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The Numerical Matrix in Samonà's Architecture in Messina: From Geometry to Visual Modeling

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Abstract
The drawings of the residential buildings designed by Giuseppe Samonà for the *Cortina del Porto* of Messina are set in the historical context of the mid-twentieth century, a period in which the transition from academic graphic virtuosity to the exaltation of line as an expression of design invention had already occurred. Graphic language becomes the means of communicating architecture, where pure geometric figures and rational numbers are the codified expression that visualizes form, defines functions, and verifies dimensions. The representation of the elevation is the tool with which Samonà expresses the syntactic variations of the blocks. Ink drawings on tracing paper, a differentiated stroke for each element defines the rigid structural structure, the window divisions, or the balcony overhangs. The identification of modules and relationships become the basis for the structuring of a Python code, combined with the VPL, through which knowledge and valorization can be produced.

Keywords Drawing · Architectural analysis · Geometric grammar · Architectural matrix · Visual programming language

Introduction

Giuseppe Samonà was an engineer, architect, and urban planner with a "propensity for a long-term perspective and for project as an intellectual product" (Pujia 2020, p. 11).

His training developed during the transition from traditionalist stylistic features to the experimental approaches that brought him closer to the exponents of the Modern Movement in Europe and America. A scholar of the most important phenomena of

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modern architectural movements, focused his knowledge on the poetics of organic architecture and the compositional exploration of geometric signs. His projects are complex texts, susceptible to multiple interpretations, yet they focus on central issues in the Italian architectural and urban planning debate.

The residential buildings designed by Giuseppe Samonà, and built between 1952 and 1958, completing the *Cortina del Porto* of Messina, fit into the context of the *new* twentieth-century urbanism, whose layout is characterized by rationality and order, defining dense and homogeneous urban growth. The inflexibility of the urban plan becomes the basic tool for the architectural configuration, defined by compact volumes, regular geometries, and serial units of measurement, creating a codified expression of the city.

The *Cortina del Porto* fits into the checkerboard grid, on the edge of the bay, modifying the directions towards the sea in some sections.

The *Cortina* was not included in the Reconstruction Plan. The *Bando di Concorso per la Facciata tipo verso il mare della Nuova Palazzata* was only published in 1930.

It provided participants with “a general plan of the area with a schematic indication of the blocks” and reiterated that competitors were given ample freedom of artistic creativity. Some variations in the volumes were permitted, and “all the blocks must have an architectural framework inspired by a single style […] while avoiding monotony, which could detract from the aesthetic and panoramic function of the port view”. Furthermore, specifications were given regarding the width of each block, 17 m, the height at the eaves level 14.5 m, and the inter-floor spacing, 5 m for the ground floor and 4.75 m for each of the upper floors.

Immediately after the competition was won by the group with the motto *Post Fata Resurgo*, composed of Camillo Autore, Raffaele Leone, Guido Viola, and Giuseppe Samonà, the youngest, the public buildings were constructed in the majestic style deemed appropriate for the monumentality of the work.

Reconstruction was suspended during the war and restarted in the 1952 with the construction of the missing buildings. “Samonà, taking advantage of what is the most serious limitation for Messina’s construction—the enlargement of all structural sections—and exploiting very appropriately for plastic purposes the massive skeleton left exposed in its entirety, developed from building to building an architecture made of very simple elements, juxtaposed on the long façades with a rhythm of staggering and alternating elements that serves to impose a precise physiognomy on each building” (Tentori 1959, p. 29). Francesco Tentori underlines the structural limitations imposed by anti-seismic regulations and recognizes Samonà’s virtuosity in the search for a “plastic unity of great value” (Tentori 1959, p. 29) (Fig. 1).

Architecture and Archival Drawings

The project drawings signed by Giuseppe Samonà, preserved in the Archives of the Civil Engineering Department of Messina, in the folders corresponding to blocks IV, V, VI, and XI, are heliographic reproductions of ink drawings on tracing paper.

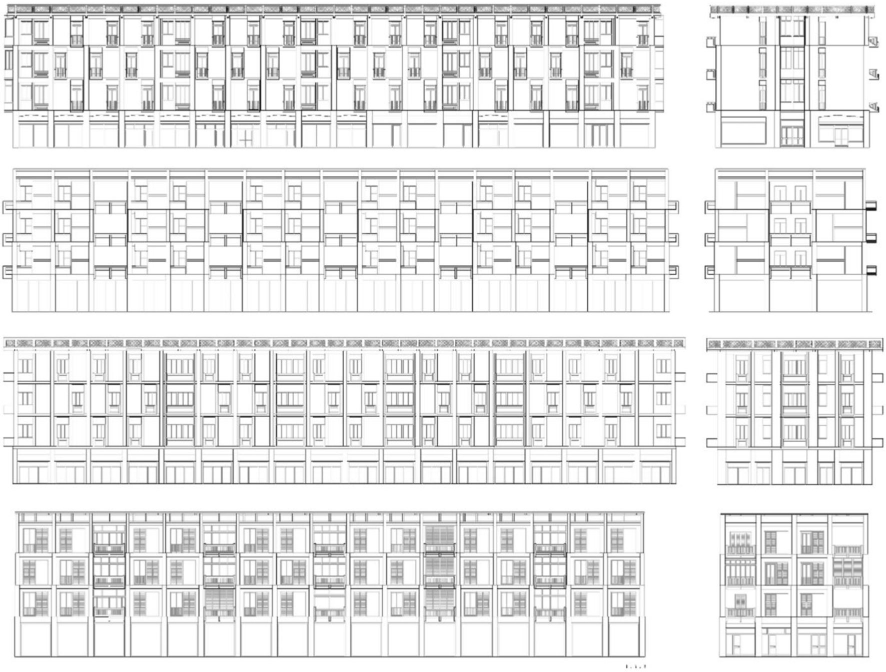

Fig. 1 Elevations of the residential blocks of the *Cortina del Porto* of Messina, blocks IV, V, VI and IX (graphic elaboration by P. Raffa)

The graphic representation contains the codes and regulatory levels required for architectural construction.

The project for each block is described with plans, sections, elevations, a perspective view, the technical report, along with all the structural data required to obtain building permits.

The drawings are composed of 33 cm high sheets folded into 21 cm modules.

The plans of the ground floor, the standard floor, and the terraced roof or utility rooms are represented at a scale of 1:100. Each plan is drawn on a sheet accompanied by a title page.

Longitudinal and lateral elevation, or a longitudinal elevation flanked by a cross-section at scale 1:100, are composed on single sheets. For each block, two elevations span are also drawing, flanked by a vertical and a horizontal section of the external wall at scale of 1:20.

