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FROM COASTAL TOWERS TO THE VALORIZATION OF THE TERRITORY THROUGH THE PAGES OF THE ROMANO CARRATELLI CODE. THE TO_KNOW PROJECT

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Abstract

Coastal towers, heritage of great historical and architectural interest, highlight passages of coastline with great landscape value, representing a resource for the territories to which they belong. The "To Know" project, financed with resources from the National Recovery and Resilience Plan, focuses on the coastal towers of Calabria Ultra, proposing a new paradigm for the enhancement of coastal heritage. The narrative device is the Romano Carratelli Code, keeper of the toponymy and geometries that were to govern the arrangement of these coastal architectures in the territory in the 16th century A.D. Through an integrated approach, between history, culture and digital, the project aims to transform coastal towers, often abandoned and in ruins, into focal points of knowledge of the territory. The initiative is based on the use of Augmented Reality techniques, through which to reconnect the artifacts to the informational and cultural layers they represent.

Keywords

Coastal Tower, Cultural Routes, Digital Humanities, Valorization, Augmented Reality, Carratelli Code, To_Know project.

1. *Introduction*

This contribution presents a working methodology aimed at enhancing architectural heritage, validated through the case study of the Coastal Towers of Calabria Ultra, as represented and cataloged in the Romano Carratelli Code.

The structure of this contribution follows the methodological steps through which the research work was carried out. The first part provides a historical perspective on the Romano Carratelli Code, focusing on the existing towers and those planned for construction within the document. The second part examines the value of these towers not only as individual architectural elements but as part of a territorial system once intended for defense, today characterized by a high tourist potential.

Starting from the study of these architectures, survey campaigns were implemented, useful for the redrawing, the typological cataloging and the semantic decomposition. Finally, the last part of the research explores innovative strategies for the enhancement: it proposes the use of advanced visualization techniques for the creation of a digital platform designed to make the content accessible to a broader audience.

2. *Between drawing and planning. The narrative of the places of Calabria Ultra through the pages of the Romano Carratelli Code*

A network of coastal towers and fortresses connects the promontory system of the Italian peninsula. From the Tyrrhenian to the Adriatic and Ionian seas, these fortifications erected between the 10th and 11th centuries to protect the coasts and ports of major cities, especially in the South, which was more exposed to Turkish incursions (Gurioli & Mesturi, 2011).

The Angiolini kings in Calabria devised a permanent defensive system, based on towers placed at strategic points along the coast and within sight of each other, from the tops of which signals were emitted with smoke and fires to ensure effective communication in case of an alert.

This defensive system was only partially expanded in the following centuries due to constant political changes. Over time, control of the fortifications passed to local feudal lords and families, who were mainly interested in

Fig. 1: Romano Carratelli Code.

protecting their domains. With the passage of the regions of Campania, Apulia, Calabria and Sicily under Spanish rule, a more stable coastal defense system was again planned, aimed at stable and continuous protection of the territory. With Spanish rule in the south, the viceroy of Naples, Don Pedro of Toledo, promoted the construction of a defense system to protect against possible Saracen attacks by requiring the construction of watchtowers.

In 1563, Viceroy Don Pedro Afán de Ribera, Duke of Alcalá, issued new instructions to provincial governors, providing for the identification by royal engineers of the most suitable locations for the construction of a continuous chain of towers throughout the Kingdom. Having overcome the economic disputes that had slowed down the work, construction of the planned towers was mostly under way and partly completed by 1567.

It is in this context that the Romano Carratelli Code was born[1] (figs. 1, 2), a manuscript dating from the last decade of the 16th century, consisting of 99 watercolor drawings (Bianchi & Saeli, 2015); each plate depicts existing or planned towers and fortifications in the territorial context, accompanied by detailed descriptions. The Code depicts the coastal territory of Calabria Ultra with simple and elegant marks: existing defensive structures, with a circular plan, are watercolored in pink, while planned towers, with a quadrangular base, appear in light blue to indicate planned new interventions[2] (fig. 3).

[1] The volume is *in folio*, with coeval stiff vellum binding, manuscript titles on the spine, altered by a lack. The watercolors, which appear on the half-page, are drawn in natural colors, are of fine workmanship, and most of them have illustrative text in elegant chancery handwriting of the period that is easily readable.

[2] The strategic choice to build an accomplished system of towers that, by supplementing the existing one, would allow the coastal populations the possibility of defense, even by escape, is basically a governmental choice, and it could not have been otherwise, that pertains to the defense of the Kingdom desired by Charles V and Philip II and that found concrete implementation during the government of Viceroy Peter of Toledo (1532-1553); this objective was taken up and continued with firm resolve a few years later also by Viceroy Duke of Alcalá (1559-1575). Following various findings, it has been concluded that the commissioning of the Code was, almost certainly, a decision of the administration of the Viceroy Count of Miranda (1586-1595).

Fig. 2: Romano Carratelli Code: pink and blue towers.

Fortifications on the Tyrrhenian coast are depicted with a view from the sea toward the land, while those on the Ionian coast are seen from the land toward the sea, probably to emphasize the enemy's coming from the east, that is, from the Turkish coast.

The value of the document lies in its overview: through the ninety-nine watercolors, the Code depicts the coastal territory in detail, illustrating existing fortifications and proposing defensive solutions. The result is a long and meticulous work, conducted with great professionalism and precision: the information given can be found with fidelity both in the graphic representation and in the toponymy of the places, which is why it is believed to be the work of a technician, (engineer or architect). In some of the drawings, it is also possible to observe the internal structure of the towers, depicted with thin hatches suggesting the layout of the rooms, with measurements in palms for the architecture and in canes for the territory.

The manuscript contains not only images of towers but also panoramic views of the most important military squares (Reggio Calabria, Crotone, Tropea, Bagnara, etc.) or portions of the territory strategically still to be defended, in the opinion of the anonymous extender, by the building of additional turreted structures.

The document constitutes a unique testimony to the defensive organization of the Calabrian coast, with historical, topographical, geographical, and anthropological value[3] (Martorano, 2015): a discovery of high value in which the ninety-nine watercolours are defined as the oldest iconography available for the Calabrese coastal historiography.

From the perspective of representation, the value of the document lies not only in its ability to "photograph" the state of things, but also in its interpretive character. Coastlines and architectures are depicted typologically, that is, they recall a recognizable order between landscape and architectural elements (Aris, 1996). The Code clearly distinguishes between quadrangular or circular towers, fortified towns, small settlements and geographical elements such as capes, gulfs, bays, natural harbors and mouths.

[3] Presented by the Region of Calabria to the general public during the 2013 edition of the Turin International Book Fair, and illustrated for the occasion in the guidebook *Una Regione per leggere*, in November 2013 the Region of Calabria's Councillor for Culture, Mario Caligiuri, asked UNESCO for recognition of the Romano Carratelli Code to the Memory of the World Program.

