èkphrasis

46th International Conference
of Representation Disciplines Teachers
Congress of Unione Italiana per il Disegno

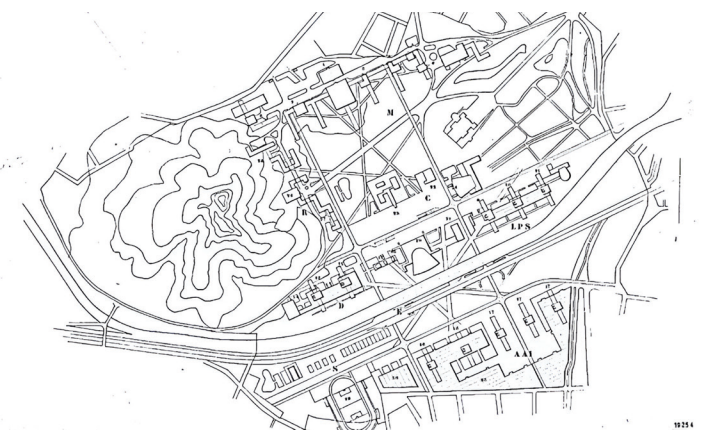
Artificial Intelligence in Le Corbusier's Redrawn Process - Rio de Janeiro University City Project

Juliana Costa Motta Benetti
Ana Tagliari

Abstract

This paper explores the increasingly notable intersection between natural and artificial intelligence in architecture, highlighting the redrawing method as an approach to illustrate how these two intelligences can work together to achieve significant results. While natural intelligence represents human knowledge of the built environment and its interactions, artificial intelligence offers advanced resources for analyzing, optimizing, and designing architectural spaces. Using an experimental study, we tested the ability of the Redraw Artificial Intelligence System to generate digital images based on Le Corbusier's sketches for the University City in Rio de Janeiro. The focus was on evaluating whether Redraw could replace the traditional redrawing method, highlighting the benefits of this integration to study and understand the project. By combining human sensitivity with the analytical capacity of machines, we gain a more comprehensive approach to data aggregation, allowing for a deeper understanding of architectural challenges and project characteristics.

Keywords
Le Corbusier, Artificial Intelligence, comparative analysis, redrawing, architecture.



Vectorized drawing of Le Corbusier's design for the University City of Rio de Janeiro, site plan. Based on the original drawing from Fondation Le Corbusier. Created using the REDRAW system (AI).

doi.org/10.3280/oa-1430-c915

Introduction

The introduction of Artificial Intelligence (AI) in architectural redrawing presents challenges and opportunities, transforming traditional practices. While human creativity is key to interpreting cultural and historical aspects, AI enhances analysis, precision, and expedites the redrawing process. However, this integration requires critical reflection on the limitations and potential of technology, especially in complex, historical projects.

This paper explores the challenges of AI redrawing and its impact on traditional methods. For this sample, two original Le Corbusier drawings were selected for their spatial and conceptual relevance. These were uploaded to Redraw with metadata on materials, location, date, and stylistic traits from the period. The AI-generated images were then compared to the original drawings through qualitative visual analysis, focusing on spatial configuration, material accuracy, and interpretive coherence. Redraw is Brazil's irst AI to convert sketches into 3D images [Redação Arqbrasil 2023]. Launched in 2023, the software generates visualizations within seconds, raising questions about the relevance of manual redrawing. Challenges include the need for supervision to ensure AI aligns with the architect's intentions and the continued value of manual redrawing.

Architectural Drawing and the Practice of Redrawing

Drawing, an essential practice for architects, encompasses technical, artistic, and analytical records. Crucial in the design process, sketches present ideas, while perspectives highlight concepts and details that reflect intentions. Many authors are references in the study of architectural drawing, such as Luigi Vagnetti [Vagnetti 1958], Vittorio Gregotti [Gregotti 2014], Paolo Belardi [Belardi 2014], Mario Docci, Marco Gaiani, Diego Maestri [Docci, Gaiani, Maestri 2017], among others, who emphasize the various types of drawing and representation in architecture and their significance. Manfredo Massironi highlights the communicative aspects of drawing [Massironi 2015]. Vagnetti notes in *Disegno e Architettura* that representation takes on a meaningful characterization of an era, acting as a living testimony of a period and a taste of the time [Vagnetti 1958, p. 26]. Florio emphasizes sketching as a fundamental record in architectural conception, aimed at finding design solutions [Florio 2010]. It explores forms and spatial arrangements without being tied to technical details, allowing multiple options to be explored in a short time.

