

SURVEY, RECOVERY AND REGENERATION OF POST-MODERN ARCHITECTURE. The BIM approach in the case study of the Sports Hall in Bastia Umbra (Italy).

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ABSTRACT:

This study deals with the redevelopment of buildings built in the last decades of the Nineteenth century, with a style that can be defined "post-modern". In those years, communication became an architectural theme superimposed and abstract by functional and structural needs, with "architectural elements" abstract in a hyperbolic way with respect to the function. The result of an architectural culture, interesting for the research they narrate but incongruous with functional needs, also because of the materials used, the energy and architectural requirements impose a review to combine functional performance, in nZEB projection, and structural with the need for "venustas", what is "done well", the same facet of the same architectural rationale. The need to renew these spaces must take into account the qualities of forms that, with their material decay and in the peculiar language, may not bring out the centrality of preserving and compositional choices of the work.

1. INTRODUCTION

The present research starts from the studies carried out on a case of postmodern architecture, located in Umbria, in the city of Bastia Umbra, between Perugia and Assisi. This is the Sports Hall, designed by architect Leoncilli Massi (Leoncilli Massi, 2013, 1985), professor of Architectural Composition at the University of Florence. It is a building built in the Eighties, strongly influenced by the stylistic features, language and construction techniques of that period, which needs a recovery from a functional and performance point of view, projecting itself towards "nZeb" solutions (Costanzo, 2019), without however losing those qualities that led it to be included among the contemporary Umbrian works cataloged by MiBac ("Architetture del secondo 900," n.d.).

If the architectures of the previous period of the Modern have found codifications of the strategies of recovery and regeneration (Bardelli, 2001; Poretti, 1999), the Post-modern, in its definition, carries within itself a reflection translated into signs on the society of communication (McLuhan, 1964), born from the great architectural theorist Charles Jencks (Jencks, 2007, 2005, 1991, 1987), in particular from his famous work "The Language of Post-Modern Architecture" (Jencks, 1991), which went on to sell over 160,000 copies over seven editions in 10 languages. This style is in fact part of a debate on architectural language, a process that includes semantic questions (N. et al., 1934) and structuralism (Lévi-Strauss, 1978; Lévi-Strauss and Naumann, 1971) by relating in the form communication processes and the value of meanings (Jencks, 1969). Thus, a specific architectural language is strengthened (Wiseman et al., 1990), which accompanies lightness and irony (Petit, 2013) to an irreverent subversion typical of post-1968 culture (Adamson and Pavitt, 2011). In reality, as Robert Venturi will come to theorize in his masterpiece "Complexity and Contradictions in Architecture" (Venturi, 1967), the

manifesto of post-modern architecture, the proposed critique is a harbinger of awareness of the plurality of meanings (Bianconi and Filippucci, 2021) and an already strong dynamism in the "on the road" culture (Appleyard et al., 1966; Venturi et al., 1977). In Italy, post-modern culture is grafted with the pragmatism of the typological debate (Benevolo, 1960; Insolera, 1960; Melograni, 1960; Ponti, 1956; Quaroni, 1960, 1957, 1956; Quartulli, 1967; Ripamonti, 1956; Romita, 1956; Samonà, 1959, 1949; Tafuri, 1982; Zevi, 1956), enriching itself with conceptualizations linked to history that enhance its qualities. Aldo Rossi, with his famous volume of 1966 (Rossi, 1966), practically parallel to the work of Venturi, entered the international debate in a disruptive way, and, it is not secondary to point out the value of the first Venice Biennale of 1980, dedicated to "The Presence of the Past" (Pirovano, 1980), an event that would mark the history of architecture in the second half of the twentieth century, marking an affirmation of Post-Modern culture (Portoghesi, 1982), which finds in Aldo Rossi himself, albeit with a different seriousness with respect to the international scene (Mosley and Sara, 2013) one of its protagonists (Cantafora and Rossi, 1999).

In this relationship between semantics, history, meaning and image, architectural solutions are determined, such as that of the case in question, where the denotative elements become connotative (Dorfles, 1992), where the particular (Andriani, 1981; Cellini et al., 1979) becomes all-encompassing (Barthes, 1979), where the architectural elements (e.g. the beams) are symbolically placed outside to communicate and critically subvert, retracing similar processes (Dorfles, 1984) to those that occurred in the Baroque (Frommel and Sladek, 2000; Zevi, 2018). Attempts to construct a material semiology of architecture run into problems of a theoretical and applicative nature (Garroni, 1970): the metalanguage is in fact based on the need for a common codification, a condition that is lost over time, by reinforcing the specificity of the temporality of what

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was born for the present. In the subversion of the critique inherent in postmodern avant-garde, then some substantial issues inherent in the pragmatic value of the tradition of building are lost, where order is born first of all from needs and from an orthopraxis verified over time. As in the case study, some solutions appear for this same subversion and recomposition of the fragment that do not perform over time, adding to the complexity and impromptu nature of the decoding, even more practical needs that redetermine a rethinking and a return to realism, to which it is associated another language than the metaphor of symbolism.