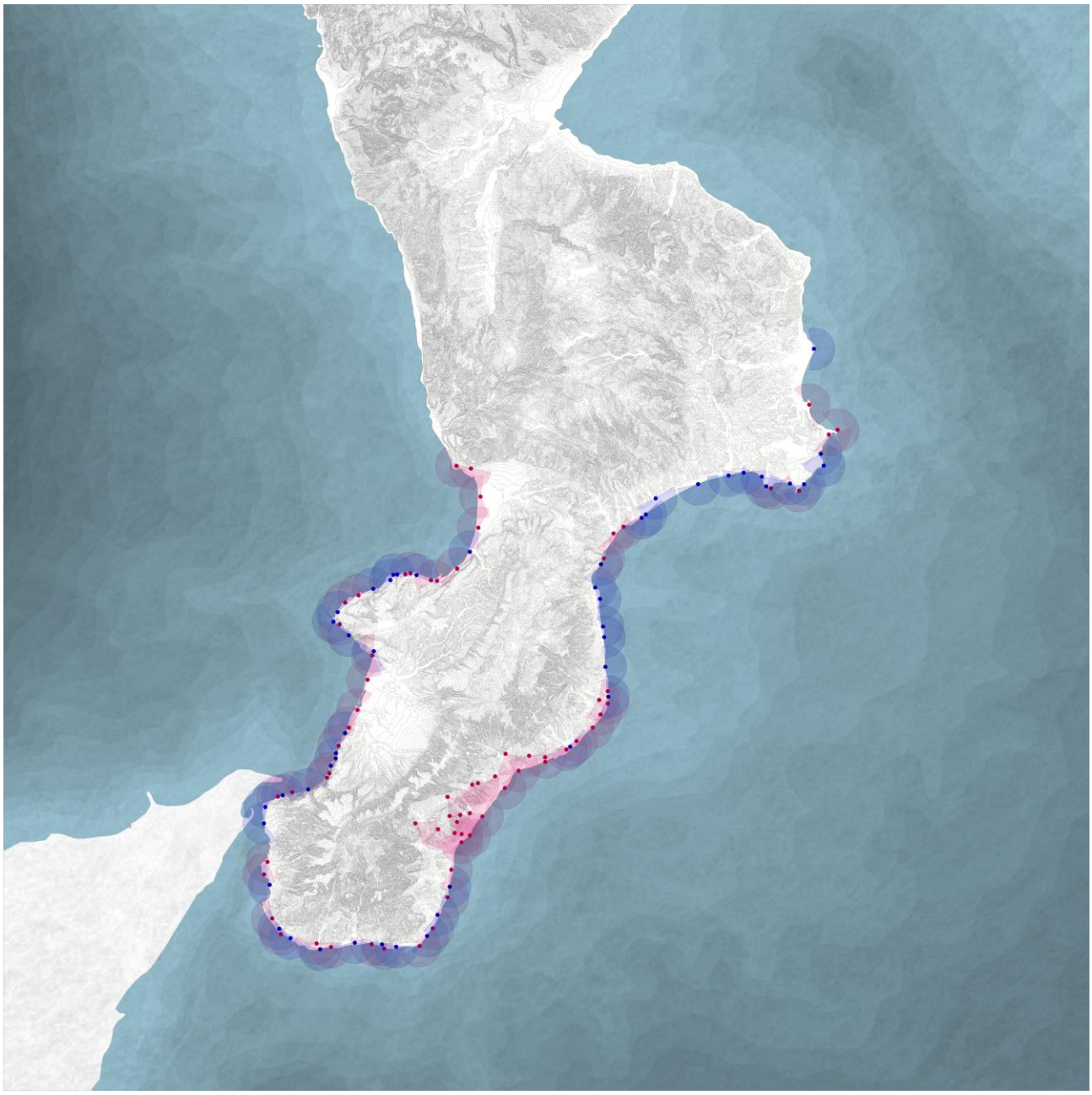

Fig. 3: Geolocation and relationship between existing pink towers and planned blue towers. Elaboration by the authors.

The document can then be defined as a typological abacus of the relationship between architectural forms and geographical space, capable of representing with a solid semantic structure the articulation of the Calabrian coastal landscape.

Its rigorous structure is based on a clear categorization of coastline and architecture, adopting the criterion of the landscape view differentiated by Tyrrhenian and Ionian sides. This approach made it possible to integrate architectures and toponyms into a coherent and unified framework. To complement the codification of the representational language, the Code also makes use of Greek cross elements, which are useful in highlighting the places elected for the construction of new artifacts.

The Romano Carratelli Code is not only an account of the Calabrian coastline, but a model that reflects the complexity of critical thinking of the time, contributing to the development of the science of land representation and the construction of methodologically replicable models.

3. *Material and immaterial networks for reconnecting places: the "geometries of the gaze"*

Leafing through the pages of the Codice Romano Carratelli it is possible to take a complex journey through the Calabrian coastal landscape, marked by regular modules and reciprocal visual cross-references; a long red thread capable of linking rocky promontories to flat shorelines. If in the past the turreted network was defined as a complex and monolithic system of defense, today this network changes in meaning, accomplice to the emergence of deeply urbanized areas. Visual relationships change in meaning, transforming towers from sighting elements to conspicuous identifiers and catalysts, landmarks of pathways and cultural memories towering along the entire coastal system. The towers themselves become protagonists in the mutations of the landscape (Settis, 2013), attracting a «circuit of material and immaterial tensions that link physical space and the space of observation» (Pierluisi, 1992, p. 197). The visual relationships are thus interrupted by the elements of the contemporary urban landscape; there are only a few, in fact, towers still included in the system composed of different viewpoints: «all together expelled from the original system-cycle that are involved in the different developments of the environment in which they insist» (Giorgianni & Sartori, 1992, p. 167).

Thus, the systematization of coastal tower architectures is an approach with high cognitive and strategic potential, through which to stitch together the indissoluble intertwining that the towers of Calabria Ultra entertain with the surrounding area, capable of increasing and enhancing the tangible and intangible ties of the territory (Condorelli, Luigini, & Nicastro, 2024).

The reconnection of places allows the creation of a dense weave that links history to landscape, founded on what is visibility, temporality and narrative (Venturi Ferriolo, 2009). The eye investigates the surroundings in depth, to reveal what are the relationships and plots of the future, that is, the interweaving of the events that happened in a place, therefore, the facts that determined it (Turri, 2011). The succession of events creates ever new scenarios to be encoded: imaginative projections, historical knowledge, figurative suggestions otherwise lost as they are not accompanied by an effective communication of them. This is what, according to Morin (1958) with his *homme imaginaire*, feeds dualities, enhances connections and stimulates the union between the real and the imaginary.

In the context of communication and the relationship between the real and the imagined, coastal landscapes and their related architectures in fact play a fundamental role in the emergence and development of the intangible cultural heritage of these landscapes (Bozzato & Bandiera, 2019), defined by multipolar nodes where cities intersect with social spaces and neighboring shores, places where the cultures, economies and characteristics proper to coastal settlements manifest themselves (Vallega, 2003).

The Calabrian coast is thus configured as a structuring element and catalyst for the reconnection of cultures and cultural assets, toward a possible opening of new networks (Governa, 1999). The sea-land interface is thus a connecting portal of material and immaterial flows, in which mutual interactions are transformed into new forms and landscapes, a liquid city centered on culture (Bauman, 2014), knowledge and the connection of the territory, in which the waterfront becomes the driving element of modernity (Sloterdijk, 2002).

