An Immersive 360° Experience in Rio de Janeiro in the Late 19th Century

The panorama of Victor Meirelles and Henri Langerock

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This essay is related to the research project ``The immersive experience in 360°: investigation, representation and digital immersion in the city of Rio de Janeiro in the 19th and 20th centuries'', developed at PROURB in FAU-UFRJ, Rio de Janeiro/Brazil. This work will investigate the Panorama of Rio de Janeiro looking for memories and historical truths in its context: Which part represents a historical point of view? Which part is invention? How were the city and its landscape represented on the canvas? As the most well-known Rio de Janeiro's panorama, which project was idealized by the Brazilian painter Victor Meirelles de Lima (1832-1903) and the Belgian photo-painter Henri Charles Langerock (1830-1915), it was exhibited in Brussels 1888, Paris 1889, and Rio de Janeiro 1891-1896, with great recognition in all these cities. This paper will explore this Panorama, its initial studies, its landscape and the architecture depicted, newspapers descriptions of its exhibitions, and mainly, distinguishing among memories, historical truths and verisimilitudes. In order to achieve these objectives, digital and analogical systems of representations, sketches and computer graphics techniques, specially, tridimensional models will be developed and applied.

Keywords: Panorama of Rio de Janeiro, Immersive experience in 360°, Geolocation, Virtual Reality, Digital Technologies, Cultural Heritage

INTRODUCTION

The fourth industrial revolution brings a new way of relating to technology. This significant change will be able to transform the way we live, work, study, and the way we relate to ourselves and the world. Evidentially, Architecture is not far from this transformation.

The use of new technologies in education and architectural practice is becoming more frequent, where 360° immersive experiences can be highlighted as a good opportunity for research and stud-

ies application. In the most cases, they are implemented in design development as a decision-making in the creation process or for a reproduction of its final visualization.

However, Immersive 360° experiences could be more related to the cities' History: How could be the 360° experience of being in a city of the past? How to enjoy a 360° historical experience that no longer exists in the contemporary city? Which elements (buildings, architecture, landscape, others) of this city are needed to characterize its history?
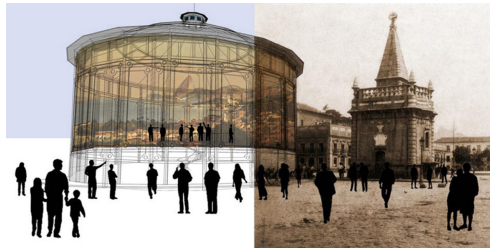
In 1785, the Irish artist-painter Robert Barker invented the first system of representation for a 360° experience: the Panorama. From its beginning, in a circular and closed painting, could be considered a form of art, entertainment, and mainly, able to offer diverse experiences for observers in time and space, as contemplate beautiful landscapes, be part of battles, and religious moments (Leitão, 2009). The environment created by the Panorama and its visitors could be directly related with and immersive experience of nowadays, putting the observer in the center of these experiences. In order to examine such questions, the 'Panorama' as a representation system of an immersive 360° experience was taken as the object of study.

To analyze and discuss these themes pointed out by the Panorama, the following authors were established: Ernst Gombrich, in Art and Illusion (2004) where he sees the relationship between observer and painting as the center of experience, and how the painting is the great illusory media capable to dialog with the observer; Oliver Grau, in Virtual Art (2003), with his understanding about how virtual art increasingly codify and interpret the immersive experience that was offered in 19th century, highlighted by Panoramas as the greatest immersive media, and also, how the 'illusion' has been changing into immersion, in total immersion; and Gordon Calleja, in In-Game (2011) where he debates about how immersion is discussed today, in different levels, its relationship developed by video-games, and how the observer becomes a user, able to enjoy the immersive experience and perform actions which can modify his own experience. These authors discuss and explore the idea of ⊠immersive experiences.

