Communicate the results of an architectural research. How to design a digital scientific article in the architectural field

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Abstract

The scientific paper is the preferred method through advancements in any scientific field are communicated. The publishing of scientific journals has undergone a digital transformation, even in areas such as architecture, where this process has been paradoxically slow. However, papers that make it in architectural journals are still written and published as if they were still in a printed format, the conventional system inaugurated by Gutenberg. Such traditional publications are limited to a two-dimensional format, which does not recognize the way of communicating ideas in architecture today. This article explores the possibilities of this new digital format, closer to the architectural gesture, which, while valuing traditional forms such as sketches, plans or photographs, incorporates new possibilities offered by digital magazines such as digital models and evolving infographics. These types of projective representations multiply the communication possibilities of researchers and creators. As a result, the contemporary paper can and should be representative of the innovation that underlies its existence. Its content is a vivid reflection of the natural evolution of architectural, urban or landscape research. This makes it necessary for the scientific paper to include new types of dynamic formats. This article presents some of these formats and methods for communicating the results of architectural research today: hypertexts, embedded resources, geo-referenced images, 3D models and linked bibliography, among others. This article is in turn an invitation to the authors to enrich their practices with the resources of visual, graphic and textual language.

Keywords: scientific paper, digital resources, architecture, research, architectural communication.

Introduction

In recent decades, academic papers have migrated from printed to digital format. This, coupled with open access, has allowed for their prompt dissemination on a global scale, which, in turn, ensures greater influence to their content.

These innovations incorporated instant, ubiquitous, and free access to content, and in turn, eliminated the barriers of time, distance, and limits in length, and to the number and size of images or accompanying materials. Hyperlinked content allows the diachronic reading of references and learning about the cited papers, which promotes an experience where ideas and creativity flow, and authors and readers are connected in dialogue. This ideal world requires journals capable of supporting these papers and, above all, papers developed multidimensionally, which reflect the practices of making, reading, and creating architecture.

However, progress in the publishing process and in the implementation of technology has not always been reflected in the content of published articles, nor in the manner in which authors conceive and develop their manuscripts. Editors of specialized journals have done little to drive change, and the authors have not demanded much.

Despite efforts to advance digitalization (...) current scientific papers remain attached to printed traditions: multi-page documents with text and static images, a format currently considered “obsolete” by some (Somers 2018).

Research in areas such as architecture, commonly follows methodologies designed for the social sciences. And while the formats of these methodologies can be adapted to different disciplines, they can also limit the communication of particular graphic elements, such as those derived from architectural research. This results in a major problem, since the graphical elements accompanying the research may be as, or even more, valuable than the results themselves.

It is in this context that this article aims to investigate the techniques of representation and communication currently available for the elaboration of academic papers, specifically in the area of architecture, urban planning, and landscaping. The objective is to bring dynamic and interactive alternatives to researchers - compatible with the current digital format of contemporary research journals - that allow for a better transmission of the knowledge obtained.

It is proposed that the use of dynamic digital formats - such as video or embedded content, and interactive or immersive media - provides a greater amount of information to architectural research while it promotes the participation of the reader in the publications.

This research is not intended as a recipe for new processes that may make the production and publication of papers more difficult for researchers. It is, on the contrary, based on the idea that any paper seeks to promote and provoke thinking, dialog, and long-term actions, and that it does not stop at the findings published at a specific moment and time (Spinka, et al. 2019).

The “Article of the Future” project

In 2010, the Dutch publisher Elsevier, together with a community of scientists, launched the project The Article of the Future, an initiative that proclaimed a transformation in the way research was communicated and promoted in all areas of knowledge (Zudilova-Seinstra, 2013). The project was aimed at making the format of the articles published in Elsevier’s journals more innovative, and was based on 3 basic principles: readability, discoverability and extensibility.

The project claimed that a research article published in a digital journal should not be a static page - a downloadable .pdf or text file - derived from what was previously a print edition. Rather, the Article of the Future should be understood as something similar to a separate and article-specific website, which would host all research information and related resources (Image 1).

Although the project did not continue, it set an important precedent for the explorations that would later be carried out for this purpose. The Article of the Future managed to compile and disseminate the possibilities that, by 2015, digital platforms could make available to publishers, and these in turn to researchers. It was based on the use and access to high-quality, downloadable, digital resources linked to the article, which would allow for a greater exchange of information.