Today, thanks to their location and height – standing out from the coasts closest to the sea to the mountains and cliffs above them – they thus represent the territorial landmark, a rocky placeholder capable of scanning the coastal landscape and the gaze. It is in this context that the visual representation and reconnection of places and culture comes into play, to be carried

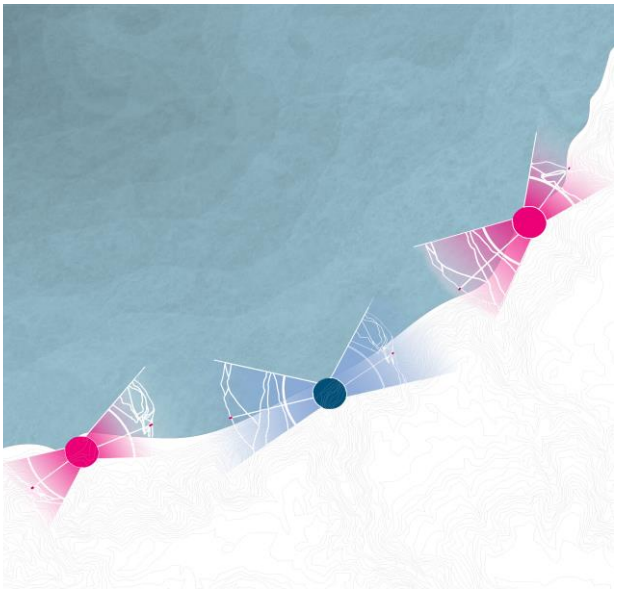

Fig. 4: "Geometries of the gaze". Elaboration by the authors.

out through tourist routes based on the use of augmented reality, through which to reconnect the material and immaterial networks of knowledge.

Reconstructing the "geometries of the gaze" therefore means superimposing visual cones from the coastal towers of Calabria Ultra to landscapes that never existed or no longer exist, through which to learn about material and immaterial coastal relationships and networks (Fatta, Marraffa, & Patanè, 2020) (fig. 4).

In the context of the juxtaposition of the real and the virtual, the methodologies of digital representation related to augmented reality are inserted, useful to promote the area in an innovative way, capable of linking cultural tourism to slow mobility. The overlap between the real environment and digital information, are in fact capable of increasing the perception and knowledge of the surrounding environment: «a layer of information connected to an image or representation of the world in such a way as to offer users the possibility of accessing, in extremely intuitive ways, localized information» (Rossi, 2013, p. 27).

The superimposition of space offers the possibility of simplifying and at the same time increasing the perception of the architectural element, making usable coastal connections otherwise lost in time, or yet never existed (fig. 5). As part of the knowledge of the territory through the narrative device of the Romano Carratelli Code, a first fruition for the valorization of the coastal architectural heritage – in parallel to what will soon be explicated as the repository of today's architectural consistencies – proposes the possibility of gazing at the surrounding landscape through the visualization of an excerpt depicting the towers represented in the Code, combining fruition with the valorization of the documentary asset.

This type of support represents a fundamental imprint for the remembrance of history and the past, to be implemented in the context of built or never built architecture. Archival heritage becomes a "mute" fragment of memory, awaiting relative recognition as an example of the succession of architectural history over time (Albisinni & De Carlo, 2011).

Indeed, the protection and preservation of architectural footprints turn out to have a prominent future in the digital realm, in which the relative valorization depends on the critical interpretation of documentation, enabling the forward projection of one's past into a future present (Culotta & Sciascia 2008), through digital transposition techniques capable of developing a renewed interest of architecture inextricably linked to history.

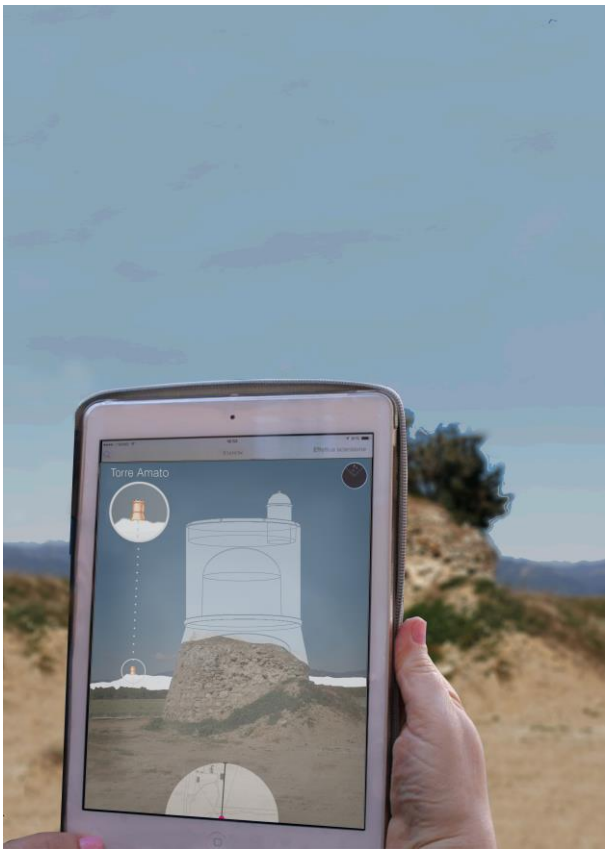

Fig. 5: "Geometries of the gaze": AR visualization. Elaboration by the authors.

4. *Architectural Consistency and Methodological Framework. The construction of a documentary repository*

The To_Know project[4] proposes the digitization of the heritage of the coastal towers of Calabria Ultra and the use of augmented reality to digitally reconstruct these architectures, linking them to the informational and cultural layers of which they are historically a part.

These towers, in addition to being symbols of local history, hold traditions handed down through time. The project aims to turn them into "territorial antennas", places to preserve and spread knowledge about the area.

[4] The To_Know project, born within the "Mediterranea" University of Reggio Calabria and funded with PNRR resources, is a choral work coordinated by Professors Marinella Arena and Francesca Fatta in which Professors Daniele Colistra, Domenico Mediati, Paola Raffa and researchers Nicola La Vitola and Sonia Mollica participate.

