Design Methodology: From the Interpretation of Portuguese Interior Design Projects Through Virtual Reality

Liliana Neves and Fátima Pombo

Abstract This article discusses a design methodology's model to interpret Portuguese historic interior design spaces from the project's definition to its recreation in Virtual Reality. This methodology is based upon 5 phases: Project Definition; Data Collection; Data Processing and Analysis; 3D Space and Virtual Space. As this investigation intends to interpret interior design and architecture projects, hermeneutics appears as the elected framework for the design methodology presented in this study. The hermeneutical design interpretation enhances to understand the project's collected data and its context till the application in the three-dimensional modelling of the space and consequently how its recreation occurs in the virtual space. This methodology is intended to be replicated in other historical interior spaces, even those that are no longer physically available. In this sense, the study is aligned with the Digital Era challenges and the opportunities within contemporary paradigms. This research interacts with Digital contents as a channel to learn and to preserve knowledge and cultural heritage.

Keywords Design methodology · Interior design projects · Hermeneutics · Virtual reality

1 Introduction

This article, part of a doctoral research in Design, aims to translate domestic interior projects into Virtual Reality, as a way to preserve its memory and contribute to ensure its cultural heritage. It discusses the design methodology developed as a proposal to achieve the main goal referred. Therefore, the spaces transformed into Virtual Reality become a digital content that offer information in a more accessible and captivating format. Current times have turned the moment of the digital era and as consequence our day-to-day life has started to consume and produce digital content massively. Thus, this investigation is in line with the spirit of time pro-

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moting and facilitating access to information of Portuguese historical interior design projects.

Starting from the Post World War II, it is to say that the social and economic framework of the world required a new approach to respond to the production of goods, services and information. In the 1960s, at the HfG Ulm, design methodology became an essential discipline, as it allowed the designer to respond to problems that consisted not only of form, aesthetics or production, but also of a context and target audience. The names of Tomás Maldonado and Gui Bonsiepe stand out and are known to turn the project activity into something more 'scientific', through a methodology more based on mathematics and functionalism. During the 1970s the paradigm and the methodological orientation has changed, it is clear that the production of knowledge is not a uniform and linear process, highlighting the work of Feyerabend who was opposed to the thought of the existence of a single method and in turn believed that knowledge should favour variety and be compatible with the humanist conception. In the 1980s, human sciences gained strength and the design methodology started to be dictated by two components: the experience and hermeneutic. Designed objects came to their own language not only ordered by their function, but they have also started to be seen as a form of communication, being susceptible to interpretations. In this way, semiotics, hermeneutics and phenomenology became a research instrument allowing the interpretation and meaning attribution as a contribution to the methodological process in Design.

As this investigation intends to interpret Interior Design and Architecture projects, hermeneutics appears as the elected basis for the Design methodology applied in this study. Thus, this hermeneutical design interpretation allows not only to understand the project and its context, but also to interpret the collected data, making connections and creating designed phases that integrated and complemented each other, allowing their application in the three-dimensional modelling of the space and consequently in the creation of the Virtual Space.

Once this methodology is based on documents' analysis as technical drawings, photographs and texts, it can also be applied to historical domestic interior design projects that are no longer physically available or are not possible to be accessed.

2 Design Methodology: State of the Art

With the Post World War II Era, the social context, economic power, the increase in wages and population, products and services provided offer was much more than of essential goods like products and services for private consumption and tourism. In these circumstances, Design starts to play a fundamental role in society, to create functional and aesthetically appealing products and services. According to Maldonado (2012) in 1961 the role of the designer "consisted of designing the shape of the product" (p. 13) as "supposed aesthetic appearance, without taking into account the nature of the technical-productive process" (p. 13).

In 1962, the first *Conference on Design Methods* takes place in London, where Design Research Society was born, contributing strongly to the development and creation of new design methodologies.

According to Bürdek (2006, p. 251), the design methodology originated in the 1960s at HfG Ulm followed the increase in the types of task developed by Design for the industry of the time. In 1964, Christopher Alexander was considered one of the fathers of Design methodology and professor at Ulm. He developed a methodological process focused on the problem between the form and the context, addressing the problems of the project in a deductive way. The First-Generation Systems were characterized by dividing the design process into several well-defined steps: (1) the problem; (2) collecting information; (3) information analysis; (4) development of alternative solutions; (5) evaluation of solution; and (6) test and implementation (Bürdek 2006, p. 252).