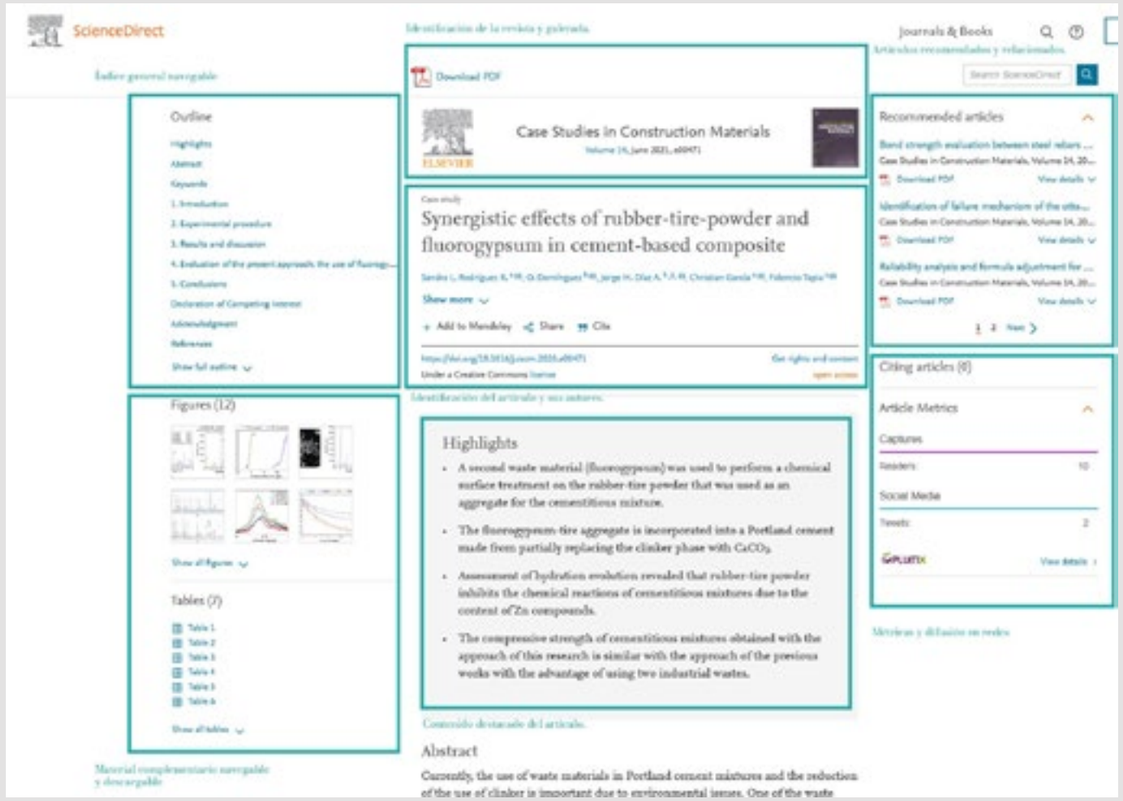

Image 1. Layout of an article of the future. Produced by Elsevier in Science Direct Platform.

Exploring the possibilities of digitalization outside the field of Architecture

The communication of information is a field of study in itself. There is plenty - and extensive - research that defines methods, strategies and tools for the dissemination of each type of information obtained within the research. As mentioned above, the communication of information within the scope of digital scientific papers is one of the issues that needs to be reviewed. To achieve this, it is important to note the advances that digital media such as newspapers, magazines and news portals have used to disseminate their articles, mainly associated with investigative journalism.

For this type of content, digital portals have used programming as an instrument to express ideas in an explicit way, using interactive materials adapted to the information they communicate. Within this spectrum, it is important to point out two types: first, articles with content that communicates through diagrams, images or videos; formats that provide animation, but that do not allow the user or reader to interact. The second type is articles that allow the reader to interact, in which the content is intentionally modified according to information provided by the user.

Interactive graphs allow readers to dig deeper into the underlying data of a news story, and are common on websites such as the New York Times and fivethirtyeight.com, but are less common in scientific publications (Perkel, 2018)

Newspapers like The New York Times or The Observer have implemented interactive articles in their digital editions. This type of content - generally aimed at economic, financial or political issues - allows the reader to include personal data such as: age, annual income, political tendency, will to vote, among others, to prove the hypothesis stated. In these cases, the verification of the results can be carried out in real time and in a personalized way by the readers as they follow the article, thus inviting them to be part of the process.

An example of this is the interactive article published by the US newspaper The New York Times, in response to the pandemic caused by the spread of COVID-19, entitled "See How the Vaccine Rollout Is Going in Your County and State", that allows internet users to follow the progress of the coronavirus vaccination process. The article is updated daily and in addition to the figures, it distinguishes between the number of people who have received the first and second doses of the vaccine.

This kind of interactive article has brought together the greatest number of innovative features that Elsevier announced in 2015 for The Article of the Future. They are not peer-reviewed publications, nor do they communicate scientific research, but they are interesting approaches that bring large amounts of information to readers in an intentional, systematized and effective way. As a result, they are consolidated into web repositories where specialized and up-to-date information on a specific topic of interest can be found.

The possibilities of digital publishing platforms

As stated above, the printed format has limited the shaping and communication of information to what can be disseminated or transmitted through two types of resources: texts and images, because it depended on printing as a reproduction tool.

In the case of academic journals, the printed format has almost entirely disappeared, and has been replaced by electronic or digital journals. This has resulted in a number of important changes in multiple directions that can be stated as follows:

- The speed of dissemination of generated content has been increased.
- The whole process of peer evaluation and layout is done digitally. The peer review process, managed by an expert editorial team, ensures that only manuscripts that represent a contribution to the discipline will be published.
- The content in the articles has been linked to the sources referenced in the digital format.
- The implementation of digital editions has resulted in the backup of content in digital repositories, many of them open access.
- Digital publishing has allowed more variety in the formats that can be used to represent and communicate the findings of research - for general or partial results.
- Subscription barriers have been removed, which has allowed reading for free.
- Scientific journals are indexed by general-purpose search engines such as Google, thus ensuring documentary access.
- The indexing of comprehensive international databases makes it possible to distinguish mainstream scientific journals from those that are not.
- The requirement for metadata in a lingua franca, that enables access for a reader anywhere in the world, has become a necessity.
- Unique methods for identifying articles that ensure a permanent URL have emerged, like the DOI.
- The journals have been able to abandon periodicity, typical of the consolidation of issues to go to the printing press. The article has become a publishable unit, once it has met the quality control requirements of the editorial team.
- This has allowed universities and small publishers to produce journals with global visibility, which compete with the big names in scientific publishing.
- Authors can disseminate their academic production, and make it more visible on a global scale.
- The communities in different fields find in these journals a channel of reliable communication that facilitates an effective dialogue of ideas.