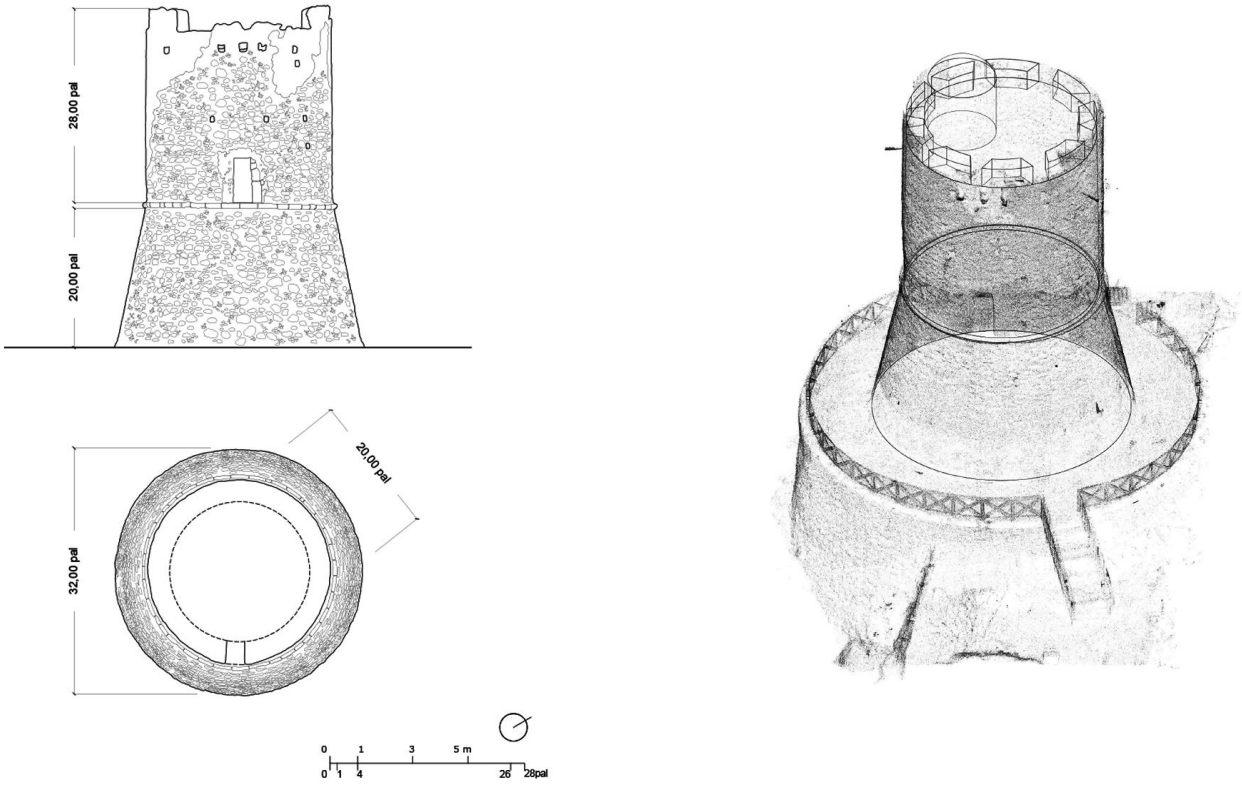

Fig. 6: Instrumental survey and comparison with parametric modeling. Elaboration by the authors.

A key element of this approach is the Romano Carratelli Code, a valuable document describing the toponymy and layout of coastal architecture in the 16th century.

For the digitization of the towers, a survey and census campaign was conducted with 23 instrumental surveys performed with mixed techniques[5], which were the first step toward the creation of digital architectural models. The processing of the laser scanner data and their subsequent registration was carried out on the basis of previously placed markers that ensured the merging of individual scans and subsequent alignment with aerial photogrammetry, ensuring the accuracy of the overlays, integrated into a georeferenced system.

Errors and overlaps resulting from registration were checked, ensuring that they were within the metric error limits of the representation scale. (Leserri & Rossi, 2023). At this point, an overall point cloud was generated from which to extract data for the final graphical representation (Gomez & Orozco, 2022).

The metric accuracy of laser scanner data complements the descriptive and photographic qualities of digital stereoscopic photogrammetry, providing a suitable orthographic basis for subsequent redrawing, representation and production of digital 3D model.

Graphical representation operations were drafted based on the orthophotos extracted from the total point cloud and digital photogrammetry processing (Barba et al., 2023).

The data collected by means of the laser scanner survey and aerial photogrammetry were placed side by side with the data collected through the direct survey and detailed photographs so that the graphic representation, therefore, becomes the result of a selection, not an automated one, but the product of the interpretation of the information therein contained (Mayorga, 2023).

Thus, the two-dimensional graphic elements identified to represent these simple architectures were: 2 floor plans at the level of the cistern and one meter from the stringcourse, a plan of the roofs, 4 elevations, 1 longitudinal section, and 1 cross section.

[5] During the campaign, a FARO FOCUS S150+ with a maximum range of 150 meters was used for outdoor and height acquisitions while aerial shots were taken by means of a DJI Mavic 2 Pro drone equipped with a 1-inch CMOS sensor, effective pixels: 20MP. In total, more than 8,000 photographic shots were acquired, of which 5,000 were used for photogrammetric processing and the remainder-about 200 per artifact-for documentary purposes and to support graphic representation. The drone shots documented with greater quality of detail the covering surfaces of the turreted elements.

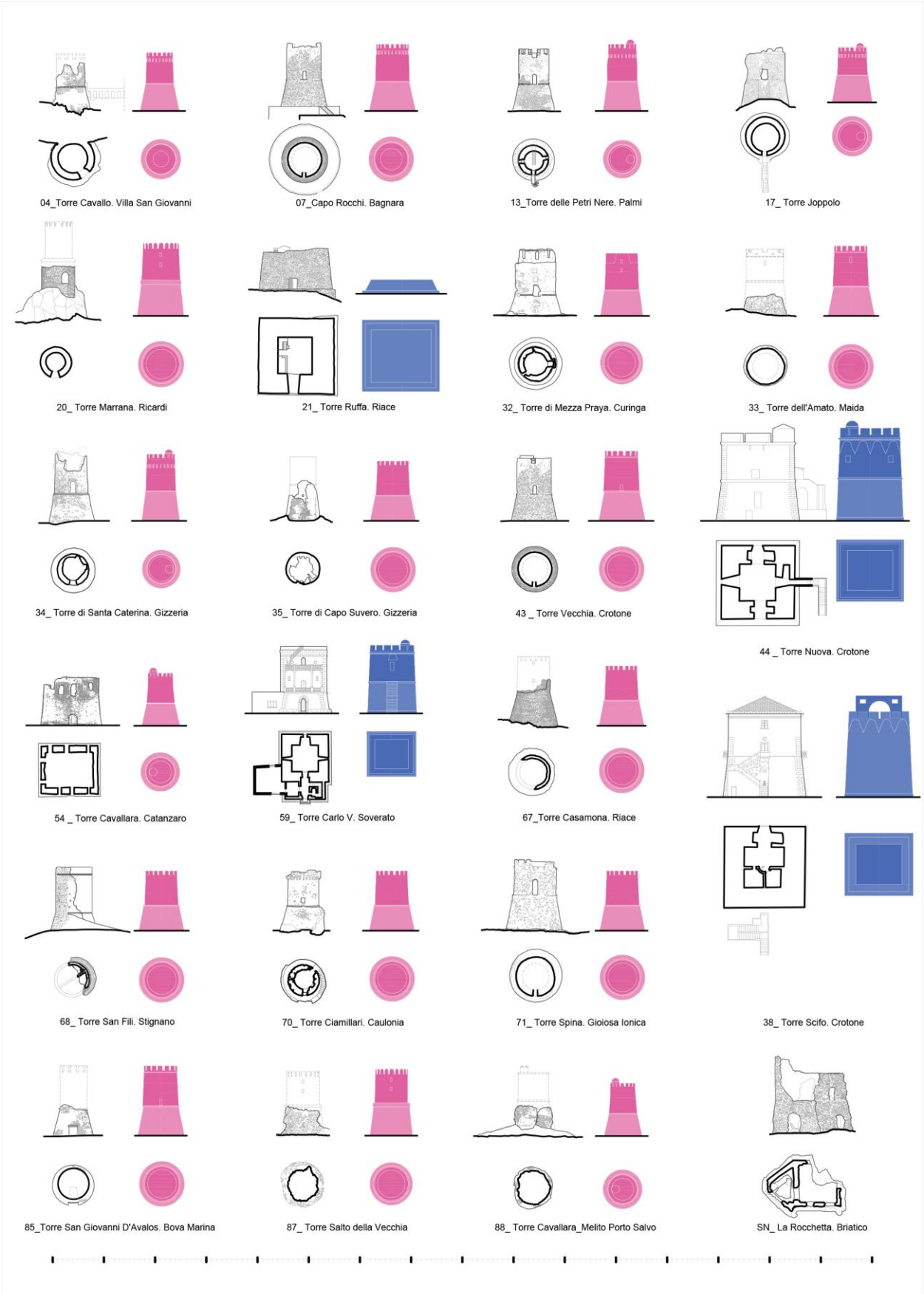

Fig. 7: Comparison of instrumental survey and measurements of architecture deduced by the Romano Carratelli Code. Elaboration by the authors.

