ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/360230365

Analysis and Geographical Representation of Cilento's Monastic Architecture

Chapter · January 2022

DOI: 10.1007/978-3-031-04632-2_1

CITATIONS
0

READS
157

4 authors, including:

Tomás Enrique Martínez Chao
University of Naples Federico II
10 PUBLICATIONS **1** CITATION
SEE PROFILE

Pedro Gabriel Vindrola
University of Naples Federico II
5 PUBLICATIONS **0** CITATIONS
SEE PROFILE

Carlo Giannattasio
Leica Geosystems AG
8 PUBLICATIONS **7** CITATIONS
SEE PROFILE

All content following this page was uploaded by Tomás Enrique Martínez Chao on 10 May 2022.

The user has requested enhancement of the downloaded file.

Springer Series in Design and Innovation 21

Manuel A. Ródenas-López
José Calvo-López
Macarena Salcedo-Galera *Editors*

Architectural Graphics

Volume 1 - Graphics for Analysis

Springer

Springer Series in Design and Innovation

Volume 21

Editor-in-Chief

Francesca Tosi, University of Florence, Florence, Italy

Series Editors

Claudio Germak, Politecnico di Torino, Turin, Italy

Francesco Zurlo, Politecnico di Milano, Milan, Italy

Zhi Jinyi, Southwest Jiaotong University, Chengdu, China

Marilaine Pozzatti Amadori, Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil

Maurizio Caon, University of Applied Sciences and Arts, Fribourg, Switzerland

Springer Series in Design and Innovation (SSDI) publishes books on innovation and the latest developments in the fields of Product Design, Interior Design and Communication Design, with particular emphasis on technological and formal innovation, and on the application of digital technologies and new materials. The series explores all aspects of design, e.g. Human-Centered Design/User Experience, Service Design, and Design Thinking, which provide transversal and innovative approaches oriented on the involvement of people throughout the design development process. In addition, it covers emerging areas of research that may represent essential opportunities for economic and social development.

In fields ranging from the humanities to engineering and architecture, design is increasingly being recognized as a key means of bringing ideas to the market by transforming them into user-friendly and appealing products or services. Moreover, it provides a variety of methodologies, tools and techniques that can be used at different stages of the innovation process to enhance the value of new products and services.

The series' scope includes monographs, professional books, advanced textbooks, selected contributions from specialized conferences and workshops, and outstanding Ph.D. theses.

The volumes of the series are single-blind peer-reviewed.

Keywords: Product and System Innovation; Product design; Interior design; Communication Design; Human-Centered Design/User Experience; Service Design; Design Thinking; Digital Innovation; Innovation of Materials.

How to submit proposals

Proposals must include: title, keywords, presentation (max 10,000 characters), table of contents, chapter abstracts, editors'/authors' CV.

In case of proceedings, chairmen/editors are requested to submit the link to conference website (incl. relevant information such as committee members, topics, key dates, keynote speakers, information about the reviewing process, etc.), and approx. number of papers.

Proposals must be sent to: series editor Prof. Francesca Tosi (francesca.tosi@unifi.it) and/or publishing editor Mr. Pierpaolo Riva (pierpaolo.riva@springer.com).

More information about this series at https://link.springer.com/bookseries/16270

Manuel A. Ródenas-López ·
José Calvo-López · Macarena Salcedo-Galera
Editors

Architectural Graphics

Volume 1 - Graphics for Analysis

Springer

Región de Murcia

f SéNeCa (+)
Agencia de Ciencia y Tecnología
Región de Murcia

Editors
Manuel A. Ródenas-López
Architecture and Building Technology
Polytechnic University of Cartagena
Cartagena, Spain

José Calvo-López
Architecture and Building Technology
Polytechnic University of Cartagena
Cartagena, Spain

Macarena Salcedo-Galera
Architecture and Building Technology
Polytechnic University of Cartagena
Cartagena, Spain

ISSN 2661-8184 ISSN 2661-8192 (electronic)
Springer Series in Design and Innovation
ISBN 978-3-031-04631-5 ISBN 978-3-031-04632-2 (eBook)
https://doi.org/10.1007/978-3-031-04632-2

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Switzerland AG 2022
This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Graphic expression is a primordial characteristic of architectural activity and its most common way of representation. Architecture and urban planning have in graphic representation their basic tool not only for making projects a reality, but also for their reflection and research. Practically every day, architects, urban planners and designers make use of any graphic tool to think, face problems and propose solutions, in different phases and at different scales. If we add to these facts the large number of methods and techniques that can be used, we can understand that architectural graphic expression represents a fairly broad field of knowledge.

In this sense, the departments and areas of architectural graphic expression of the different European universities are responsible for improving teaching and promoting research in this discipline. To this end, the EGA International Congresses are a meeting point where they can present and share the main advances in their lines of research. This Congress series started in 1986 in Seville and has been held biannually since this year. As usual, these events revolve around a central theme proposed by the Congress and sub-themes or thematic lines that try to cover the different areas of work of professionals and researchers within the field of architectural graphics.

After two years that have shaken the world, in which our habits and our habitat have been transformed, where uncertainty has been declared a variable to be assumed in our daily lives, we have been able to observe how different independent initiatives have emerged from the most diverse areas of society to provide solutions to new problems and adapt to new situations. All of this made it pertinent to reflect on the capacity of our area to provide solutions to these new scenarios. For this reason, the central theme chosen for the last EGA Congress was the transfer of knowledge to a society in a process of change, from the different points of view and the specialties that we can cover. This volume is an offspring of the 19th International Congress on Architectural Graphics, held in Cartagena in June 2022. Each author or group of authors contributed an abstract, in their mother tongue, which was included in the Congress proceedings, published by Universidad Politécnica de Cartagena.

