Virtual Reality for Interior Design History. The Ofir House as Experimental Project

Liliana Neves and Fátima Pombo

Abstract In a world where technologies are becoming a current interface in daily life, this study is aligned with the digital era and the advantages obtained from the Virtual Reality in order to extend the knowledge and the dissemination of Interior Design History. Teaching that subject is also a privileged academic area of enjoying the exploration of virtual spaces and of learning through an experience closer to the reality. This article discusses the experimental project that enlightens Ofir House designed by the Portuguese architect Fernando Távora (1923–2005) through Virtual Reality. Ofir House, as a landmark in Portuguese Architecture and interior design, is known as a "compound" between modernism and tradition, in a criticism of international architecture that, at the time, Portugal tried to emulate. This experimental space boosts the understanding of the necessary steps to create the Virtual Space and to convert it into Virtual Reality. Moreover, the methodology applied for Ofir House can be used to convert any historical domestic space from 2d to Virtual Reality, and therefore be replicated throughout other interiors. This article focuses on phase 1 and 2 of a methodology that can be extended to 5 phases. And if in effect phase 1 and phase 2 are already a coherent discussion's topic, the other 3 phases that constitute subject of another article are already emerging in the present text.

Keywords Interior Design History · Virtual Reality · Ofir House · Technology

1 Introduction

This article presents a project that uses Virtual Reality as a learning tool within the discipline of Portuguese Interior Design History. In a world where technologies are becoming in a daily basis a current interface to communicate, this study is aligned with the digital era to extend the knowledge and the dissemination of Portuguese Interior Design History. There are already some specialized areas, like medical or military that use already immersive Virtual Reality as a form of training, allowing the

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formative experience to be performed as realistically as possible. At the same time, we have seen an increase in the creation of virtual platforms allowing to visiting places from our armchair. Therefore, our intention is to draw the attention of implementing an existing technology as an innovative teaching tool in the course of Portuguese Interior Design History.

As Margolin advocates:

> "First of all, a few young people have any solid understanding of design before they enter a design program. One function of a design history course is to explain to them what they have chosen to study and to assert that design is not a fallback profession for aspiring artists, but an independent practice with its own culture" (Margolin 1996, p. 1–2).

Following Margolin, it is worth to say that the programmatic content of history should develop a critical attitude and a better link between history and issues of design, focusing on all the components of transdisciplinarity and on the challenges of the practice in future contexts. In the course of Interior Design, students have the opportunity to study projects where 'issues of design' as concepts like volumes, objects, materials, scales, atmospheres are present and that later on, in the professional life, will be real demands to face and to solve.

According to Babich (2018) nowadays the learning process has two problems: one is teaching being focused on the retention method and the other is the massive amount of information provided in a short period of time. Babich writes "being educated isn't the same as being informed" and as a result of the amount of information "they become bored, disengaged, and usually not sure why they are learning about a topic in the first place" (2018). Virtual Reality offers a different learning scenery based upon a contemporary 'language' with which students are familiar.

Why to choose Ofir House as experimental project to showcase the steps taken to convert an interior into Virtual Reality?

The Ofir House designed by the architect Fernando Távora is a landmark in Portuguese architecture and interior design. It was known to be a "compound" between modernism and the traditional, in a criticism of international architecture of which, at the time, Portugal tried to emulate (Neves and Pombo 2018). In terms of Interior Design, the house presents a modern flow through a tripartite plan, where the service, personal and common spaces are well defined. The house is also marked by the use of natural and endogenous materials, like the natural stone and wood, chosen by the architect in compound with modern material like apparent concrete. This house is a global project where the architect not only designs the building but also draws and details many essential equipment and furniture.

As result of this study it is intended to support the teaching of Portuguese Interior Design History by allowing an interactive experience in the learning process, fostering in the students more interest and knowledge for the topics of the above-mentioned course. Moreover, it underlines the argument that the interpretation of an historical space can be aligned with the digital era and benefit from the Virtual Reality knowledge.