As work of this essay, it was decided to use the Panorama of Rio de Janeiro, painted in 1888 by the Brazilian painter Victor Meirelles (1832-1903) and the Belgian photo-painter Henri Charles Langerock (1830-1915) as a model to be investigated and developed with the objective of relating its immersive experience with city's History. This Panorama presented the city and the landscape of Rio de Janeiro with a unique 360º view in the end of 19th century.

Both painters decided to realize the Panorama from Morro de Santo Antônio, in that way, representing the most part of the city's central area. The Panorama was composed by six studies, which were exposed at Meirelles' atelier in Rio de Janeiro, in early 1886. With the initial studies and the fund needed to realize the Panorama, the two painters traveled to Ostend, Belgium's coast, to complete the painting in Europe, where the Panorama would be exhibited. On April 4, 1888, in Brussels, at the old Boulevard Hainaut, now Avenue Maurice Lemonier the Panorama da Baía e da Cidade do Rio de Janeiro was exposed for the first time. One year later, the same Panorama was inaugurated in Paris, at Avenue Suffren, on March 14, 1889, before the official opening of the World's Fair. On January 3, 1891, the Panorama was finally inaugurated in Brazil, in the city of Rio de Janeiro, at Praça XV de Novembro (15th November Square) (Leitão, 2014). Figure 1.

In 1902, a few months before his death, Meirelles donated his Panoramas to Museu Nacional da Quinta

Figure 1
The Panorama of Rio de Janeiro, in Rio de Janeiro, near to Master Valentim's fountain: Photography X 3D model based in newspapers' reports, 2018, Private Collection

da Boa Vista (National Museum of Quinta da Boa Vista). They were inadequately stored, and after a few years, nobody knows exactly what happened with them. Unfortunately, just a few original documents survived: the initial studies prepared with Langerock, now in Museu Nacional de Belas Artes (National Museum of Beauty Arts); some letters from 1910, in Arquivos da Escola de Belas Artes da UFRJ (Archives of the School of Beauty Arts of the Federal University of Rio de Janeiro), today, D. João VI Museum, requesting to remove the Panoramas from the museum; and two brochures, from the 1st and 2nd Panoramas exhibitions in Museu Histórico Nacional (National Historical Museum), and a few visitor's reports published in old newspapers.

OBJECTIVES

In order to investigate and recreate the immersive 360° experience of the Panorama of Rio de Janeiro by Meirelles and Langerock and relates to its city's History, the main objectives of this essay are: Analyze in detail the remaining studies; identify in the studies the main buildings, squares, streets, the landscape and its hills and mountains pointed out in Panorama's description; verify, approximately, the points of view used by Meirelles and Langerock when they did the studies; elaborate a 3D-model of Rio de Janeiro city's center and check these possible points of view; establish a methodological process to redraw this Panorama in its original format into a single 360° based on all data collected; develop in this panorama the best immersive experience as possible, considering the Virtual Reality system of HTC vive; identify the historical views of the two painters in the contemporary city, by geolocation, and then, create a base for contemporary panoramas in comparison with the historical; experience these both panoramas in Augmented Reality Glasses, and specially, foster the discussion between students and researchers about immersion in Architecture and Urbanism.

METHOD

In addition to the theoretical discussion of Ernst Gombrich, in Art and Illusion (2004), Oliver Grau, in Virtual Art (2003), Gordon Calleja, in In-Game (2011), about the immersive experience of history, art history and digital media, other important research is needed: the rebuild of an immersive experience, especially through maps, sketches and 3D models. In order to approach this discussion, an important artist was selected to be analyzed: Yadegar Asisi (1955) , specially for his Panoramas of Rome CCCXII, Baroque Dresden 1756, and Pergamon.