A "*Veduta prospettica verso il mare*" (Perspective view towards the sea), not necessary but useful, takes in each block inserted in the context of the *Cortina*, in which the city and the avenue with the row of trees can be glimpsed in the background, the sky dotted with non-uniform parallel lines.

The theme of the executive drawing is expressed by Samonà by applying the "thread-like drawing method, corresponding to its content, in the search for new rhythms: diaphragms that order the space according to a fantastic abstraction" (Sacripanti 1953, p. 57). Heir to the culture of European rationalism of the 1930s and attentive to the instrumental role of drawing, he relies on the 'useful drawing' in thread-like ink.

The representation system is closely linked to the construction process; it describes architecture, and the hose in particular, through the assembly of technical components and materials. Industrial production also develops a series of graphic codes designed to accurately and unambiguously describe the forms and composition of architecture, the quality of which is communicated through the sign.

In the plans, the thickness of the ink stroke is used according to the object represented: the two parallel lines filled in in black around the perimeter of the building clearly indicate the cavity contained within the two curtain walls, a clear expression of the use of perforated bricks; the reinforced concrete structure of the pillars is represented with 45° hatching within the area delimited by a thin line; the external openings do not provide indications of the division of the window frames but only of the width and attachment to the wall of the iron profile (of the window frame); the thin, continuous line marks the balconies, indicating the metal parts (railings) and the masonry parts; the sectioned dividing walls are filled in in black, a double projection line in thin stroke indicates the doorways; the thin line is used for the squares of different sizes, or parallel lines to indicate the distribution areas; schematic furnishings define the position of the sanitary fixtures in the bathrooms and in the kitchen.

The dimensional and informative description of the project is achieved through a meticulous system of dimensions that emphasizes how the geometric sequence becomes an expression of architecture.

All elevations are characterized by the serial repetition of the structural bays, a result of the limitations already stated in the *Bando di Concorso*. The load-bearing structure's module is always highlighted on the façade plane, sometimes divided in half by more slender structures, but always dominant and slender from ground floor to terrace.

The lateral elevations are connected to the longitudinal ones with syntactic continuity. They are based on bilateral symmetries with respect to the central bay, the axis of the shared services, which is smaller than the two lateral bays. Here too, throughout the three elevations of the residential floors, the verticality of the pillars prevails, reaching seamlessly up to the terrace level.

The design of the elevations maintains the linearity of the architectural language; the lines are uniform and continuous, without variations in thickness; the design of the iron fixtures contributes to the overall configuration (Fig. 2).

In the detailed drawings, at scale 1:20, architecture materializes in the transition between drawn and built, reflecting what Samonà himself writes about the project phases, from conception to completion, which "could be summarized in this axiomatic truth: every problem must always present itself as a great problem, even if it refers to small and very modest things" (Samonà 1958, p. 83).

The elements and materials take shape in the thickness of the ink strokes and in the sequence of parallel lines drawn at the correct distance. The iron window frames and railings, the masonry parts, and the surface textures take shape. In the side-by-side sections, the elevation takes on the thickness, never too pronounced towards the street, of the balcony overhangs, but also of the pilasters between the bays and the

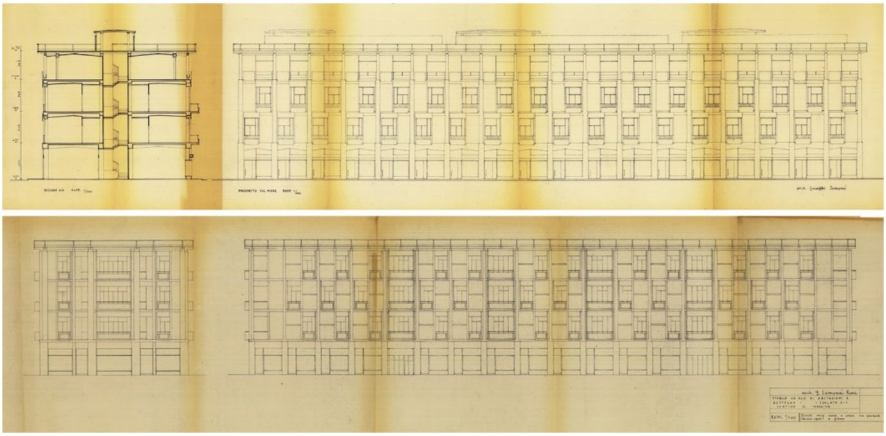

Fig. 2 G. Samonà, Project drawings of blocks V and VI (Civil Engineering Archives of Messina)

dimensions of the pillars. The freehand annotations clarify the type of material, and the measurements leave no room for misunderstanding.

Samonà is a skilled draftsman, mastering graphic techniques and executing sophisticated perspectives. He navigates the delicate transition between traditional architectural drawing culture and new representation techniques. He expresses his design thinking through reduction and abstraction of the sign to highlight the correspondence between architectural elements and the technical characteristics of the material.

Representation and Analysis of Elevations

In the report on block V, Samonà writes: “The architectural execution of the work is clear from the attached project drawings, which show a exposed reinforced concrete structure with brick masonry panels” (from Report of Project, 8 June 1953). The earthquake-proof report details the structure: “The construction system is a reinforced concrete framework, consisting of 18 transverse frames spaced 4.28 and 4.30 m apart and distributed across three identical building blocks” (from Earthquake-proof Report, 14 december 1953).

The structural frame is therefore the compositional matrix of the four blocks, generating the geometric structure of the elevations and enabling the eurhythmicity that harmonizes the parts. The reference to Italian Rationalism is confirmed.

The syntax of each façade is determined by the different declinations of the compositional elements. The classical language resides in the composition of the unit, in which the base, crown, and partitions are clearly defined; while compositional inventiveness determines the relationships between the elements, the alternations between solids and voids, between horizontality and verticality, and the modular repetition.

In the redrawing of the block façades, the process of configuring the elevations in double orthogonal projections allowed for a high level of dimensional precision in the structural elements, wall panels, and balconies.

The digital representation of the elevations was organized by category of element, to make them comparable and highlight the theoretical aspects underlying the architectural composition. This graphic apparatus exposes the structural elements of the façade to define elementary geometric forms and regular measurements, ensuring full control over the project.

Rules and partitions, modules and alignments, but also and above all exceptions, variations, and slight shifts invisible to the naked eye. On a rigid structural text punctuated by a constant dimensional rhythm, Samonà develops syntactic variations in which the codes of architectural language combine in sequential formal and figurative variations (Cardullo 2006) (Fig. 3).