Although Le Corbusier's design for the University City in Rio de Janeiro was never built, its study is revealing. As Tagliari points out, unrealized projects are important for the ideas that structure them, integrating them into the architect's broader body of work [Tagliari 2012]. Revisiting elements through redrawing allows for an investigation of the project's conception, offering a deeper understanding of its characteristics. Redrawing facilitates visualization and acts as a tool for analysis and the discovery of the essence of the project.

According to Gomes "Redrawing work allows for the synthesis of information from original documents collected in an archive, with additional elements gathered during a site visit. This interpretative synthesis of all the collected information enables and supports a tectonic analysis of the respective work. The descriptive and narrative capacity of the newly produced documents, particularly redrawing, as represented in the axonometrics, provides information that is inherent to its visualization as both an image and an architectural project" [Gomes 2019, p. 169]. Redrawing consists of reviewing and reinterpreting an existing project to understand its strengths and weaknesses, identify improvements, and explore solutions that assist future design practices. An investigation that utilizes various sources of information can clarify both the work and its process of origin. The redrawing process closely follows the development and conception of a project. According to Mahfuz "What I propose is continuous work on architecture: redrawing exemplary projects as a way to acquire specific knowledge about the key aspects of architecture. Any building with which we have had close contact – whether by designing it, constructing it, or redrawing it – will never leave our memory, becoming raw material for future works" [Mahfuz 2013, n. p.].

Redrawing sketches is less common, as they are considered personal, making analysis more difficult. Carvalho's research, which involved redrawing sketches of Enrique Miralles' work, sought to understand the design actions in the project [Carvalho 2021], as did Alessi in the study of

Eduardo Souto de Moura's architecture [Alessi 2017]. These studies raise questions about the interpretation and challenges in the analysis of this type of drawing.
Given the historical significance of redrawing as a means of gaining a deeper understanding of architectural works, this study proposes AI as a contemporary extension of this method. Rather than replacing manual techniques, AI-generated redrawing is evaluated for its potential to accelerate, visualize, and even reinterpret architectural intentions.

Experimental Study on the Redrawing of Le Corbusier's University City Project in Brazil

This section explores digital redrawing generated by AI based on Le Corbusier's drawings for the University City project in Rio de Janeiro. To provide some context, according to Harris, this project had several versions and was initiated by Marcello Piacentini [Harris 1987]. Following criticism, Minister Capanema formally requested that Le Corbusier evaluate Piacentini's plan during his visit to Brazil. According to Alberto, Lucio Costa, a member of the technical committeewas, already discussing with Capanema the possibility of hiring Le Corbusier as a consultant for the University City project [Alberto 2003, p. 106]. Lucio Costa sought the support of an international authority, but the government was already committed to Piacentini. In this backdrop, Le Corbusier's drawings emerged, serving as both criticism and guidance to the initial project.
In this work, we will evaluate two of these conceptual drawings: one related to the overall perspective of the project and the other to an approach characteristic. The originals reveal his vision and creative sensitivity. As Perrone highlights, "architectural drawing as a graphic, didactic, and explanatory argument is Le Corbusier's most compelling and effective contribution to the formulation of modern architecture" [Perrone 1993, p. 419].

Le Corbusier's Drawings and Redrawings with AI in the Redraw System: Analysis of an Experiment
According to Sischman "There is no proper academic definition of what AI is. It is certainly a branch of computer science/engineering, and therefore aims to develop computational systems that solve problems". Therefore, "Instead of trying to define AI, it would be more appropriate

