



The Role of Infographics in the Representation of Design Research

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Abstract. This paper examines what the “narrative task” of Communication Design, in its infographic declination, may be in the different stages of “doing research through design”. That is to say that - crossing simultaneously the fields of theory and praxis - design research is required to elaborate a visual language capable of coherently presenting the entirety of its development (from the meta-design to final products) made up of data processed in the ante, during and post phases. In other words, the actual, useful and inalienable results of doing research must fully include the communicative and visual design of its “process” that unfolds throughout its desk and field actions. The theme of the “representation of research” therefore becomes the core of the paper, which highlights how the descriptive development of the actions and manifestations of research proceeds through visual models known as process and result models. What is proposed, in fact, in this contribution, is a reflection on the visual models that describe research in its phases, through different tools such as *scientific drawing*, *hypothetigraphy* and *infographic* presentation, the latter to be understood as a conceptual and visual synthesis of complex processes.

Keywords: Research Storytelling · Information Design · Infographics · Visual Grammars · Process Model

1 Representing Research

If ‘doing research’ is absolutely the development and production of data, its communicative dimension of scientific matrix belongs integrally first to the perimeter of *data visualization* (as data mapping) and then to the field of *infographics* (as visual storytelling). In these terms, we can consider the space of visual information as a place where all those representations of processes that require a mapping-type organization manifest themselves. In fact, from the processing and transposition of data and information to the realization of narrative sequences, it is the task of the researcher-designer to elaborate specific alphabets, syntaxes and visual grammars that are consistent with the phenomenon to be communicated. Furthermore, if to design is to see in advance, the researcher-designer operates first and foremost as a visualizer, using suitable techniques to make manifest and recognizable his or her research path and the results obtained from it. The representation of the process and the result is, therefore, a visualization intended to allow the manifestation of the actions of exploration, analysis and discovery.

On the basis of this preface, some observations on the role of infographics in the representation of research in Design are proposed below. More specifically, we intend to think about the theme of information visualization applied to project-research, as well as on the nature and elaboration of research communication models, both in terms of ‘process models’ and ‘outcome models’ that derive from research and simultaneously develop as tools of the research itself. First of all, the investigation into the representation of research brought three main issues into focus: 1) how to represent *what is already known*; 2) how to represent the research *process*; 3) how to represent *what is still unknown* or only imaginable. Accordingly, the topics of interest that will be here examined are: 1) the representation of the known and visible through the tool of *scientific drawing*; 2) the representation of the intangible and invisible through the tool of *Information Design*; 3) process modelling through the tool of *hypothetigraphy*.

2 Drawings and Infographics for Scientific Representation

Starting from how to represent *what is known*, a distinction must be made between *what is known and visible* and *what is known and invisible*. In the first case, it is necessary to consider how scientific drawing has been the tool par excellence in the field of research both in the natural sciences and in design sciences such as architecture, with the aim of reproducing and disseminating knowledge but also and above all as a tool for advancing knowledge itself in operational terms. What distinguishes scientific drawing is the objective representation starting from the direct observation of phenomena, just think of the production of graphic and illustrative material about human anatomy produced by Leonardo da Vinci or the three-dimensional cutaways of structures and buildings from the classical or imperial era reproduced for study and dissemination by 16th and 17th century architects.

At the same time, with regard to the second case, as the representation of *what is known but not visible* (such as information and complex phenomena), we can point out what Manfredo Massironi writes, who, taking up the thought of Wertheimer, Koestler and Parry, argues that: “There are conditions in which only reasoning by images makes it possible to solve a problem or achieve an otherwise unattainable cognitive result” [1, 119]. Indeed, as already in the time of the pioneers of information between 1700 and 1900, the representation of information constituted and constitutes, also nowadays, a fundamental tool for research in both operational and communicative terms. It is based on the subjective representation from the interpretation of the phenomenon: we can recall the use of the mapping of London by the doctor John Snow (1854), which enabled him to identify the points of diffusion of cholera in the Soho district, or in the same year the applications of statistics and data representation by the nurse Florence Nightingale on the disastrous English health system in the aftermath of the Crimean War (1853-56).