On these three Panoramas, Rome, Dresden and Pergamon, the German artist used numerous maps, sketches and 3D models, but with slightly different applications. In Rome's Panorama (2005), based on the original Alexander von Wagner's brochure (1838-1919), Asisi could correct and adjust some of incongruities found in the image's, such as: size, buildings' position, and proportions, among others. In this occasion, sketches and 3D models were used as verification and validation processes between the images presented with historical maps of Rome. In Dresden Panorama (2006), Asisi established the point of view, as well as its composition, in choosing to hold the Panorama from the top of the main church. For this occasion, the 3D models, completed by numerous sketches, were used as a simulation, to model the city's architecture in that time. And in the Panorama of Pergamon (2011), Asisi combines these two situations: simulation, now, of a landscape, from an aerial photograph of a no longer existent point of view, with fragments' verification of the architecture, especially with Pergamon's altar. Thus, as Asisi points out, maps, sketches and 3D models can be good and interesting tools for rebuild immersive experiences and Panoramas, demonstrating how they could be applied.

The theoretical and practical approaches are important, essential, and in this case, complementary. With them, is possible to understand, reflect and discuss what an immersive experience is and how it can be achieved. The learning offered by these authors

will be applied and developed throughout this work related to the Panorama of Rio de Janeiro by Meirelles and Langerock.

The first experiment: the Panorama's rebuilt from the descriptive text x remaining studies

After all historical research, the starting point was to analyze the Panorama's remaining documents in detail; mainly, the brochure with Victor Meirelles' text presented in the exhibitions and the six remaining painted studies.

The descriptive document was divided according to the remaining studies, the first part of the text is referenced to the first study; the second part to the second study; and so on. Analyzing each one it was possible to identify elements that are related to city's Architecture and Landscape, such as: churches, institutions, fortifications, streets and avenues, hills, and Guanabara's bay itself.

Once each of these elements were identified in all the six remaining studies, the following survey was established: The first study with 30 elements found; the second with 14; the third with 23; the forth with 21; the fifth with 23; and the sixth with 10.

In that way, the six studies together would indicate 126 key points of the city of Rio de Janeiro that should be identifiable in the Panorama; although, it was not possible to say that Meirelles followed this number.

To continue into the process of reconstitution of the Panorama, it became necessary make a comparison of the survey from the descriptive text with the study. For study 1, from the 30 elements pointed, only 21 were found; study 2, from 14, only 8; study 3, from 23, only 12; study 4, from 21, only 11; study 5, from 23, only 12; study 6, from 10, only 6. Thus, to identify all these key elements pointed out by the text wouldn't be a simple task. In addition, many doubts and great imprecision were generated: from 126 elements pointed out, only 70 were identified. This method proved to be ineffective, since almost half of the elements were not found. A new method needed to be developed. Figure 2.
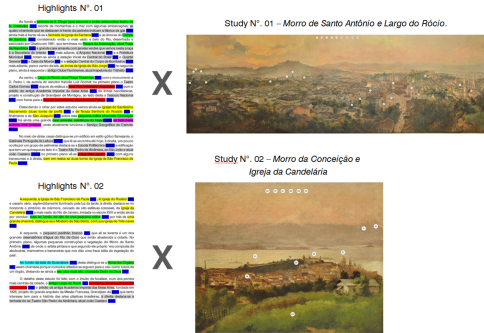
The second experiment: the Panorama's rebuilt from another panorama x 3D Models

It can't be said that the previous experience was totally unsuccessful. Elseways, it was important to establish the basis for the next investigation method: the precise elements' identification pointed out by the text presented graphically on the six studies.

It is important to highlight that the Panorama of Meirelles and Langerock was made from Saint Antônio's hill in 1885, one of the four city central area's hills. A series of urban changes occurred in this area, in the late nineteenth till mid-twentieth century. These changes occurred in the architecture and urban scales, and especially, in the city's landscape. The Saint Antônio's hill, as visited by the two painters, no longer exists in the same shape and scale. Notwithstanding, another Panorama, no longer as a painting, but photographic, was realized in the same hill: the panorama of the photographer Hubmeyer in 1913, exactly 25 years later than Meirelles and Langerock Panorama's first exhibition.