2 Learning Interior Design History Through an Emergent Technology

Table 1 depicts the higher education framework of Interior Design Courses in Portugal referring to the level of education, course and institution and the history subject in the course. There are four institutions that offer a degree, two a master's degree and one other institution that offers a postgraduate degree. Among diverse approaches to Interior Design's core we do agree with Ching and Binggeli (2015) while underlining it as a transdisciplinary subject that should include architecture, equipment and furniture, materials and finishing's, lighting, etc. and mainly the relationship between man and space.

As it is possible to observe, usually, in the 1st year of the course, considering the degree level or the postgraduate level, history is introduced in the wider context of both Arts and Design in general and only in the 2nd or 3rd year it appears more focused with the specificity of the course/profession, by integrating history of interiors, history of space or history of environmental equipment. In the master's degree level history is transformed in a discipline focused on theory and critic of design. That means that is only in the 2nd year of the degree level that history accommodates in the studies plan some content closer to the profession of the interior designer to be.

In the last decade various scientific studies have shown that Virtual Reality with immersive and interactive experience is helping in the learning process in different scientific areas because it increases emotional reactions to what students are experiencing, which is fundamental to forming memories (Lin and Lan 2015; Mills and Araújo 1999; Rahaman and Tan 2011; Roussou et al. 2008).

Before computers, people used books as the main tool for the learning process. In the digital era, even if there are still books available, many of them turned into eBooks. Using a digital technology doesn't mean that the fact retention method does not apply anymore. However, some features related with the Virtual Reality are "powerful for education" as Babich (2018) argues:

1. "better sense of place" (VR allow not just words and illustrations, but the students to explore and live an experience);
2. "scale learning experiences" (when is not possible to visit a space or the reference that we have are just words and images, sometimes that is not enough to understand the relation between men, objects and space. In this case VR give us the purpose and create engagement);
3. "learning by doing" (in some areas the training is vital for the success of the student, however, is too expensive or too dangerous, so in this case VR becomes more affordable and safer);
4. "emotional reaction" (as we have already described a visceral reaction is important to create memories);
5. "develop creativity";
6. "visual learning" (most of the design students are a visual learners and in the case of interior design it is the three-dimensional visualization where VR allows

Table 1 Higher education of interior design in the Portuguese context (2020). *Source* Authors

Level of education	Course and institution		History subject in the course
Degree	**Interior and Equipment Design** at Polytechnic of Castelo Branco—School of Applied Arts	(1st year)	**Art** History
		(2nd year)	**Design** History
		(3rd year)	None
	Interior Design at ESAD Matosinhos	(1st year)	**Art** and **Design** History
		(2nd year)	**Interiors** History
		(3rd year)	None
	Urban and Environmental Design at Polytechnic of Viana do Castelo—School of Technology and Management	(1st year)	History of **Art** and **Culture**; History and Critic of **Design**
		(2nd year)	None
		(3rd year)	History of **Environmental Equipment**
	Interior and Spatial Design at Polytechnic of Leiria—School of Arts and Design	(1st year)	None
		(2nd year)	History and Culture of **Design**; Theories and History of **Space**
		(3rd year)	History and Culture of **Design**
Postgraduate degree	**Interior and Spatial Design** at Polytechnic of Oporto—School of Media Arts and Design	(1st year)	**Design Culture**
Master's degree	**Interior and Furniture Design** at Polytechnic of Castelo Branco—School of Applied Arts	(1st year)	Theory and Critic of **Design**
		(2nd year)	None
	Interior Design at ESAD Matosinhos	(1st year)	**Contextual Studies**
		(2nd year)	None

the students to understand the relations between all components in the project: volumetrics, objects, textures and materials, lights);

7. "users are ready to embrace new technologies" (VR used to be dedicated to gaming, however more and more projects and research have proved that the educational experience could benefit from the integration of VR on the classroom).

