Data Visualization, Accessibility and Graphicacy: A Qualitative Study of Communicative Artifacts through SUS Questionnaire

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Abstract: The study presented here examines the accessibility of information conveyed through the language of infographics, analyzing the usability by users in the fruition of information content of five Data Visualization artifacts, selected according to the degree of iconicity of representation by Anceschi. Specifically, the study compared the SUS evaluation by two groups [F=100 – M=100] homogeneous in educational grade and age but distinguished in owning proven Visual Design competence or not. It is therefore investigated, whether basic soft skill, is sufficient to achieve an optimal level of accessibility or rather, whether Graphicacy competence is discriminated. Therefore, understanding whether infographic language could be considered ad a universal language or no. A three–variable correlation design was therefore constructed: two independent variables, the System Usability Scale (SUS) along with the degree of iconicity of the representation, and one dependent variable, namely the amount of information extracted from the infographic. The results show that in both Group A and B is evident a general difficulty in accessibility of information correlated to the degree of iconicity of the infographic representation. Specifically, in "non designer" group, no infographics achieved the minimum usability rating, which, on the other hand, in "designer" group, is achieved by the only two artifacts with a medium/low degree of iconicity. From the analysis of the data, Graphicacy – acquired within the educational curriculum of Designers – would appear to be a determinate element in the correct decoding of communicative artifacts. The contribution, through existing data and literature, leads, on the one hand, to confirm that Graphicacy has been found to be neglected in comparison to Literacy, Numeracy, and Articulacy and that the complexity and sophistication of infoaesthetic may be incomprehensible without timely data visualization literacy.

1 INTRODUCTION

Historically, it were Balchin and Coleman (1966) who coined the term *Graphicacy* referring to the skills of orientation, comprehension and use of cartography for educational purposes. The scholars point out that activities related to the consumption of cartographic artifacts are only possible provided knowledge of visual codes, and the ability to orient with respect to canonical systems of visual representation, which cannot be conveyed solely using written language or by simple numbers such as coordinates. Wilmot (1999) through his own studies in South Africa, takes up the research of Balchin and Coleman and affirms the need and urgency to establish curricula related to the teaching of Graphicacy within all educational systems. Wilmot states how this skill should be considered the 'Four R's' within each individual child's basic cultural background, alongside the skills of *Articulacy*, *Numeracy*, and *Literacy*, as "encountering visual representations, such as infographics, matrices, maps, logos, diagrams, word clouds, and icons, on a daily basis, require symbolic language" to translate concepts into "spatial relationships" (Wilmot, 1999, p. 91). In these terms, Graphicacy represents a competence that combines mathematical, textual, media, technological and graphic skills; additionally,

Graphicacy is the competence related to infographic language skills. An infographic literate citizen therefore can read and write through the language of graphs, mastering its grammar and using it critically to shape and form. Such interaction is further referred to as the "language of Design" by

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Schön (1983). In this regard, a study conducted by Culbertson and Powers (1959) examined various types of graphs and tried to detect the effectiveness of correlations between Graphicacy and other skills, such as verbal skills. So, can we argue about an innate competence?

Infographics has be able to communicate complex topics in a quickly, simply, and easily way to be understood by a wide audience (Tufte, 1982/2001) due to the visual nature of their representation, which should allow them to "communicate more immediately than other systems (primarily writing)" (Falcinelli, 2014, p. 148). In order to achieve this goal, accessibility of information is crucial. Paraphrasing Dieter Ramhs' concept of the usability of good Design (Kirk, 2019), a Data Visualization product must meet certain criteria: functional, psychological, and aesthetic; so, good Design – i.e. a good visualization emphasizes the usefulness of a product while ignoring anything that might detract from it. To do this, certain principles of good design can be applied that enable us to develop an artifact that tends to be functional.

For example, Kosslyn (1989) provides a broad framework for evaluating both graphs and diagrams to convey information effectively, classifying the constituents of the basic–level graph into four components: the background, the picture, the indicator, and the labels. In Information Design, information accessibility is defined as the ability of information systems to deliver services and provide information usable, without discrimination, even by those who due to disabilities require assistive technologies or special configurations (Ware, 2019).