With all these changes, journals still prevail as the preferred way to communicate new discoveries, creations and ideas. They are proof that a result has been achieved by one author before others, and that the accumulation of articles published in a journal represents the production of knowledge and creation that emerged within a field of study over time. However, in the midst of all these changes, the vast majority of papers remain two-dimensional, as if the possibilities of digital media did not exist.

As can be seen, the implementation of digital platforms has greatly increased the scope of publications, and specifically scientific publications, both in the quality of their content and in their scope. This has resulted in a number of improvements in the process of transmission of knowledge.

The generalized implementation of the use of these resources may improve the correspondence between the advances from research and the way in which readers appropriate the new findings. Some of the opportunities for researchers, publishers, and institutions that drive these publications include:

- The possibility of including a greater number of resources such as: interactive graphics and tables, infographics or downloadable content, geographic references, videos, photographs, immersive renderings, among others.
- The availability of resources for the reader, with the highest possible quality.
- The immediate verification and consultation of bibliographic references.
- The possibility of global access.

This new picture contrasts widely with the possibilities available to publish papers until not long ago, where all content - regardless of its nature - had to be presented using the only two resources available – static text and image – and their access was limited exclusively to physical availability. In that sense, a printable .pdf file is closer to the scientific article of the past than to the article of the future.

SciELO and the XML/JATS format

A worldwide pioneer in the transformation of printed into digital journals was the SciELO (Scientific Electronic Library Online) project, an initiative of the São Paulo Research Foundation, Brazil (Fundação de Amparo à Pesquisa do Estado de São Paulo — FAPESP) and the The Latin American and Caribbean Center on Health Sciences Information (BIREME) led by Regelio Meneghini and Abel Paker in 1998, and followed by Anna Maria Prat at the CONICYT of Chile in 1999 (Brito, 2001).

One of the most important advances in the migration of scientific journals to digital platforms was the implementation of the Extensible Markup Language (XML) format in the articles. This allows the interoperability of the files in various systems, by marking the essential and identifying information of the manuscript such as: title, summary, keywords, tables, lists, text, images, source of the resources, references, among others (Packer, et al: 2014).

Resources in architectural research

In the case of academic publications in the field of Architecture, articles can cover a variety of areas (history, theory, critique, project, representation, construction, management, among others) and make reference to countless topics. However, in this article, two areas will be distinguished: those relating to findings on historical and/or heritage buildings and those analyzing projects.

In the case of research related to historical buildings, there is a value associated with original documents, since they provide data on the origin of the building. Using those documents, it is possible to generate representations in other formats, using reference coordinates, vectorized drawings, 3D models, and interactive graphics, which become contributions for future research. In this specific type of articles, the use of new formats complements but does not replace the information (Images 2 and 3).