Mills and Araújo (1999) develop a preliminary investigation to understand how Virtual Reality could be helpful for learning and they refer that VR should "encourage the student to explore and to learn through constructing their own knowledge patterns" and "should increase the student's motivation for learning by allowing the student to feel a sense of presence within the world" (p. 455). Regarding the

sense of presence, Champion and Dave (2002) wrote in the article "Where is this place?" that the creation of virtual environments should have the notion of 'place' (p. 93) where the 'place' must not be just identifiable but also allowing to know more about it. It is to conclude "that a sense of presence in virtual environment and real experiences is not just consequence of being surrounded by spatial setting but of being engaged in another place" (Champion and Dave 2002, p. 94).

3 Experimental Project—Ofir House

3.1 Project Context

It is intended with the experimental project of Ofir House to provide a reliable and reasoned space in Virtual Reality, available also online in order that it can be visited anytime and by anyone, helping the dissemination about the history of the project, its architect and also to contribute to the spreading of the Portuguese Interior Design History.

Therefore, the methodology created by the authors for Ofir House can be used to convert any historical domestic space from 2d to Virtual Reality adding to the literature and knowledge that can be used to teach and learn about Portuguese interior design. After presenting the space in Virtual Reality it will be necessary to create a platform that will provide the dissemination and the use of the virtual model into immersive experience. It is a learning tool that can be accessed outside the classroom anytime there is interest about the topic. In the platform will be added as much as possible additional information to be acquainted with the space in question.

3.2 The Ofir House

Following analysis of the Arquitectura Magazine between 1927–1980 there were more than 160 projects related to Portuguese domestic space. Considering the large number of projects that were depicted in the magazine, we chose Ofir House (Fig. 1) by architect Fernando Távora (1923–2005) for our project considering two main criteria: 1) the historical iconic value as it represents a turning point in Portuguese Architecture and Interior Design; 2) the learning experience of getting in touch with such space through Virtual Reality.

The Ofir House, also known as Dr. Fernando Ribeiro da Silva House (name of the owner) was designed and built between 1957–1958 by architect Fernando Távora and it is a landmark in the history of Portuguese architecture and interior design. Távora (1957) described it as a "compound of many factors" not only inherent to the architect, but also to the family who inhabited the space and the location of the building, "as far as he is concerned, the house is more than just a building" (p. 11).

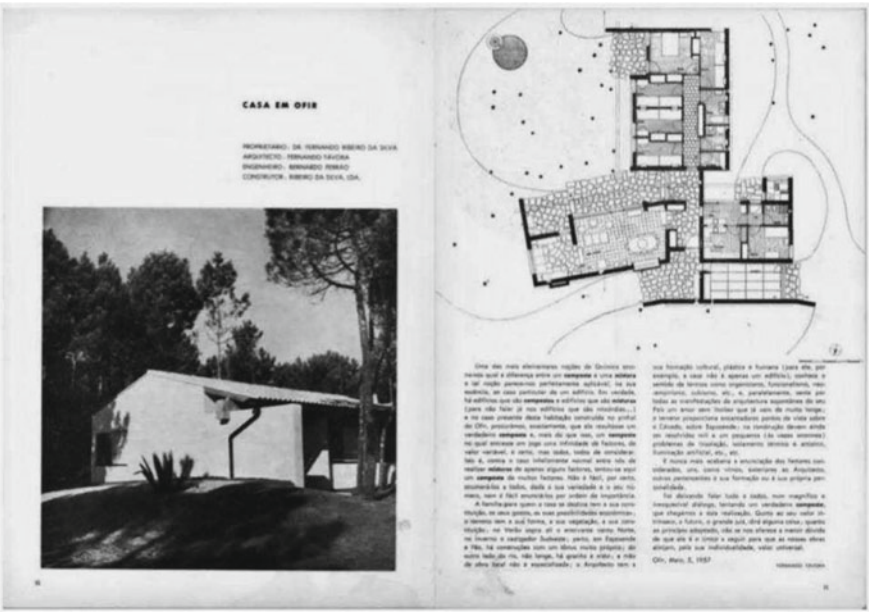

Fig. 1 Article about Ofir House in Arquitectura Magazine (July 1957), 3rd series, volume 59, p. 10–11