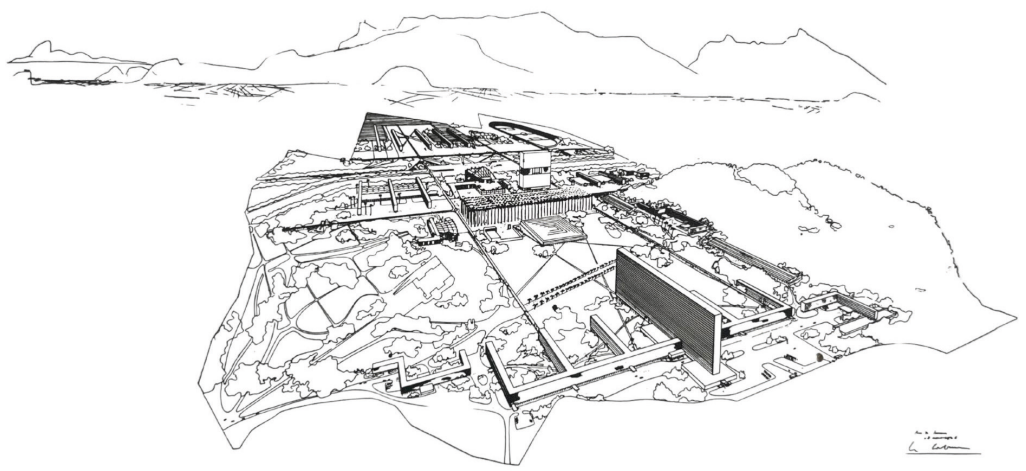


Fig. 1. Le Corbusier's design for the University City of Rio de Janeiro, general perspective.

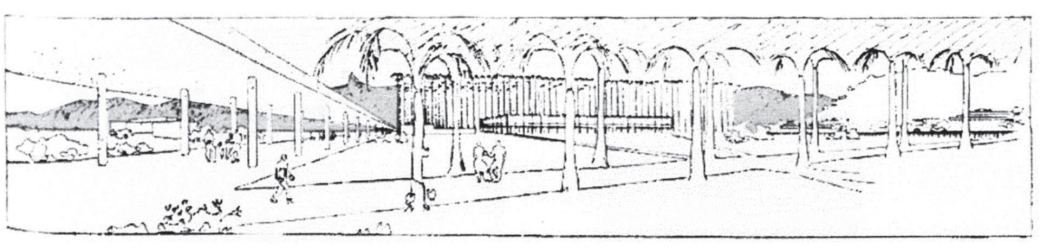


Fig. 2. Le Corbusier's design for the University City of Rio de Janeiro, enlarged sector.

to attempt to characterize the goals of the field. One of the first attempts at this approach [...] is as follows: the goal of AI is to develop systems to perform tasks that, at present, (i) are better carried out by humans than by machines, or (i) tasks for which there is no viable algorithmic solution through conventional computing" [Sichman 2021, p. 38]. The digital images generated by AI in the Redraw system, based on the reading of the drawing, provide a more accurate visualization of Le Corbusier's architectural spaces and forms, adding materiality, colors, and textures. They are created by algorithms that process data and specific parameters to generate a virtual representation of the project.

An analysis of the digital redrawing by the Redraw system shows that the AI-generated images capture the essence of the original project, reflecting the architect's general intentions. However, there are discrepancies in details such as window frames and materialization. Le Corbusier, known for his use of raw materials such as concrete, proposed striking elements such as the robust marquee connecting buildings. In the digital redrawing, however, the marquee appears light, almost like a glass skin, distorting this material characteristic. The digital AI-generated redrawing helps understand the whole image by highlighting the axes more clearly. , As described by Harris, simple criteria, such as proper circulation for cars and pedestrians respecting the landscape, become clearer after adding materiality [Harris 1987]. However, the accuracy of the applications is partial, even after giving the system directions. The system's reading of the drawing relies on specific data, such as location, materials, and techniques, selected by the operator, ensuring the process is deliberate, not random. Using AI in architectural redrawing presents challenges, especially regarding the need for human supervision to avoid distorting the architect's original intentions. The algorithms follow predefined patterns, which can limit an accurate reproduction of the artistic subjectivity in manual drawings. Additionally, AI does not understand the cultural and historical context with the depth that a human researcher provides.

According to Almeida "While AI can process data on a large scale, humans can think and make abstract connections of various kinds, including developing tools to create intelligence that is

