

DIGITAL MODERN

'Towards a new materiality' of Modern Architecture in Fortaleza-Ceará (Brazil).

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The topic 'Digital Modern' is a metaphor for expressing the importance of the valorization of Modernism in the current stage of capitalism and in the context of the 4th Industrial Revolution, marked also by the inclusion of the virtual/digital in architecture design, 'towards a new materiality'. Linking, past, present and future, this paper aims to discuss the importance of documentation of the most emblematic modern works of Fortaleza, capital of Ceará (Brazil), using digital technologies, such as the BIM platform and 3D printing, with the goal of contributing to the valorization of memory and conservation of this important architectural heritage.

Keywords: digital modeling, modern architecture, BIM, digital documentation, Fortaleza-CE (Brazil)

INTRODUCTION

The word 'modern' has Latin origin in *modernus*, which means present, up to date, which belongs to recent times. In architecture, the term is a paradox, as long as the modern is already past. Since the Renaissance, the term is used to designate an opposition to the old and, at the beginning of the XX century, it consolidates as an adjective that signals a rupture with the classic tradition, identifying with the modernization triggered by the Industrial Revolution and with the Modernism, that is, the cultural and artistic expression of modernity. Thus, the Modern was used to qualify an artistic and architectural production committed and engaged with the alignment to the material progress of humanity, impacting the urban and architectural production in a hegemonic

way in different places of the world, projecting itself for the future.

The topic 'Digital Modern' is a metaphor for expressing the importance of the valorization of Modernism in the current stage of capitalism and in the context of the 4th Industrial Revolution, marked also by the inclusion of the virtual/digital in architecture design, 'towards a new materiality' (Picon, 2004).

The digital age enables every object and every material, at each stage of its elaboration, to be rigorously defined. True novelty might very well lie ultimately in the generalization of design, as a practice regarding not only buildings and their various technological systems, but also materials and beyond them nature as an engineered reality (Picon, 2004, p. 120).

At this time of transformations in the material-

ity in the representation and architecture design, it is fundamental: to recover the importance of the built collection of modern architecture and consider it as heritage; to discuss the state of continuity and validity of modernist principles in contemporary times for the design and intervention in existing buildings and; to incorporate digital technologies as tools of valorization, documentation and conservation of the modern architecture. In all the previous statements mentioned, it is essential to articulate past, present and future, referring to the transformations in the materiality of architecture.

Many studies have been devoted to the use of digital technologies to produce knowledge about heritage. The virtual (re)construction of modern architecture in Fortaleza, Ceará, in the Northeast Region of Brazil, through the digital modeling and prototyping of the most emblematic buildings, presents as a possibility to extend the existence of this built heritage, either by rescuing the memory of demolished buildings, resuscitating them, or by valuing the remaining collection.

The production of the digital documentation of these works constitutes an important contribution to the historiography of the architecture in Brazil, being an instrument of preservation of the memory of this architectural heritage. Although it belongs to a recent past, it presents many examples already demolished or in advanced stage of degradation.

Thus, this paper aims to discuss the importance of documentation of the most emblematic modern works of Fortaleza, capital of Ceará (Brazil), using digital technologies, such as the BIM platform and 3D printing, with the goal of contributing to the valorization of memory and conservation of this important architectural heritage.

THEORETICAL ASSUMPTIONS: THE DIGITAL REDRAWING

The materiality of architectural drawings often does not withstand the passage of time, making it difficult to understand the genesis of the building and the memory of the architectural design that since the Re-

naissance has elevated the status of the architect and irreversibly altered professional practice. There is no doubt that the techniques of design and registration of modern architecture were also impacted by the new possibilities of representation provoked by the technological advances of the Industrial Revolution. Thus, the most recent architectural patrimony, especially the modern one, had the privilege of having the drawings of its most emblematic samples published in specialized magazines and monographs on the most outstanding architects.

Either with or without the permanence of original designs of historic buildings (modern or not), the redrawing is an important tool of historical research, since it constitutes *"a metalinguistic practice, that is, an intentional and directed design simulacrum: a project of the own project"* (Ramos, 2016, p.5-6), as long as it allows to deepen the knowledge about the past, the present and the future of the building, its conception, materialization, as well as existing and planned interventions.

The advent of new digital technologies and their impacts in the area of Architecture, Engineering and Construction have contributed widely to the dissemination of knowledge and played a relevant role as an instrument, not only for design, development of the project, generation and management of information, but also for the materialization and innovations of great value for the documentation and even intervention in the architectural and urban heritage.