On the one hand, it has been suggested by Lewandowsky and Spence (1989) that most graphs are easy to interpret and Wainer (1980) for example, argued that children at age 9, had, on average, reached the minimum acceptable level of comprehension on par with an adult. Ainley (2000) reported intuitive reading of graphs among 6–year–olds as an example of the universality of some aspects of graphical representation capable, therefore, of decreeing a good level of reading of diagrams and maps. Additionally, pictures and visual artifacts in general have been considered easier to read than prose because they do not involve the use of words (Hittleman, 1985).

There is numerous evidence of improvements in cognition and access to information when it is translated through visual formats. Indeed, research in psychology and communication has demonstrated the benefits of nonverbal language (Dansereau and Simpson, 2009). Nevertheless, numerous studies have investigated the difficulties in the population in perceiving graphs, arguing that comprehension and aspects beyond the most obvious proportional relationships can cause extreme difficulties (Bowen and Roth, 2003; Preece, 1983; Bowen, Roth, and McGinn, 1999; Åberg–Bengtsson and Ottosson, 2006). Since it is possible to consider communicative–infographic artifacts to be part of the broader discipline of Information Design – which leads it to be defined as an information system (Botta, 2006) – it was decided to associate the concept of infographic accessibility with that of digital accessibility, according to Jakob Nielsen (1993) that defines accessibility as a quality attribute that assesses how user–friendly user interfaces are, i.e. how an information is easily extracted from an information design artifact.

2 METHODOLOGY

The study examines the accessibility of information that is conveyed through infographic language and specifically in five Data Journalism artifacts. The perception and interpretation of users in the fruition of such content is analysed. Two groups – homogeneous in terms of educational level and age but differ in having or not studies in the field of Visual Communication Design – are compared. Therefore, it is investigated whether the basic knowledge offered by educational curricula or mere prior experience, is sufficient to reach a good level of access to information or on the other hand, Graphicacy skill – theoretically more developed in the subjects of the 'Designer' Group – is discriminated in the perception, interpretation and therefore accessibility of information. Starting from these premises, the study focuses on the following questions:

- Q1. Is the infographic language accessible to all?
- Q2. Is there a correlation between the accessibility to data visualization and the degree of iconicity of its representation?
- Q3. Is graphical competence innate?
- Q4. Is the design education path necessary in order to develop the graphical competence?

For the study, it was selected the System Usability Scale (SUS) (Brooke, 1996), a one–dimensional rating system that can assess the usability of a variety of products or services and the most widely used (Lewis and Sauro, 2018). According to Bangor, Korum and Miller (2009), three aspects characterize the success and effectiveness of this tool: (i) it consists of 10 items and is therefore easily administered (ii); it is a royalty free questionnaire; and (iii) it is technologically agnostic, being able to be applied to any artifact resulting from the discipline of Information Design. The standard version of the SUS consists of ten items, each with five mandatory "evaluation" from "Strongly Disagree" to "Strongly Agree.". Based on research over the years, a SUS score above 68 pt would be considered the threshold above average for usability. For the purposes of the study, the items were adapted – in terms – to avoid possible misunderstanding by the study sample. The items submitted were as follows:

- I think I would like to read this kind of infographic frequently.
- I found the infographic unnecessarily complex.
- I found the infographic very easy to read.
- I think I would need the support of a person in order to understand this infographic.
- I found the various graphic elements of this infographic well integrated.
- I found inconsistencies in the graphic elements of this infographic.
- I think most people can learn to understand this infographic easily.
- I found the infographic very difficult to understand.
- I felt comfortable reading the infographic.
- I needed to learn many processes before I could read and understand the infographic.

Along with the SUS questionnaire, two specific questions were administered about the amount of information that could be extracted from the infographic and their relevance.