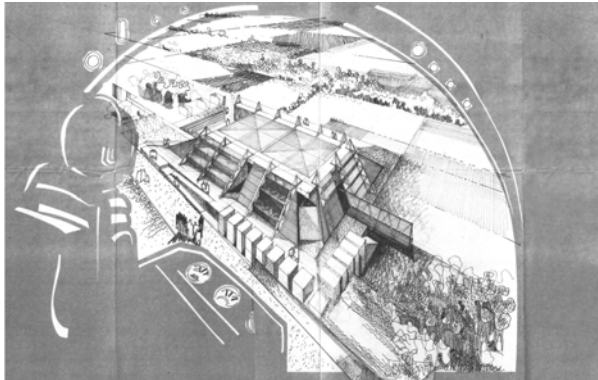


Figure 1. Perspective of the first project of what was initially a covered market drawn up by prof. Leoncilli Massi in 1972.

The question that then opens up is how to intervene on these architectures that have their own language and style that do not require restoration but a regeneration, to redevelop functions and redetermine meanings that go beyond expressivism. In this sense, there are numerous cases in which there is a reuse of the artifacts through a single homogeneous color. Paradigmatic is the gold color that the OMA Foundation has provided for the Prada Foundation building ("Fondazione Prada a Milano - Domus," n.d.), or the chiaroscuro effect given by the shades of gray for the Burri Foundation ("Fondazione Palazzo Albizzini Collezione Burri - Alberto Burri, Città di Castello, Burri Centenario, Alberto Burri nel Mondo, Burri New York, Ex Seccatoi del Tabacco," n.d.), already in the early nineties, or in the MACRO Museum ("MACRO Museo di arte contemporanea - Roma (edificio di Odile Decq)," n.d.) taken from Odille Deck. Transparency is another element that is often proposed, as opposed to the full elements of architecture: it is what Pietro Carlo Pellegrini presented for the Ex Fornace in Riccione ("Recupero della ex-Fornace di Riccione," n.d.), which has now become a school building. If the revaluation of modern buildings has already accepted and codified stylistic features, the same cannot be said for contemporary architecture for which, for temporal reasons, recovery is not yet contemplated. However, the operational question of how to intervene on these works remains substantial. The first question that arises is on the knowledge of the good and its qualities, placing in the first place on the theme of the relief (Fabio Bianconi and Filippucci, 2019a; de Rubertis, 1996, 1991) the fundamental question of the understanding of the good (Giandebiaggi, 2005). The knowledge of the good, however, is not limited to the form, but it is projected to find on this simulacrum the place of an interpretative model (Bianconi et al., 2019; Bianconi and Filippucci, 2017; F Bianconi and Filippucci, 2019) suited to integrate different data (Bianconi et al., 2018; Fabio Bianconi and Filippucci, 2019b) to transform them first into information, and then, with culture, into knowledge. Representation thus becomes the necessary, operational and theoretical process,

where it is possible to bring together the many activities necessary to understand the relationship between past and present and to simulate the near future.



Figure 2. The current state of the Sports Hall built in 1983.

2. THE CASE STUDY

The Sports Hall was born as a covered market for the city of Bastia Umbra, in the area of S. Lucia; the design is entrusted to the "Collettivo Punto Zero", in which the Arch. Giancarlo Leoncilli Massi follows the architectural part. A first draft of the project dates back to 1972, the year in which it was approved by the City Council indicating as the destination of the space a covered market. The troubled design process led to the modification of the first proposal, identifying the function of the spaces in the need for a sports space, in any case following the disbursement of funds by CONI. This new condition that leads to obtaining a second project, subsequently modified again in correspondence with its realization, whose completion only takes place in 1983.

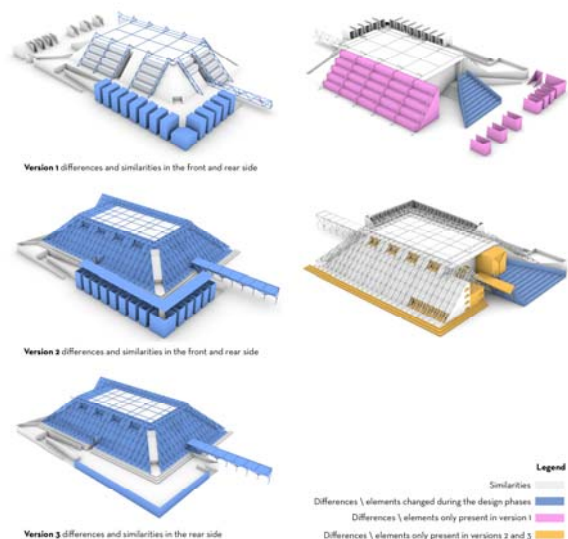


Figure 3. The evolution of the architectural project.