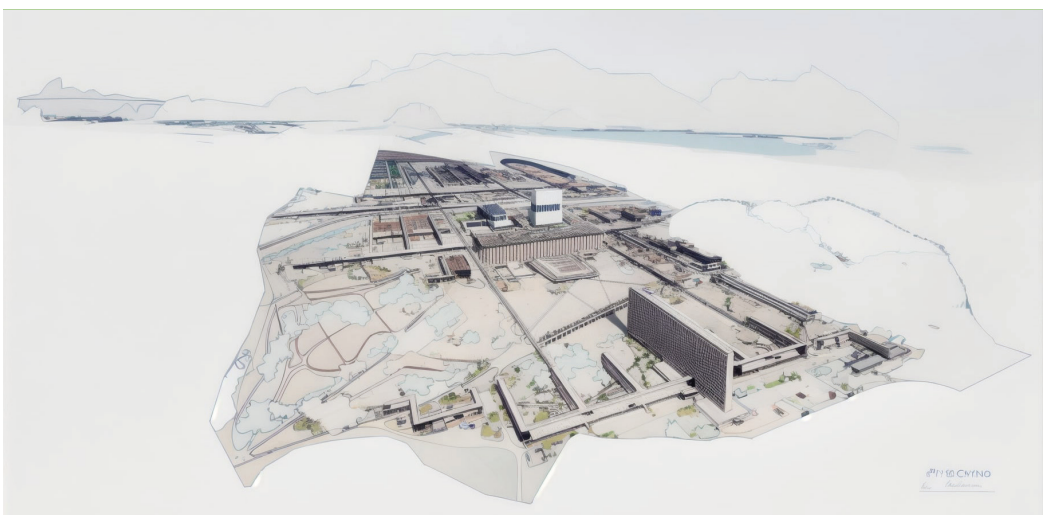


Fig. 3. Digital redrawing of Le Corbusier's design for the University City of Rio de Janeiro, general perspective, created by the authors using the REDRAW system (AI).

Fig. 4. Digital redrawing of Le Corbusier's design for the University City of Rio de Janeiro, approximate sector, created by the authors using the REDRAW system (AI).

not human, yet it is of no use unless utilized by humans. The true revolution comes from the collaboration between artificial and human intelligence. The combination of these two forms of intelligence can lead to more effective and innovative solutions. AI can be used to process data and identify patterns, while humans provide the context and intuition needed to interpret these data meaningfully" [Almeida 2024, p. p 215-216].
Traditionally, redrawing involved manual sketches and physical models. Using digital technologies, advanced 3D modeling software and simulations have emerged, enhancing this process. Redrawing does not replace these tools but acts as an auxiliary resource to enrich the analyses. According to Gallo "In an era where technological instruments dominate the scene, traditional processes of knowledge acquisition need to be revalued, especially in architecture and urbanism. Within the formative spheres of architecture, there is a division of opinions, ranging from nostalgia for the old lost procedures to the uncritical idolization of new technological instruments. Without exhausting this discussion, I only contextualize it, recording a point of view grounded in a practice carried out, assuming that 'inclusion is always richer than exclusion': I accept the qualifying role of technological means, while also attempting to understand their limits and the exclusionary processes that impoverish the results" [Gallo 2019, n. p.].
Collaboration between architects, engineers, and AI specialists is essential to enhance digital tools and improve processes. Each area shows expertise that, when integrated, enables more effective approaches. Without this interaction, the evolution of traditional methods is limited. Redrawing, as an analysis stage, requires time for deep understanding. The speed of AI in generating redrawn images offers a visually attractive product, but it does not imply that the researcher has understood and analyzed the project; therefore, it does not replace analysis and understanding essential to the methodological process.

Final Considerations

The comparison between AI-generated images and an architect's original drawings highlights the importance of integrating both natural and artificial intelligence in the practice of architectural redrawing. Both methods have their merits and challenges, and their complementary use can lead to more robust and innovative results. One method accelerates the understanding and comprehension of the other. While the Redraw system offers a more immediate dynamic of the process's result, which assists traditional digital redrawing. The latter provides rotation and diversification of angles, as well as closer approximations with greater clarity. In this format, it becomes clear that there are no features that suggest the replacement of traditional redrawing methods.
Manual redrawing continues to play a crucial role in complementing and integrating the intrinsic details of a project, offering a deeper understanding of the architectural work. Nevertheless, it is essential to consider the different perspectives and approaches that can be adopted in redrawing. The introduction of AI in the architectural redrawing process marks a new approach to visualizing and analyzing projects, especially when dealing with historical works. Using systems, for instance, Redraw, opens up possibilities for a more in-depth and accessible study of drawings, perspectives, and complex sketches, such as those by Le Corbusier. While human supervision remains essential to ensure historical and interpretive accuracy, AI provides a powerful tool for reproducing, analyzing and preserving architectural projects, enriching the field of architecture with new ways of interacting with the past and the present.
Thus, this study does not end with its preliminary results, but is rather a starting point for future investigations, pointing to methodological and critical paths that can be further explored. Rather than focusing on immediate success, the aim is to understand the process, detours, and insights that arise. Reflecting on the limitations encountered helps set clearer expectations for the role artificial intelligence may play in historiography and architectural design. From these initial steps, new possibilities may emerge. Over time, technology could engage in a more sensitive and intelligent dialogue with the complexities of architecture.