As an independent, external activity, the Scientific Committee selected a number of authors and invited them to contribute a different, longer text, about a series of specific topics connected with the main issues in architectural graphics which are included in this volume. These topics were proposed by the Organizing Committee, and they are as follows: Analysis, for the graphics tools as a method for detailed studies; Knowledge, for the study of the evolution of graphics methods themselves; Production, for researches related to architecture contributions; Thought, for critical and reflective works; and Education, for recent results in the field of teaching graphics.

For that purpose, researchers and professors belonging to the architectural graphic expression departments from all Spanish Schools of Architecture were invited to write and send a paper in which they describe their research related to the proposed topics. This invitation was also extended to researchers in the field of architectural graphics from other countries, belonging to different European universities from Portugal, Greece, Belgium, Italy and Germany, which are: Évora (Portugal); Bologna, Pavia, Genova, Reggio Calabria, Milano, Campania, La Sapienza di Roma, Molise, Bari, Firenze, Pescara, Padova, Palermo, Cagliari and Torino (Italy); Siegen and Dresden (Germany); Thessaly (Greece); and Leuven (Belgium). In addition, American authors from Colombia International University, Buenos Aires University (Argentina) and Guadalajara University (Mexico) have been also participated and even from Cuesta College in California. As a result, more than 250 researchers participated in the selection process, and 135 research works were received with the aim of being published.

The selection process of the works contained in this publication consisted of a double-blind peer review of the papers. Around 50 reviewers from different countries, who are recognized experts in the field of architectural graphics, were carefully chosen according to the papers presented. Finally, after this exhaustive review process, 130 papers were definitively accepted and classified by research topics: 47 chapters for Analysis, 33 chapters for Knowledge, 9 chapters for Production, 19 chapters for Education and 22 chapters for Thinking. Consequently, this publication consists of three volumes distributed as follows. *Volume 1: Graphics for Analysis* with 47 chapters, *Volume 2: Graphics for Knowledge and Production* with 42 chapters and *Volume 3: Graphics for Education and Thought* with 41 chapters.

Under those circumstances, we can define this publication as a compendium of research works in the field of architectural graphic expression developed in some of the most relevant architecture schools in Mediterranean Europe. Therefore, we can consider it a faithful proof of what is being done in our universities right now. This is not only about the academic scope, but also about the research works that

are being carried out, the new trends in graphic education, and the evolution of teaching adapted to the rapid changes to which universities are constantly subjected.

Manuel A. Ródenas-López
José Calvo-López
Macarena Salcedo-Galera

Contents

Analysis and Geographical Representation of Cilento's Monastic Architecture 1
Tomás E. Martinez Chao, Pedro G. Vindrola, Antonello Cerbone, and Carlo Giannattasio

Analysis of the Critical Issues Occurring in the Procedures of Image-Based Acquisition of Cultural Heritage 11
Rosina Iaderosa

Architectural Survey for Analysis and Conservation of Fortifications of Belver De Los Montes (Zamora) 21
Licinia Aliberti and Pedro Iglesias Picazo

Connections Between the Architectural Drawings of Miralles and Mackintosh. From Ichnographia to Scaenographia 31
Gonzalo Sotelo-Calvillo and María Teresa Raventós-Viñas

Detailed Knowledge of Territory: Exploration and Army 40
Francisco Javier Fraga López

Digital Reprocessing of Historical Cartography Through Historiographic Analysis of Sites 50
Álvaro Moral García, Andrea di Filippo, and Emanuela De Feo

Drawing as a Tool for Knowledge: Analysis of the Graphics for a Design Proposal for the E42 in Rome that Remained on Paper 58
Piero Barlozzini, Laura Carnevale, and Fabio Lanfranchi

From Earthquake to Earthquake. Compositional Languages Analysis of L'Aquila Civil Architecture 68
Caterina Palestini

From Historical Representation to Spatial Data Infrastructure. Contextualisation of the Underground Heritage Spaces in the City of Carmona (Seville) 77
Andrés Galera-Rodríguez, Francisco Pinto-Puerto, and Mario Algarín-Comino

From Survey to Graphical Analysis of the Monumental Entrance to the Verano Cemetery in Rome 86
Piero Barlozzini, Laura Carnevali, and Fabio Lanfranchi

Generative Modeling as an Alternative Analysis Tool for Cultural Heritage. The Case Study of Helicoidal Staircases 97
Giuseppe D'Acunto, Antonio Calandriello, and Enrico Caldo

Geometric Assessment of Curvatures in Ribbed Vaults from TLS Point Clouds 107
Raffaele Argiolas and Vincenzo Bagnolo

GIS-Based Design for Urban Heritage Routes 117
Cristina Vicente-Gilabert, Marina López-Sánchez, and Mercedes Linares-Gómez del Pulgar

Graphic Mapping of English Houses in Bogotá (1930–1950) 128
Victor Hugo Velásquez Hernández, Andrés Felipe Erazo Barco, and Margarita María Roa Rojas

Graphic Representation of Architecture as a Support for the Parameterization of Habitable Spaces Within Heritage Contexts: The Convent of Santa Clara de la Columna in Belalcázar (Córdoba) . . . 138
Pablo Manuel Millán-Millán and Celia Chacón-Carretón

Graphical Description of Twenty Chimneys Designed by Antoni Gaudí 148
Albert Samper

Hans Scharoun and the Organic Urbanism. The Proposal for *Hauptstadt Berlin* Through Hugo Häring 158
Martino Peña Fernandez Serrano

Hybrid 2D/3D Models for Photo-Based Animations of Virtual Urban Scenes. The *Plaza de la Virgen* of Valencia, in the 1870s 168
Jose Luis Cabanes Gines