For the acquisition of the intangible component, the Romano Carratelli Code was used as a narrative expedient, trying to capture and return the semantic complexity, intangible aspects, perceptual and visual (Bignante, 2011; Ciacci, 2001).

The Romano Carratelli Code provides an essential historical framework for understanding the context of the towers, representing them typologically with recurring architectural elements: base, stringcourse and crowning. Digital modeling links the instrumental study of the towers with their critical representation in the Code. The 3D model allows instrumental survey data to be integrated with parametric modeling, in many cases demonstrating consistency between the manuscript and existing architecture (fig. 6).

The construction of the digital twin archive (fig. 7) is a preparatory step to sharing this heritage, which will be made accessible through a smartphone application. The collection of data, divided into tangible and intangible information, promotes knowledge of the architecture, history and symbolic value of the towers (Montella, 2009). Parallel to the data collection, the logical scheme of the application was developed, which will govern the virtual experience. This is where edutainment (McLuhan, 1964), a popularizing mode that blends learning and communication to create an engaging knowledge system, comes into play (Cervellini & Rossi, 2011). Engagement becomes critical to the success of the project: the more accessible and adaptable the experience, the more effective communication is fostered.

5. *Ontology in the service of knowledge. Typological analysis and semantic decomposition for parametric modeling*

The identification of the constituent elements of architecture, i.e., the cognitive stage, is undoubtedly the first step to be taken as part of the creation of a methodology directed toward the understanding and dissemination of systemic cultural heritage, from the particular to the general.

The reconnection of architecture and places passes through the structuring of semantics useful for the understanding and analysis of the elements belonging to the domain of study: a universal cataloging, for which terminology and structure play a fundamental role in its systematization (Acierno et al., 2017).

Ontological semantics lays the foundation for a common analysis and understanding of the architecture associated with its meaning and the knowledge to be researched and disseminated, toward shared and interoperable knowledge.

With regard to the thermino-semantic structuring of the towers of Calabria Ultra, the architectural structural components were identified (fig. 8), both in the geometric-spatial sense and in the terminological sphere, through which to produce universally recognized and sharable knowledge, due to the rules of inference.

In the context of valorization, historical heritage cannot be exempt from the production of classifications, for which archival sources are configured to be the basis for a correct explication of historical identity (Grasso, 2011). Archival and digital classification represent a key to the understanding of history, as well as constituting themselves as the basis through which to ensure knowledge that is increasingly accessible to all types of users, exponentially multiplying attention to cultural heritage (Empler, 2017).

Regarding ontological structuring, classes are configured as a set of "individuals" organized hierarchically according to superclasses and subclasses, the latter including all relational properties of elements (Noy & McGuinness, 2001). Properties are binary relations on the category individuals, i.e., instances embedded in classes, divided into two types: object properties and datatype properties. The former is defined as a relationship that binds different individuals; the latter represents the binding of a specific individual to datatype values. Finally, restrictions, i.e., bindings between individuals, grouped according to three categories: quantity restrictions, cardinality restrictions and hasValue restrictions, composed of properties, a quantifier and a filler.

Thus, in summary, we can state how the following elements are needed for the design of an ontology: determination of the domain and purpose for which the ontology is created; organization of classes by a hierarchy according to classes and subclasses; definition of attributes of relationship or relation between concepts; definition of instances of classes and subclasses.

The structure of the ontological domain of the Romano Carratelli Code lays its foundation in the typological decomposition deducible in the Code representations.

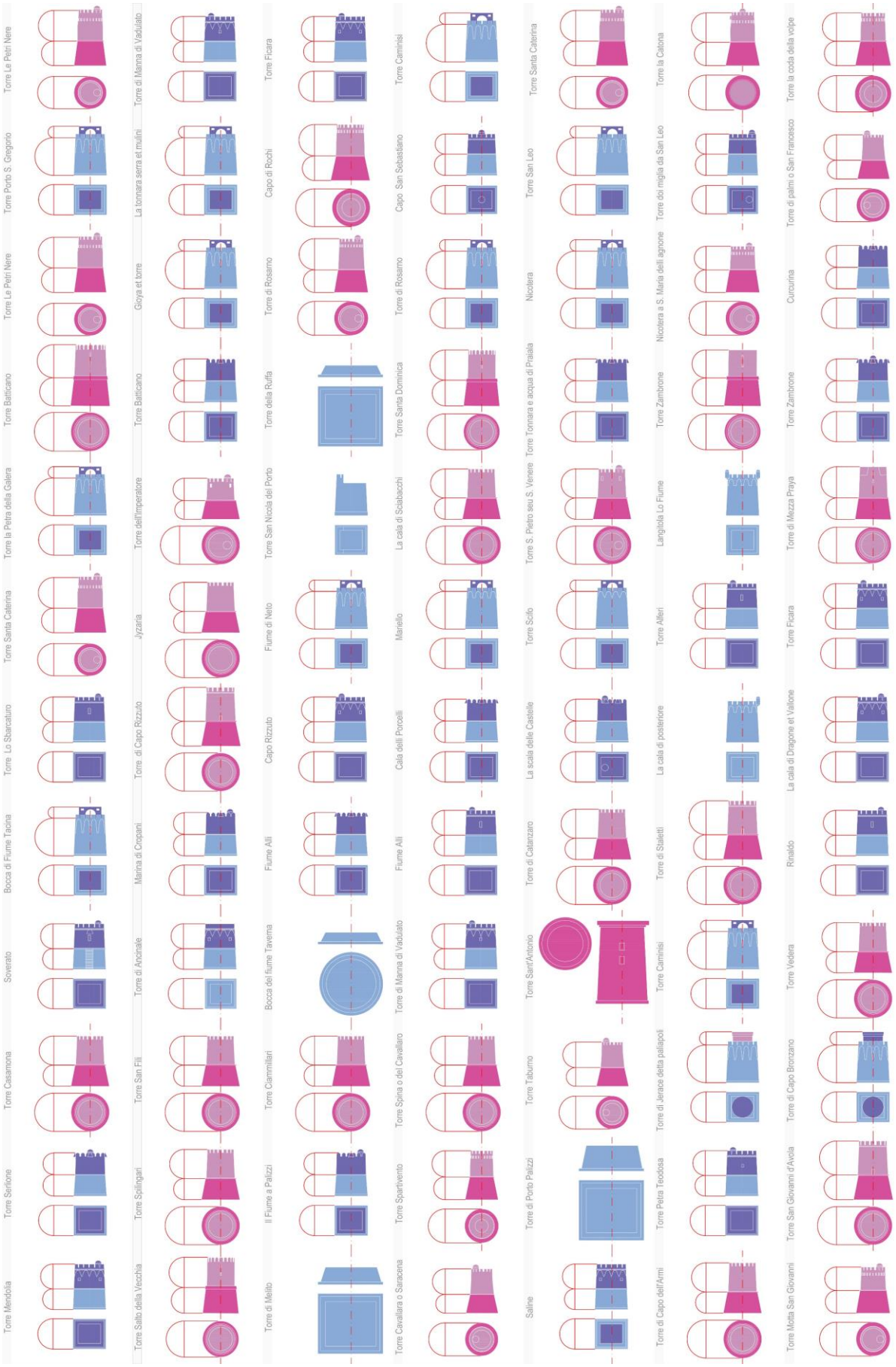

Fig. 8: Typological breakdown of the Code towers. Elaboration by the authors. Elaboration by the authors.