Tomás Maldonado and Gui Bonsiepe were, in 1964, responsible for the first retrospective on "the scientification of project activities" (Bürdek 2006, p. 254). Both professors at HfG Ulm were able to translate their interest in science and methods into design teaching, basing their methodologies on mathematics and on functionalism. By the end of the 1970s, there was a change in paradigms with a new methodological orientation. "With the term paradigm shift it should become clear that science does not advance or collect more knowledge in a uniform way, but that from time to time it lives on revolutionary failures or radical modifications that change current thinking" (Seiffert cit in Bürdek 2006, p. 256). In this sense, Feyerabend's (1993 [1975]) work was very imperative, as it was opposed to the thought of the existence of a determined method that should be accepted unanimously. Thus, objective knowledge lacked several ideas, favouring variety as the only method compatible with a humanistic conception.

Until the 1970s, the methods used were mostly deductive (from the outside to the inside; from the general problem to the specific solution), but with those new paradigms the work started to be more intuitive (from the inside to the outside; specific project for a specific market). In the 1980s, the humanities gained prominence and Christopher Alexander took a fundamental role in the development of a new methodological approach that had the unity of form and context as its main concern. This argument was developed in *Pattern Language* (Alexander et al. 1977), being the *context* generally referred to practical requirements that the designer must take into account when designing a new project. These requirements are no longer just a matter of form but are as well a matter of the meaning of things. In this decade, two authors stood out, and they are still a reference in the teaching of design methodology nowadays: Bruno Munari, with his work in *Das Coisas nascem Coisas* (2014) [*Da Cosa nasce Cosa*,f 1981] and Gui Bonsiepe in *Metodologia Experimental: Desenho Industrial* (1984).

According to Munari "the design method is nothing more than a series of necessary operations, arranged in a logical order, dictated by experience. Its objective is to achieve the best result with the least effort" (2014, p. 20). For Munari "the design method for the designer is neither absolute nor definitive; it is something that can be modified if other objective values are found that improve the

process" (2014, p. 21). Munari draws his methodology between the problem and the solution, creating several steps, where experimentation is the main contribute to get the solution. Also, Bonsiepe (1992) argues that the design methodology should offer two things "a series of guidelines and clarify the structure of the design process" (p. 204–205), thus containing "a praxiological component and a hermeneutic component" (p. 205). For this author, the mindset is not just to present a step-by-step structural way of solving problems, but to interpret several hypotheses or alternatives to achieve the solution. The 1990s brought a new reality —digitalization. In this sense, Alexander's methodology gains a new context in the development of hardware and software where the user starts to have a fundamental role. In short, it is considered that mainly from the 1970s on, Design presents itself as an everyday language life associated with the product's language. Selle also argues that "Language is a mean of interpreting reality and the language of the product allows the consumer the possibility of identification with the product and its verbal proposal of reality level often seems irrational and dreamlike" (Selle cit in Bürdek 2006, p. 286). Following this argument, Donald Norman (2013) writes: "What people need, and what designers must provide are signifiers. Good design requires, among other things, good communication of the purpose, structure, and operation of the device to the people who use it. That is the role of the signifier" (p. 14).

Since this investigation is focused on understanding and interpreting the language associated with Architecture, Design of Interior Spaces and its interconnection, we could consider semiotics, hermeneutics and phenomenology as possible methodological approaches. However, for this investigation, hermeneutics was the selected one, once it allows the researcher to relate content of various contexts theoretical frameworks. Regarding this methodological approach, Snodgrass and Coyne wrote:

> The operation of the hermeneutical circle is not the employment of a method. It is not something we can choose to use or not, in the manner of a tool. It is, rather, embedded in all thought and in all action. (Snodgrass and Coyne cit in Soares and Pombo 2010, p. 1353)