2.1 The Usability Study

In the usability study presented, five infographics were evaluated by a homogeneous sample of 200 university graduates [M=100 – F=100 – mean age 22 – Italian], divided into two groups according to the criterion of certified competence. Namely:

- Group A. Graduates in other disciplines.
- Group B. Graduates in Visual Design and related fields (i.e., product, industrial etc.).

The infographics examined were published in Italian – and English–language newspapers (Fig. 1).

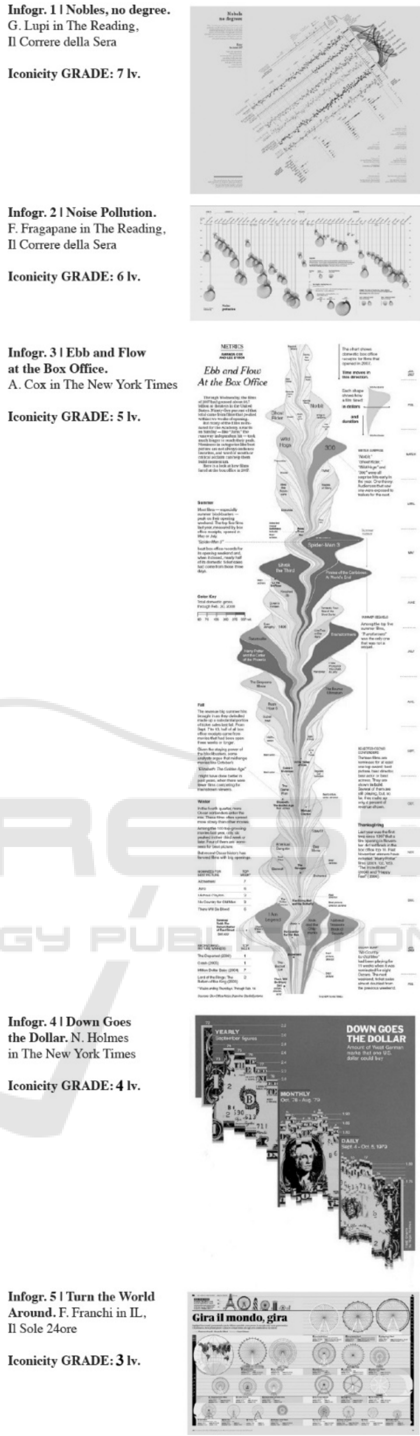

Figure 1: Selected Infographics and related Iconicity Grade. Disclaimer: Fair use of images for research purpose.

The infographics were selected according to the degree of iconicity of the representation, applying Anceschi's scale of depiction (1992) from a more properly figurative degree to an abstract one, that should be considered "two [extremes of] possibilities on the level of graphic expression, not being exclusive of each other, since the formal properties of a graphic symbol do not prejudice the functions, in terms of effectiveness and efficiency of linguistic encoding, necessary to realize a written text" (Botta, 2006, p.31). The act of representation, in fact, should be understood as an action of analysis–reduction and synthesis–restitution: thus, accomplishing data analysis and Data Visualization. Studies on representation can be found in the work of De Saussure (1916) and Peirce (1958) from the mathematical theories of communication processes of Shannon and Weaver (Mannori, Borello, 2007). Anceschi, within 'The Object of Representation' (1992), takes up the studies of Massironi and Moles, proposing a seven–factor classification (Branzaglia, 2011) – from 1 to 7 – that was selected for the presented study, applying the latter classification to the communicative–infographic artifact results in the following classification:

- Grade 1 iconicity: Photograph Retouching or Illustrative Function.
- Grade 2 iconicity: Simplification to the stroke or Taxonomic–descriptive function.
- Grade 3 iconicity: Technical Drawing or Operational Function.
- Grade 4 iconicity: Normalized Construction Diagram.
- Grade 5 iconicity: Flowchart.
- Grade 6 iconicity: Field diagram or evocative function or hypothethesia.
- Grade 7 iconicity: Abstract art or perfect abstraction.