Thus, an *"emergent materiality"* (Picon, 2004) has also influenced the use of redrawing in historical research, although, researchers in the urban and architecture history are not always involved in the construction of the 3D model. *"The recognition of the modeling process importance to the historical analysis and research depends often on the interaction between those two groups"* (Kos, 2002, p. 507). It is important to note that a new materiality is under way in the process of documentation and conservation of historical heritage.

Since they are not static, but dynamic, digital representations introduce in the architecture research (his-

torical, critical, analytical, etc.) possibilities of approach to the architectural object that neither the traditional analogical means, nor the original drawings contemplate. The mobility of the image and the possibility of wandering through the work, although virtually, open an unknown interpretive field. Even modeling with parametric software can bring new types of data, such as quantitative ones, that have never been used in historical research (Ramos, 2016, p. 5).

Among the various technologies, Virtual Reality, Mixed and / or Augmented Reality, Web Technologies, GIS, CAD, BIM, Rapid Prototyping, Digital Fabrication can be highlighted.

The BIM (Building Information Modeling) consists of privileging a contextual construction, supported by an intelligent simulation of the space-form relationship, replacing the traditional abstract representation of fragmented communication conventions. (Andrade; Ruschel, 2011) The construction of the object in BIM has as its premise a central information model, in which abstraction is replaced by simulation, that is, it evolves in an analogous way to a virtual design process. In case of using it for documentation, it may be employed for restitution of the object built or already demolished.

It is still possible to comprehend BIM from what it is not. Thus, it is not considered BIM platform software, whose archives: (i) it only contains digital three-dimensional models without attributes, rendering project analysis and data extraction and integration impracticable; (ii) that it does not use parametric intelligence, hindering the generation of views and making them incoherent and imprecise; (iii) it contains multiple references of uncombined 2D CAD files in a feasible 3D model; (iv) that it does not allow automatic changes in views when there are changes in dimensions (Estman et al, 2014).

Descending from BIM, Historic Building Information Modeling (HBIM) has a specific role focused on documentation, analysis and conservation. It is a reverse engineering process that, through the mapping of the architectural elements, uses as a resource a laser scanner or photogrammetry. For Murphy; Mc-

Govern; Pavia (2013, p. 89):

Historic Building Information Modelling (HBIM) is a novel solution whereby interactive parametric objects representing architectural elements are constructed from historic data, these elements (including detail behind the scan surface) are accurately mapped onto a point cloud or image based survey. (...) Full engineering drawings orthographic, sectional and 3D models can then be automatically produced from the Historic Building Information Model.

Overall, HBIM has been used more for documentation of older buildings than for modern ones, perhaps because it functions as a very suitable feature for scanning ornamental elements and building details.

For Kos (2002), digital modeling is more than simply a representation, it constitutes a digital/virtual research database, which brings together primary sources, images, drawings, documents, vectored or non-vectored collections, functioning as the matrix of historical research on the built patrimony.

PRACTICAL ASSUMPTIONS: (RE) CONSTRUCTION OF MODERN ARCHITECTURE IN FORTALEZA

Modern architecture in Brazil developed in a heterogeneous way in time and space, due to the different forms of articulation between the emitting and receiving centers. In Ceará, the penetration of the principles of modern Brazilian architecture are related to the displacements of “*migrant, nomadic and pilgrim architects*” (Segawa, 2002), responsible for the conception of the first modernist projects and involved with teaching, in the case of Fortaleza, in the context of creation of the School of Architecture of the Federal University of Ceará in 1964. In addition, it is important to highlight the production of works by some Brazilian architects in Fortaleza. The prominence of these modern architects constitutes a relevant contribution, especially the legacy of the constructed works.

This paper is a product of an empirical research that involves the modeling of 52 buildings that are

included in the Guide of Modern Architecture of Fortaleza (1960-1982).

The digital (re) construction of these buildings implied the need to systematize the iconographic sources and confront them with the empirical object (in the case of the remaining buildings), since the work *“has in itself the most meaningful data for its knowledge”* (Waisman, 2013, p. 11), allowing to infer about the mismatches between the project and the work and the transformations and interventions suffered over time.

In order to organize and standardize the information collected, a database has been produced to document and to systematize the information that was compiled in building characterization sheets. However, the database is not restricted to the fiches, since primary, secondary sources were collected and the virtual modeling designed in Archicad constitutes the most important process and product of the digital documentation.