The work has an atypical truncated pyramid shape, reminiscent of the Egyptian mastaba, however, it has a rectangular rather than a square base, and a basement, which in principle had to contain boxes for the outdoor market. But if the pyramid works by gravity, Leoncilli Massi overturns the logic and inserts an exoskeleton, the characterizing element of the whole project. The structure recalls the themes of post-modern architecture, such as the colors chosen or rather the thermal arch-window; every corner is not simply closed, but stairways, entrances,

exits are inserted to determine a fragmentary nature. Another representative element is constituted by the shelters, supported by a steel structure with a triangular section roof with the vertex facing down, which do not convey a feeling of protection. Lastly, the offset of the base rectangle, with the base creating an "L" on the east side; the two directions are connected by the access ramp to the main entrance. From a structural point of view, it is a mixed structure: the pyramid is made of steel with the beams that make up the exposed exoskeleton, while the rest is made of reinforced concrete.

The state of the good is of an architecture that requires a path of regeneration, by virtue of material degradation due to the materials and technologies used, of the architectural choices that have created performance problems in terms of energy, with consequent punctual deterioration, of a lack of maintenance, as well as an incongruous and not very civil use, which is projected again in graffiti and in a dangerous parkour above the extrados beams.



Figure 4. The state of deterioration of the good.

3. METHODS AND TOOLS

The investigation process of the work involved cognitive and interpretative activities for an exhaustive knowledge of the artifact. This is described by two key categories, namely that of direct analysis (geometric investigation, material) in which methods, tools and results are also indicated and that of indirect analysis (bibliographic, archival, iconographic research, etc.).

In detail, in this second analysis, by analyzing the design tables it was highlighted the compositional evolution of the Sports Hall; in particular, a first perspective drawing shows the lack of the exoskeleton, in favor of a series of steps separated from each other by reticular beams. Instead, there are boxes for the open-air market and a large staircase at the rear.

We subsequently witness an evolution of the project: the intended use is still in the covered market; it is clear from the external boxes which, although changed in number, are still present, but surmounted by a particular triangular section canopy. The staircase on the rear side is mirrored, in order to facilitate the entry along this side. It is at this stage that the characteristic exoskeleton appears. Finally, the whole structure rests on three steps, which therefore constitute the crepidoma. In the last design phase, we arrive at the current configuration of the Sports Hall, and this means that the external boxes are incorporated into a single compact element.

For this study, the possibility of collecting all the data in a virtual 3D model has become a fundamental objective to support the conservation and planning of the interventions that will be foreseen in a contemporary rethinking of the artefact. The analysis of the current state therefore represented a fundamental knowledge step for the planning of future interventions.

For this purpose, the direct analysis was carried out through the survey (Figure 5); in this case, it was chosen the use of a laser scanner associated with a spherical camera. The instrumentation has been appropriately positioned so as to cover the entire area, both inside and outside the Sports Hall to fully define the point cloud.

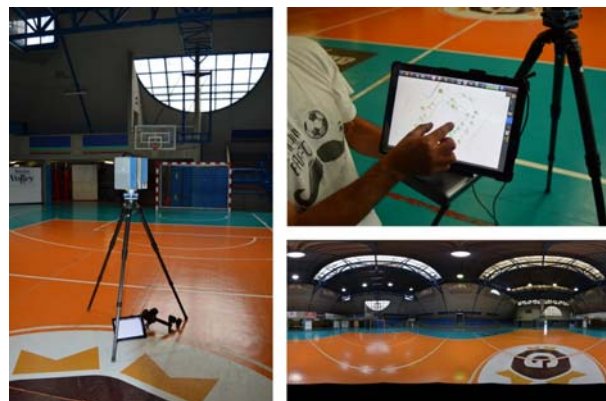


Figure 5. Scanning with the laser scanner and the spherical images obtained.

To make the point cloud suitable for subsequent processing, the ReCap 360 (Reality Capture) software was used, which allows to prepare the point clouds to be used within a CAD and BIM environment. It allows the subdivision of the clouds, whether from laser scanners or digital photography, into architectural components and their export in .rpt, file format supported by Autodesk Revit (Matrone, 2018).



Figure 6. The point cloud obtained by the laser scanner.