Hubmeyer presents part of the city with some modifications and it's possible to do an immediate comparison with the painters' Panorama. Fortunately, this panorama had presented a long descriptive text of its main key points, that were identified in the photograph, through numbers and legends. Henceforth, Hubmeyer's panorama has been used

Figure 3
Demonstration of
the original studies
of Meirelles and
Langerock's
Panorama in a
unique 360°
landscape, and
their resizing for
better comparison
with the Hubmeyer
Panorama, 2018,
Private Collection.
Figure 4
Three images
demonstrating the
studies N°02, N°03
and N°05 in the
urban 3D model
with Meirelles and
Langerock's points
of view, 2018,
Private Collection.

as an auxiliary base for elements' identification presented in the Meirelles and Langerock's Panorama.

Therefore, the comparison between these two panoramas became necessary: Hubmeyer's was made from a single point, composed by panoramic photographs; and the two painters' portrayed it by six studies, in six different places, as it is possible to realize when analyzing them in detail. But, how this correlation could be done?
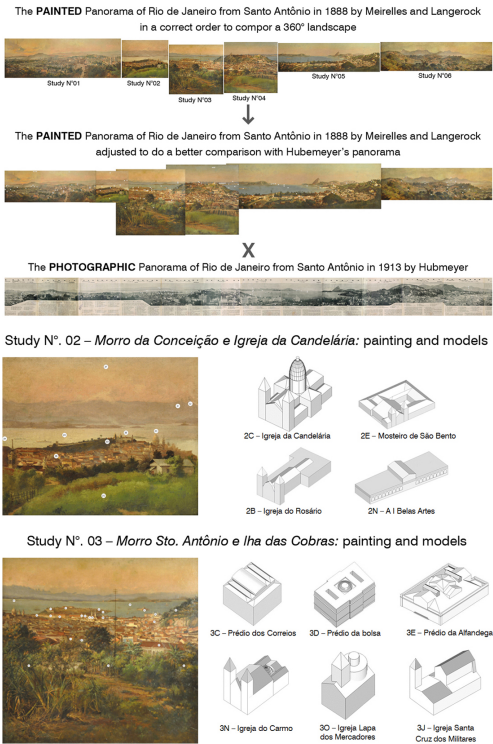
The answer was established by setting the remaining studies in the landscape presented by Hubmeyer. It was necessary to resize the studies, as close as possible, to Hubmeyer's landscape. The proportion of studies' by Meirelles and Langerock has always been maintained, never altered or distorted, only resized, and in a few cases, overlapped in the photographer's work. Once the two panoramas could be compared the elements' identification could be done.

This comparison proved to be a successful method: from 126 elements pointed out only 7 were not found, which represents a 95% success rate. In order to rebuild the Panorama of Meirelles and Langerock, based on these elements' identification, trying to locate them spatially in the city it would be fundamental; comprising that the approximate location of the six points used by the painters would help to understand the composition of the six studies, and also, to realize a single circular image in 360°. Figure 3.

From this moment, the 3D models were constituted as the main methodological instrument for this work. They became indispensable and were used in three different scales: architectural objects, such as churches, institutions and fortifications; historical city's topography, with the four central area's hills, Saint Antônio's hill, Castelo hill, Saint Bento's hill and Conceição hill; the historical city's urban form. It should be emphasized that the proper organization of these 3D models constituted an important challenge.

For the first scale of observation, the architectural objects were modeled without windows and ornaments. It was crucial to search on historical books, visits (to those that still exists), and old photographs

and documents to achieve a satisfactory 3D modelling. Figure 4.