After an initial necessary differentiation between Calabria Ultra and Calabria Citra, the domain identifies three macrocategories: geometric characteristics, historical data, and relationships with the context.

Regarding geometric characteristics, the class "volumetry" intercepts different subclasses, related to the shape of the basement, the height, the presence of an upper volume, scarps and sighting and/or protection elements: this is the case of *bertesche*, *garitte* and *guardiole*. Historical data, on the other hand, are closely linked to the context, defining the year of construction, historical-artistic proximity, georeferenced location, nomenclature, and the state of preservation of the towers themselves as connecting criteria.

However, the taxonomy just set forth does notturn out to be sufficient to generate the logical connections necessary to structure a formal ontology. Indeed, it is necessary to describe the internal structure of concepts by relating, through the imposition of data and object properties, individuals with respect to specific features, providing a restriction and/or connection. Thus, all those connection relationships between the tower and a given semantic, historical and functional feature defined arbitrarily, though commonly shared, are entered as object properties.

Through object properties, such as the relation "as_architectural_pertinence," one connects a specific tower with respect to a specific cultural aspect; or again the relation "as_section_basis," with which one defines as a common datum the geometry in plan of the tower, proceeding with the structuring of the entire connective apparatus. With data properties, on the other hand, a given case study is uniquely identified with respect to a specific datum, in this case pertaining to the specific geographic location of individual towers.

The semantic, historical and cultural data are thus reconnected to a specific case study, defining the set of semantics "decomposed" toward the structuring of knowledge graphs; it is with the latter that it is possible to select some or all of the entered categories, visualizing the different connections and links that characterize the chosen elements. Such recomposition makes possible not only the creation of interactive ontological knowledge – bringing together specific semantic, cultural and historical features to different case studies – but also the possible

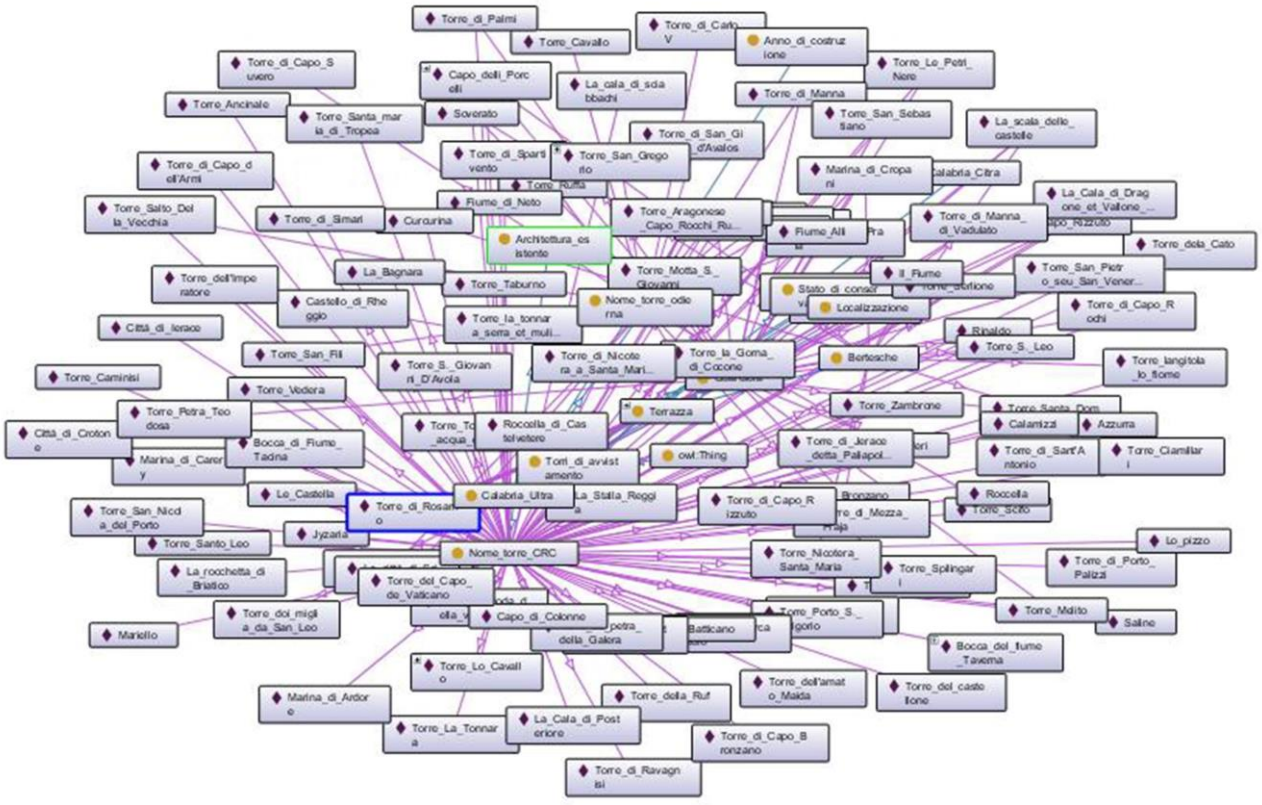

Fig. 9: Semantic recomposition of the Code towers. Elaboration by the authors.

union of digital modeling processes and textual ontological knowledge (fig. 9). Indeed, parametric modeling is closely linked to geometric decomposition, making the macro components and their accessory geometric features already defined to be associated with the visual modeling script (VPL) (figs. 10, 11). Such a modeling process, in addition to making the digital modeling process more expeditious, also makes possible a greater enjoyment and understanding of the linkages and geometries addressable to an expert audience, as well as laying the groundwork for an inclusive popularization of the archetypal form of architecture by simplifying the script into an intuitive game.