Even today, in the ‘data society’, the aim of Information Design (the branch of Visual Communication Design that deals with giving data-information a visual dress according to specific visual grammars) is the representation and revelation of the complexity of the phenomena it is intended to synthesize, through a process that involves the observation of the phenomenon described through its information, the translation of the data derived from it and their interpretation in order to allow a narrative development. As Edward Tufte

[2] states, the aim of these representations is to reveal the complexity of phenomena. It is no coincidence that the importance of information visualization (*Data Visualization*) lies in the set of strategies that allow accessibility, by means of a specially designed language, to complex theoretical knowledge and, due to the aforementioned heuristic value of infographics, to the use of the model as a design tool, and not only as a communicative artifact. With regard to visual models, it is worth emphasising how they allow us to observe the frame of the phenomenon in its entirety and the ways in which each element relates to the others and to the whole, because they “Help us explain and understand how things work by simplifying complexity; [...] they can broaden our perspective; [...] they provide a common conceptual frame of reference just like a vocabulary; [...] they clarify relationships, identify key elements and eliminate confounding factors” [3, XXV].

3 Visual Process Models

The result of this process is an information architecture that aims to present, compare, organize, and relate information, through the encoding of a visual language. From the research and systematization of the main theoretical contributions on the linguistic analysis of the “visual text”, some attempts at taxonomic synthesis are characterized by the affinity of the proposals. In particular, the contributions of Robert Horn [4], Jörg Von Engelhardt [5], Massimo Botta [6] and Riccardo Mazza [7] suggest an interpretation of the graphic artefact structured according to a grammar, similarly to what happens with the verbal text (morphology, syntax, semantics). Starting from this assumption, the reading of visual composition through three progressive levels is proposed here:

- 1) A graphical-formal level based on *morphology*, which concerns the external aspect of representation is addressed, i.e. what is visually perceived, broken down into its basic elements (morphemes);
- 2) A logical-relational level based on *syntactics*, i.e., the structural composition and configuration of the individual elements that compose it, according to a relational logic in a formal way;
- 3) A heuristic-interpretive level based on *semantics*, i.e., on the interpretation of the visual representation, hence on the meaning contained within it, interpreted through a relational logic in a semantic way.

According to the proposed levels suggested by the study of *Visual Language*, we can think of applying this structure also to the representation of the research process, considering research as “observed phenomenon”¹. The transition from the data collection phase in the different steps of the research (desk, field and in the desk + field synthesis) to a data design operation in narrative systems is verified by studying the design dynamics through the linguistic component of the research data configuration, according to the morphological, syntactic and semantic levels of a *process model*.

¹ In the terms of Complexity Science, complexity does not lie in the nature of phenomena, but in the code used to model the phenomenon: «If complexity is not in the nature of things [...], it would reside in the model that the observer constructs for himself of the phenomenon he considers complex. [...] Complexity is consequently no longer a property of the Observed System, but of the Observing System» [13, 67].

On the topic of the representation of the process model, it is necessary to point out how the researcher/designer/model-maker's point of view unequivocally influences the development of the model. This particular perspective is developed by the so-called "Second-Order Cybernetics", in particular by Heinz Von Foerster's work "Observing Systems" [8], which emphasizes that cognitive processes are recursive processes of computation and that the phenomena we observe are, in reality, representations of relations. This concept brings with it the consideration that the observer is, therefore, part of the observing system, introducing the shift from linear causality to circular causality. The link between Second-Order Cybernetics and Design is also supported by contributions from Hugh Dubberly and Paul Pangaro, who, quoting Ranulph Glanville, argue that: «Cybernetics and Design are two sides of the same coin» [9, 73]. These arguments also bring the theme of "drawing" with its baggage of perceptual assumptions into design research. If drawing is, therefore, the representation of thought, that is to say, the designer operates according to his or her own "language of thought" [10] which forms the basis of the "internal conversation" between drawing and designer [11]. The conversational model introduced by Schön [Ibid.], later defined by Gabriela Goldschmidt as the "dialectic of sketching" [12, 37], is what enables the designer to handle different levels of abstraction simultaneously and build the bridge that allows him to transit from the problem space to the solution space. If design is founded, therefore, on the observer-observed system relationship and interaction, then it is possible to think that the encoding of a language and the tool of drawing constitute the fundamental elements of a process model that connects thought and drawing in a conversational way.

