the assumptions held during the investigation, we found that:

1. Digital infographics can be evaluated through the syntax of design because it is precisely this discipline that allows a way to place visual resources and for them to carry the message clearly. Syntax as an area of semiotics is what gives rise to understanding, derived from the use of each graphic element for its proposal in a graphic composition, in which the meaning shared with other elements is greater, and the coherence between the meanings increases the possibility that the message is carried effectively to the user.

2. The design of digital infographics (including the arrangement of the elements) causes microreactions in the user that affect the visual communication of the information. Viewers, when looking at an infographic in which they are looking for certain information, first perceive its composition, which is what gives way to an understanding of the data shown. the absolute, according to the preparation of the graphic material.

3. Communication is influenced by the graphic composition of a digital infographic. In the same sense as the previous conclusion, the brief reactions in the users' gestures allow us to ensure that

there is a direct relationship between the graphic composition of the infographic and the perception of the contents. This is stated because what users perceive before the informative content itself is the coding support, which is made up of visual aspects such as texture, shape, structure, module, movement, which, if analyzed in their particular derivatives, give rise to color, typography or image.

4. To improve design in digital graphic products, it is imperative to correctly name and identify digital infographics. The graphic composition is the essential feature in its design, so it should not be underestimated, prioritizing only the informative content.

5. Microreactions are an opportunity to explore the perception of content in digital infographics, but they are not only useful for studying this type of design products.

6. Eye Tracking is a tool that promises to contribute a lot in the field of knowledge about how the information emitted by infographics is received at the user's neural level. As it is an involuntary physical reaction, this would create general parameters to validate the use of the infographic; it may even be a way to evaluate design as a catalyst for infographic content.

7. It is important to continue with the application of experiments that provide findings produced by the Eye Tracking method regarding the design of digital infographics, whether they may be directed at other topics or other user segments. They could even be applied in different types of digital infographics, depending on their graphic composition.

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