2.1.1 Procedure, Design of Correlations and Measurements

For each of these studies conducted on the individual infographic, usability tests were conducted individually through an online administration. No participant was aware of those who would take the test, and all forms of security in terms of privacy and data protection were ensured in compliance with GDPR regulations. The user, upon receiving the link to the test, completes the related task – i.e., perception, extraction, processing, and comprehension of information – and completes the related assessments, highlighting the amount of information extracted.

This study used a three–variable correlation design: two independent variables, the System Usability Scale (SUS), and the degree of iconicity of the representation; and one dependent variable, namely the amount of information extracted from the infographic. The SUS scores were calculated using the method developed by John Brooke (1996), while the summary assessment according to the Lewis–Sauro's model (2018). For the scores related to the amount of information extracted, the proportion of information that each participant extracted, was calculated on a scale from 0 to 5. For degrees of iconicity, the 7–point scale remained unchanged.

3 RESULTS AND DISCUSSION

Tables 1 and 2 provide the mean, standard deviation, and skewness values for the SUS questionnaire scores, and the number of information extracted from all infographics, broken down for the two groups of the sample. In general, in both group A and B there is evidence of a general usability of the infographics evaluated in relation to the degree of iconicity of their representation. In Group A, no infographic exceeds the minimum threshold of 68 average points. Nevertheless, in group B, this threshold is exceeded only by the artifact of F. Franchi and A. Cox.

Table 1: Sus Questionnaire Results – Group A.

	Mean	Std. D.	Asym.	Grade	Ico-Lv
Infogr. 1	37,78	16,71	-0,39	F	7
Extracted info	1,71	1,35	0,39		
Infogr.2	45,17	21,33	1,47	F	6
Extracted info	2,72	1,02	-0,2		
Infogr.3	46,45	20,66	-0,28	F	5
Extracted info	2,43	1,38	0,12		
Infogr.4	55,68	20,8	1,59	D	4
Extracted info	2,61	-0,15	-0,43		
Infogr.5	58,02	23,97	-0,23	D	3
Extracted info	2,87	1,66	-0,13		

Table 2: Sus Questionnaire Results – Group B.

	Mean	Std. D.	Asym.	Grade	Ico-Lv
Infogr. 1	60,62	23,63	-0,52	D	7
Extracted info	2,95	1,61	-0,18		
Infogr.2	65,32	20,80	-1,22	C	6
Extracted info	4,33	1,38	-2,10		
Infogr.3	65,9	20,64	-1,12	C	5
Extracted info	3,76	1,33	-0,87		
Infogr.4	69,4	18,17	-0,77	C	4
Extracted info	3,63	1,41	-0,50		
Infogr.5	74,65	15.39	-1,09	B	3
Extracted info	3,75	1,32	-0,74		

To verify the research questions and analyse the scores obtained from the SUS questionnaire, the amount of information extracted and the degree of iconicity of the representation, it was chosen to calculate the different correlations through the Bravais–Pearson r coefficient.

Table 3 shows that in both Group A and B, the average usability performance and the number of information extracted in individual infographics follows a significant positive progression (r12) with values between 0.61 and 0.79.

Table 3: Correlation between Sus Questionnaire Results and extracted information.

	r 12 | SUS and Extracted Information
Infogr. 1	
Group A	0,66
Group B	0,73
Infogr. 2	
Group A	0,69
Group B	0,61
Infogr. 3	
Group A	0,64
Group B	0,64
Infogr. 4	
Group A	0,69
Group B	0,79
Infogr. 5	
Group A	0,70
Group B	0,63

Table 4: Correlation between Sus Questionnaire Results, extracted information and grade of iconicity.

	r12	r13	r23
Group A+B	0,87	-0,53	-0,29
Group A	0,82	-0,97	-0,77
Group B	0,27	0,97	-0,28

In Table 4, two highly significant data emerge. The first is the negative correlation between SUS and Iconicity (r13), a sign of an inversely proportional relationship between the abstraction of the representation and its ease of use. The second, related to the first, shows that the tendency to extract information from the communicative–infographic artifact tends to be favoured by its iconicity (r23). While in the first case we see an almost perfect correlation – with value -0.97 on both groups – in the second case, the range of values widens, oscillating between -0.77 in Group A and 0.28 in Group B.