Having mentioned the first two instruments of research representation (scientific drawing and infographics) and the subject of modelling, it remains to describe a third tool that concerns a key aspect of scientific research, namely its uncertainty in the process phase. If the scientific drawing represents what is directly observed, and infographics act as a translator of what is not visible such as information, it is necessary to reflect on how to represent the intermediate stage that straddles the state of the art of research and its results, i.e. the formulation of hypotheses. As argued in the relevant literature, in Design the formulation of hypotheses for solutions to a given design problem is never presented as a single proposal but as a framework of multiple hypotheses [14, 15] or even as a system of solutions [16–18].

Therefore, in order to deal with the representation of *what is still unknown* within the research process, we report the interesting concept of *hypothetigraphy*, elaborated by Manfredo Massironi in 1982. Massironi defines *hypothetigraphy* as a graphic product that describes processes that are not directly visible but can only be speculated on the basis of fragmentary data collected experimentally: "[...] we could define all this vast cognitive-communicative production with the term *hypothetigraphy*, meaning that graphic product that contributes to giving visual form to hypotheses formulated to explain the behaviour or functioning of natural conditions that have been intuited or observed experimentally and of which an explanatory model is constituted" [1, 126]². Massironi further clarifies that the graphic image behaves, in this sense, as a hypothetical model

² The visual models described here can be defined as "intuitive models", as: «allowing a visualization or mental representation of processes that are only formally described by theory» [19].

of a phenomenon and of the knowledge about it that has accrued up to that moment and he identifies geometry as the tool on which hypothetigraphy is built, due to its potential for bridging the empirical and the abstract.

4 From Hypothetigraphy to Infographics: From Process Model to Result Model

This leads us to think about the great value of hypothetigraphy in design research, considering in it the need to move from theory, which presupposes invisible conceptual contents, to graphic models of communication of the same, which instead presuppose the visual and perceptible concretization of information (Fig. 1).

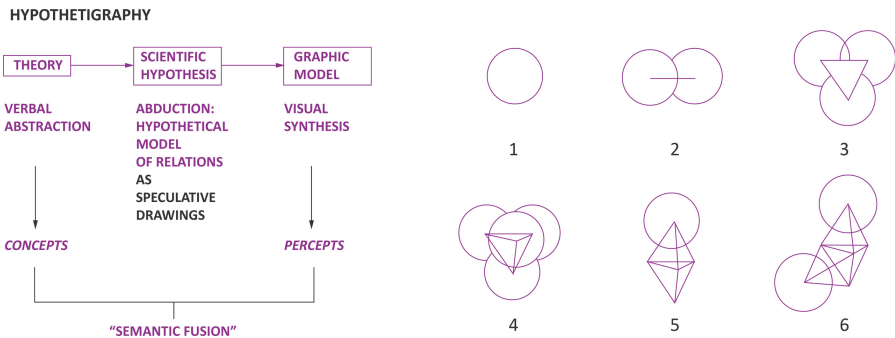


Fig. 1. On the left: From theory to model. The role of abduction and hypothetigraphy in Design research; on the right, a reproduction of hypothetigraphy by Manfredo Massironi (1982). Representation by the authors (2022).