In effect, for Snodgrass and Coyne (1997) the interpretation is always based on pre-existing references, which will question and formulate hypotheses for a better understanding of the project. Interpretation based on hermeneutics recognizes and understands signs in order to interpret their meaning. The hermeneutic circle relates the meaning of the parts to the whole in each interpretation: "The whole and the part give meaning to each other; understanding is circular" (Snodgrass and Coyne 1997, p. 72). For both authors, interpretation is a continuous circle of small interpretations that contribute to interpret the whole. Indeed, studying an interior design/architecture project is not just about the building as a structure. There is a need to analyse its historical, cultural context, the physical environment where the building will take place, the materials to be used and the architect/designer intentions expressed or emphasized in the interior space in dialogue with the exterior environment.

3 From the Interpretation of Projects to Virtual Reality

3.1 Project Context

As mentioned above, this article is part of the investigation related with the PhD thesis in Design entitled *Da interpretação do projeto à realidade virtual para a preservação do design de interiores doméstico Português* [From the interpretation of the project to Virtual Reality for the preservation of Portuguese domestic interior design]. This PhD research has been developed around the documentary base *Arquitectura* Magazine which allowed us to select the domestic projects involving architectural design and interior design that were most prominent in Portugal, paying special attention to Portuguese modernism (Neves and Pombo 2018, 2020). Naturally the *Ofir* House (1957–1958) by Fernando Távora was a project to try out for several reasons (Neves and Pombo 2021): (1) marks a turning point at the *Arquitectura* Magazine Editorial's perspective on Portuguese modernism style; (2) it is recognized as a landmark in the history of Architecture and Interior Design in Portugal; (3) it almost disappeared after a violent fire that left it in ruins and abandoned for some years. As one of the PhD project goals is to contribute to learn about Portuguese Interior Design history, recently it was developed a preliminary study that has allowed to understand if Virtual Reality could be a complementary learning tool (Neves et al. 2020). The results showed that students are more willing to learn through Virtual Reality because they consider it to be an innovative teaching methodology, a more engaging technology and more captivating way to study.

Therefore, in the path of previous research, this article is consequently focusing on the establishment of a design methodology that not only will recreate the *Ofir* House in Virtual Reality as an experimental project (Neves and Pombo 2020), but will also offer a methodological tool to recreate other historic domestic spaces in Virtual Reality as a contribution to the History of Portuguese Interior Design.

With this methodology it is intended to: (1) accomplish the three-dimensional digitalization of historic spaces and make it available to the public, especially as a tool to learn about history; (2) recreate digitally historical domestic space, whether it still physically exists or not, with the great potential to enable the designer/researcher to create virtual spaces that have already been destroyed or that went through processes of transformation and change.

3.2 Proposal Methodology

Regarding this project, it is important to emphasize that its core is not just about creating a methodology per se but about developing a methodology that can be applied to different historical interior design projects to create virtual spaces.

The methodology then consists of 5 phases namely: Project Definition, Data Collect, Data Processing and Analysis, 3D Space and Virtual Space. As can be seen in Fig. 1 these phases are intertwined with hermeneutical phases, as: Definition, Understanding, Interpretation, 3D Application and Virtual Reality Application.

The image above also shows in detail several topics for each phase that will be discussed below.

Phase 1—"Project Definition" defines and selects the project that will be studied. At this point is necessary, first and foremost, to make a literature review about the project that will be interpreted and translated into Virtual Reality. As it is possible to observe in Fig. 2, two types of criteria have been taken into account with the intention of finding and delimiting the project that fits the current research aims and goals: inclusion and alignment.

The inclusion criterion defines that this is a Portuguese domestic space project, with the Interior Design component designed by a well-known author, goes through a project of historical relevance, ensures that the project was executed/built and that it is possible to access several types of documentation/information about it. The chosen project must check all these pointed criteria.

The alignment criterion complements information about the project by keeping the focus on the research objectives, offering multiple choices.

Phase 2—"Data Collect" describes three types of data: (1) technical documentation (plans, sections and construction details), especially from a documentary archive of the architect/designer, (2) photographs of the constructed building (interior and exterior), and (3) complementary textual information (descriptive memory, author's notes, scientific and non-scientific texts). Figure 3 shows the collected data interconnection that promotes the understanding of the project.