Reference List

Alberto, K.C. (2003). *Três Projetos para uma Universidade do Brasil. 2003*. Dissertação de Mestrado em Urbanismo. Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Alessi, E.S. (2017). *O Desenho como Método de Investigação do Processo de Projeto do Arquiteto Eduardo Souto de Moura*. Dissertação de Mestrado. São Paulo: Universidade Presbiteriana Mackenzie.

Almeida, L.B. de (2024). Explorando o Futuro da Inteligência com a inteligência artificial, os seres humanos, a aprendizagem no contexto e na experiência. In *Revista Psicopedagogia,* v. 41, n. 125, pp. 215-219. https://doi.org/10.51207/2179-4057.20240036.

Belardi, P. (2014). *Why architects still draw*. Cambridge: The MIT Press.

Carvalho, M A.A. de (2021). *Olhares de Miralles: a transformação da realidade a partir dos princípios criativos de Enric Miralles*. Dissertação de Mestrado. São Paulo: FAUUSP.

Docci, M., Gaiani, M., Maestri, D. (2017). *Scienza del disegno*. Novara: CittáStudi Edizioni.

Florio, W. (2010). Croquis de concepção no processo de projeto em Arquitetura. In *Exacta*, n. 8/3, pp. 373-383.

Gallo, H. (2019). *O croqui como instrumento de conhecimento: registro de uma experiência internacional em arquitetura e urbanismo*. In *Arquitextos*, São Paulo, ano 19, n. 224. 01, Vitruvius. https://vitruvius. com. br/revistas/read/arquitextos/19. 224/7273.

Gomes, R. A. (2019). Redesenho como Método Analítico e Instrumento de Investigação em Arquitetura. In *Expressão Múltipla II. Teoria e Prática do Desenho,* Atas das Conferências. Universidade de Lisboa, Faculdade de Belas-Artes, Centro de Investigação e Estudos em Belas-Artes, pp. 167-177. http://hdl. handle. net/10451/40647.

Gregotti, V. (2014). *Il Disegno come strumento del progetto*. Milano: Christian Marinotti Edizioni.

Harris, E.D. (1987). *Le Corbusier. Riscos brasileiros*. São Paulo: Nobel.

Mahfuz, E. da Cunha (2013). Banalidade ou correção: dois modos de ensinar arquitetura e suas consequências. In *Arquitextos*, São Paulo, ano 14, n. 159. 05, Vitruvius. https://vitruvius.com.br/revistas/read/arquitextos/14.159/4857.

Massironi, M. (2015). *Ver pelo desenho. Aspectos Técnicos, Cognitivos, Comunicativos*. São Paulo: Edições 70.

Perrone, R. A. C. (1993). *O desenho como signo da arquitetura*. Tese de Doutorado em Estruturas Ambientais Urbanas, Faculdade de Arquitetura e Urbanismo, orientador L. Ferrara. Universidade de São Paulo.

Redação Arqbrasil (November 25, 2023). *Renderização em tempo recorde com IA*. https://arqbrasil. com. br/29530/renderizacao-em-tempo-recorde-com-ia/.

Sichman, J. S. (2021). Inteligência artificial e sociedade: avanços e riscos. In *Estudos Avançados*, São Paulo, v. 35, n. 101, pp. 37-49. https://doi.org/10.1590/s0103-4014.2021.35101.004.

Tagliari, A. (2012). *Os projetos residenciais não construídos de Vilanova Artigas em São Paulo*. Tese de Doutorado em Projeto de Arquitetura, Faculdade de Arquitetura e Urbanismo, orientador R. A. C. Perrone. FAUUSP.

Vagnetti, L. (1958). *Disegno e Architettura*. Genova: Società Editrice Vitali e Ghianda.

Authors
Juliana Costa Motta Benetti, Universidade Estadual de Campinas (UNICAMP), j196318@dac.unicamp.br
Ana Tagliari, Universidade Estadual de Campinas (UNICAMP), anatagli@unicamp.br

To cite this chapter: Juliana Costa Motta Benetti, Ana Tagliari (2025). Artificial Intelligence in Le Corbusier's Redrawn Process - Rio de Janeiro University City Project. In L. Carlevaris *et al.* (Eds.). *èkphrasis. Descrizioni nello spazio della rappresentazione/èkphrasis. Descriptions in the space of representation.* Proceedings of the 46th International Conference of Representation Disciplines Teachers. Milano: FrancoAngeli, pp. 3091-3096. DOI: 10.3280/oa-1430-c915.

ISBN 9788835182412