In other words, the shift from process models to result models. We have therefore associated the subject of hypothetigraphy with the cognitive modality of abduction³, which is typical of the design discipline, as it is based on the elaboration of hypothetical models of relations [12, 20, 21], thanks to which it is hypothesized that it is possible to realize what Horn calls the “semantic fusion” between *concepts* and *percepts*, that means perceiving and interpreting both the specific aspects of verbal concepts and visual elements: «In traditional communication, *concepts* have been treated verbally and *percepts* have been limited to separate boxes in which illustrations or diagrams appear. Visual language emphasizes the selection, inclusion and integration of percepts with concepts» [4, 95]. A conceptual advance on the subject of hypothetigraphy has been proposed by Giovanni Anceschi, who argues that hypothetigraphies are, by definition, only such for a certain period of time, that is, until the phenomenon or artefact they represent becomes visible, known and representable with certainty [22]. Therefore, we can hypothesize

³ On the concept of “abduction” as a third mode of investigation, it is specified that: «A speculative design cannot be logically determined because the mode of reasoning involved is essentially abductive [...]. Deduction shows that something *must* be, induction shows that something *is* actually operative, abduction suggests that something *can* be» [12,19].

that, should this happen, what is made known by research would make it possible to move from a hypothetical to an infographic type of representation (Fig. 2). An example of this transition is the evolution of scientific knowledge on the configuration of the universe and the solar system, starting from the Ptolemaic model, passing through the Copernican model (both hypothetigraphical representations) to the three-dimensional models elaborated by NASA (infographics as they are representative of a phenomenon that has finally been directly observed and made visible).

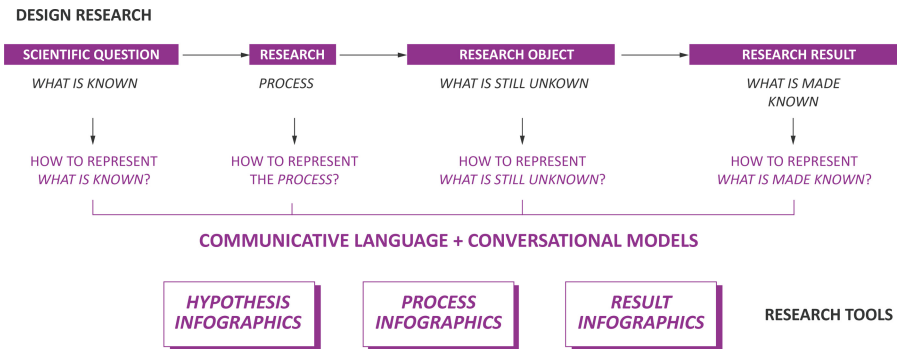


Fig. 2. How to represent Design research? The proposal of conversational models for the representation of research through its phases and tools. Representation by the authors (2022).

5 Conclusions

In conclusion, we can state that the topic of research representation can be investigated in its communicative and instrumental modalities through the consideration of conversational models that can be developed as infographics of hypothesis, process and outcome through the encoding of communicative languages, which in turn serve as tools for the research itself. It is useful to recall that such examples of models are composed of a set of signs to describe, explain or predict something, but above all that models manage to abstract reality while simultaneously preserving its essence [23]. The subject of modelling brings with it the reciprocity between the act of drawing and the thought associated with it, evidence that leads us to state that understanding a problem depends on its very representation [24]. Drawing combined with designing also possesses its own complexity, which for Tomás Maldonado [25] falls within the field of cognitive psychology. He states that drawing in order to design manifests itself at the same time as “drawing while designing” and “designing while drawing”. And it is precisely this interacting co-presence between the tool (drawing) and the end (designing) that allows progress towards the sought-after solution. In this bivalent process, the linguistic (semantic) component of design is decisive and central if we consider that through the configuration of the elements-instruments it is possible to study the dynamics of design [26]. If the definition, from a cognitive point of view, of design as an activity of information processing [27] is valid, as well as the “dialectic of sketching” as the transition from problem to

solution [16] the sketching-design symmetry recalls the theme of the “representation of research”, mentioned above, not as a mere portrayal choice, but as a processual tool before and after the research itself, in the sense that research requires a communicative language when it instructs, processes, returns and disseminates its outcomes [28].

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