Influence of the Camera Lens in the Photogrammetric Survey of Historic Plasterworks. Comparative Study in the Royal Alcazar of Seville. 178
Elena Cabrera-Revuelta, Joaquín Aguilar-Camacho, and Gabriel Granado-Castro

Integrated Architectural Survey Techniques for the Cultural Heritage Preservation and Enhancement in the Covid-Era. The Case Study of Venosa's Most Holy Trinity Complex, Italy 188
Cesare Verdoscia, Michele Buldo, Antonella Musicco, and Riccardo Tavolare

Knowledge Through the Survey: Comparative Analysis and Reconstruction of Time-Line of the Granja de San Ildefonso 199
Davide Carleo, Martina Gargiulo, Giovanni Ciampi, Luigi Corniello, Pilar Chìas Navarro, and Michelangelo Scorpio

Landscape Scenarios from the Lines-Strokes of Georgia O'Keeffe and Lina Bo Bardi 208
Fermina Garrido and Mara Sánchez-Llorens

Landscape Views of Sierra de Oriche Drawn by the Italian Cartographic Unit During the Spanish Civil War 218
Santiago Elía-García, Ana Ruiz-Varona, and Rafael Temes-Cordovez

Mario Labò and the Various Design Proposals for the Oriental Art Museum of Genoa 228
Alessandro Meloni

Methodological and Conceptual Phases for HBIM Modelling: The Case of the Monastery of San Millán de la Cogolla de Yuso (Spain) . . . 237
Jaione Korro Bañuelos, Francisco Pinto-Puerto, Manuel Castellano-Román, José M. Valle-Melón, and Álvaro Rodríguez Miranda

Modelling from Ruins: Virtual Recreation of an Architectural Complex of the Spanish Civil War 247
Amparo Bernal López-Sanvicente and Ana Sáez Heras

Narrative Cartographies. Developing a Socio-spatial Method of Graphic Analysis to Investigate Emergent Occupation Practices in Depopulated Rural Settlements. A Study-Case from the Spanish Central Pyrenees 257
Ignacio Galán-Fernández, Ángel Comeras-Serrano, Yves Schoonjans, and Gisèle Gantois

Past and Present in the Geometry of Dhaka Parliament by Louis Kahn 267
Cristina Càndito

Planimetric Review and Analysis of Arches and Vaults of a Mudejar Architecture. Santa Tecla in Cervera de la Cañad1 277
Luis Agustín-Hernández, Angélica Fernández-Morales, and Marta Quintilla Castán

Proposal for a Digital Information Model to Manage the Archaeological Site of Itálica 286
José María Guerrero Vega, Roque Angulo Fornos, and Manuel Castellano Román

Representation of Oblique Circles in CAD Implemented in a Python Script for Rhinoceros 294
Pau Natividad-Vivó, Ricardo García-Baño, Macarena Salcedo-Galera, and José Calvo-López

Section Drawing as a Designing Tool 304
Belén Butragueño Diaz-Guerra, Javier Francisco Raposo Grau, and María Asunción Salgado de la Rosa

Study and Application of NURBS and Free-Form Surfaces for Design and Architecture 314
Ismael García-Ríos, Federico L. del Blanco García, and Ana González-Uriel

Telling the Invisible. Graphic Strategies for the Narration of the Roman *necropolis* of Porta Palio in Verona 324
Francesca Picchio and Francesca Galasso

The Almina of Ceuta. Graphic Analysis of Its Historical Cartography 332
José Fco. Montes de la Vega, María Teresa Pérez Cano, and Ramón Queiro Quijada

The Analysis of Inaccessible Religious Architecture: Graphic Documentation for the Knowledge and Use of Meteora Monasteries in Greece 343
Adriana Trematerra

The Bust of the Emperor Hadrian. Documentation and Graphic Analysis of the Bust in the Archaeological Museum of Yecla 353
Josefina García-León, Filippo Fantini, and Jesús A. González García

The Drawing of an Idea. Graphic Reconstruction of an Unbuilt Dwelling in Bayview by J. Utzon 363
Marta Alonso Rodríguez, Sara Peña Fernández, and Eduardo Carazo Lefort

The Golden Ratio as a Compositional and Structural Tool in Renaissance Artists. A Comparative Example 373
Miguel García Córdoba, Rafael García Sánchez, Josefina García León, and Gemma Vázquez Arenas

The Hermetic Staircases by Buontalenti for the Florentine Sant'Egidio and Santa Trinita Churches: Digital Analyses 384
Maria Teresa Bartoli and Alessandro Nocentini

The Lighthouses: Real and Virtual Lines. Geometries and Coastal Maps 395
Sonia Mollica

The Main Staircase of Palazzo Spinelli di Laurino in Naples. Function, Shape, Geometry 405
Ornella Zerlenga and Vincenzo Cirillo

The Mosque-Cathedral of Córdoba: Three Interior Perspectives by Laborde (1812) 415
Antonio Gámiz-Gordo, Juan Cantizani-Oliva,
and Juan-Francisco Reinoso-Gordo

Town Planning Reforms Made in the Historical Town of Guadalajara in the Late 19th Century and Early 20th Century Analyzed Through the Cartography of the Spanish Geographic and Statistical Institute . . . 425
Antonio Miguel Trallero Sanz

Vertical Architectures in the Contemporary. Contemporary Bell Towers in Naples. Territorial Survey at Urban Scale and Case Study 433
Margherita Cicala

Visualization of the Local Distortions on the Oldest Known Urban Map of Seville (1771) 443
Joaquín Aguilar-Camacho, Gabriel Granado-Castro,
and Elena Cabrera-Revuelta