"The recognition of objects in HBIM projects includes identification, extraction of relationships and semantic information. The methods and tools for recognizing the object differ according to the geometric complexity of the building, the level of detail required, the capture technique, the data

format, the processing time. Nowadays there are multiple methods supported by algorithms" (Chiabrand et al., 2016). To speed up and facilitate the recognition process of the elements of the point clouds, it was used the Scan to Bim plug-in, which, on the basis of recognition algorithms (Volk et al., 2014), allows to create objects directly starting from the geometries from the point cloud.

The heart of the research is in the definition of data integration and information that correlates to the indexing and hierarchy of data that dynamically grow over time. The research led to the creation of an informative digital model developed on 5 levels of development (LOD), a concept derived by the American legislation and related to the case study. Level 0 is characterized by minimum LOG (Level of Geometry) and LOI (Level of Information), both gradually increase to the As-Built BIM, the LOG and LOI maxima. Using Revit to nest in a single file all the different levels, thus creating a "master" file from which it is possible to access to the levels where it is going to increase. This system allows to contain all information within a single link and manage it in the hierarchy of their properties (F Bianconi and Filippucci, 2019). The various information, also recovered as a result of archival research, as in the case of the Maxisol panels (Acieroid Italiana, n.d.), were inserted into the geometries as families, as well as all the characteristics of the steel carpentry, reconstructed from the executive drawings pieces recovered from the archive of the Franchi firm, also from Bastia Umbra, which created these elements.

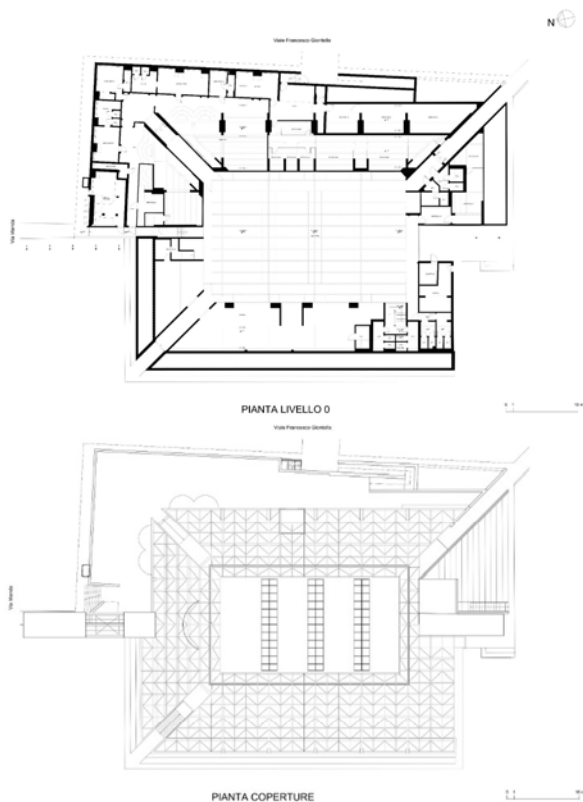


Figure 7. The plans of the surveyed building.

The interpretation of the geometric model inherent in the BIM modeling was subsequently verified with the starting cloud (Surface Analysis Tools of the PointSense plug-in), estimating an average deviation between the surfaces and the point cloud of 3 cm, in line with the tolerance of the scale of representation (Matrone, 2018), confirmation of the congruity of the model.

The digital model also allowed an energy analysis, assisted by a thermographic survey, with the data that further enriched the BIM platform. The superposition of the data with the geometries confirmed the presence of thermal bridges and dispersions over the entire structure. It was thus possible to obtain the current value of the transmittance and then hypothesize an internal insulation in order to obtain the performance compliant with those of the current regulations ("Decreto Interministeriale Requisiti Minimi del 26 giugno 2015," 2015).

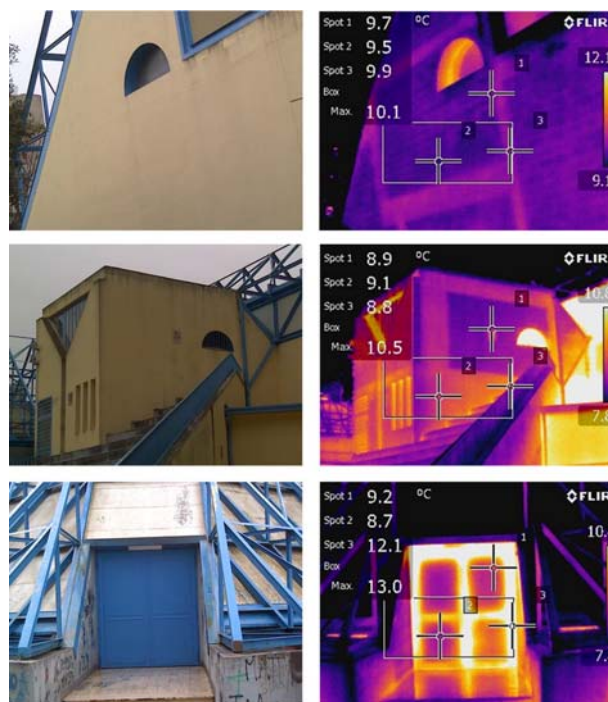


Figure 8. The results of thermal scanning.