For the digital modeling, the Archicad 20 software, based on BIM technology, has been used. The choice of this software is justified by the capacitance to store information with reduced file sizes, facilitating its use; rapid learning curve; interoperability; easy navigation; free student availability and export effectiveness in a variety of formats. Following, the 3D impressions of buildings are being produced.

RESULTS

One of the main results of the research is the construction of the digital database. Out of the total of 52 works that comprise the scope of the research, 45 models were completed (Figure 1) and 7 are in the development stage.

As a complementary product of the digital modeling, sheets were adopted, which allow to establish parallels and comparative studies between the works, as well as parameters of the building analysis. Among the items that make up the characterization sheet, it is possible to highlight: the name of the building, the use, the architect, the constructor, the

date, the land areas, location, situation map, images and references.

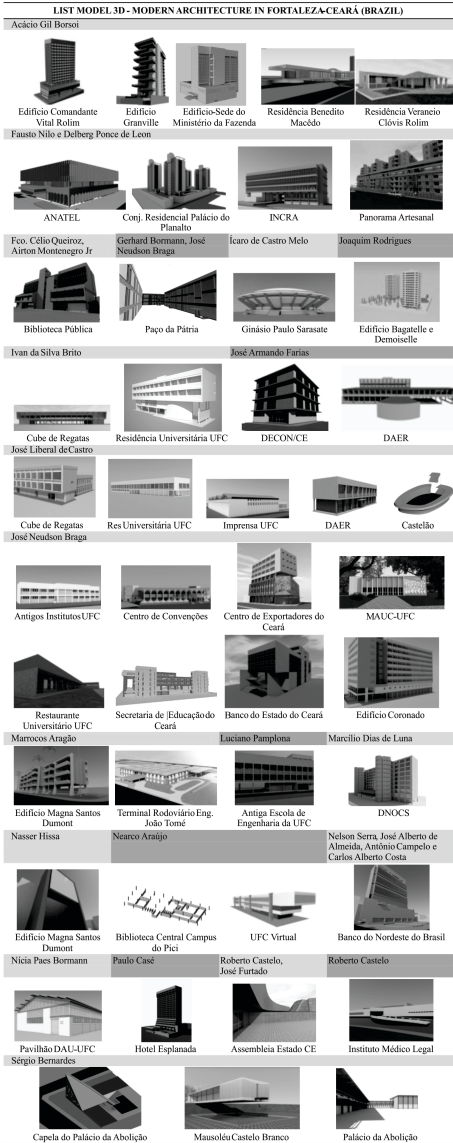


Figure 1
List of 3D Model -
Modern
Architecture in
Fortaleza

The sheets are being produced in two formats: the first as a banner, with synthetic information and greater graphic appeal, which will be used in physical and virtual exhibition (Figure 2); the second, as an inventory, gathering in-depth information about the works, drawings and 2D and 3D images extracted from the digital modeling (Figure 3).

Figure 2
Example 3D Model
Banner



In addition to the dissemination and availability of the research product (modeling and sheets) on the website of the Guide of Modern Architecture in Fortaleza, the research contemplates the insertion of the model and digital documentation in the BIMx software, which consists of a “hypermodel” (format.bimx). The BIMx Model may contain complete documentation of your ARCHICAD project: the 3D model, as well as views, layouts and camera paths (Figure 4). It expands the horizons of documentation of modern buildings, making it easy for architects, engineers, ordinary users and customers to

access through diverse accessible platforms (computer, mobile, tablets). For the general public, it extends the possibility of apprehension, understanding and new interpretations through insertion within the 3D model, besides facilitating access to information, contributing to the knowledge, valorization and consequent preservation of this built heritage. In order to control open access, it is possible to leave it private and password-only access for registered users, who must commit to the educational and academic use of the data.

The final product of the research is to perform a physical and virtual exhibition of the modeled buildings, showing the entire digital modeling process, from primary sources to 3D printing (Figure 5).

The 3D printing process is being developed in partnership between LoCAU (Laboratory of Critics in Architecture, Urbanism and Urbanization) and LED (Laboratory of Teaching, Research and Extension in Digital Design), both belong to the Department of Architecture and Urbanism and Design of the Federal University of Ceará. The research also counts on the support of scientific initiation scholarship students from both laboratories.