VPL for HBIM: Algorithmic Generative Processes for the Thematic Mapping of Information Models 453
Emanuela Lanzara, Simona Scandurra, Margherita Pulcrano,
Sabrina Acquaviva, Mara Gallo, Daniela Palomba,
and Antonella di Luggo

Author Index 465

Analysis and Geographical Representation of Cilento's Monastic Architecture

Tomás E. Martinez Chao(✉), Pedro G. Vindrola, Antonello Cerbone, and Carlo Giannattasio

Dipartimento Di Ingegneria Civile, Edile Ed Ambientale, Università Degli Studi Di Napoli, Federico II, Naples, Italy
tomasenrique.martinezchao@unina.it

Abstract. This paper is part of a wider research on the Cilento monastic architectures of Italo-Greek origin located in southern Campania (Italy). The investigation concentrates on the study, updating and analysis of the existing constructions for the enrichment of the geographical information databases of the Cilento. On this opportunity, the analysis focuses specifically on two monuments of Basilian foundation: the Abbey of Santa Maria di Pattano, in Vallo della Lucania, and the church of San Nicola di Myra in Sacco Vecchia. The first case study presents superfetations that make it difficult to read the architectural languages and to interpret its conformation. On the other hand, the church of San Nicola in Myra, despite being located in one of the most famous ghost towns of the Cilento countryside and showing important deterioration, still preserves its original morphology, characterized by a splendid hieratic character that is completely Basilian. The study of these constructions was carried out with digital models and geographic information systems, in order to obtain the original conformation of the Badia of Pattano. The comparative analysis of the information gathered on the other monument was used to obtain the necessary data to clarify and identify the main construction patterns of the Byzantine and Basilian architectures of the area. These data will serve to enrich the current information and, furthermore, to develop more specific multidisciplinary analyses in the future.

Keywords: Photogrammetric survey · Monastic architecture · Digital models · Ground information modelling · Early middle ages

1 Introduction

The analyses and the methodology applied for this article are part of a larger study of the historical sites - in many cases abandoned - in the Cilento area (Fig. 1). The motivation of this research arises from the need to recover the interest in the historical sites located in this region. With the use of technological tools it is possible to create informative and instructive databases that can serve as technical support for restorers, architects or specialists in charge of the recovery of these heritages places. The data obtained are enriched with photographic archives, historical analysis, geometric studies,

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2022
M. A. Ródenas-López et al. (Eds.): EGA 2022, SSDI 21, pp. 1–10, 2022.
https://doi.org/10.1007/978-3-031-04632-2_1

geographical data, among others elements that allow to understand the history and the transformations suffered throughout time.

For this specific project different analyses were made to two architectural structures from the High Middle Age period. The comparative results obtained serve as the foundation for further in-depth study. The analysis was carried out to understand both constructions separately and to enrich the current data on both of them. During the process, a parallel comparative analysis allowed to determine the influence that one could have had on the other, due to their geographical proximity and the history that frames them.

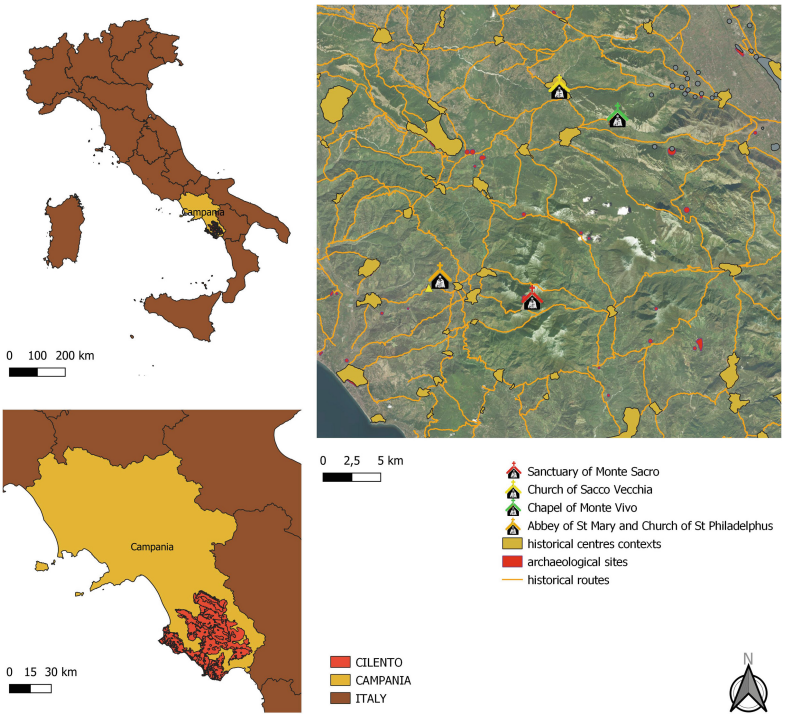

Fig. 1. Global information system of the cilentian region.

2 Global Information System: Case of Study the Cilento

After the fall of the Western Roman Empire, southern Italy was strongly influenced by Eastern monasticism due to the arrival of Italo-Greek monks who were forced to emigrate from their origins. These monks, called Basilians, had a strong impact on the economic, cultural and, above all, religious life of the region [X], they were decisive in the revival of activities in the Cilento territory [2]. However, the connecting routes that led the monks into the Cilento hinterland are uncertain: some authors hypothesize that

the monks disembarked at the ancient port of Velia [3] and ascended along the rivers. Other authors state that, in the case of those coming from the Terra d'Otranto, they traveled northward, through Calabria, in the direction of Apulia; instead, those coming from Sicily traveled to settle initially on Mount Pollino, and then entered the Cilento [4–6].