The decoding of the façades, designed by Samonà, through the representation of geometric-compositional components, allowed the architectural elements to be organized according to a graphic code and their figurative aspect to be defined. It is precisely the analytical graph, developed in the spirit of the deconstruction of the floor partitions, that defines the architectural themes: linearity, abstraction, organicity, but also brutalism (Raffa 2021).

The *Cortina* blocks send back to a consolidated language, in which the notion of *order* is the primary foundation of *construction*, a moment in which the building's main structure coincides with its logical structure (Tentori 1959). Analysis of the elevations highlights the value of architecture through geometric schematization and expressive conciseness, translating reality into signs that underlie a theoretical process in which the breakdown into parts becomes the criterion for defining architectural elements. The vertical structure marks and defines the span. The pillars, which protrude and diminish in size as they rise, are the basic element within which compositional variations alternate: perforations, remodeling, balconies, and even the division of the window frames. The vertical structure defines the architectural and urban order of the façade; the span, which marks the rhythm of the partition, in turn becomes the basic element of the decorative partition. It is precisely within the span's aggregation system that the

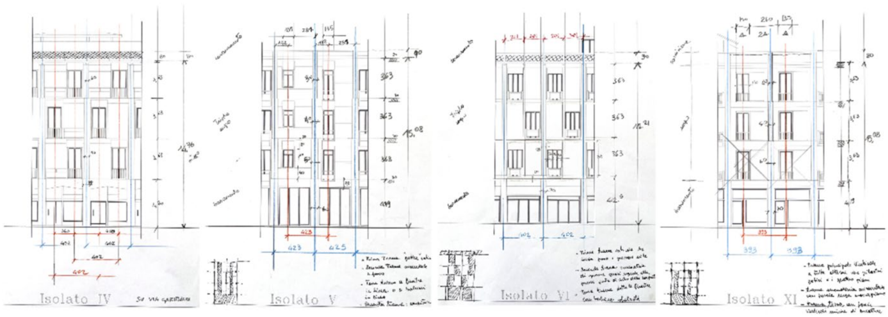

Fig. 3 F. Cardullo, study and analysis of the standard span of blocks IV, V, VI and IX

compositional order of the architectural elements is contained, which are repeated in serial alternations, defining other modular orders. The horizontal division, marking the second geometric plane of the façade, is emphasized by the beams, always set back from the pilasters, and by the remodeling that materializes the position of the windows and becomes lines of force in the protruding balconies. The openings, balconies, and windows are regular, coplanar geometric elements, always defined within their frames and highlighted by the architrave's web that masks the roller shutter. The balconies, strongly projecting, misaligned, or continuous, negate banal symmetries and incisively cast the shadow that reveals the sculptural rationale of the façade (Fig. 4).

The surface is defined by horizontal and vertical lines that mark axes and reshapings within the span and divide it into modules. Decorative elements that emphasize dimensional proportions through variations in color and material complement the solid/empty relationship and contribute to the structural partition. Each beam defining a projecting or recessed plane is treated with a different material and color (Cardullo 2006).

The façade contains no hierarchical elements; there are no marked axes of symmetry, but is a serial repetition of relationships and variations between the morphology of the elements and the positions they occupy. The order followed in the interpretation is based on the theoretical assumption that the façade is both an expression of the architecture and a function of the urban space it defines (De Fusco 1973).

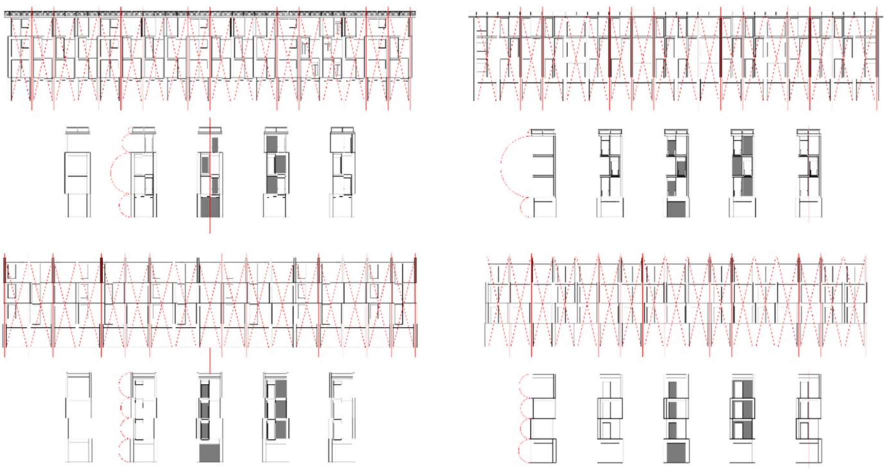

Fig. 4 Rhythm, proportion and repetition module of blocks IV, V, VI and IX (graphic elaboration by P. Raffa)

Dimensional Relationships: Towards a Semantic Interpretation of Structure

The study of the dimensions and relationships between the elevations of blocks IV, V, VI, and XI of the *Cortina del Porto* becomes a method for understanding forms, modules, and structural semantics. Dimension, understood as the relationship between parts, becomes a tool for interpreting the order, repetition, and controlled variation that defines and characterizes the entire building system.

The main elevations are defined by a regular rhythm of vertical and horizontal modules, generated by the interaction between the load-bearing structural grid and the sequence of openings. The constant relationship between the height of the interfloor and the structural spacing of the bays produces a legible and reiterated rhythm, ensuring a perception of visual continuity throughout the entire *Cortina*, both on the urban and maritime fronts. This proportional relationship allows for a balance between verticality and horizontality, avoiding dominant hierarchies between floors and reinforcing the idea of a unified organism.

The succession of floors is further emphasized by the presence of continuous horizontal bands, which mark the building's functional stratification and reinforce the perception of the floors as autonomous yet interdependent units. The horizontal elements, interrupted at the pilasters, establish a constant dialogue with the vertical order of the pillars, whose progressive thinning towards the top contributes to a visual modulation of the masses, lightening the overall perception of the building façade.

The perception of a continuous and compact façade is therefore the result of a complex interaction between dimensional relationships, structural elements, and projecting components. The balconies, with their regular and measured overhangs, introduce a controlled depth that enriches the façade without compromising its overall readability. They act as intermediary elements between interior and exterior space, contributing to the construction of the façade's rhythm and strengthening the semantic coherence between the different buildings.

The side and end elevations are instead defined by a mostly tripartite composition, in which the central span is smaller than the two external spans. Despite this variation, the proportional relationships between the parts remain constant, confirming the design intent to maintain a shared geometric order even for the less exposed elevations. This choice allows for the preservation of the unity of the architectural language and the avoidance of episodic or purely decorative solutions.