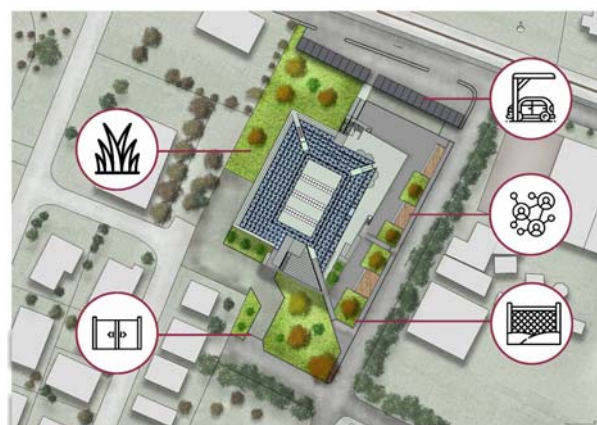


Figure 9. Graphic Master Plan of the interventions.

4. RESULTS AND PROJECT

Obtained the HBIM digital model (Brusaporci et al., 2018; Chiabrand et al., 2016), as it is the basis for benefits that will be greater in the subsequent construction phases and for facility management (Barlish and Sullivan, 2012; Dejaco et al., 2019; Hemmerling and Cocchiarella, 2018; Khanzode et al., 2008), it was possible to define a series of design solutions that are able

to overcome technological difficulties, aiming at an energy requalification and finally restore the architectural contemporaneity.

First of all, the technical problems deriving from obsolete technological solutions as well as from the architectural conformation linked to the extrados beams were addressed, and above all, those of water infiltrations that occur in particular at the level of the corrugated sheet roof, specifically at the level of the sheath, which moreover has worn out over the years. The opportunity is to completely review the roof covering, i.e. both the insulating layer, assumed to be EPS, and the waterproofing one. Another weak point are the internal lunettes, in this case the infiltration goes back into the frame. In order not to change the architectural composition desired by Arch. Leoncilli Massi, it was decided to leave the thermal windows intact inside, closing them on the outside and restoring continuity with what is the panel below the exoskeleton through an insulated closure. After having detected and designed the architectural elements and the issues inherent in the architectural choices that today appear to be inadequate, the critical issues of the Sports Hall related to the materials used, and in particular the exposed concrete, were addressed to face the problems of deterioration related to the use of the structure, and in particular to the phenomenon of graffiti. To answer both questions, beyond conservative interventions, an external covering in stoneware was created, a light material, easy to apply and washable.



Figure 10. Simulation of the chromatic requalification and the insertion of the micro-perforated sheet.

In face of a necessary recovery of the work from an architectural point of view, which does not distort the intention of the design, but it is able to give a contemporary interpretation, it was first thought to connote the place with that non-color of gray dark that exalted the forms without having to appear. In parallel, it was decided to cover the steel structure with an expanded metal sheet of the same color, suitably hooked to the existing structure. Its texture will still allow you to see the important exoskeleton, but at the same time it will prevent that

incongruous use perpetuated today that sees young people climbing here. Figure 10 summarize and show, in the light of the proposed interventions, the new configuration of the Sports Hall, in the day and night version.

Together with the work proposed for the Sports Hall, solutions were also suggested for the area that delimits it. At present, there are many green spaces, however street furniture is almost non-existent: there are only a few seats along Viale Giontella, close to the road, in direct communication with the cycle path and the opposite parking lot. The area is accessible in all its parts, and if this might seem a strength, in reality it is also a weakness, as the Sports Hall has no barriers and it is vulnerable to the phenomena of vandalism that has already been mentioned and treated. It is therefore necessary to redefine what is the urban space, giving greater attention to planning and design, which until now has been neglected.

The space was therefore delimited by a fence that divides the private space of the Sports Hall from the public one; this is also interspersed with a series of pedestrian and driveway gates for entering into the structure. The layout of the fence determines a series of squares, which can offer citizens some services, from information about the events of the Sports Hall, to smart accessories, such as charging for smartphones. Inside the Sports Hall, the delimitation of the spaces is given by the green areas. Finally, on the side facing Via Irlanda, the existing car park was equipped with a shelter, which can house photovoltaic panels or charging columns for electric cars.