The territory of the Cilento was ideal for the monks due, firstly, to the natural isolation guaranteed by the mountainous territory (inaccessible and almost without connections) that facilitated Basilian asceticism and, secondly, to the fertility of the land and the presence of watercourses that allowed the cultivation and breeding of livestock [7]. This favored the foundation of religious communities which, although initially inspired by the strict rule of the asceticism, soon became economic and labor poles that were true points of reference for the native populations [8], even also for other religious movements, like Byzantines.

With the passage of time the architectural legacy, for unknown reasons, has taken very different paths of conservation in the Cilento region, many of these works are today abandoned, in ruins or their degradation is imminent, others underwent numerous historical changes of which there is no record. The purpose of this study is to provide a multidisciplinary tool to facilitate the study of this architectural legacy of this period in the Cilento region.

In order to provide an information system that facilitates the study of the monastic legacy in the Cilento region, it was decided to create a geographic database. In it, all the sites with historical interest within the defined area are collected, focusing on those from the High Middle Ages period (fifth century B.C. - tenth century B.C.). This tool allows to identify the geographical position of the different architectural, sacred or civil works, as well as to collect historical, photographic, geometric and specialized information, in order to study them together to deepen the knowledge and understand the impact of these civilizations in the region and their relationship with others.

Based on the existing geospatial data of the area, such as archaeological sites, architecture of the different periods, routes and historical settlements, the research work focused on the identification and insertion of the medieval sites with Basilian and Byzantine influence. This was done through the analysis of the morphology, the history of each of the constructions, the distances between them and their distribution in the specific area of the Cilento. The data collected, images, plans and historical archives will facilitate the multidisciplinary study and research focused on each historical period and its different contemporary movements.

As the firsts studies case for the enrichment of the GIS databases, two churches were chosen that had a significant impact on the surrounding communities. They are located in similar environments, geographically close to each other and with architectural similarities that took very different conservation paths. The first one, Church of San Nicola di Myra in Sacco Vecchia, has the characteristic appearance of the Basilian constructions of the period [9]. The building has not undergone constructive changes that have modified its shape, but it has endured alterations due to the effect of time and atmospheric agents, unlike other architectures located in the same historical period. The parts that are still visible have allowed to obtain precise measurements of its original form and to use it as a reference to find similarities with contemporary structures. The

second building, the Abbey of Santa Maria di Pattano, has several buildings belonging to different medieval periods, from the eighth century AD to the fourteenth century and, therefore, to different movements, including the Basilian and Byzantine (there are also buildings from the nineteenth century).

2.1 Historical Analysis

Church of San Nicola of Myra, Sacco Vecchia: Sacco Vecchia is an archaeological site, located on the western slope of Mount Motola, with remarkable testimonies from different periods. In fact, artefacts have been found that testify to the Hellenists, Lombards and Basilians presence on the site. According to some authors [5], the settlement was the result of the migration of Greek hunters who had previously occupied some neighboring areas. In 580 a.C., the site was occupied by the Lombards and, according to an eighteenth-century historian [6], a Lombard Duke had a castle built there for his wife Sacchia [9].

The presence of the fortress, combined with its strategic location, transformed the place into a military bastion, the remains of which can still be seen today. Finally, in the X century, the Basilian monks arrived, settled and built a church (Fig. 2) of St. Nicola of Myra. The sacred building, built directly into the rock face, has a perfectly recognizable single-wing plan of about 100 m^2, with a semi-circular apse on the east facade, that today is completely absent. Looking at the rest of the facades, on the south side there are three single-lancet windows, one of which is still perfectly visible, while on the north side there is an almost total absence of openings, where only the outline of a door can be seen. Finally, in the west facade, the entrance is characterized by two towers that protrude along the entire facade and which, according to Troccoli's reconstructions (2004), represent the remains of a simple bell tower.

Abbey of Santa Maria of Pattano: The monastery complex, that occupies an area of approximately 1,000 m^2 (Fig. 3), is located two kilometers southwest of Vallo della Lucania. Originally, between the VIII and the first half of the X century, the monastery consisted of two contiguous rooms on the ground floor, covered by ribbed vaults and connected by a barrel-vaulted corridor. On the first floor, there were two other rooms accessed by an external staircase and a balcony. From the old street, now known as Badia Street, it is possible to enter to a small cloister that gave access to the courtyard.

A peculiar element of the monastic complex is the church of Saint Mary, dating from the X century. It is about 25 m long and 8 m wide, currently with no roof, which must have had a two-sloped roof supported by wooden trusses. Later, in the Angevin period, an imposing pointed triumphal arch was built to connect the nave to the hexagonal apse, that was once covered with pointed sections. The church also had two side chapels, alluding to a Latin-cross plan with pointed-arch entrances.

It is believed that the bell tower was built between the X and XI centuries. Another valuable example of Byzantine art in this site is the chapel dedicated to St Philadelphus, the first ecumene of the Pattano monastery who lived between the X and XI centuries. In this chapel, the apse, the intradoses of the arches and some parts of the west wall still preserve precious Byzantine frescoes [1].

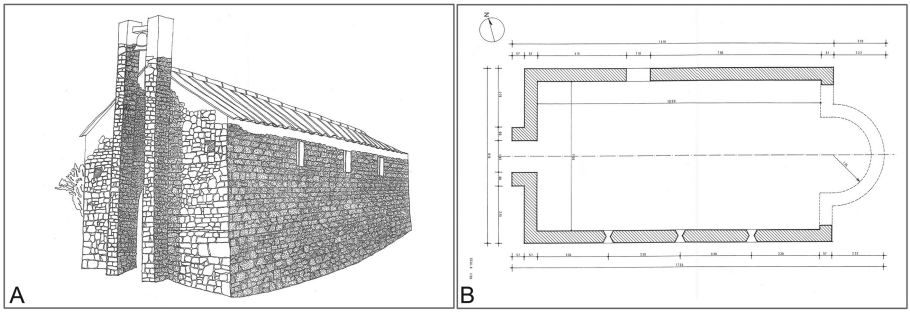

Fig. 2. Reconstructions of the church of San Nicola in Myra (Troccoli 2004] (a) Hypothesis of reconstruction of the church and bell tower, p. 106; (b) Plan of the church of San Nicola in Myra, p.122.