A comparative analysis of the four elevations of blocks IV, V, VI, and XI highlights a clear dialectic between repetition and variation, discernible within a summation of the parts guided by the residential function and their relative distribution relationships. The differences between the elevations are not arbitrary exceptions, but rather controlled adaptations to urban conditions, responding to a modern urban vision attentive to the dynamic perception of space and the relationship between architecture and context.

Despite the evident morphological differences between the urban and lateral elevations, it is possible to trace common relationships at the planimetric and perspective levels, which are summarized in the average ratio of 4:1 between the main elevations and the lateral and end elevations (Fig. 5). This relationship, frequently maintained within the semantic-structural repetition of façade elements, represents an ordering principle that lends coherence to the entire building system of the *Cortina del Porto*, transforming dimension into a tool for formal, functional, and perceptual control.

The study of relationships thus enables the coherent and unified identification of the semantic elements that characterize the residential buildings of the *Cortina del Porto*, for which the subdivision of forms becomes the foundational action of the process of discretization of the compositional system, the formal basis for the structuring of an algorithmic cognitive device capable of relating geometry, structure, and meaning.

Architectural Semantics: Towards a Categorization of Elements

Object classification can be defined as a common practice of human perceptual activity, capable of systematically separating the essential from the accessory. The separation of elements becomes the foundational action of the ordering process of the compositional system, in which lines, shapes, and geometries become the tool for constructing an interior image, a dynamic source of knowledge, capable of perceptually reviewing the distinctive features of the infinite similar objects present in the world. The result is the definition of semantic indeterminacy, attributable to the process of recognizing and classifying the object through multiple meanings (Garroni 2005).

Every tangible object can be classified through the imposition of specific characteristics. This practice is particularly validated when associated with

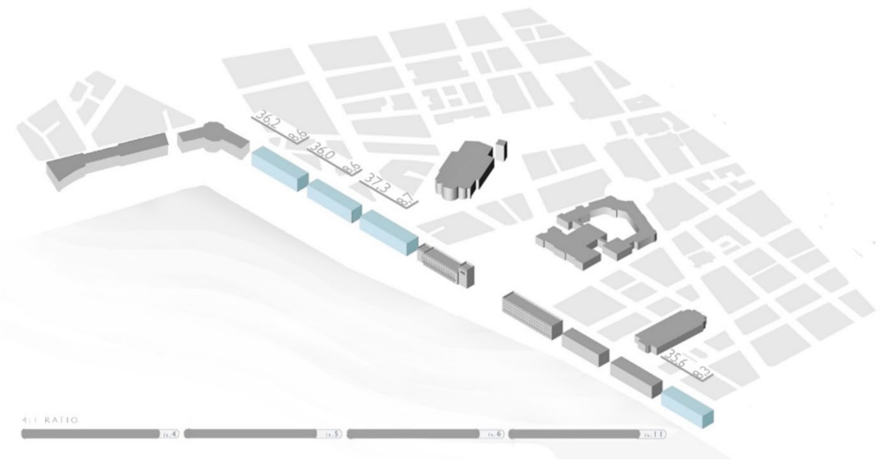

Fig. 5 Relationship between the main elevations and the lateral elevations of blocks IV, V, VI and XI of the *Cortina del Porto* (graphic elaboration by S. Mollica)

the forms and measurements that make up the architectural scale, structuring elements balanced by solids and voids, capable of ordering and classifying the spaces of community and private living. In this context, structural semantics investigates how the constructional and formal elements of a façade communicate meanings, intentions, and cultural values. The façade, from a mere functional envelope, becomes a semiotic device, capable of transmitting information through the arrangement, hierarchy, and relationships between its components, analyzing the rules governing the coherence and legibility of the architectural front.

The façade can therefore be broken down into its fundamental elements, on the basis of which the relative relationships can be analysed. Elements such as columns, beams, cornices, and openings have more than just a technical function: they operate as signs that reference aesthetic, historical, or technological codes.

In addition to studying the elements that compose the façade's components, structural semantics analyzes the rhythmic and proportional configuration of the elements, considering it as a visual grammar. Regular repetitions of openings and modules structure perceptual systems that are carefully considered and designed to ensure the harmony of the elements, in concert with the existing relationship between solids and voids, assuming a communicative role for the whole.

At the procedural level, semantic decomposition goes hand in hand with the identification of primordial geometries, composed of broken or curved lines, which generate the form and compositional structure of each element. The entire geometric apparatus is brought to life by the line (Brusantin 1993), described as an invisible entity; the trace of a moving point, the destruction of the point itself, in continuous transformation from static to dynamic. The continuation of the point becomes a line. The horizontal line is the simplest and corresponds to the surface line on which the human being stands and moves; the latter, in union with the vertical line, forms a right angle, transforming flatness into height. The diagonal line detaches itself from the previous lines, forming an equal angle towards both, representing the union in equal measure (Kandinsky 2021). The union and combination of these lines create simple geometric figures, in turn defining meanings associated with the individual elementary geometric representations.

We therefore intend to define a typological semantic structure of the elements that constitute the residential buildings of the *Cortina del Porto*, providing a theoretical and practical basis for the creation of a Python algorithm for the visual programming language (VPL). This algorithm will systematize the modular architectural structure, useful for the creation of adaptive generative models for analysis and study. The structure consists of the definition and identification of fundamental and accessory elements, on the basis of which the corresponding decompositions and analyses are produced.

The methodological approach is top-down, an optimal procedure for processing and managing information data and for knowledge in the IT and humanities fields. On a theoretical level, the analysis and modeling of forms places particular emphasis on flat facades rather than the building's volumetric representation, fostering a deeper understanding of the modular logic and rhythm of the structural steps that organize the elevation.

The analysis of flat facades allows for a clearer and more immediate reading of the compositional modules, allowing for more precise isolation and recognition of the repetition of structural elements and their proportional relationships. Through a two-dimensional representation of the elevation, it becomes possible to easily identify the order and regularity of the modules that constitute the building's layout, fundamental elements for the analysis of the structural system and the presentation of elements in a VPL structure. The flat representation therefore emerges as a more effective analytical tool, capable of facilitating geometric abstraction and the translation of modules and structural steps into parametric rules that are readable and replicable within the modeling environment. The emphasis on volumes therefore introduces a level of visual complexity that is inadequate for the research objectives, which should be implemented upon completion of the analysis and modular modeling.

On a structural level, the semantic decomposition was performed for the main elements, the identification of the architectural volume, the openings, and the exposed structure (Figs. 6, 7); Regarding the accessory or ornamental elements, the volumetric elements supporting the structural scheme were identified, divided into flat elements and projecting elements (Fig. 8). The semantic subdivision of the system therefore lays the foundation for the creation of a basic script aimed at understanding the relationships and modeling the different case studies.