It was decided to make a distinction between the two types of images because the photograph reports the building as a constructed piece and the technical drawing only reports the intention of the architect/interior designer. On the other hand, because photography is not an orthogonal image, it enables to differentiate volumetry, spatial and object relationships, light-shadow, materials and textures.

Phase 3—"Data Processing and Analysis" regards the step of interpretation. It is developed through the empirical triangulation of the three data entry mentioned in phase 2. As depicted in Fig. 4 this "Data processing and analysis" expands through six complementary sections, creating a representation of and hermeneutical circle.

In this Phase 3 the know-how of the researcher is important because it facilitates the design of data interconnection and the interpretation of the collected data. It was used a vectorial software that enables to place the collected data side by side and therefore to make connections between the information and take notes for further developments. For that reason, the six established sections are translated into six parameters of interpretation:

1. Digital plan: convert the documentary plan into digital, CAD. The scale of technical drawing must be respected.
2. Structure: analysis and interpretation of the plan with section, technical details and its interconnection with the collected photographs.

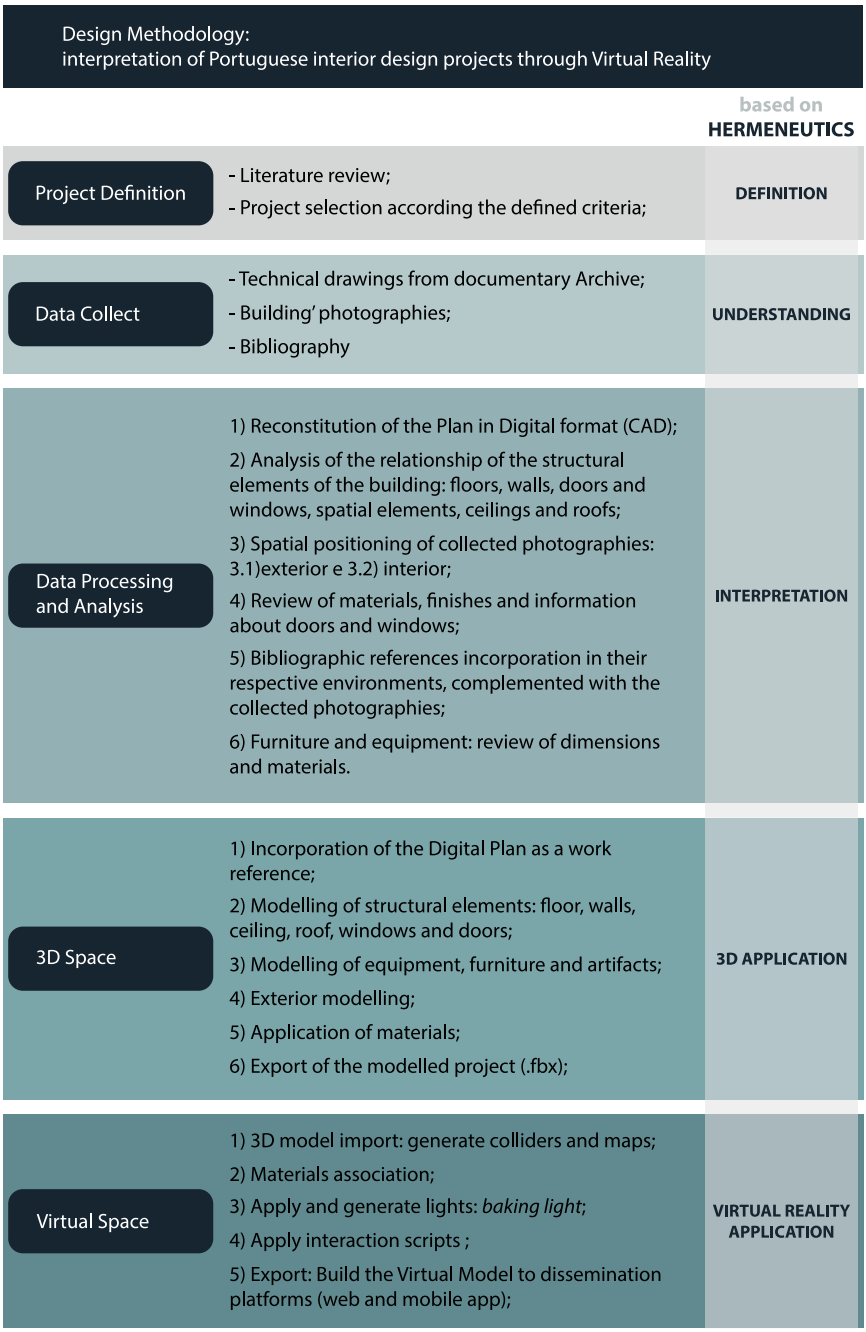

Fig. 1 Design Methodology based on Hermeneutics. *Source* authors

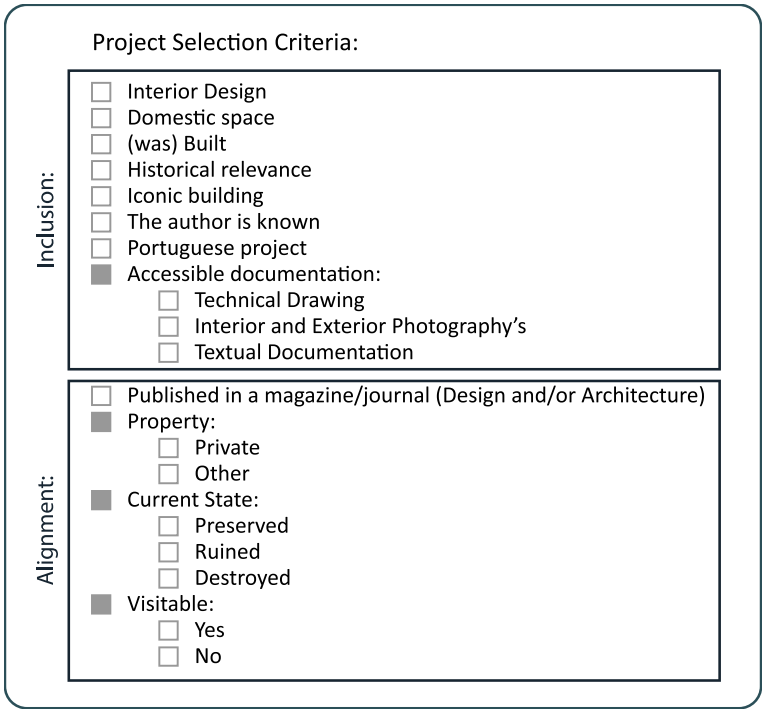

Fig. 2 Project Selection criteria definition. *Source* Authors

Fig. 3 Representation of Data Collection Triangulation. *Source* Authors

3. Spatial positioning of the collected photographs: understand and relate photography with the space and its point of view. It allows to interpret the volumetry of space and objects, light and shadows, materials and textures. At this point is possible to observe the global project.

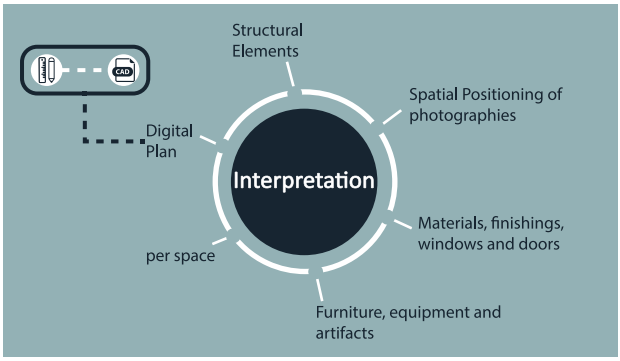

Fig. 4 Representation of the hermeneutical circle design for the interpretation of Portuguese historical domestic spaces. *Source* Authors

4. Materials, finishings, windows and doors: intertwine the plan with meta data annotation. These meta data are collected through the analysis of the bibliography. Here it is possible to become aware of some details that are not showed in photographs.
5. Furniture, equipment and artifacts: interconnection with photographs and technical drawing to find the right dimensions, materials and finishings.
6. Per space: if possible, aggregate on the same page all the information collected about a given space.