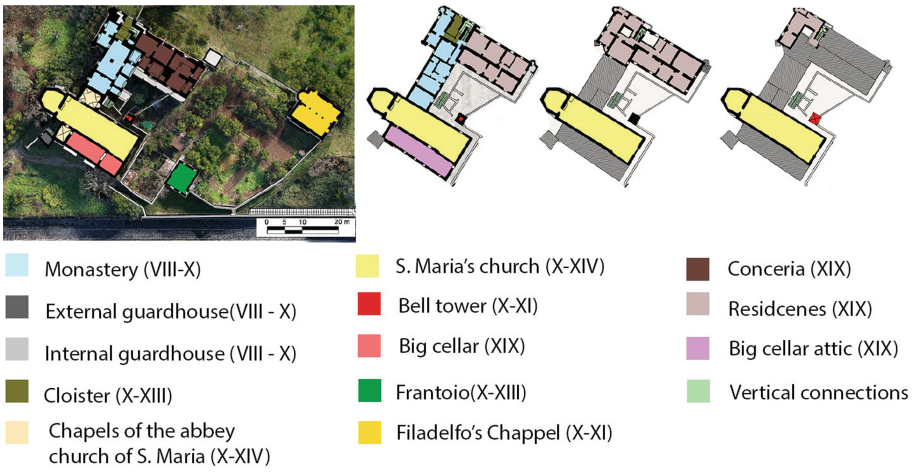

Fig. 3. The monastery complex of Pattano, Vallo della Lucania.

2.2 From Model to Geometric Analysis

Starting from the data obtained by means of aerial photogrammetric surveys, using a DJI Spark drone with a 12 MPx on-board camera, from which digital geometric models were obtained, it was possible to obtain the planimetric measurements of the churches (Fig. 4). With this data, the respective analyses were started, beginning with the church of San Nicola in Myra (Fig. 5) because is the one that belongs entirely to the Basilian monk's movement. It can be observed that it is a rectangular plan with a single nave oriented east to west; with a rotation of exactly 20º. The main door is located on the west facade and is assumed that in the east was the altar, given that all information regarding that facade has been lost.

On the south facade three regular windows can be seen that maintain a rhythm and two holes in the walls, which Troccoli states in his analysis, that they did not belong to the original construction, but are traces of changes over the years. In contrast to the

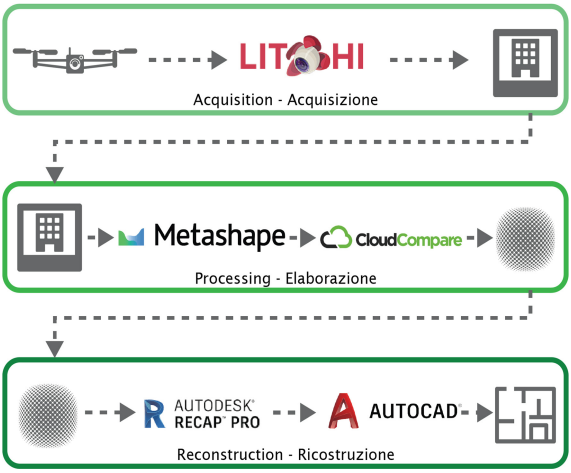

Fig. 4. Data collection and processing scheme.

latter, the north facade has only one door. In (Fig. 6a), a bell tower can be seen in plain sight, which corresponds to the existing projections of the main entrance wall. Finally, on the east facade, in Fig. 5b, we can see how the church ended with a simple apse with a radius of 1.75 m.

After analysing the church in detail, a totally modular church can be observed. The measurement "A" taken from one window's axis to the next is 3.30 m and creates a rhythm that is repeated throughout the construction. Module "A" is repeated four times in the main body of the church and, assuming that the apse's radius was not 1,75 m but 2,15 m, gives a floor plan that is 5 times "A" in length. The width of the church, according to Troccoli's analysis, was 7 m. With the measurements obtained from the photogrammetry data, it was determent that it was 6.6 m, which gives a distance of two times "A". On the other hand, in the analysis of the facades it can be observed that the module "A" arrives exactly at the beginning of the windows and, it is supposed that, with the addition of another module "A" it would coincide with the ridge of the roof and/or the end of the bell tower (Fig. 6). Unfortunately the last information cannot be verified due to the lack of these elements.

Next, we proceeded to the analysis of the church of Santa Maria di Pattano, within the complex of the Abadia di Pattano, a Byzantine church according to previous data. However, there are several particularities that lead us to believe that the Basilian monks influenced the construction of this church. Firstly, the orientation is exactly the same as the San Nicola church, east to west, with a rotation of 20°. This was not the typical orientation used by the Byzantines since they used to place three windows on the east wall so that the first light of the morning would illuminate the altar. Secondly, the atypical construction of a single nave crowned by an apse. However, what lead to assumption that there were Basilian influences during the construction of this church are the strict modulation of the architectural elements and the relationship between the modules of the two churches.