Systematization of Semantic Relations: Structuring a VPL Algorithm

Visual programming language (VPL) fits into the context of the grammar of forms and the serial repetition of relationships and relations. This tool offers significant potential when applied to the analysis and development of architectural geometric

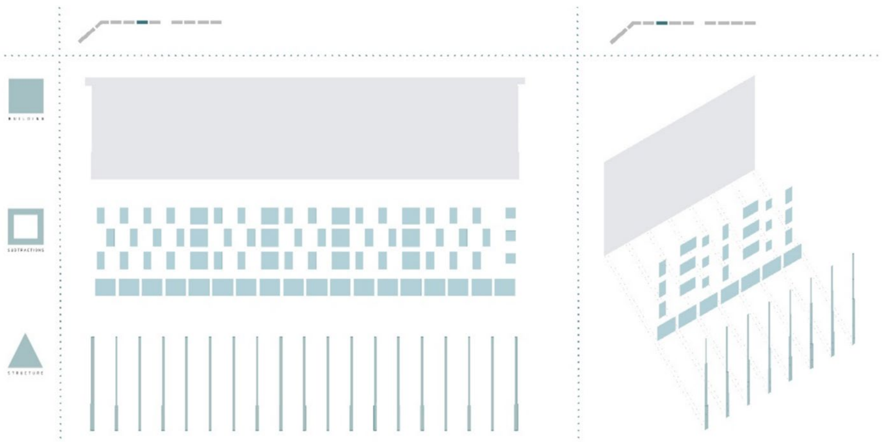

Fig. 6 Semantic definition of the main elements constituting the *Cortina del Porto*: blocks VI and V (graphic elaboration by S. Mollica)

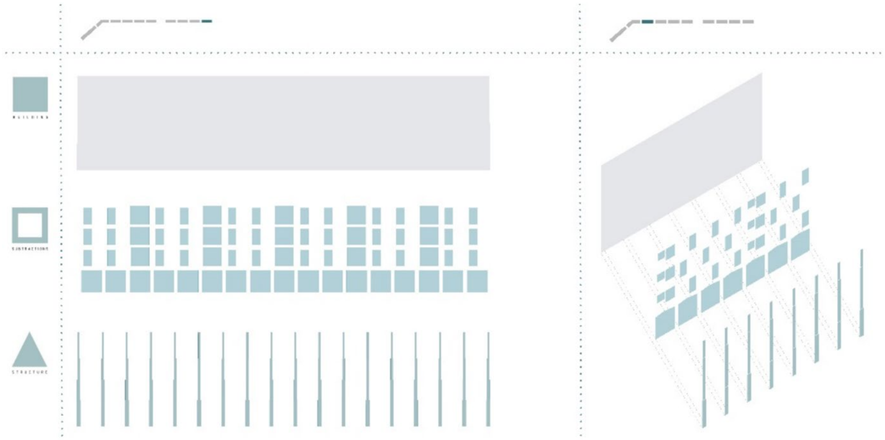

Fig. 7 Semantic definition of the main elements constituting the *Cortina del Porto*: blocks IX and IV (graphic elaboration by S. Mollica)

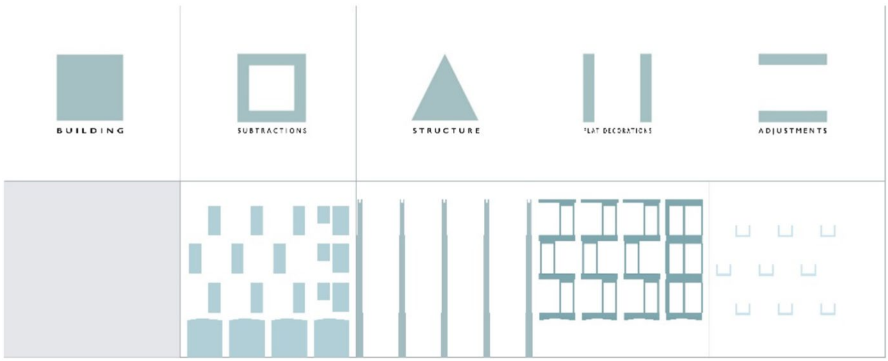

Fig. 8 Semantic definition of the main and ornamental elements constituting the *Cortina del Porto*: block IV (graphic elaboration by S. Mollica)

matrices, enabling the construction of a formal modeling framework for analyzing geometries and their relationships (Tedeschi 2011).

In the technical-procedural context, VPL is defined as the ability of algorithms to describe complex relationships, generating mutually connected geometries; the form is no longer obtained according to additive logic but is generated through an ordered sequence of instructions. Visual programming languages are based on the same principles as traditional computer languages, such as flow control, data management, and modularity, but differ in their syntactical expression. The graphical representation that distinguishes VPL facilitates greater immediacy in understanding program behavior, reducing the cognitive load associated with reading and writing textual code. This code, which is equally straightforward at the modeling level, is more complex for users with less programming experience. Its use, through the writing of textual codes or logical node systems, enables the identification of predefined components and modules, connected to each other through semantic and dimensional relationships, constituting a linked flow that can be verified and modified in real time. Here, input data plays a central role in constructing the form and representation (Avella 2017), facilitating the understanding of geometric relationships and connections, strengthening the geometric understanding that underlies the geometric elements being analyzed.

The structuring of a VPL system is not limited to the mere generation and manipulation of geometries and volumes but focuses on the extraction of compositional rules and their corresponding algorithmic formalization, through the generation of a workflow dedicated to the interpretation and processing of the elements. The algorithm thus becomes a *metamodel*, in which each node represents not only a geometric entity, but an element loaded with semantic meaning, related to the whole through explicit constraints (Calvano et al. 2022). The node-based construction therefore breaks down the façade into recognizable elementary units, identifying modules, alignments, repetitions, and variations that structure its formal structure, assigning it a semantic value, made explicit by the nodes, duly structured and grouped for a functional interpretation of the scripting.

The integration of Python scripting within visual environments like Grasshopper allows for a further level of control, facilitating the definition of customized algorithmic functions and relationships, not immediately achievable using visual nodes alone. By writing Python code, it is possible to encode algorithms for the automatic recognition of compositional patterns, the dimensional normalization of modules, and the association of semantic attributes to identified elements, enhancing the parametric approach from a computational perspective (Esenarro Vargas et al. 2025). In this way, the façade elements are not simply reconstructed, but interpreted as bearers of meaning, in relation to their functional, structural, or linguistic role within the overall system.