Figure 11. Simulation of the redevelopment of the urban space with the courts as meeting places and the front with the photovoltaic shelter.

5. CONCLUSIONS

Regenerating an architecture born conceptually with its own fluidity and with typical stylistic features linked to the image and its transience is an operation of complex implementation. The need to redevelop both the spaces and the image is confronted in a relationship with the past that is placed at the center of the design process, without the reverence of maintaining what appears today. The path has developed, in addition to technical approaches, by juxtaposing a comparison with citizenship, with questionnaires that highlighted the "resistance to change" of those who have always lived in these places, and the inability to grasp the meanings of those who

finds himself to relate to these spaces "out of time", external to a story and from that image that generates affection and roots values.

The investigation process of the work made it possible to collect data, which were then transformed into information by technical knowledge, and into knowledge for the project by culture, which is called to interpret and project them into the near future. Point clouds, integrated information, data complexity management, are all elements that converge within the BIM logic to define a certainly technical path, based on data, but projected to information, with the concrete prospect of transforming it into knowledge, which is the basis that "supports" the project.

In this way, a path is developed that is projected towards urban and architectural regeneration, overcoming the requalification needs in the redesign of a place and its meanings that is projected to give birth to the sense of place, the processes of belonging, the living of this space. Respecting history, a connotative language, architecture and urban space are analyzed in the relationship with time, reading those adaptive logics and behaviors to find solutions capable of surviving over time. The theme of regeneration places the person and the community at the center, seeking in architecture the reason to rethink a social relationship, especially by virtue of the social and cultural distancing resulting from the pandemic period. Regenerating means giving new life to meanings, entering, through the image, into the heart of the life of those who live the places, in order to convert in a deeper sense, the role of public spaces, well beyond the symbolic aspects, places that can instead positively mark the life and well-being of the community that lives them.



Figure 12. Simulation of the morphological enhancement inherent in the architectural and urban recovery and regeneration path.

REFERENCES

Acieroid Italiana, *Costruire Pareti*. Agema, Milano.

Adamson, G., Pavitt, J. (Eds.), 2011: *Postmodernism: Style and Subversion, 1970-1990*. Victoria & Albert Pubs, London.

Andriani, C., 1981. Mario Ridolfi. Il linguaggio senza parole dell'architettura. *Controspazio* XII, 194–211.

Appleyard, D., Lynch, K., Myer, J.R., 1966: *The View from the Road*. Joint Center for Urban Studies of the Massachusetts Institute of Technology and Harvard University, Cambridge.

Architetture del secondo 900, <http://www.architetturecontemporanee.beniculturali.it/architetture/index.php> (accessed 6.27.21).

Bardelli, P.G., 2001: *La costruzione moderna in Italia: indagine sui caratteri originari e sul degrado di alcuni edifici*. EdilStampa, Roma.

Barlish, K., Sullivan, K., 2012: How to measure the benefits of BIM — A case study approach. *Automation in Construction* 24, 149–159. <https://doi.org/10.1016/J.AUTCON.2012.02.008>

Barthes, R., 1979: *Frammenti di un discorso amoroso*. Einaudi, Torino.

Benevolo, L., 1960: La progettazione dei quartieri INA-casa. *Centro sociale*, 30–31.

Bianconi, F., Filippucci, M. (Eds.), 2021: *Digital Draw Connections, Lecture Notes in Civil Engineering*. Springer International Publishing, Cham.

Bianconi, Fabio, Filippucci, M., 2019a: Visione e disegno. Percezione, rilievo e progetto per nuovi modelli di spazi urbani, *Mondi e Modi Dell'abitare Per Una Sociologia Della Convivenza*. Rubbettino, Soveria Mannelli (CZ), 81–104.

Bianconi, F., Filippucci, M., 2019: *WOOD, CAD AND AI: Digital modelling as place of convergence of natural and artificial intelligent to design timber architecture*, Lecture Notes in Civil Engineering. https://doi.org/10.1007/978-3-030-03676-8_1

Bianconi, F., Filippucci, M., 2019b: *Landscape Lab. Drawing, Perception and Design for the Next Landscape Models*. Springer, Basingstoke.

Bianconi, F., Filippucci, M., 2017. Il disegno degli olivi tra forma e luce. Le potenzialità analitiche della rappresentazione parametrica nell'interdisciplinarietà della ricerca, in: Gangemi (Ed.), *Territori e Frontiere Della Rappresentazione / Territories and Frontiers of Representation*. Gangemi, Roma, pp. 439–450.