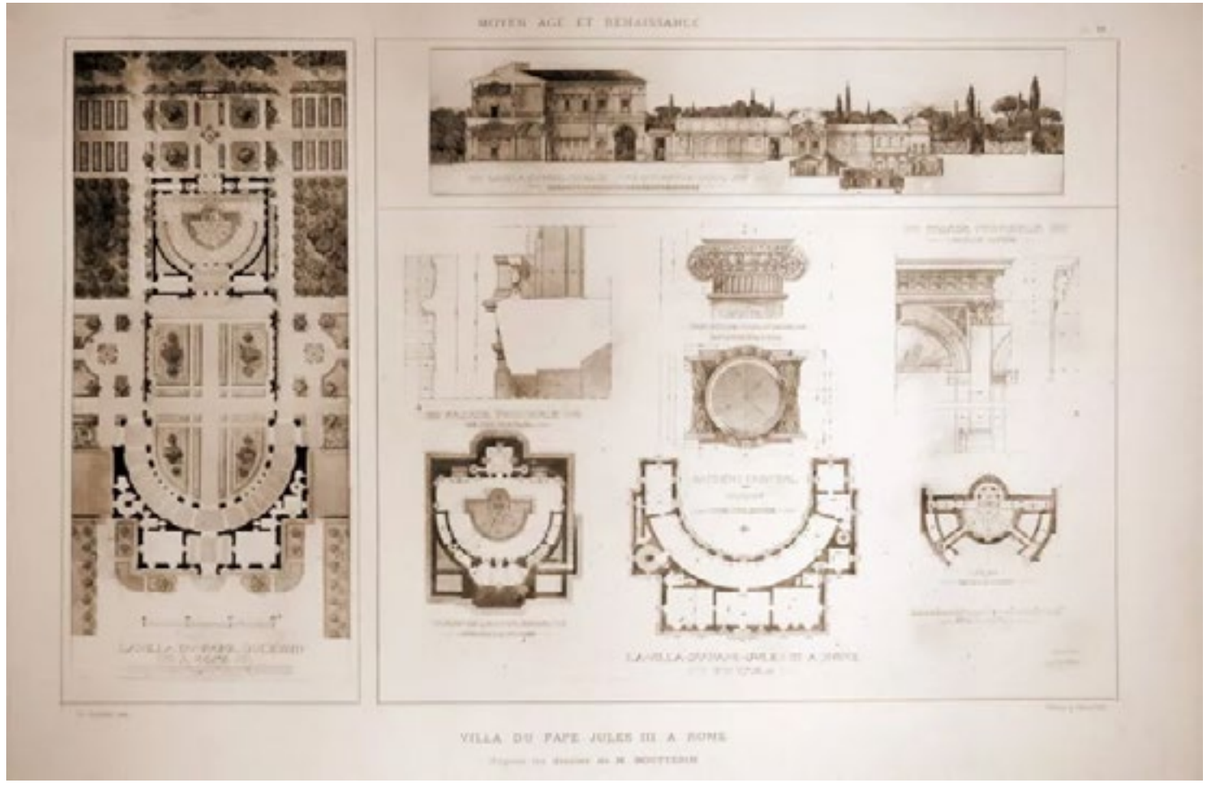

Image 2. Original plans of Renaissance Villa Giulia by Giacomo Barozzi da Vignola between 1551 and 1553.

Image 3. Social Housing Project. Master's Degree Dissertation on Housing for the 21st Century. By: Architects Andrea Castro Marcucci and José Juan Garza (2011).

In general, few researchers produce new documentation of their case studies from the initial information. The articles reflect the research work involved in finding the primary sources and the original documents, which may constitute one of the main findings, and they draw conclusions from these findings, like traditional articles with text and images.

In the case of research that refers to architectural or urban projects, underutilization of resources may be even more pronounced. In general, planimetric images obtained from vectorizations and three-dimensional models are usually presented, making it clear that technology is available but that the researcher does not deem it as an element of interest to their manuscript. Also, it might mean that the researcher is not aware that this element can effectively be integrated into the article in order to add greater value to their research (Image 4).

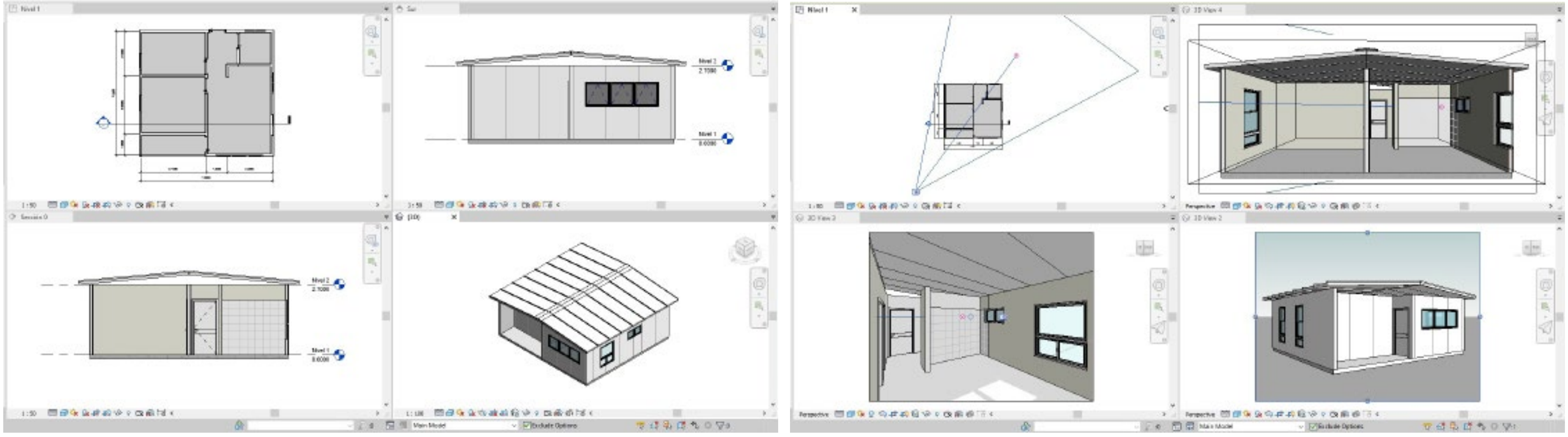

Image 4. Prepared by the authors from a prototype of a detached single-family dwelling, made with Autodesk Revit.

The logic of diagrams

Diagrams are one of the elements that have been transformed to be adapted to the new technologies of representation in architectural ideation. Until the 1980s, the germinal or initial ideas of the projects were shown as freehand sketches, which constituted the first and most valuable of the documents in a project: the idea (Image 5). At the beginning of the 1990s, sketches began to be supplemented with diagrams (Rodríguez, 2018) which then became common graphic elements among the designers, until they became an indispensable tool for the presentation of an architectural project. According to architect and critic Stan Allen, "the diagram may be the channel through which any communication with architecture's outside must travel" (Allen, 1998).