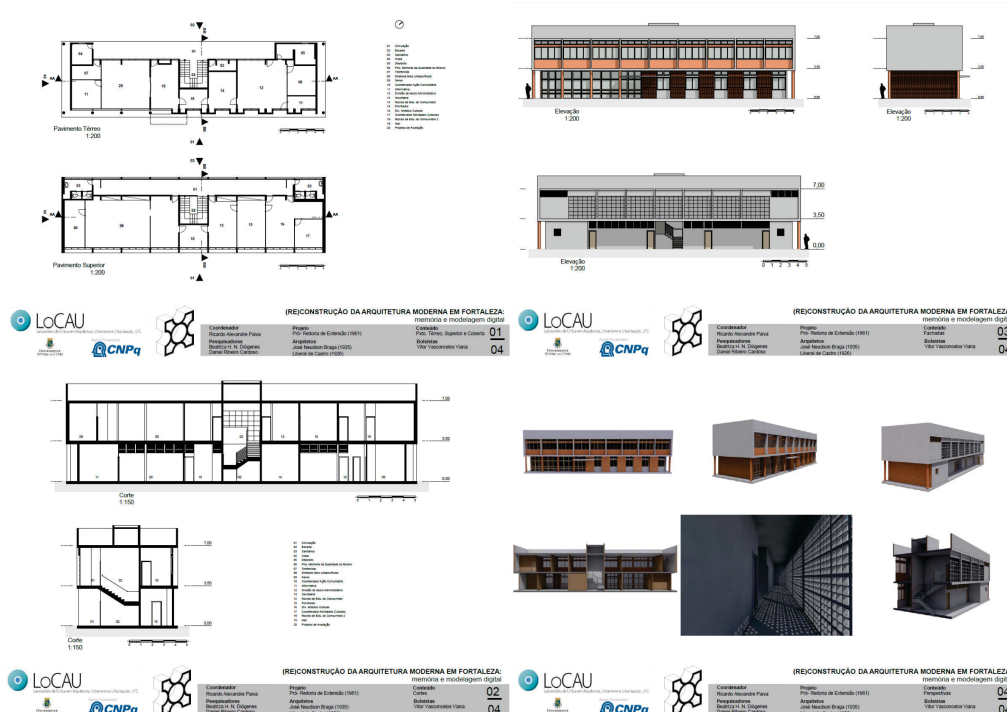
In the site of the Guide of Modern Architecture of Fortaleza (1960-1982), which will host the modeling, there will be a search system related to the routes, different typologies and the architects authors of the projects, as well as how to allow updates and additions of new works.

Still as a research product, it is worth mentioning that the models are used in the last discipline of Architectural Design in the Course of Architecture and Urbanism of UFC, whose theme is intervention in existing buildings. At the end of the research, as a counterpart to sources provided by companies and public agencies, digital modeling will be made available to stakeholders and can serve as an important support for the management of interventions in buildings.

FINAL REMARKS

The drawing, as a principal means of representation in the field of architecture, plays a fundamental role

Figure 3
Examples of
detailed
characterization
sheets



to make the project “intelligible, viable and transferable and, as such, it constitutes a symptom of technological and cultural development in a given historical-social context” (Paiva, 2015, p.3). At the service of art and technique, often synthesized and present in the architecture, the drawing constitutes historical document and legacy of the material production of humanity, in addition to the buildings the drawing represents.

The means of representation maintains a dialectical relationship with technology, insofar as they are means and ends, that is, they intensify the technological development at the same time as they compose it. The adoption of new digital means of creation, representation, documentation and information in architecture has led to an ongoing process of

replacing more abstract representations with simulations of the object to be constructed, with the increasing approximation of representation to real objects.

The new digital technologies must be incorporated as an allied in the process of documentation and conservation of the architecture, being BIM an important platform for parameterization and information of the built heritage, allowing possible referrals regarding the intervention in the existing building and consequently its preservation.

In this field, digital redrawing has a great potential to rescue the memory of projects and buildings, which can be promising in the modeling of buildings that have been decharacterized or demolished, since “the object that witnesses our past disappears, its

Figure 4
Interfaces in
smartphone of the
BIMx program with
the 3D model of the
headquarters
building of the
Ministry of Finance