Bianconi, F., Filippucci, M., Amoruso, G., Bertinelli, M., 2019: FROM THE INTEGRATED SURVEY OF HISTORIC SETTLEMENTS TO THE PATTERN BOOK WITHIN THE BIM. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLII-2/W9*, 135–142. <https://doi.org/10.5194/isprs-archives-xlii-2-w9-135-2019>

Bianconi, F., Filippucci, M., Seccaroni, M., 2018. Rappresentare la percezione: ricostruzione d'ambiente e algoritmi per la valutazione dell'impatto delle forme nel paesaggio, *3D MODELING & BIM. Nuove Frontiere*. DEI s.r.l. TIPOGRAFIA DEL GENIO CIVILE, Roma, 336–349.

Brusaporci, S., Ruggeri, G., Maiezza, P., Tata, A., 2018: AHBIM per l'analisi stratigrafica dell'architettura storica. *Restauro Archeologico* 27, 112–132.

Cantafora, A., Rossi, A., 1999: *Aldo Rossi. Tutte le opere*. Electa, Milano.

Cellini, F., D'Amato, C., Valeriani, E., 1979: *Le Architetture di Ridolfi e Frankl*.

Chiabrando, F., Sammartano, G., Spanò, A., 2016: HISTORICAL BUILDINGS MODELS AND THEIR HANDLING VIA 3D SURVEY: FROM POINTS CLOUDS

- TO USER-ORIENTED HBIM. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* XLI-B5, 633–640. <https://doi.org/10.5194/isprs-archives-xli-b5-633-2016>
- Costanzo, E., 2019: *Osservatorio degli edifici a energia quasi zero (nZEB) in Italia: 2016-2018*. Roma.
- de Rubertis, R., 1996: Il modello conoscitivo e le "sue" rappresentazioni, *Il Rilievo. Dall'architettura Concreta Al Suo Modello Immateriale*. Centro di Stampa dell'Università degli Studi di Perugia, Perugia.
- de Rubertis, R., 1991. La relazione introduttiva. Dimensioni del disegno. Il rilievo fra Storia e Scienza. *XY* 11–12.
- Decreto Interministeriale Requisiti Minimi del 26 giugno 2015, 2015.
- Dejaco, M.C., Revolti, A., Moretti, N., 2019: A BIM approach for small construction sites, *CIB World Building Congress 2019 Constructing Smart Cities 17–21 June 2019*. Hong Kong, 1–10.
- Dorfles, G., 1992: Strutturalismo e semiologia in architettura, Jencks, C., Baird, G. (Eds.), *Il Significato in Architettura*. Dedalo, Bari.
- Dorfles, G., 1984: *Architetture ambigue. Dal neobarocco al postmoderno*. Edizioni Dedalo, Bari.
- Fondazione Palazzo Albizzini Collezione Burri - Alberto Burri, Città di Castello, Burri Centenario, Alberto Burri nel Mondo, Burri New York, Ex Seccatoi del Tabacco, URL <https://www.fondazioneburri.org/> (accessed 6.27.21).
- Fondazione Prada a Milano - Domus https://www.domusweb.it/it/architettura/2015/05/11/fondazione_prada_a_milano.html (accessed 6.27.21).
- Frommel, C.L., Sladek, E., 2000: Francesco Borromini. *Comitato Nazionale per le celebrazioni del quarto centenario della nascita di Pietro da Cortona, Bernini, Borromini - Bibliotheca Hertziana (Max-Planck-Institut)*, Roma.
- Garroni, E., 1970: Semiotica e architettura. Alcuni problemi teorico-applicativi. *Op.cit.* 18.
- Giandebiaggi, P., 2005. Rilievo e conoscenza dell'architettura: ricerca delle innovazioni nella tradizione costruita, Bertozzi, P., Ghini, A., Guardigli, L. (Eds.), *Le Forme Della Tradizione in Architettura. Esperienze a Confronto*. FrancoAngeli, Milano.
- Hemmerling, M., Cocchiarella, L. (Eds.), 2018: *Informed architecture: computational strategies in architectural design*. Springer, Cham.
- Insolera, I., 1960: Lo spazio sociale della periferia urbana. *Centro sociale*, 30–31.
- Jencks, C., 2007: *Critical Modernism: Where is Post-Modernism Going? What is Post-Modernism?* Academy Press, Cambridge.
- Jencks, C., 2005: *Iconic Building: The Power of Enigma*. Frances Lincoln Publishers Ltd, London.
- Jencks, C., 1991: *Language of Postmodern Architecture*, 6th ed. Wiley-Academy, London.
- Jencks, C., 1987: *Post-modernism: the new classicism in art and architecture*. Academy, London.
- Jencks, C., 1969: *Meaning in architecture*. The Cresset Press, London.
- Khanzode, A., Fischer, M., Reed, D., 2008: Benefits and lessons learned of implementing building virtual design and construction (VDC) technologies for coordination of mechanical, electrical, and plumbing (MEP) systems on a large healthcare project. *ITcon* 13, 324–342.
- Leoncilli Massi, G., 2013: *La leggenda del comporre*. Alinea, Firenze.
- Leoncilli Massi, G., 1985: *La composizione commentari*. Marsilio, Venezia.
- Lévi-Strauss, C., 1978: Myth and Meaning: *Cracking the Code of Culture*, Schocken, New York.
- Lévi-Strauss, C., Naumann, H., 1971: *Strutturale Anthropologie I*, Suhrkamp-Taschenbuch.
- MACRO Museo di arte contemporanea - Roma (edificio di Odile Decq) <https://www.inexhibit.com/it/mymuseum/macro-roma/> (accessed 6.27.21).
- Matrone, F., 2018: HBIM FROM POINT CLOUDS: METRIC ACCURACY AND RESULTS ASSESSMENT. *Bollettino Sifet* 2.
- McLuhan, M., 1964: *Understanding Media*. Gingko Press, Berkeley.
- Melograni, C., 1960: L'intervento pubblico dell'edilizia economica nella pianificazione urbana. *Centro sociale*, 30–31.
- Mosley, J., Sara, R., 2013: Architecture and transgression: An interview with bernard tschumi, *Architectural Design*. John Wiley & Sons, Ltd, 32–37.
- N., E., Hartshorne, C., Weiss, P., 1934: Collected Papers of Charles Sanders Peirce. *The Journal of Philosophy*. <https://doi.org/10.2307/2016224>
- Petit, E.J., 2013: *Irony; or, The Self-Critical Opacity of Postmodern Architecture*. Yale University Press, New Heaven.
- Pirovano, C. (Ed.), 1980: *La Presenza del Passato: Prima Mostra Internazionale di Architettura*. Electa, Venezia.
- Ponti, G., 1956: Nelle architetture dette popolari fantasia come in antico. *Domus* 314.
- Poretti, S., 1999: Il modo di costruire: un filo di continuità nell'architettura del Novecento, Casciato, M., Al., E. (Eds.), *Architettura Moderna in Italia. Documentazione e Conservazione Atti Del Primo Convegno Nazionale Docomomo Italia*. EdilStampa, Roma.
- Portoghesi, P., 1982: *Postmodern. L'architettura nella società postindustriale*. Mondadori Electa, Milano.