In general terms, the scores made by the two groups show an almost linear progressive trend as the proposed infographic acquires lower and lower levels of iconicity. On average, Group B obtain 38 percent higher ratings than Group A, thus suggesting how a prior competence could be decisive in terms of perception and understanding of the displayed information as argued by Kosslin (1994) and Cairo (2017). However, analysing the results of individual infographics in detail reveals interesting findings in order to answer the research questions posed in the beginning.

Let us consider the Grade 7 infographic and the Grade 3 infographic (see Table 6 and fig. 1). The first infographic obtains, on the one hand, 37.78 pts (Grade F) from Group A, and on the other hand, 60.30 pts (Grade D) from Group B, marking a variation of 60.8% between the two results. In the second infographic, the SUS value obtained by the first group is 58.02 pts (Grade D), while the second has an average value of 74.65 pts (Grade C), marking a positive variance of 28.7%. The percentage difference between the two groups is a relevant finding as there is a progressive decrease in the performance gap, the more the degree of iconicity tends to value of less than 5. In fact, as shown in Table 4 the SUS values of group B go from practically sustained increases of +60.5% (infographic by G. Lupi) to values of +41.9 % (infographic by N. Holmes), marking the lowest increase value at + 24.7 % (infographic by A. Cox).

Table 5: Group A and B - Differences between SUS results compared.

	SUS | Mean	Difference Extracted
Infogr. 1		
Group A	37,78	-
Group B	60,92	+ 60,5%
Infogr. 2		
Group A	45,17	-
Group B	65,32	+ 44,6 %
Infogr. 3		
Group A	46,45	-
Group B	65,90	+ 41,9 %
Infogr. 4		
Group A	55,68	-
Group B	69,40	+ 24,7 %
Infogr. 5		
Group A	58,02	-
Group B	74,65	+ 28,7 %

Such preliminary evidence allows us to be able to begin discussing about question Q2, namely, whether iconicity of representation affects the usability of infographics. In both groups, there is an improvement in SUS ratings as the degree of iconicity tends toward the figurative over the abstract. Group A increases by 53.6%, Group B by 23.2%. The more sustained increase in the first group may be since 'non–design literate' subjects have greater difficulty in processing abstract representations, and conversely, 'literate' subjects have less difficulty and for that reason, more uniform performance. On the one hand, keeping these values in mind, it's possible to reflect on the fact that the performance gap tends to narrow according to the degree of iconicity; pointing to a possible relationship between basic graphic competence and infographic reading ability. On the other hand, grade 6 and 7 infographics make use of a complex visual alphabet whose grammar doesn't seem to be intuitive, as underlined by the large gap between the values of 60.%. In contrast, a grade 3 infographic, in addition to being generically rated better by both groups, shows a smaller delta of performances.

With reference to question Q1 i.e., whether infographic language is accessible, Tables 1 and 2 provide a preliminary answer. The results of the SUS show that the infographics submitted for testing – except for the Holmes and Franchi artifacts evaluated by Group B – do not, as an average score, exceed the minimum levels of accessibility despite being in power excellent visual artifacts. However, if we were to make a combined average of ratings between Group A and Group B – plausible in reflecting the state of the art – no infographic would achieve the minimum rating of 68 pts (the highest value would be set at 66.3 pts for the grade 3 infographic).

The individual ratings of the two groups with respect to the individual infographic bring out how accessibility of information is particularly variable within the same groups. Lupi's infographic (iconicity grade 7) received ratings above 68 pts from 47% of Group B and only 1% of Group A. Fragapane's infographic, on the other hand, 13% (A), 51% (B). Holmes' infographic, 10% (A), 59% (B). Cox's infographic, 30% (A), 59% (B). Finally, Franchi's infographic, 33% (A), 75% (B). Such a fluctuation prompts one to hypothesize – answering question Q1 and Q3 – that the ability to read visual artifacts cannot be considered an innate endowment and that infographics themselves are not as accessible in terms of information acquisition.