It was in the past few decades of the 20th century and at the beginning of the 21st century that diagrams were spread with greater intensity (Montaner, 2014). International studies by Star Architects (Ponzini & Nastasi, 2011) such as Rem Koolhaas, MVRDV, UNStudio, among others, used diagrams as the main piece in their projects in international publications. These infographics were graphics that allowed an open reading of the strategies, ideas, and architectural processes. They also included information on the shape of the building, together with statistical data, area plans, demographic information and other data (Montaner, 2014) that the architect had used to feed their design process. In this sense, diagrams represent one of the most important processes within the evolution of architectural communication (Images 6 and 7).

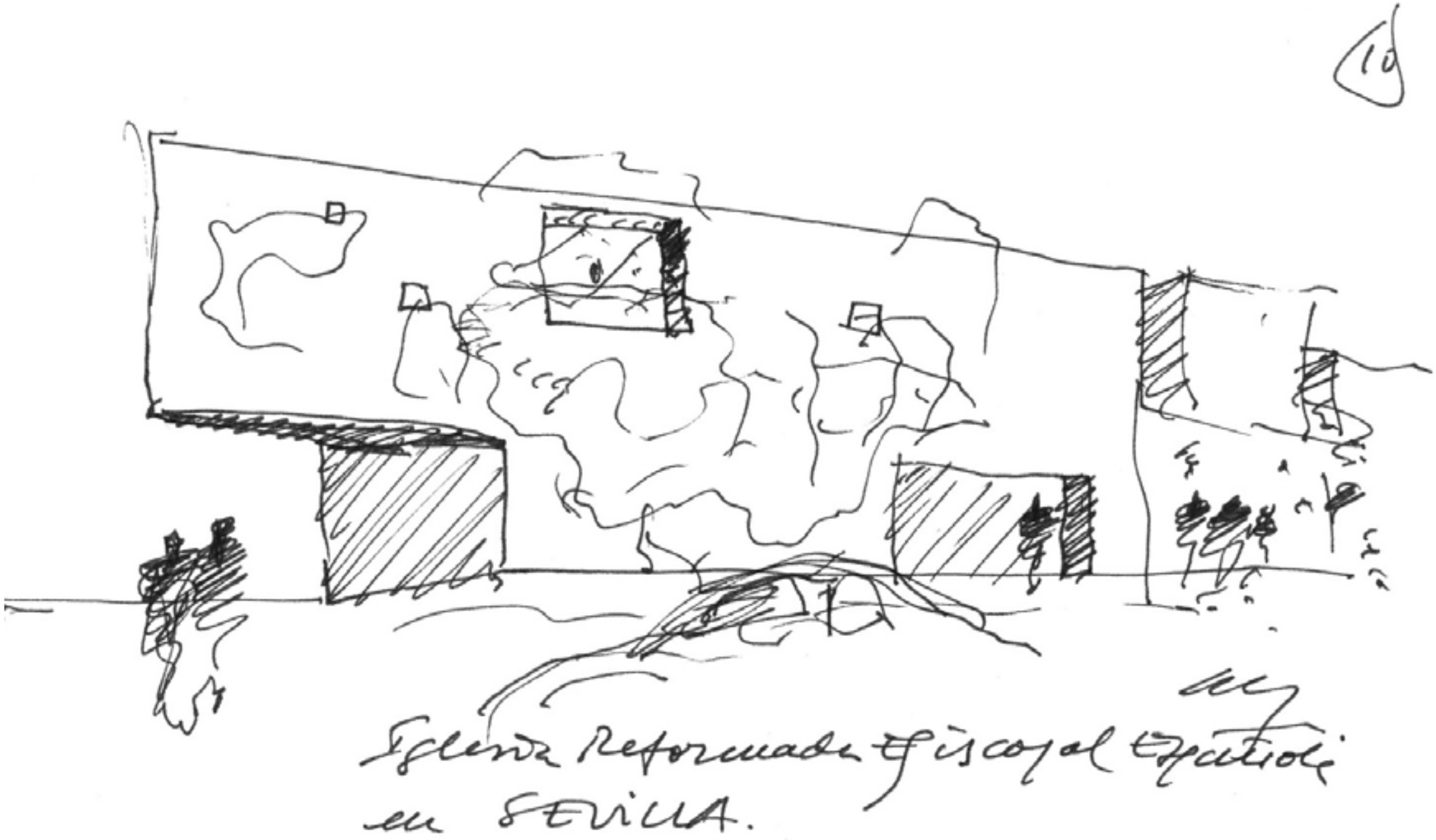

Image 5. Alberto Campo Baeza. Hand sketch for the Project Iglesia de la Asunción in the neighborhood La Macarena, Seville, Spain (2004).

Image 6. OMA. Architectural program for the Shenzhen Stock Exchange Offices project (2013)