Quaroni, L., 1960: L'abitazione per le famiglie a basso reddito. *Urbanistica* 31.

Quaroni, L., 1957: La politica del quartiere. *Urbanistica* 22.

Quaroni, L., 1956: Città e quartiere nella attuale fase critica di cultura. *La Casa*.

Quartulli, A., 1967: I protagonisti dell'edilizia popolare. *Edilizia Popolare* 79.

Recupero della ex-Fornace di Riccione
http://www.pietrocarlopellegrini.it/progetti/news-3/28_pellegrini-07-14-066-copy/ (accessed 6.27.21).

Ripamonti, C., 1956: Analisi della situazione edilizia in Italia e in Europa. *Edilizia Popolare* 10.

Romita, G., 1956: *La città, il quartiere, la casa*. Ministero dei LL.PP., Roma.

Rossi, A., 1966: *L'architettura della città*. Marsilio, Padova.

Samonà, G., 1959: *L'Urbanistica e l'avvenire della città*. Laterza, Bari.

Samonà, G., 1949: Il piano Fanfani in rapporto all'attività edilizia dei liberi professionisti. *Metron* 33–34.

Tafari, M., 1982: *Architettura italiana 1944-1981*. Einaudi, Torino.

Venturi, R., 1967: *Complexity and Contradiction in Architecture*. The Museum of modern art, New York.

Venturi, R.C., Scott Brown, D., Izenour, S., 1977: *Learning from Las Vegas: the forgotten symbolism of architectural form*. Mit Pr, Cambridge.

Volk, R., Stengel, J., Schultmann, F., 2014: Building Information Models (BIM) for existing buildings - literature review and future needs. *Automation in Construction* 38, 109–127.

Wiseman, M.B., Klotz, H., Donnell, R., 1990: The History of Postmodern Architecture. *The Journal of Aesthetics and Art Criticism* 48. <https://doi.org/10.2307/430914>

Zevi, B., 1974: *Architettura e storiografia: le matrici antiche del linguaggio moderno*. Einaudi, Torino.

Zevi, B., 1956: Quartieri coordinati in città disarticolate. *L'Architettura* 9.