Távora was a young but important architect in the 1950s and the Ofir House was known for its blend of modern and the traditional (Trigueiros 1992). This building is famous for the exploration of the central living-room (Fig. 2), which demonstrates the influence of modernism on Portuguese domestic habits. Also, the plasticity that Távora gave to the materials and the way they present themselves are a representation of the traditional culture (Neves and Pombo 2018).

By the point-of-view of the interior project the house presents a tripartite plan separating the service, the common and the bedroom areas. The architect paid attention to detail not only of the building and used materials, but also to the drawing of some furniture, like built-in cabinets, chairs, tables and lamps (Neves and Pombo 2020, p. 381).

This project was also the first in the 3rd series of the Arquitectura Magazine and was also a turning point in the editorial direction and the type of publication. This volume of the Magazine not only tried to promote a new generation of Portuguese architects but also encourage those who wanted to reflect on the Portuguese reality informed by the International style, but critic about it (Neves and Pombo 2018).

This building is part of the Portugal cultural heritage and is also classified as a Portuguese Public Interest Monument (DGPC 2018). In 2011 the house was decimated by a fire leaving it destroyed, however in 2017 the reconstruction was finished with the help of the North Section of the Architects Order and the Architecture Faculty of University of Oporto. The house remains in the possession of private

Fig. 2 Central living-room in Ofir House, interior photography after construction. *Source* Luiz Trigueiros

owners and is currently part of a tourist route promoted by Esposende City Hall. Visits are made from the exterior. However, it is possible to visit the interior by prior appointment and agreement with the owners (Andrade 2017; Maia 2017; Pinheiro 2018).

3.3 Development and Contribution

This study consists of five phases as it is possible to observe in Fig. 3. The 1st, 2nd and 3rd phases are related to the creation of the virtual environment and how it will be presented to the students' target audience. The 4th phase concerns the evaluation of the virtual model and its contribution to the teaching and learning process, and to analyse any issues related to the usability of the application. Finally, the 5th phase is the dissemination step where the Ofir House experimental project will be made public, alongside other virtual spaces that could be modelled.

The virtual spaces created are based on the information retrieved from several references about the space like photography, textual documents and technical drawings.

Initially these spaces are drawn in AutoCad to enable the space to be in the correct dimension for a digital format, after that, 3d space is design using Autodesk 3d Max Studio software and the Vray rendering engine that helps to create more realistic texture materials and light. The choice of this software is personal, but also because it remains the most used rendering software in Portugal, which allows the 2D to 3D transposition methods that we design to be more easily replicable. The combination of this software and the render engine allows the results to be more realistic; a CAAD (Computer-Aided Architecture Design) is already designed to be used by architects and designers with specific objects and techniques embedded in the system.

After the creation of the virtual models, the virtual spaces are designed using the Unity 3DSoftware, thus converting the three-dimensional model into Virtual Reality. This software makes paths that can be crossed by the futures users and