In the context of flat façades, the semantic model, understood as an informed system of architectural components, is based on the identification of basic modules and dimensional relationships that govern the compositional order of the building envelope. Through the VPL code, these modules are defined as parametric entities with geometric and semantic attributes, while the relationships– proportional, rhythmic, or functional –are formalized with aggregation and transformation rules. This allows not only the automatic generation of coherent configurations, but also the possibility of interrogating the model in terms of architectural meaning, performance, and typological variability. The semantic model is therefore structured with a declarative approach to the project, in which methodological transparency declares and verifies the design choices adopted, to be used as a cognitive device capable of formalizing and communicating the architectural order through modular and proportional relationships.

Analysis of the façades of blocks IV, V, VI, and XI of the *Cortina del Porto* reveals a clear architectural semantics that can be rationalized across different geometric levels: the structure, the windows, and the basic monolithic volume (Apollonio et al. 2015) (Fig. 9). These elements, reported in the algorithmic script, exploit the seriality that distinguishes these architectures, through which an analysis

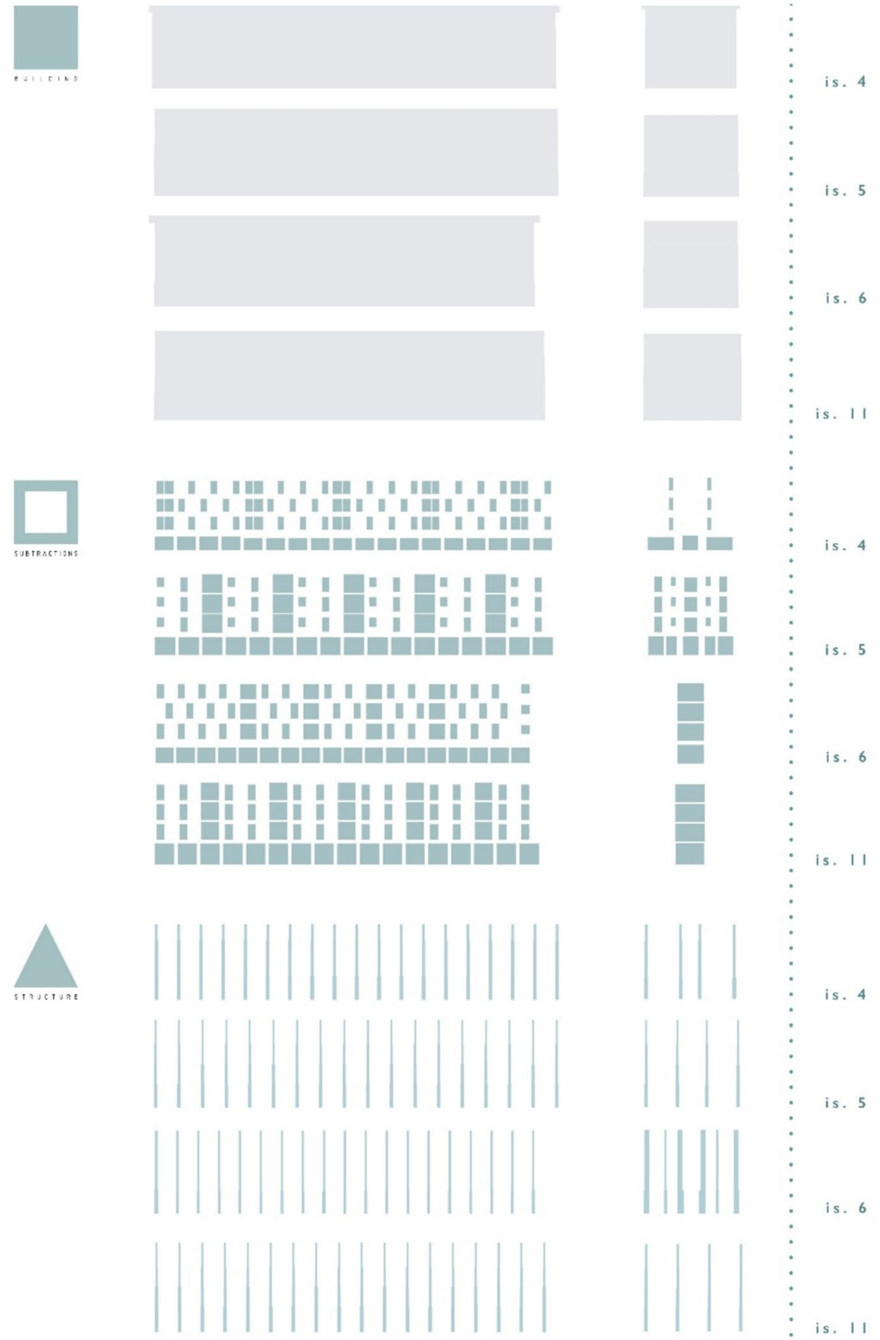

Fig. 9 Semantic definition of the main elements constituting the *Cortina del Porto*: blocks VI and V (graphic elaboration by S. Mollica)

process aimed at understanding and formally disseminating an architectural heritage that symbolizes the city's identity can be proposed. The algorithm was created respecting the previously identified formal characteristics, through which it was possible to emphasize and adaptively construct the relationships that differentiate the different blocks, constituted by the same architectural language.

The semantic structuring therefore made it possible to create a basic algorithm (Fig. 10), duly informed by the rules, relationships, and planar elements defining the façade systems of the four residential blocks. The script, structured both through nodes and Python scripting, enabled the modeling of the different case studies (Fig. 11), transforming the principles into an algorithmic model in a geometric-declarative structure, capable of formalizing the identified compositional rules and making them interrogable, replicable, and adaptable. The generative model created is therefore not limited to being a mere digital reconstruction tool, but is configured as a true cognitive device, capable of connecting geometry, structure, and meaning.

Conclusions

The consolidated language of the blocks of the Samonà *Cortina del Porto*, in which the notion of *seriality* becomes the primary foundation for the *construction* of the logical structure of architecture, becomes the formal prerequisite for the definition of algorithmic analyses and methodologies aimed at transmitting the rules of modern architecture. The façade system emerges as a complex linguistic device, in which structure, proportion, and semantics contribute to the definition of a unified architectural identity, capable of adapting to urban specificities without sacrificing overall formal coherence.

The process of graphic, dimensional, and semantic deconstruction highlights how proportional relationships, structural modules, and the serial repetition of elements are not merely formal outcomes, but respond to a precise constructive and perceptual logic. In this framework, size becomes a tool for controlling and critically interpreting architecture, while variation takes on the role of an expressive device within a shared grammar.

Algorithmic construction becomes a useful tool for identifying and systematizing a recurring semantic structure, through which graphic analysis, parameters, and structure can be fused. This discretization, a distinctive feature of algorithmic modeling, becomes the key to understanding the relationships between different elements, highlighting their generative structure and promoting processes aimed at understanding the architectural asset.