The **PAINTED** Panorama of Rio de Janeiro from Santo Antônio in 1888 by Meirelles and Langerock in a correct order to compor a 360° landscape

Study N°01 Study N°02 Study N°03 Study N°04 Study N°05 Study N°06

The **PAINTED** Panorama of Rio de Janeiro from Santo Antônio in 1888 by Meirelles and Langerock adjusted to do a better comparison with Hubmeyer's panorama

X

The **PHOTOGRAPHIC** Panorama of Rio de Janeiro from Santo Antônio in 1913 by Hubmeyer

Study N°. 02 – *Morro da Conceição e Igreja da Candelária:* painting and models

2C – Igreja da Candelária   2E – Mosteiro de São Bento
2B – Igreja do Rosário   2N – A I Belas Artes

Study N°. 03 – *Morro Sto. Antônio e Ilha das Cobras:* painting and models

3C – Prédio dos Correios   3D – Prédio da bolsa   3E – Prédio da Alfandega
3N – Igreja do Carmo   3O – Igreja Lapa dos Mercadores   3J – Igreja Santa Cruz dos Militares

For the second, a specific historical search had to be done. It was important to find the contour lines of the four hills, in 1888. Part of this problem was easily solved, since the hills of Saint Bento and Conceição were practically unaltered, in that way, accessing the city's CAD files map was fundamental. Contrarily, the contour lines of Saint Antônio and Castelo's were only found in urban form projects in the late 19th century that were detached and redrawn in a CAD format. Once all the information was assembled, the hills were modeled in 3D. Figure 5.

For the third scale, the historical urban form, it was used the city of Rio de Janeiro masterplan draw
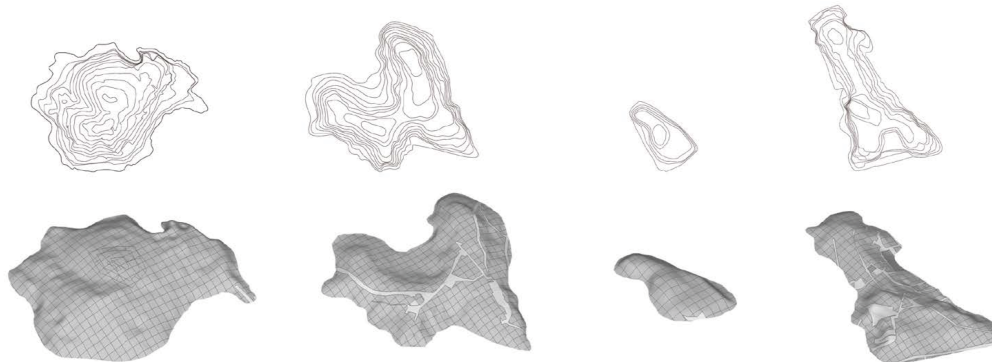
made by the Engineer Leopoldo José da Silva, a very rare and precise historical map. It dates from 1870, almost 20 years before the Panorama of Meirelles and Langerock. Nonetheless, it should be noted that in this period the city did not had major changes, taking this in consideration, it was fattible to use it as a urban base. The old document was constituted by a 100 boards, but only 18 contained the city's central area, so, with the selected boards it was possible to perceive the original drawing of the city in that period and to make a comparison with the actual urban form. In this way, it became fundamental to carry out a thorough work of overlapping the old document with the current city map. This process was constituted by three digital steps: the first one, assemble all the boards together and making a huge and unique one; the second, cutting out the blocks and squares, removing all the streets, in that way, making evident rio's territory; and the last, overlapping the result of the previous steps into the city cad map. This stage was crucial to develop our final urban form document, a CAD georeferenced map from the nineteenth century; which was possible by virtue of the adjustments that were made according to the actual Rio de Janeiro's maps files, that are totally georeferenced and published in CAD format. Making it achievable the base for urban 3D model. Figure 6.

Once these three scales of observation were established, and with all 3D models finished it was fattible to combine them. From Meirelles and Langerock studies was conceivable, by trial and error, to find the points of view used by the two painters, and mainly, locate them at the urban model. The 3D Model's camera was set at observer's height, in a way that it was possible 'walk' through the virtual Saint Antônio's hill, seeing simultaneously the architectural objects modeled and Meirelles and Langerock's studies behind them. This possibility could help to identify, approximately, the painters' angle of view, and locate the remaining studies in the 3D model. Figures 7, 8, 9.