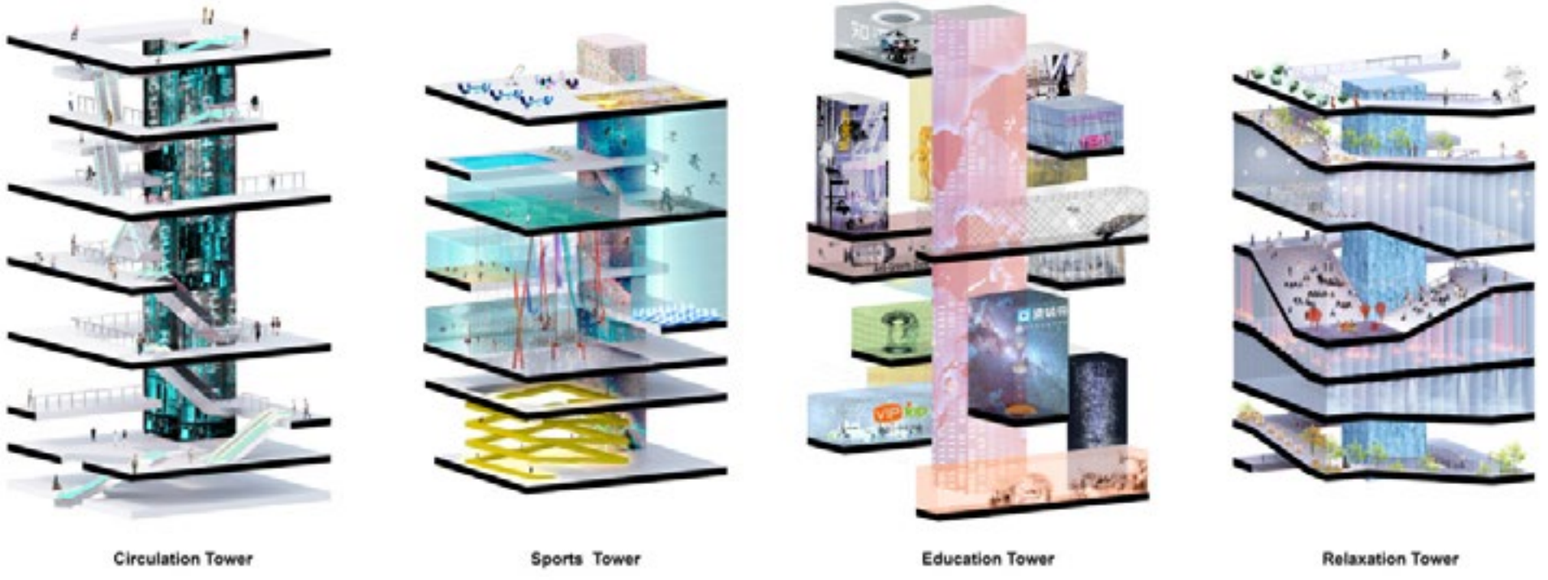

Image 7. OMA. Architectural program for Unicorn Island project in China (2018)

As mentioned above, the areas of knowledge within the discipline of architecture are wide and diverse, and as a result, architectural research can be classified into large thematic groups. However, interdisciplinarity and the cross-linking of areas of knowledge in contemporary research are increasingly being strengthened. Thus, for example, a project research may be partly documentary or historical. Or critical research might contain specific parts dedicated to project representation. Or an investigation into the study of materials and building practices may have influence on processes related to projects.

In this context, rather than attempting to group areas of knowledge, and therefore of architectural research, it may be more useful to classify representation and communication resources based on their potential application. Thus, for example, graphics and diagrams can be included for theoretical processes; photographs, videos, plans or models for documentary processes; and illustrations, animations, plans or models, and codes or scripts, when considering design processes. All this is also combined with the expected textual content, and with general resources such as hyperlinks to internal or external elements and references.

Traditionally, the work of the researcher who produces an academic paper ends with the final manuscript, or the compilation of images. As exposed so far, the proposal is to add a final task of editing and of communication design. Thus, the fundamental idea of this process is to analyze, evaluate, and choose the strategies, formats, and type of content that are suitable for expressing the documentation process and the findings obtained.

Today, technology allows access to a large amount of computing resources. It is necessary to apply them to generate more attractive and, above all, dynamic communication, with open access information that can be embedded within the article's web page.

Two-dimensional texts that become multidimensional hypertexts

The first element to be transformed is the base text, which with the implementation of XML files will include hyperlinks to bibliographic references. This text, conceived as a flat file with information produced within a word processor, can be transformed into hypertextual content. Using XML markup, interactive links are added to bibliographic references, images, raw and processed data, graphics, or any other resource required.

Another recent contribution to the communication of scientific articles has been the transformation of technical or specialized language into a language more accessible to all areas of knowledge (Ynnerman, 2018). This has allowed more media to approach and disseminate the results of scientific papers, allowing for greater dissemination and reach of their findings. Likewise, there is a transition from a connotative language - typical of a particular architectural school - to a language common to the discipline.

Location Plans

One of the important pieces in the formulation of any research in the architectural field, is the location plan of the area of study. This planimetric study marks the starting point of the research, and it may be current or in reference to a file previously scanned by the author.

In this case, the proposal is to supplement the original plan view with a site visualization window in an open-access satellite environment (Appleton & Lovett, 2005). This information would be inserted into the paper by means of a link to an embedded browser window within the XML file (Image 8).

Image 8. Aerial view of New York City in the Google Earth platform in embedding format.

Another possibility is to provide access to the cadastral information of the sites being studied. Nowadays, some cities have open access websites with this information, which even allow the viewing of previously digitalized historical records. This may signify an important contribution to research, since this information can be added easily from a specific URL (Image 9).

These resources provide researchers with a real and automated visualization of the designated location, as these images are regularly updated from satellite images. It also becomes a tool for the reader to visualize the current state of the designated location and to be able to make comparisons with the original document, provided by the researcher.