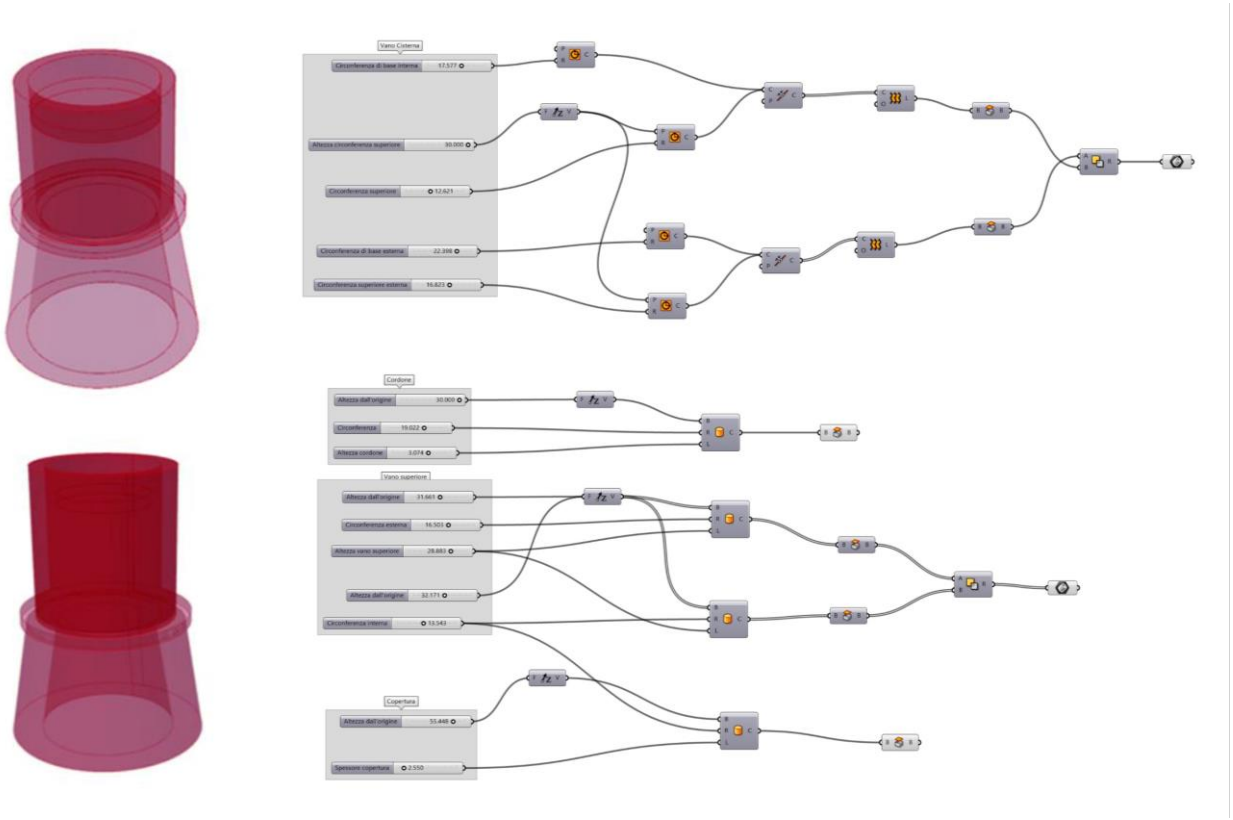

Fig. 10: Visual Programming Language (VPL) of the pink towers. Elaboration by the authors.

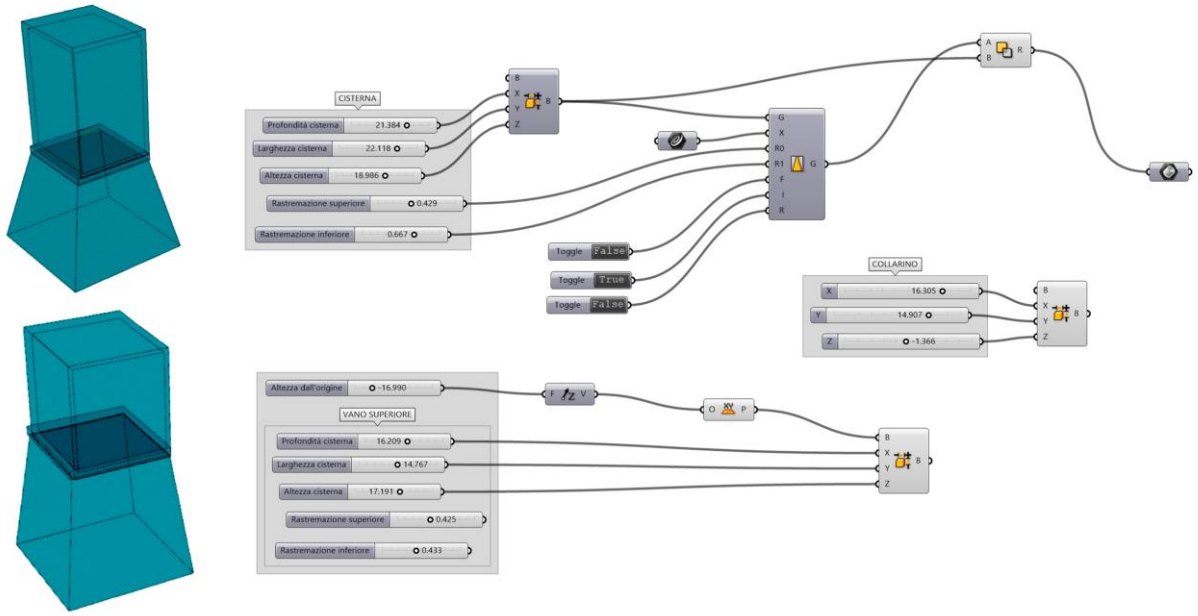

Fig. 11: Visual Programming Language (VPL) of the blue towers. Elaboration by the authors.

6. *Augmented reality for the enhancement of the coastal landscapes of Calabria Ultra*

The integration of digital information in the real context, i.e., a hybrid experience that enriches the physical world with virtual content, represents a significant opportunity to enhance the cultural heritage (Lasorella et al., 2021).

Recent events, such as the pandemic, have confirmed the vulnerability of tangible and intangible cultural heritage, which is highly at risk due to the extended impossibility of directly experiencing the physical dimension of places. This scenario has encouraged the entire scientific community to consider digital technologies as a driving force in the development of new paradigms for cultural heritage (Clini & Quattrini, 2021).

Users, through these new fruition paradigms, can use mobile devices, to explore cultural sites, viewing 3D models or additional information directly on site (Rossi, 2013). Alternatively, virtual reality viewers enable total immersion in digitized environments, offering multisensory experiences that allow users to explore reconstructed historical sites or interact with cultural objects (Russo et al., 2024) on-site and remotely. These approaches, accessible through visors, motion sensors, and open source software (Lütjens et al., 2019; Gutiérrez, Vexo, & Thalmann, 2008), are successfully applied in the enjoyment of cultural heritage. Communication can be further amplified by designed storytelling that adapts the message to different types of users, creating emotional and cultural connections (Pagliano & Ansaldi, 2023).

Fig. 12: Visualization of coastal routes in AR. Elaboration by the authors.

In this context, the To_Know project aims to offer interactive experiences that allow the public to immerse themselves in the historical paths of coastal towers, strengthening community identity and projecting heritage into the future.

The use of augmented and virtual reality facilitates accessibility to information and learning, offering new ways of immersive and participatory enjoyment of historical and artistic heritage (Gatto & Semeraro, 2024).

Specifically, the To_Know project involves the development of a smartphone app that integrates digital reconstructions of coastal towers based on the Romano Carratelli Code with dedicated cultural itineraries. The app allows users to plan routes along the coast of Calabria Ultra, exploring the towers through augmented reality content, in which the pages of the Code serve as a reference point for an interactive tour (Arena, La Vitola, & Mollica, 2024) (figs. 12, 13).

The Code thus represents a fundamental resource for cultural tourism: the application offers a digital view not only of the towers but also of the geometries and alignments between them, making it possible to rediscover a now-lost architecture-territory relationship and thus reconstruct the "red thread" that in the Romano Carratelli Code narrative was supposed to connect the towers to the territory.

Experimentation with augmented reality will take place in two ways: through the three-dimensional reconstruction of the architecture depicted in the Romano Carratelli Code, using the document as a marker (fig. 14), and through the reconstruction of the visual relationships between the towers. To ensure stable anchorage in outdoor environments, markerless technology based on three-dimensional image or object recognition will be used, avoiding deterioration of historical documents or artifacts.