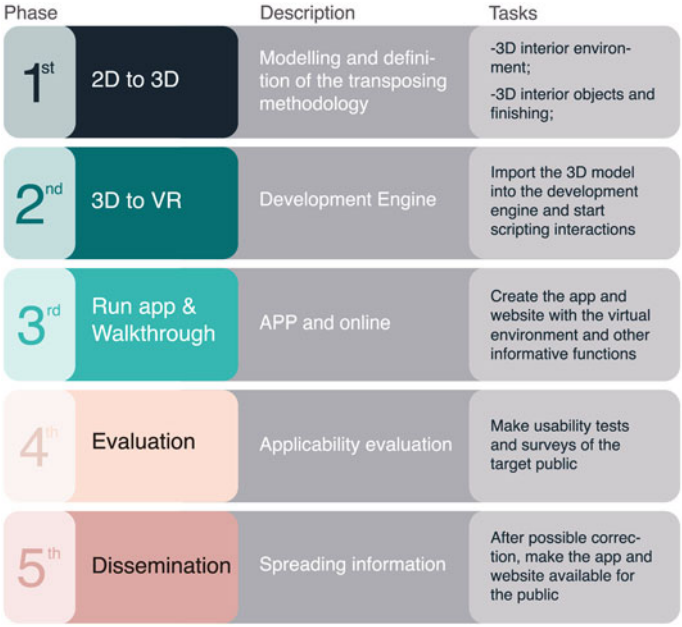

Fig. 3 Development stages for this study. Font: authors

programs scripts that enable the use of the virtual model in devices for VR display. For example, in Oculus rift or a mobile phone the user can have an immersive experience in which he/she can move him/herself and interact with the space. Or in devices like a computer, by using a mouse or the keyboard, the navigation through space can be done with keys or navigation commands.

The 1st phase is the transposing from 2D to 3D. In this step is used a methodology that helps to create not just the Ofir House, but any other domestic interior. The methodology is based on the crossing information of the analysis of images, technical drawings and texts that converge in the three-dimensional construction, as reliable and reasonably as possible.

Figure 4 showcases the Ofir House 3D model in Autodesk Studio Max where is possible to observe the interior environment and the architectural building.

The 2nd phase concerns the development engine that converts 3d into Virtual Reality. By importing 3d to the engine software starts the program of interaction among the user, the virtual space and the objects. Figure 5 demonstrates the 3d model of Ofir House imported to Unity where it is possible to script the interaction of the future user with the space as well as to build the app and to export to the dissemination platform.