General drawings in architectural planning

They are the main instrument for the communication of the architectural project. Within historical and/or heritage research, they constitute the first findings of the project and may be the argument and proof of the researcher's hypothesis. In the case of project research, drawings are the neuralgic documents, which allow the reading and understanding of the building in the language of architecture, and from which the researcher can draw the strategies in the work of the designer.

Progress in this area is aimed directly at the implementation and use of three-dimensional models. More specifically, they are geared towards the implementation and use of building information models (BIM) from which it is possible to generate conventional documentation elements such as floor plans, cross-sections or façade plans, and to provide an endless amount of additional data, always with the highest level of accuracy possible.

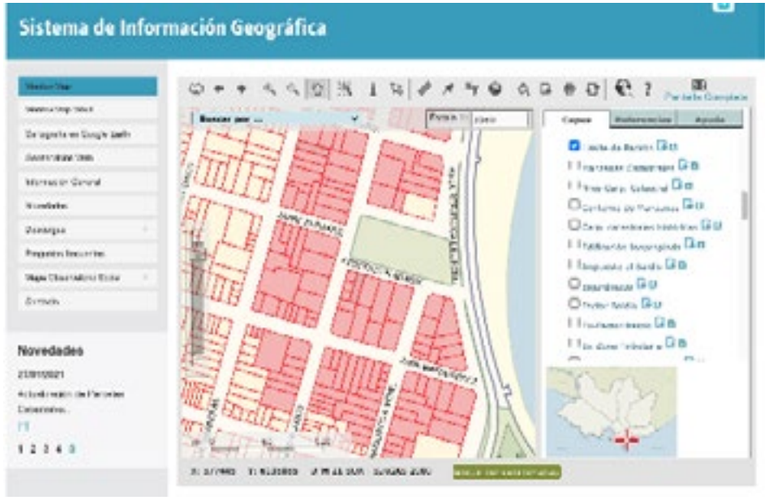

Image 9. Geographic Information System of the city of Montevideo, Uruguay.

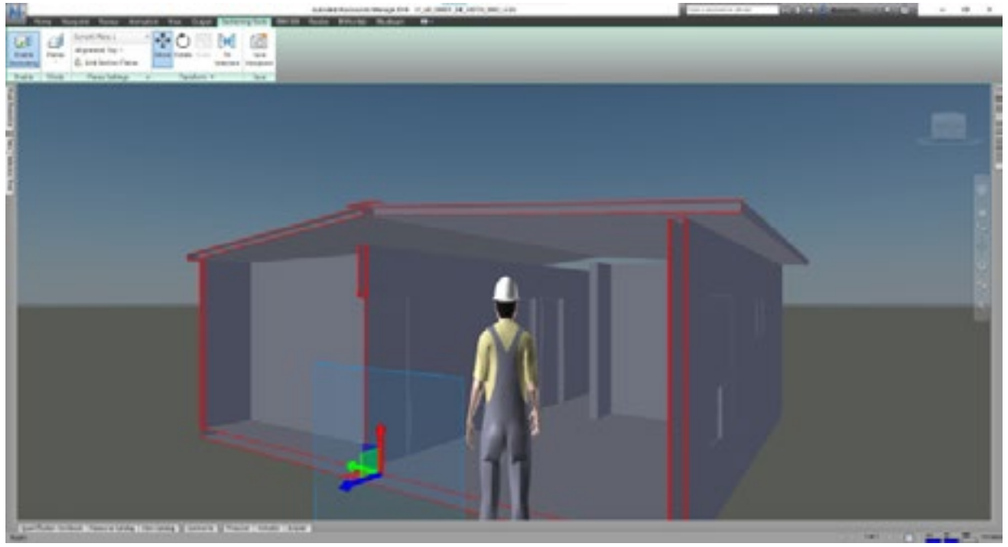

Image 10. Model visualization in IFC exchange format using BIM coordination software Autodesk Navisworks. Prepared by the authors.

This type of information models can be included in a paper as interactive pieces using the .ifc exchange format and open-access visualizers. Some applications allow the user to orbit and navigate through models in the article with read-only access (Image 10).

This mechanism allows the author of the original model to make changes and publish them; the modifications being visible to everyone. It also allows the reader to be aware of the time of the last update, which provides valuable information regarding error checking and the evolution of the project over time.

Georeferenced images

Images have been the architectural researcher's main means of communication in all types of research. Images are more complex now, and they may contain additional data that provides information about their origin. For photographs that represent real places, they can contain georeferenced information of the location where they were taken, and if the author so wishes, they can be part of a set of images that are displayed within a general map.

Also, for some years now it has been possible to display information concerning the device with which the image was captured: camera model, lens, year, exact date, and time, among others. All of these data might be relevant to the researcher, but what is important is to have the possibility of making it available to the readers of the article (Image 11).