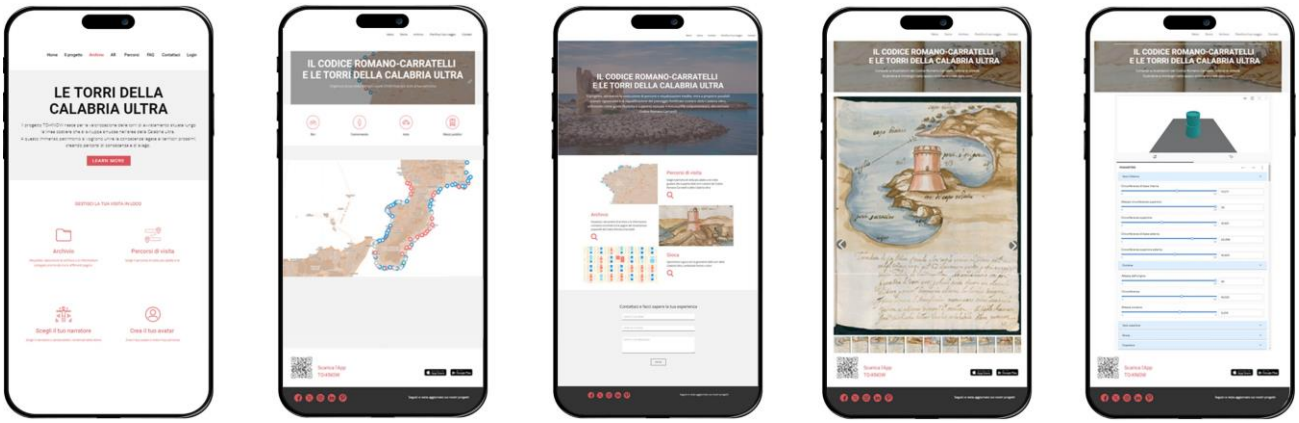

Fig. 13: Screenshots of the application from smartphone. Elaboration by the authors.

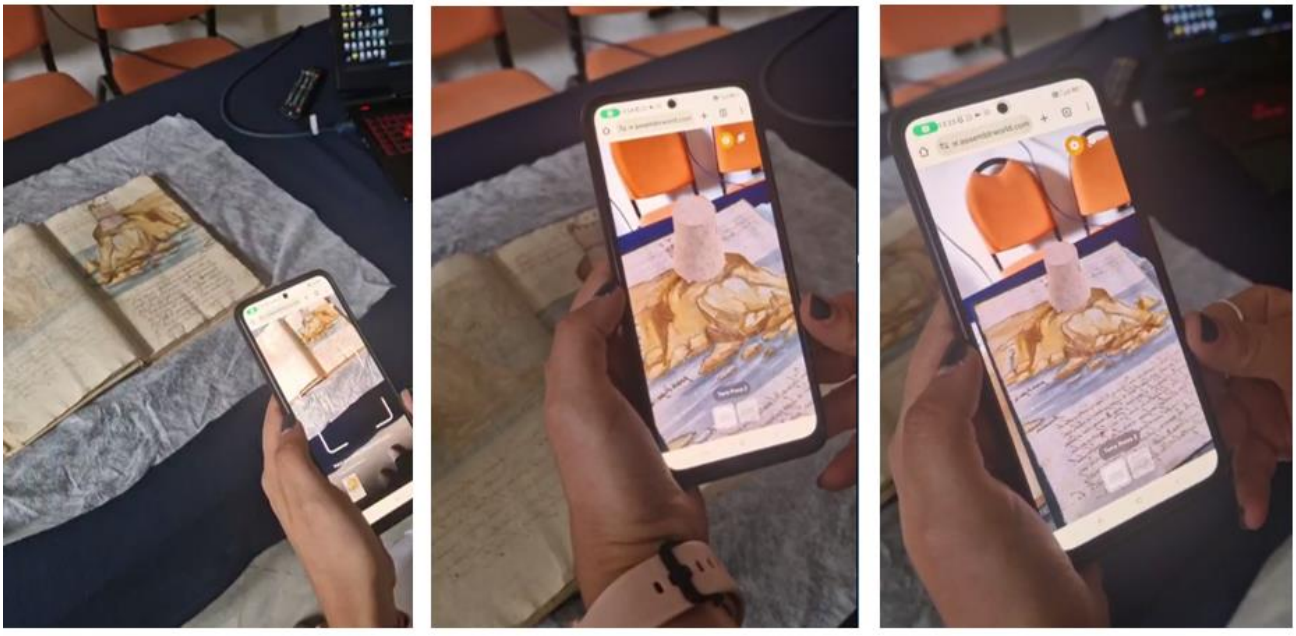

Fig. 14: Visualization of the digital model of the Code through AR.. Elaboration by the authors.

Working on architecture means paying special attention with regard to the use of markeless technology, as it avoids deterioration of the artifact (or archival document as in the former case) due to marker application, as well as operational problems attributable to marker displacement or detachment. For this reason, markerless anchoring can take place in two ways: with image recognition or with recognition of a three-dimensional object. Hence the need for an app with a "sparse cloud" scanning and recognition function, enabling the anchoring of the three-dimensional model to an element of the architecture in the case of the outdoor application. Customizable itineraries will make lesser-known tourist routes accessible, offering a systemic view of the area with the towers as landmarks. Visitors, having arrived at the site, will be able to explore the representation of the historical landscape according to the perspectives of the time through augmented reality scenes. The ultimate goal is to enhance cultural heritage through interactive and customizable digital narratives, promoting sustainable and conscious tourism.

The user-centered approach ensures adapted experiences, creating emotional and cognitive links with heritage. The To_Know project wants to demonstrate how edutainment can rediscover and enhance history, combining learning and fun with the support of the Romano Carratelli Code and immersive technologies. Gamification, through user-friendly parametric modeling tools, adds a playful element that stimulates creativity, turning exploration into an engaging activity. This approach, geared toward slow and sustainable tourism, gives the proposed method general validity and applicability in other contexts of cultural heritage enhancement.

7. Conclusions

Edutainment is today a powerful tool for the valorization of cultural heritage, further enhanced by the use of augmented reality technologies. These tools are accompanied by storytelling, through which to create engaging and educational experiences, capable of making cultural heritage accessible and interesting for everyone.

The human-centric approach to new technologies allows us to put the user at the centre, capable of creating personalized paths for inclusive knowledge of cultural heritage. Narration, used as a teaching tool, facilitates the understanding and assimilation of cultural information, towards the construction of an emotional and cognitive bond with places and traditions.

The To_Know project with its focus on the coastal towers of Calabria Ultra, is a concrete example of how edutainment can be applied to rediscover and enhance the historical and architectural heritage, in a perfect balance between local identities and cultural dissemination. Through the use of the Romano Carratelli Code and augmented reality technologies, visitors can explore the area in an interactive and immersive way, living an experience that combines the game with the knowledge. Finally, gamification in the form of a treasure hunt offers a further playful dimension, transforming learning into an engaging game, educating and stimulating creativity and storytelling ability.

The aim of the project is to make this rich heritage of knowledge accessible through web-apps that allow users to discover cultural and historical routes. In this way, To_Know enhances not only the coastal heritage of Calabria Ultra, but also promotes forms of slow and sustainable tourism, which focus on the discovery and appreciation of the territory and its thousand-year history.

Credits

The study is the result of the collaboration between the two authors, who wrote the paragraphs 1, 2, 7; N. La Vitola wrote the paragraphs 4 and 6; S. Mollica wrote paragraphs 3 and 5.

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