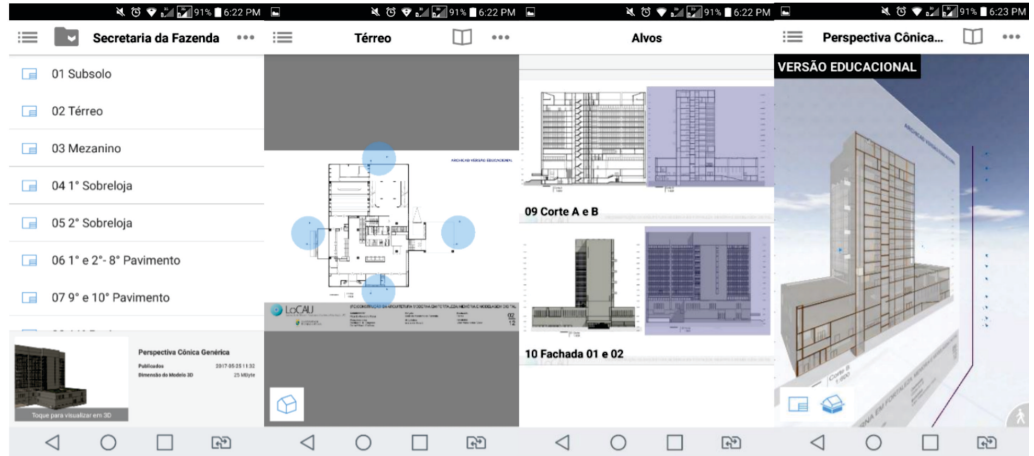


Figure 5
3D Printing
Examples - Palácio
Coronado Building
and Education
Secretary of Ceará,
both designed by
José Neudson
Braga. Produced at
master degree
research by
Cristiane de Araújo
Alves Siqueira
denominated
'Neudson Braga e o
modernismo
arquitetônico em
Fortaleza'.

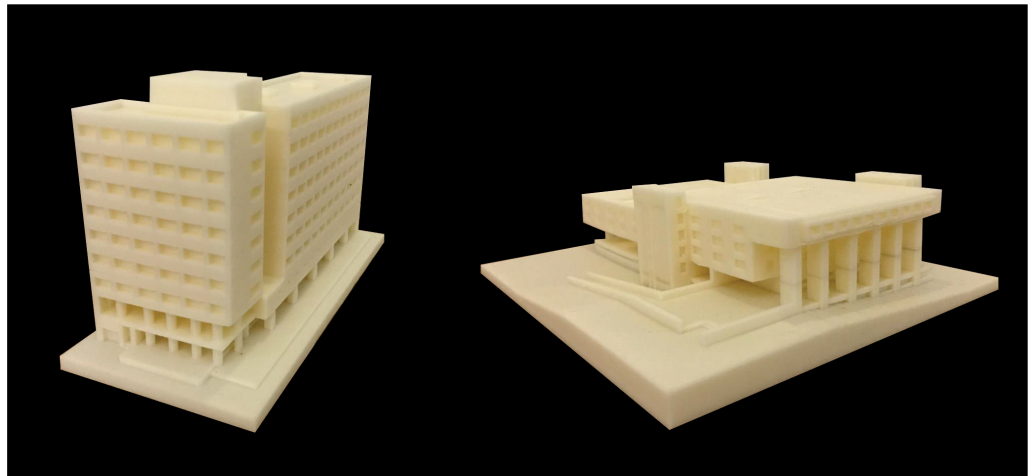


image can replace, though in part, the immanent need of human nature to keep in touch with what has gone. Hence one of the several uses of cadastral representations as a way of preserving memory" (Oliveira, 2008, p.13). Thus, expanding the limits of documentation by adding new forms and platforms of modeling and

documentation towards a new materiality will contribute effectively to historical research.

The research has interfaces with studies dedicated to the subject and has found a privileged forum for discussion and dissemination of knowledge in seminars about the Modern Movement, such as

the various editions of DOCOMOMO Conferences (international, national and regional), as well as on the use of digital technologies in historical research as SIGraDI.

The production of these digital models enables a new way of documenting modern works in Fortaleza, contributing to the historiography and expanding the possibilities of interpretation and apprehension of its essential characteristics, such as the structural system, constructive materiality, spatial solutions, formal expression, among other aspects.

Finally, this article synthesizes a research that is a development of education, research and extension activities at the undergraduate and postgraduate levels, contributing to the formation of architects committed to the issue of built heritage, which is widely threatened by contemporary urban dynamics. Thus, the idea of 'Digital Modern' is a way of understanding the transformations that contemporary technologies impose on the way of perceiving, representing and intervening in these buildings 'towards a new materiality', making its existence last.

ACKNOWLEDGEMENTS

This research was supported by the CNPq, which granted financial assistance for the research "(Re) construction of modern architecture in Fortaleza: memory and digital modeling" and Scholarship PIBIT (Institutional Program of Initiatives in Technological Development and Innovation) and by the Federal University of Ceará.

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