RESULTS

It is possible to affirm that the greater conclusion of this work was the development of the process itself. The detailed analysis of the six studies by Meirelles and Langerock enable to identify almost all the elements mentioned in the descriptive texts: from 126 elements only 7 were not found. The 3D models were very important for rebuilt the historical city,

Figure 7
Image demonstrating the study N°02 in the urban 3D model with Meirelles and Langerock's points of view, 2018, Private Collection.

Figure 8
Image demonstrating the study N°03 in the urban 3D model with Meirelles and Langerock's points of view, 2018, Private Collection.

Figure 9
Image demonstrating the study N°05 in the urban 3D model with Meirelles and Langerock's points of view, 2018, Private Collection.

since they allowed finding the points of view used by the two painters. The determination, in an approximately way, of these six points of view, was also fundamental to the success of this experiment. It allowed the studies to validate the 3D models and also to demonstrate the route taken by the painters in the old Morro de Santo Antônio when they were there. Figure 10.

Certainly, the rebuild of the Panorama of Rio de Janeiro's immersive experience has not yet been fully achieved, but the present work allowed to structure an important method, to point out the new directions that should be followed.

This method has generated important learning: the use of 3D models with multiple scales of observation. It can be applied and developed over a contemporary city, a historical city, or even in a city which no longer exists. And these three cases are exactly what Rio de Janeiro's city is: a city with a forgotten memory, or dispersed by old and rare documents, which can still generate new, or unknown, Panoramas and immersive 360° experiences. Certainly this Panorama is just an example for further works that are going to be developed and researched.

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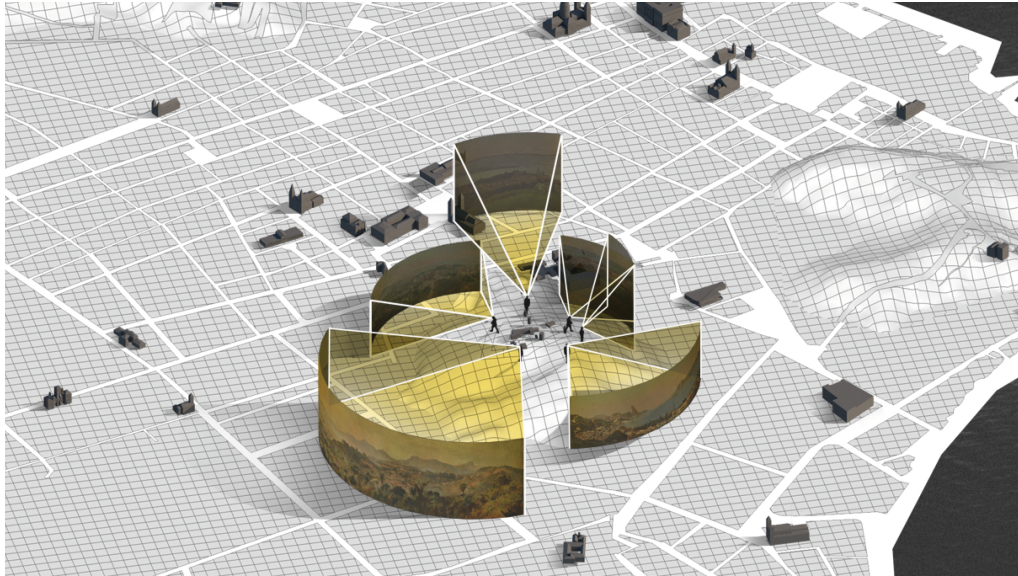
Figure 10
Painters' six points of view and the walk through the Saint Antônio's hill to realize them, 2018, Private Collection.