With respect to Q4, prior competence in the discipline of Design seems to favour greater reading ability than the performance obtained by Group A. Basic competence in Design seems to be a crucial factor in decoding artifacts in which language gives the final product a representation tending toward hypotheticalization or pure abstraction – see Lupi and Fragapane's infographic – but nevertheless it does not appear –from the data extracted from the study – a transversely acquired competence that is decisive in accessing the higher levels of information offered by data visualization. Preliminary data in possession point out how the competence defined as Graphicacy acquired within the training paths of Designers, may turn out to be a key element in the correct decoding of communicative–infographic artifacts.

Alongside this, since infographics are the result of a design action, a second competence relative to the way of processing knowledge could be considered: the Designerly way of thinking (Cross, 1982) as the way of thinking with which the designer achieves knowledge. According to Levin (1966), in fact, the Designer through the application of an ordering principle, applies his critical and creative reasoning in the search for the missing elements to solve the design problem. In these terms, it is the basis of problem-solving ability. Such thinking skill is in fact related to visual language ability (Cross, 1982). The variability of the results obtained within the individual group and the objectively lower ratings below the 68 pts threshold, put the attention on the fact that this skill either (i) is not acquired correctly by the whole population – a fact that could be confirmed by the strong discrepancy of results between Group A and B – or (ii) that this skill within the curricula in Design is not perfectly consolidated in the programs – a fact that would confirm how an average of 58.5% of the 'literate' Group can rate accessible the infographics.

Preliminary analysis of this data shows how data visualization literacy is necessary today and that studies on key skills to proper decoding are as necessary as ever. It seems that Graphicacy and the level of competence acquired through current educational systems does not fulfil its task of facilitating this cognitive process, probably for its purely notionistic nature that doesn't cover other cognitive domine as processual or metacognitive; therefore, it brings out the importance of the design thinking component i.e., the Designerly way of thinking. Since infographics are endowed with language that only in power can become universal, it needs more specific skills and in accordance with Roth and McGinn (1997), a greater experiential approach and encounter with the visualization itself, since as with verbal languages it is constant practice that is decisive. In addition, Designers themselves within their course of study, address the issue of spatial–visual configuration through the propaedeutic course of Basic Design (Anceschi, 2011), i.e., the foundation of training in the discipline, found in the literature related to the Bauhaus and Ulm school (Anceschi, 1972) as a propaedeutic course for design.

In Johannes Itten, the first to lead from 1920 the propaedeutic course – *Grundkurs* – within the Bauhaus and in Kandinsky, we can see the approach to bias correction. In fact, the purpose of the Grundkurs is to undertake a deconstructive course for the removal of bias and the preparation of the student for the foundational theories of the project, based on the predominance of art and technique over science. According to Itten's pedagogical model, the exploration of sensoriality arises, as the necessary and sufficient condition for skills and knowledge to be acquired. Therefore, by cross–referencing the data obtained, to the theory in the literature, it is possible to state that the ability to "generate, retain and manipulate abstract visual images" (Lohman, 1979, p. 188), can effectively influence the comprehension performance of communicative–infographic artifacts (Kozhevnikov, Thornton, 2006). Therefore, a low level of spatial–visual skills would thus be related to the misinterpretation of graphs.