The plan in relation to the façade shows the repetition of module "B" between the apse and altar openings. The same module of 6.3 m can be found between the pair of windows closest to the entrance. If another module is projected between the two pairs of windows, this one is exactly in the centre of the two. Due to this analysis, it is assumed that there was, in the design of the church or original construction, a fifth window that would complete the modulation relationship between the elements. To accurately determine the existence of this fifth window in the design or the construction, a survey will have to be made by specialist to study the façade in detail. The fact that the construction of the church began in the tenth century and the second floor of the adjacent monastery also dates from the same period, there is a historical possibility that this window was designed and even built.

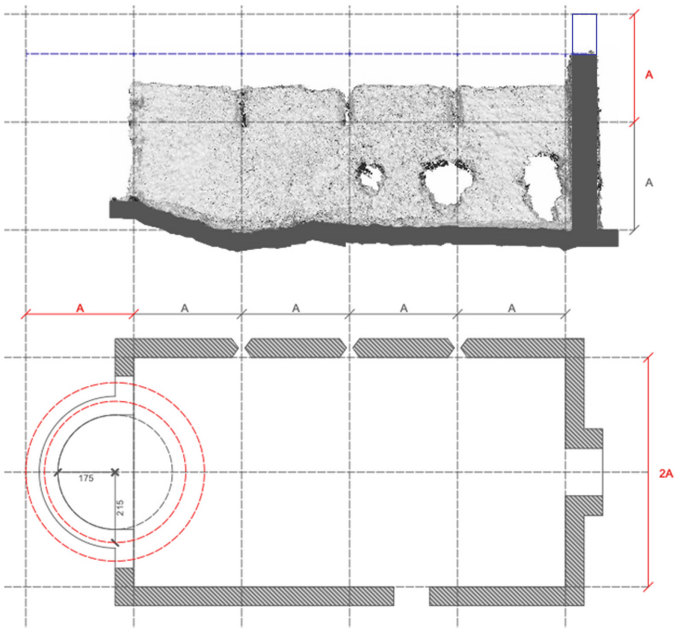

Fig. 5. Reconstructions of the church of San Nicola in Myra hypothesis of the building modules (the bell tower and roof ridge in blue).

Furthermore, following the analysis of the windows in terms of their temporal existence, material and proportional evidence were found that windows "1" belonged to the same period, but it cannot be confirmed that they were closed at the same time. Confronting the historical data, it can be stated that the windows "1" of the East façade were closed in the nineteenth century with the construction of the Big Cellar and is believed that door "4" had the same purpose. However, it is assumed that windows "3" and "2" were opened in the nineteenth century because of their close relationship to the second-floor spaces of the Great Cellar. It was also possible to verify that there is a relationship between the module "A" of the Church of Sacco and module "B" of Pattano. (Fig. 7) based on the superimposition of the floor plan of San Nicola in red over the plan

of the Abbey. The exact ratio of 2 to 1 in the length of the floor plan is observed, and also the coincidence of the modules - also 2 to 1 - between the windows. However, the modules do not follow exactly the two to one relationship because while 2 "A" = 6.6 m, "B" is 6.3 m. The relationship of module "B" in the elevation of Pattano was not able to be verified, since the instrumentation used for the survey did not allow to obtain the necessary precision for this analysis.

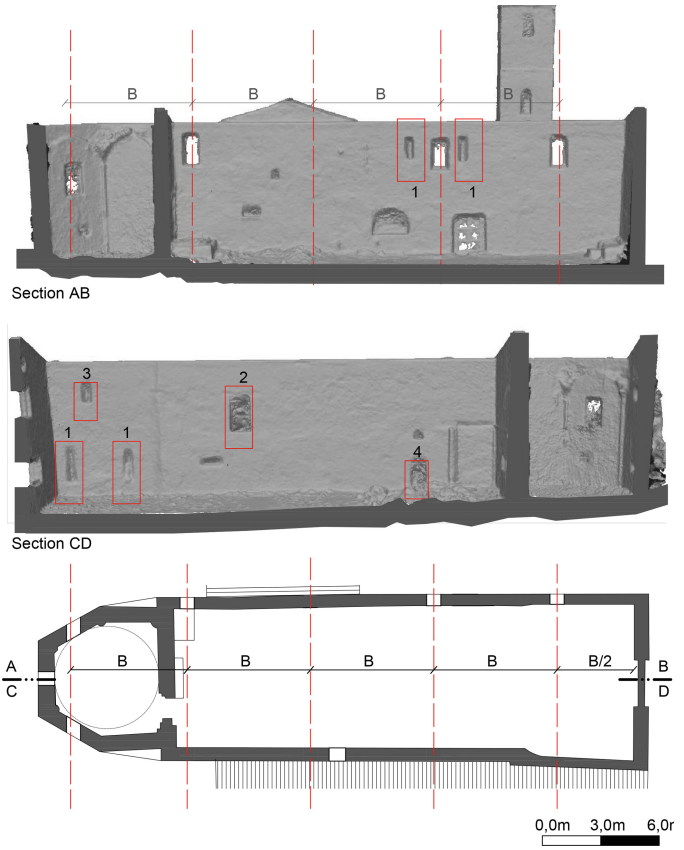

Fig. 6. Reconstructions of the church of Santa Maria di Pattano hypothesis of the building modules.

The similarities between the churches require a more detailed survey and further study of the modules in order to verify if the variation of 15 cm is due to the fluctuating measurement system of the Byzantine foot [11] or to the need for greater precision of the survey results due to the type of instrumentation used.

Unfortunately, however, when the geometric analysis was attempted (with the same methodology used for the church of Sacco Vecchio) it could not be carried out, given that the church was repeatedly restored without historical data to prove every period of the interventions. In addition to this, the survey used does not provide sufficient precision to

carry out an in-depth study of each opening, with the aim of finding modules that would guarantee a rhythm in both the facades and the ground plan (Fig. 7a). Despite the above, a coincidence was found between the plans of the churches (Fig. 7b) where it can be seen that if the two plans are overlapped, the ratio of the length is twice the length of the church of San Nicola and the width is the almost identical in both cases (Fig. 7b).