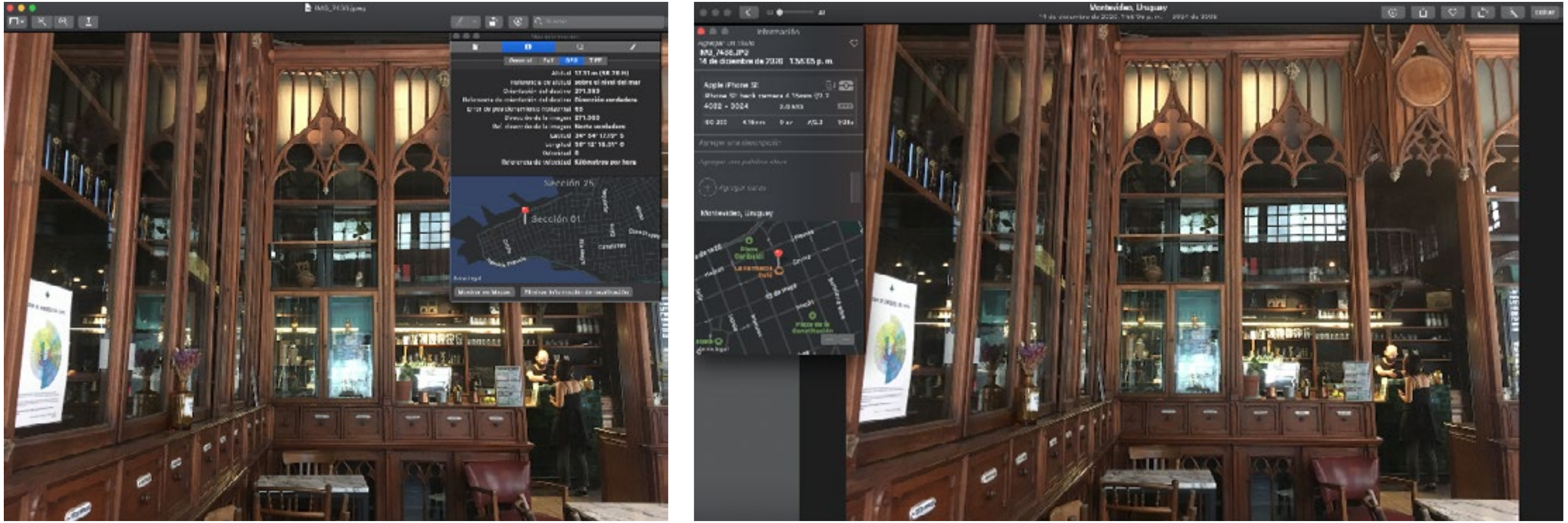

Image 11. Photographs with metadata. Information provided by the iOS Photos and Preview application. Prepared by the authors.

Another resource to be implemented is the use of videos showing interviews with informants, historians, experts, dwellers, users of the buildings analyzed, etc., to replace transcribed interviews. A video embedded in the article complements the written word and supports information in a different visual way, more dynamic for the reader.

Hyperlinked references

Digital platforms have allowed a greater number of formats for the presentation of bibliographic references. In addition to the implementation of interactive references to allow the markup of XML/JATS files, the innovation would be to allow open access references to be copied directly and entered into any search engine.

The reason for the enumeration of these possible advances within the possibilities of digital publication lies in the editors' constant pursue of innovation in the publication of academic journals dedicated to architecture. This is done by broadening the general objectives of the scope of the publications, promoting new technologies and making them available to researchers.

In general, the objective is to look for expanded ways to present the results of academic research and produce articles that constitute an experience for the reader, closer to the process of actual architectural work.

Opening a journal to the exploration of the possibilities of communication in Architecture. Experiences from editorial work

The academic journal "Anales de Investigación en Arquitectura" began a process towards digitalization three years ago. This restructuring has been carried out in two stages. The first stage was the migration of the physical content published between 2011 and 2016. The second stage, currently being carried out, has been marked by the implementation of the Open Journal System (OJS) 3.0 open access platform, and the digital resources that this system makes available to editors and researchers.

This transformation towards digital content has also brought about a conceptual restructuring that is permanently revisited. Thus, this digitalization has enabled greater diffusion and therefore greater reach and exchange, which has allowed the exploitation of new possibilities which include:

Constant dialog with the scientific committee and the academic community, which have become real thermometers of editorial work. In this sense, the Scientific Committee has been a vital asset in the definition of topics inherent to editorial work. Also, given the international quality of its members, it is possible to contrast points of view from the different regions.

One of the exercises that demonstrated this principle was the general consultation that was shared with the committee in March 2021. On that occasion, the committee members were asked: Where does innovation lie in scientific articles on architecture? This allowed different opinions to be contrasted, but also to see agreement, with references to previous works, joint visions, and trends in one place or another.

The commitment to be a journal for all, expanding the call outside the region and obtaining information from multiple places, which has enriched the vision of the journal as a scenario for debate, integration and exposition of ideas within a broad community and without ideological predispositions.

However, some challenges remain to be resolved. Just as contemporary theories support the conception of architecture as a language that leaves personal styles behind, this journal finds itself in a constant transformation to be a channel of communication for the discipline that at the same time calls for transdisciplinarity. With this, the journal seeks to build on past concepts to transcend into the future.

As a result of this process, there is a new call for the production of journals full of possibilities, where the expressive wealth of the contributions is representative of the contemporary place architecture has. The work is thus oriented towards the construction of a journal that, respecting the basic principles - such as peer intervention, publishing ethics and investigative integrity - responds to the spirit of the work of an architect.

Finally, framed in this editorial work, it is possible to affirm that this paper and every lecture on the future of articles on architecture, are ultimately a welcome call to the theoretical reflections, experimental studies, and innovative projects to come.

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