4 CONCLUSIONS

The study conducted also raises questions regarding the design sphere. The data held by the SUS evaluations make one reflect on the role of the design work of the Information Designer. If, nevertheless, on the one hand, as stated by Tufte (1982/2001) the purpose of infographics is to facilitate access to more complex knowledge by configuring the artifact as an intellectual prosthesis (Maldonado, 2005), and on the other hand, that accessibility to information is a fundamental criterion of good Information Design (Cairo, 2020; Kirk, 2019; Avgerinour and Petterson, 2016; Pettersson, 2011) arises the question of a manneristic approach to data visualization that generates an inaccessible third–party artifact, at the risk that communication may "resolve itself into a self–referential process, not very useful because it does not put itself in the shoes (i.e., in the eyes and culture) of those who look at things with a different background behind them, i.e., the majority of the public" (Falcinelli, 2014 p. 16). Moreover, while there is a clear educational need for the recipients of such artifacts, there is also a need for debate on data visualization in the terms of emerging criticality of the communicative effectiveness of representation, "shifting the centre of gravity by observing by new means [to] somewhat lighten the deliberately overloaded formal aspect by giving more vigour to the content aspect" (Klee and Barison, 2011/1959 p.81). Nevertheless, this fact should be read in the awareness of the historical condition in which we live. The infoaesthetic dimension has now reached a level of linguistic sophistication and innovation (Manovich, 2016) that does not keep pace with the population's ability to properly appreciate such products. Using a metaphor, a parallel between the current state of the art of Information Design with the work of Dante Alighieri can be show, as we are facing an unprecedented innovation of language, anticipating a new way of shaping society (Mauri, et al., 2019). In fact, even though the sample possessed an undergraduate level of education, the data at hand, and the existing literature, leads us to confirm what McCall (Schwartz, 2018) said, namely that Graphicacy has been neglected compared to its 'older' siblings namely Literacy, Numeracy and Articulacy and that the complexity and sophistication of infoaesthetic may be incomprehensible, as regarded by Balchin (1996). To bridge the gap between Designer and user of the communicative–infographic artifact it becomes necessary to invest in a systemic and democratic educational plan that unites the factual and conceptual dimension of Graphicacy with the procedural and metacognitive dimension of the Designerly way of thinking, implementing a pedagogical methodology that makes clear the knowledge of the Design process (Oxman, 1999). People today need to analyse information that is interconnected with society and the environment and that is continuously transmitted, remixed, and shared (Manovich, 2005). The visual translation of data into information makes use of a language that possesses a specific grammar of signs and channels (Horn, 1998; Bertin, 1967/2011). However, reading images is far from intuitive in that understanding the message can only occur if one is aware of the codes–such as "the use of type; the iconographic choices and the employment of colour [as well as] the arrangement of the pieces of a table" (Falcinelli, 2014, p.145) "distilled over millennia of figurative and scriptural conventions" (Falcinelli, 2014 p.16). If proper encoding and decoding (Cairo, 2020; Wilmot, 1999) does not occur, communication fails (Meirelles, 2013). The issue thus described, fits into the international debate that has developed in recent years on the centrality of policy investment in digital literacy and digital skills to provide citizens with adequate cognitive tools to decode and encode information from data (Carretero, Vuorikari and Punie, 2017; Ferrari and Punie, 2013). The difficulties are due – first – to a low level of what Balchin and Coleman (1966) define as Graphicacy and which plays a key role in the cognitive learning process (Danos, 2018) and particularly in Data Literacy (Jones, 2020; Cairo, 2017).

In summary, the paper – starting from the evidence in the literature – focused on the issue of usability and the accessibility of information when represented through Information Design languages. In particular, the results obtained, and the correlations made, may confirm the trends found in the literature on the need for visual literacy for proper decoding and perception of displayed information. In general, almost all the infographics under study did not meet the minimum threshold of usability, thus opening the reflection to two questions, in terms of competence and design. The data lead us to hypothesize that Graphicacy – tending to be more developed in Group B of Designers assisted by the Designerly component – is instrumental of achieving higher, though not excellent, levels of usability of communicative–infographic artifacts. This points to the need for democratization of such skills not from a professionalizing perspective but from a culture and access perspective. Finally, the low level of usability achieved by communicative–infographic artifacts raise questions in terms of design and the proper use of high levels of iconicity of data representation.

The scientific evidence of the low level of acquisition of the competence of coding and decoding visual artifacts is to be found, moreover, in the general side-lining of the teaching of the same, relegating it, on the one hand, to disorganized activities detectable in educational curricula around the world (Danos, 2018), and on the other hand, its presence in different educational frameworks. Thus emerges the need for a systemic design of competence in order to offer a structured pedagogical model of competence, and an updating of it through a transfer of the cognitive thinking of the Designer: the Designerly way of thinking.

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