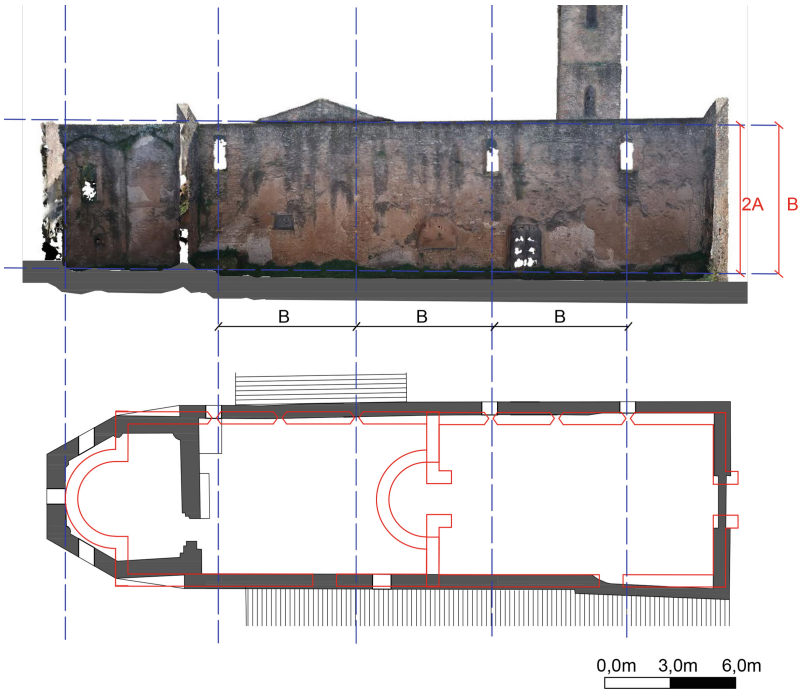

Fig. 7. Architectural comparison: plan overlaping (in red San Nicola the Myra, in grey Church of Pattano) in relation with the elevation.

3 Conclusions and Future Developments

In conclusion, the recent research provides a geographic database that can be used to analyze medieval buildings and to determine their possible influence on other building from the same period in relation to their geographic context. The creation of this database, which incorporates not only historical, geographical and geometrical information, but also other types of analysis, provides a collaborative work platform that can be easily used by different professions.

As demonstrated during the development of the research, the work was focused on the Cilento region and proposes the valorization and dissemination of the region's abandoned heritage. The work involved the analysis of two churches, one Basilian and another one Byzantine, and it was used as a stepping stone for a work methodology that

can be applied to other case studies. On the one hand, with the data gathered on the church of San Nicola de Myra, it was possible to demonstrate the rigor used by Basilian monks to modulated their architecture. On the other hand, using the same methodology in the second church, geometrical, geographical and historical relationships were found between the two churches.

Furthermore, the next step will be to incorporate to this database information collected with other survey equipment, such as terrestrial laser scanners and thermocameras, in order to obtain more precise data that will allow deeper and more exhaustive analyses.

It is the intention of this team to continue enriching the database with the incorporation of the analysis of other buildings located in the Cilento region in order to find new relationships between the architectural legacy of the area and at the same time give more value to its medieval legacy.

Acknowledgements. We thank the staff of the Surveying and Modelling Laboratory of the University of Studies of Naples, Federico II, for their participation and invaluable contribution during the elaboration of this document.

References

1. Cerbone, A., D'Auria, S.: Strategie per la valorizzazione di architetture monastiche. Il caso della Badia di Pattano nel Cilento. 42° Convegno Internazionale dei Docenti delle Discipline della Rappresentazione. Milano: FrancoAngeli, pp. 1938–1957 (2020)
2. Cappelli, B.: Le chiese rupestri del materano. In Archivio storico per la Calabria e la Lucania **26**, 223–289 (1957)
3. Cerino, V.: La Badia di S. Maria di Pattano. Zincografia Partenopea, Napoli (1997)
4. De Luca, G.: La badia di S. Maria di Pattano. In: Natura e Montagna. Pàtron Editore, Bologna, vol. XLIII, pp. 1–6 (1996)
5. Troccoli, M.F.: Sacco Vecchio Antichissimo insediamento precristiano. Salerno: Edizioni Montesacro, p. 132 (2004)
6. Sacco, A.: Dizionario Geografico del Regno di Napoli. Vincenzo Flauto, Napoli, p. 395 (1780)
7. De Magistris, E.: Problemi di Topografia del Litorale Velino. In Fra le Coste di Amalfi e Velia. Contributi di Storia antica e Archeologia. Napoli. Arte Tipografica **8**, 39–81 (1991)
8. Comes, F.: L'Architettura eremitica in Costiera Amalfitana. Specificità e problemi di conservazione.Tesi di Dottorato in Storia e conservazione dei beni architettonici e del paesaggio (XXVI Ciclo) Presso l'Università degli Studi di Napoli Federico (2014)
9. Troccoli, C.: La baronia di Saccho. In: Centro di promozione culturale per il Cilento Annali Cilentani Salerno: Chiesa e società, pp. 1510–1881 (2000)
10. Angulo, F.R.: Construcción de la base gráfica para un sistema de información y gestión del patrimonio arquitectónico: casa de Hylas. Madrid Arqueología de la arquitectura **9**, 11–25 (2012)
11. Schilbach, E.: Byzantinische Metrologie. CH Beck (1970)

View publication stats