Phase 4 and Phase 5 are related to the interpretation applicability.

Phase 4—"3D Space" is central. Here the three-dimensional space is modelled, which means all structural elements: windows, doors, equipment, furniture, other artifact, exterior environment and materials applied to all of them—this step is done in 3D max (or other compatible software). It is very important to pay attention to details because the collected and analysed data (interpretation) are ensuring and crediting all components modelled. So there is a constant feedback that complete each other. After its conclusion, the 3D model is exported using.fbx extension and becomes a digital object by its own.

Phase 5—"Virtual Space" expresses the Virtual Reality applicability. Here the 3D model is imported from a program that allows to create a Virtual Reality Space (it can be used Unity). While importing the model it must be generated the maps for the correct application of the textures and the automatic colliders. It was chosen the URP (Universal Render Pipeline) in Unity because it is a Scriptable Render Pipeline compatible with the largest types of dissemination platforms as it is an interest of this research to convert this project into web and android platform. Materials were here reapplied, upgrading the imported materials to the URP, created and baked lights, and scripted interactions for future users with *first person view* and other scripts that allow users to know more about the Portuguese historical domestic space chosen to be interpreted.

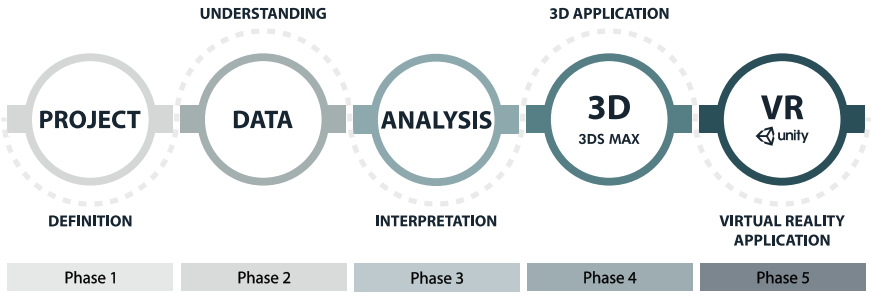

Fig. 5 Infographic of the proposal methodology. *Source* Authors

In summary, the model of the methodology proposal is visually synthetised as depicted in Fig. 5, and it begins with the definition of the project (phase 1) through the designed criteria, then is necessary to understand the project by collecting all the reliable data available (phase 2). The interpretation (phase 3) is then initiated, where the hermeneutical circle has a major importance to interconnect the collected data and create reasoned hypotheses. After that, all information and interpretation is applied for the 3D Space creation (phase 4) and becoming a 3D model that can be applied to the creation of a space in Virtual Reality (phase 5).

As already mentioned above, the dissemination process involves creating two ways of Virtual Reality access: through the web or using the mobile phone. However, on both platforms, the project is accompanied by an integrated side page where future users can find information about: (1) this particular investigation; (2) a brief description of the historical project; (3) a brief note about the author of the project (architect/designer); (4) complementary bibliography and technical information, namely instruction about how to navigate across the virtual space.

4 Final Considerations

This article demonstrates a design methodology that comes from a research that has been developed in a PhD thesis in Design, where is intended to create historical projects in Virtual Reality. This research has the *Arquitectura* Magazine as documentary base and focuses on Portuguese domestic interior design spaces, with special attention to Portuguese Modernism. *Ofir* House appears as the case study for this experimental project.

A Design methodology proposal is discussed in 5 phases, each one intertwined with a hermeneutics framework.

The knowledge gathered enabled the creation of a reliable virtual space based on the interpretation of historical domestic project. With this innovating research it was conceived a design methodology that has been tested in all phases in order to be ahead successfully implemented. In effect, this methodology is intended to be

replicated in other Portuguese historical domestic interior spaces, even those that are no longer physically available. Thus, this methodological approach enhances the preservation of the memory of specific projects and the study of Portuguese Interior Design. In this sense, this research is aligned with the Digital Era challenges and opportunities within contemporary paradigms. This research interacts with digital contents as a channel to learn and preserve knowledge and cultural heritage.

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