The digital process performed by the Visual Programming Language highlights how Samonà's creative thinking begins with a logical process based on the classical composition of architectural elements, based on serial matrices and numerical proportions. The application of the Visual Programming Language and Python scripting allowed these principles to be translated into a declarative algorithmic model, capable of formalizing the identified compositional rules and making them interrogable, reproducible, and adaptable. The generative model is not simply a

```python
import Rhino.Geometry as rg

# ============================
# PARAMETRI PRINCIPALI
# ============================
nModuli = 12          # numero moduli facciata
interasse = 3.15
spess_pilastro = 0.30
profondita = 0.10

# altezze
h_pt = 4.20
h_piano = 3.36
n_piani = 3

# ============================
# CALCOLI
# ============================
altezza_tot = h_pt + n_piani * h_piano
lunghezza = nModuli * interasse

# ============================
# VOLUME PRINCIPALE
# ============================
Volume = rg.Box(
    rg.Plane.WorldXY,
    rg.Interval(0, lunghezza),
    rg.Interval(0, profondita),
    rg.Interval(0, altezza_tot)
).ToBrep()

# ============================
# PILASTRI
# ============================
Pilastri = []

for i in range(nModuli + 1):
    x = i * interasse - spess_pilastro / 2
    pil = rg.Box(
        rg.Plane.WorldXY,
        rg.Interval(x, x + spess_pilastro),
        rg.Interval(0, profondita),
        rg.Interval(0, altezza_tot)
    ).ToBrep()
    Pilastri.append(pil)

# ============================
# FINESTRE – PIANO TERRA
# ============================
Finestre = []

w_pt = 1.80
h_pt_fin = 2.40
soglia_pt = 0.30

for i in range(nModuli):
    xc = i * interasse + interasse / 2
    fin_pt = rg.Box(
        rg.Plane.WorldXY,
        rg.Interval(xc - w_pt / 2, xc + w_pt / 2),
        rg.Interval(0, profondita),
        rg.Interval(soglia_pt, soglia_pt + h_pt_fin)
    ).ToBrep()
    Finestre.append(fin_pt)

# ============================
# FINESTRE – PIANI TIPO
# ============================
w_fin = 1.20
h_fin = 1.40
soglia = 1.00

for i in range(nModuli):
    xc = i * interasse + interasse / 2
    for p in range(n_piani):
        z0 = h_pt + p * h_piano + soglia
        fin = rg.Box(
            rg.Plane.WorldXY,
            rg.Interval(xc - w_fin / 2, xc + w_fin / 2),
            rg.Interval(0, profondita),
            rg.Interval(z0, z0 + h_fin)
        ).ToBrep()
        Finestre.append(fin)
```

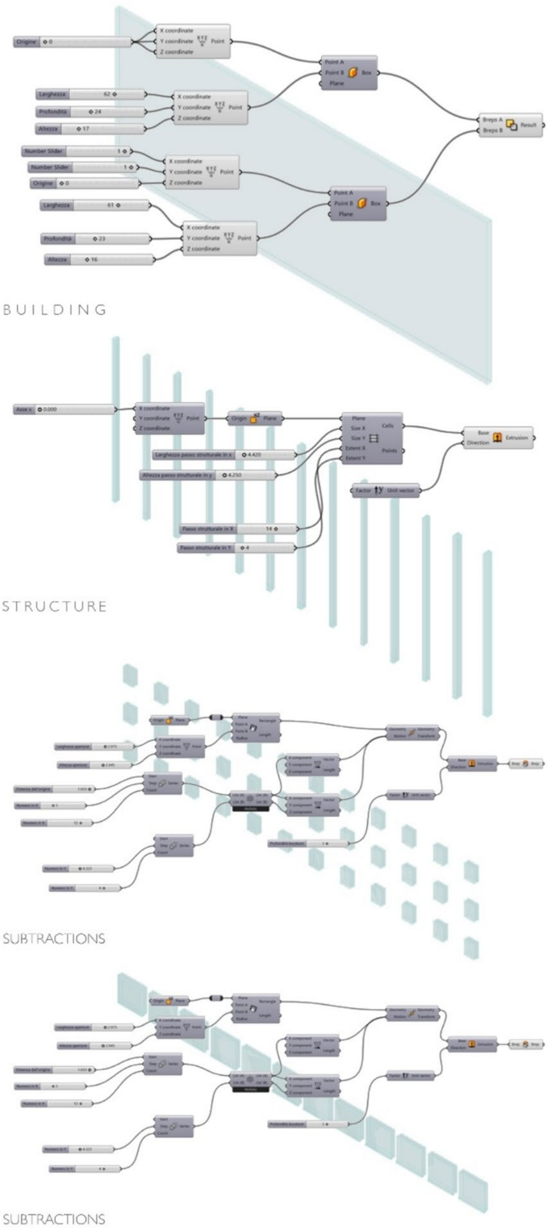

Fig. 10 Node-based algorithm structuring and Python code for basic VPL modeling (graphic elaboration by S. Mollica)

```python
import Rhino.Geometry as rg

# ============================
# PARAMETRI PRINCIPALI
# ============================
nModuli = 12            # numero moduli facciata
interasse = 3.15
spess_pilastro = 0.30
profondita = 0.10

# altezze
h_pt = 4.20
h_piano = 3.36
n_piani = 3

# ============================
# CALCOLI
# ============================
altezza_tot = h_pt + n_piani * h_piano
lunghezza = nModuli * interasse

# ============================
# VOLUME PRINCIPALE
# ============================
Volume = rg.Box(
    rg.Plane.WorldXY,
    rg.Interval(0, lunghezza),
    rg.Interval(0, profondita),
    rg.Interval(0, altezza_tot)
).ToBrep()

# ============================
# PILASTRI
# ============================
Pilastri = []

for i in range(nModuli + 1):
    x = i * interasse - spess_pilastro / 2
    pil = rg.Box(
        rg.Plane.WorldXY,
        rg.Interval(x, x + spess_pilastro),
        rg.Interval(0, profondita),
        rg.Interval(0, altezza_tot)
    ).ToBrep()
    Pilastri.append(pil)

# ============================
# FINESTRE – PIANO TERRA
# ============================
Finestre = []

w_pt = 1.80
h_pt_fin = 2.40
soglia_pt = 0.30

for i in range(nModuli):
    xc = i * interasse + interasse / 2
    fin_pt = rg.Box(
        rg.Plane.WorldXY,
        rg.Interval(xc - w_pt / 2, xc + w_pt / 2),
        rg.Interval(0, profondita),
        rg.Interval(soglia_pt, soglia_pt + h_pt_fin)
    ).ToBrep()
    Finestre.append(fin_pt)

# ============================
# FINESTRE – PIANI TIPO
# ============================
w_fin = 1.20
h_fin = 1.40
soglia = 1.00

for i in range(nModuli):
    xc = i * interasse + interasse / 2
    for p in range(n_piani):
        z0 = h_pt + p * h_piano + soglia
        fin = rg.Box(
            rg.Plane.WorldXY,
            rg.Interval(xc - w_fin / 2, xc + w_fin / 2),
            rg.Interval(0, profondita),
            rg.Interval(z0, z0 + h_fin)
        ).ToBrep()
        Finestre.append(fin)
```