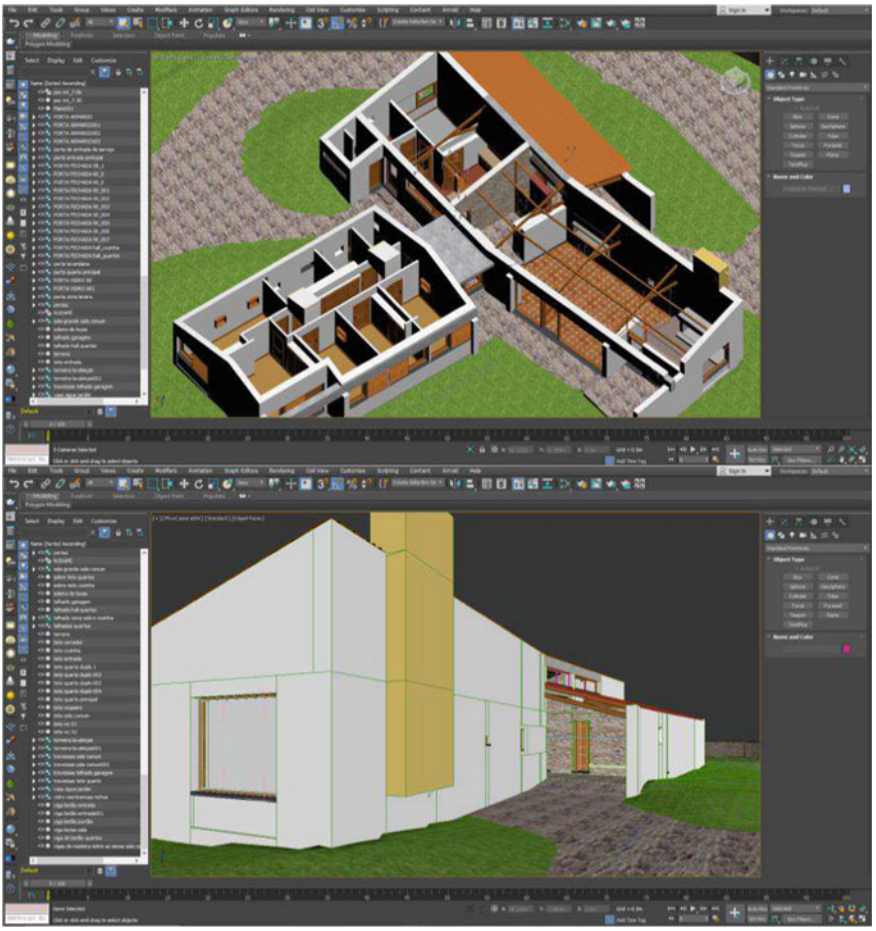

Fig. 4 3D modelling of Ofir House in 3D studio max. *Source* Authors

4 Final Considerations and Some Next Steps

With this experimental project it can be said that is possible to create a reliable and reasonable space into Virtual Reality, promoting knowledge about interior design history in Portugal. This experimental space boosts the understanding of which are the necessary steps to create the Virtual Space and to convert it into Virtual Reality, namely, what should be included in the files and how they need to be organized in each software. Also enables to design and simplify the methodology and steps to convert 2D in 3D and in Virtual Reality.

As learning tool Virtual Reality offers a better opportunity to showcase the interior flow of the space including features chosen by the architect like materials, textures,

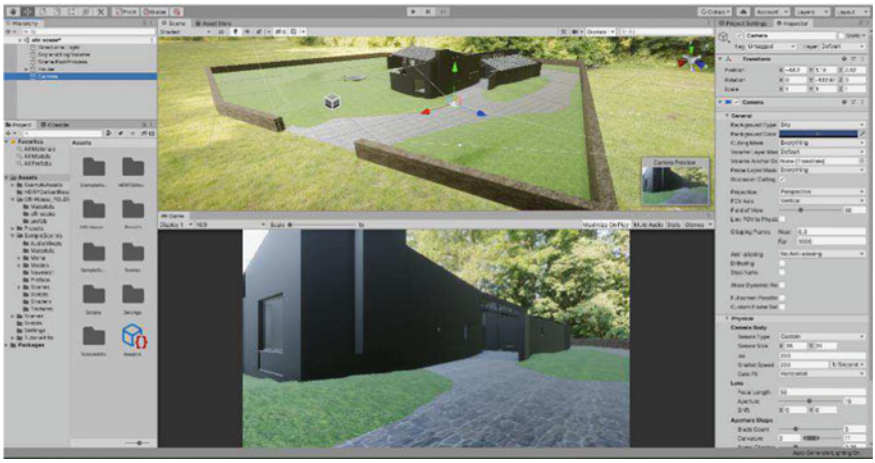

Fig. 5 Ofir house in unity, *Source* Authors

colours and the way they interplay in the place. This might create an emotional experience about the spaces and might stimulate new insights and a rewarding knowledge about it, as Donald Norman states in *Emotional Design* (2004, p. 135).

This project contributes to the extension of information about Portuguese Interior Design History providing a source of information that responds to the challenges of the contemporary digital era. The experimental project of Ofir House can be replicated throughout other interiors.

Despite the fact that the achievement done with phases 1 and 2 is already an aim in itself, the project still must run phases 3, 4 and 5 which are already planned and will constitute the content of another article. The guidelines are as following:

- 3rd phase—app and website design that will allow the access and the interaction with the virtual reality space. The application and the website will be complemented with as much as possible additional information in an easily accessible tab.
- 4th phase—evaluate how much Virtual Reality contributes to learning about Portuguese Interior Design History. It will be also assessed if the app is user friendly and which is the role of the lecturer in the classroom, namely how lecturer and students interact with Virtual Reality. In a preliminary study we found that Virtual Reality Environment can be the key to connect the students with the topic discussed because of the stimulating generated interactive ambience (Neves, Beça & Pombo, no prelo).
- 5th phase—dissemination of the information.

A last word to underline that it is intended to apply this methodology to other projects, bringing Virtual Reality to interiors' interpretation.

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