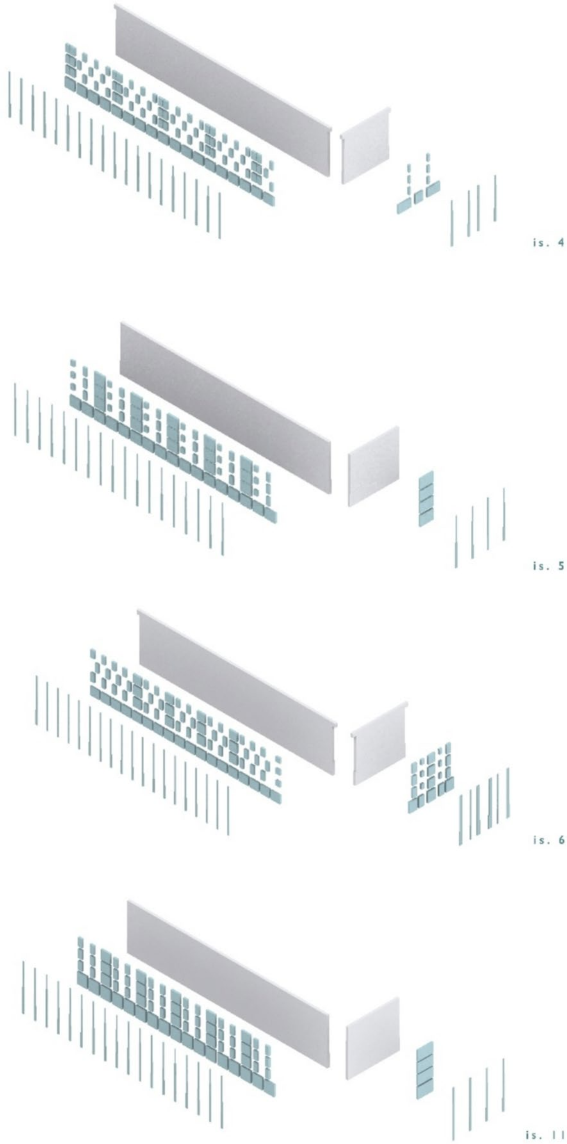

Fig. 11 Applying Python code to blocks IV, V, VI, and IX (graphic elaboration by S. Mollica)

digital reconstruction tool, but a cognitive device capable of connecting geometry, structure, and meaning.

The proposed approach opens up relevant operational perspectives both for the study of modern architecture and for the valorization of built heritage, demonstrating how the integration of historical analysis, representation, and computational methods can constitute an effective methodology for understanding and transmitting the founding rules of architectural design.

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Code Availability Not applicable.

Declarations

Conflict of interest Not applicable.

References

Apollonio, Fabrizio, Baroncini Valentina, and Baldissini Simone. 2015. Metodi di modellazione per la costruzione del geodatabase palladiano. In *Metodologie integrate per il rilievo, il disegno, la modellazione dell'architettura e della città*, eds. Emanuela Chiavoni, and Uliva Velo, 129-143. Rome: Gangemi editore.

Avella, Fabrizio. 2017. Aspetti metodologici per l'uso di modellatori parametrici di superfici nella progettazione architettonica. Un caso di studio. In *Territori e frontiere della Rappresentazione. Atti del 39° convegno internazionale dei Docenti delle discipline della Rappresentazione*, eds. Antonella Di Luggo, Paolo Giordano, Riccardo Florio, Lia Maria Papa, Adriana Rossi, Ornella Zerlenga, Salvatore Barba, Massimiliano Campi, and Alessandra Cirafici, 1733–1740. Rome: Gangemi editore.

Brusantin, Manlio. 1993. *Storia delle linee*. Turin: Einaudi.

Calvano, Michele, Martinelli Letizia, Calcerano Filippo, and Gigliarelli, Elena. 2022. Parametric Processes for the Implementation of HBIM. Visual Programming Language for the Digitisation of the Index of Masonry Quality. *ISPRS INTERNATIONAL JOURNAL OF GEO-INFORMATION*, 11:2:1–19.

Cardullo, Franco. 2006. *Giuseppe e Alberto Samonà e la Metropoli dello Stretto di Messina*. Rome: Officina Edizioni.

De Fusco, Renato. 1973. *Segni, storia e progetto dell'architettura*. Rome: Laterza.

Esenarro Vargas, Doris, Emerson Porras, Jesica Vilchez Cairo, Abigail Ortiz Curinambe, Vanessa Raymundo, Lidia Chang, Jesus Peña, Ramiro Torrico, and Santiago Paz Nakura. 2025. Use of Parametric Digital Tools in Grasshopper and Python for Optimization of CNC Prefabrication Process in WikiHouse Prototype Construction. *Buildings*, 15, no. 21: 3895. https://doi.org/10.3390/buildings15213895.

Garroni, Emilio. 2005. *Immagine Linguaggio Figura: Osservazioni e ipotesi*. Bari: Laterza.

Kandinsky, Vasilij. 2021. *Punto, linea, superficie. Contributo all'analisi degli elementi pittorici*. Milan: Adelphi.

Pujia, Laura (a cura di). 2020. *Rileggere Samonà | Re-Reading Samonà*. Roma: Edizioni Roma TrE-Press.

Raffa, Paola. 2021. La Cortina del Porto di Messina di Giuseppe Samonà: tra disegni di progetto e opera realizzata. *Disegnare. Idee Immagini*, 62 (2021), pp. 24-37.

Sacripanti, Maurizio. 1953. *Il disegno puro e il disegno architettonico*. Rome: Palombi.

Samonà, Giuseppe. 1958. Franco Albini e la cultura architettonica in Italia. *Zodiac*, 3:83-115.

Tedeschi, Arturo. 2011. *Architettura parametrica, Introduzione a Grasshopper, il Plug-in per la modellazione generativa in Rhino*. Brienza: Edizioni Le penseur.

Tentori, Francesco. 1959. Giuseppe Samonà e la Palazzata di Messina. *Casabella*, 227: 29-43.

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