Carlos L. Marcos *Editor*

Graphic Imprints

The Influence of Representation and Ideation Tools in Architecture

Springer

Carlos L. Marcos
Editor

Graphic Imprints

The Influence of Representation and Ideation Tools in Architecture

Springer

Editor
Carlos L. Marcos
University of Alicante
San Vicente del Raspeig, Alicante
Spain

ISBN 978-3-319-93748-9 ISBN 978-3-319-93749-6 (eBook)
https://doi.org/10.1007/978-3-319-93749-6

Library of Congress Control Number: 2018944358

Printed on acid-free paper

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

Organization Committee

Scientific Committee

Ángela García Codoñer	Universidad Politécnica de Valencia
Anetta Kepcynska-Walczak	Lodz University of Technology
Antonio Millán	Universidad Politécnica de Cataluña
Bob Martens	Technische Universität Wien
Dana Matejovska	Czech Technical University in Prague
Eduardo Carazo	Universidad de Valladolid
Emma Mandeli	Università di Firenze
Emanuela Chiavoni	Universtità La Sapienza di Roma
Enrique Solana	Universidad de Las Palmas
Ernest Redondo	Universidad Politécnica de Cataluña
Ernesto Echeverria	Universidad de Alcalá de Henares
Henri Achten	Czech Technical University in Prague
Javier Raposo	Universidad Politécnica de Madrid
Jorge Llopis	Universidad Politécnica de Valencia
Jose Antonio Franco	Universidad de La Coruña
José Calvo López	Universidad Politécnica de Cartagena
José María Gentil	Universidad de Sevilla
Jose Pinto Duarte	Penn State University
Juan Miguel Otxotorena	Universidad de Navarra
Liss c. Werner	Technische Universität Berlin
Margarita de Luxán	Universidad Politécnica de Madrid
Mario Docci	Università La Sapienza di Roma
Mara Capone	Università Federico II di Napoli
Marta Úbeda	Universidad de Valladolid
Mercedes Carbonell Segarra	Universidad de Alicante
Noelia Galván	Universidad de Valladolid
Pablo Lorenzo-Eiroa	Cooper Union (New York)

Pilar Chías	Universidad de Alcalá de Henares
Rivka Oxman	Israel Institute of Technology
Stefano Bertocci	Università di Firenze
Tadeja Zupancic	University of Ljubljana
Vito Cardone	Università di Salerno
Carlos L. Marcos (conference chair)	Universidad de Alicante

Peer Reviewers Committee

Aitor Goitia	Universidad San Pablo CEU
Alberto Grijalba Bengoetxea	Universidad de Valladolid
Amparo Bernal	Universidad de Burgos
Ana Torres Barchino	Universidad Politécnica de Valencia
Andrés Martínez Medina	Universidad de Alicante
Ángel Allepuz	Universidad de Alicante
Ángel José Fernández	Universidad de La Coruña
Angelica Fernández Morales	Universidad de Zaragoza
Angelique Trachana	Universidad Politécnica de Madrid
Antonio Álvaro Tordesillas	Universidad de Valladolid
Antonio Amado Lorenzo	Universidad de La Coruña
Antonio L. Ampliato Briones	Universidad de Sevilla
Burak Park	Universidad de Lovaina
Carlos Montes Serrano	Universidad de Valladolid
Carlos S. Martínez Ivars	Universidad de Alicante
Carmen Escoda Pastor	Universidad Politécnica de Cataluña
Concepción López	Universidad Politécnica de Valencia
Debora Domingo Calabuig	Universidad Politécnica de Valencia
Derya Gulec Ozer	Altinbas University (Istanbul)
Elia Gutiérrez Mozo	Universidad de Alicante
Emanuela Lanzara	Università Federico II di Napoli
Enrique Rabasa Díaz	Universidad Politécnica de Madrid
Francisco García Jara	Universidad de Alicante
Francisco Peixoto Alves	Universidade Lusiada
Gabriel Wurzer	Universidad Técnica de Viena
Gaspar Jaén i Urban	Universidad de Alicante
Giuseppe Amoruso	Politecnico di Milano
Graziano Mario Valenti	Universidad Sapienza de Roma
Inés Pernas Alonso	Universidad de La Coruña
Ismael García Ríos	Universidad Politécnica de Madrid
Jorge Domingo Gresa	Universidad de Alicante
José Carrasco Hortal	Universidad de Alicante
José Luis Oliver	Universidad de Alicante
José Parra Martínez	Universidad de Alicante

Justo Oliva Meyer	Universidad de Alicante
Lia Maria Papa	Università Federico II di Napoli
Luis Agustín Hernández	Universidad de Zaragoza
Mara Capone	Università Federico II di Napoli
Marco Lucchini	Politecnico di Milano
Maria Josefa Agudo	Universidad de Sevilla
Maria Luisa Martinez Zimmermann	Universidad de Las Palmas
Marta Alonso Rodríguez	Universidad de Valladolid
Mercedes Carbonell Segarra	Universidad de Alicante
Noelia Galván	Universidad de Valladolid
Pablo Juan Gutiérrez	Universidad de Alicante
Ramón Maestre	Universidad de Alicante
Ricardo Irles Parreño	Universidad de Alicante
Salvatore Barba	Università di Salerno
Sonia Izquierdo Esteban	Universidad San Pablo CEU

Contents

Surveying and 3D Modelling of the Andrea Palladio's Teatro Olimpico in Vicenza. First Studies on Geometric Analysis and Perspectives

Giuseppe Amoruso[1(✉)], Alberto Sdegno[2], and Andrea Manti[3]

[1] Dipartimento di Design, Politecnico di Milano, Milan, Italy
giuseppe.amoruso@polimi.it
[2] Dipartimento di Ingegneria e Architettura, Università di Trieste, Trieste, Italy
sdegno@units.it
[3] Dipartimento di Architettura e Territorio, Università degli Studi Mediterranea di Reggio Calabria, Reggio Calabria, Italy
andrea.manti@unirc.it

Abstract. The subject of the research is the Teatro Olimpico in Vicenza, designed by Andrea Palladio. The work is of great importance for the cavea geometric features and to the design of illusory scenes: it shows the maturation of Palladio in the design and practice of theatrical apparatus, after also an in deep analysis of the Vitruvian prescriptions, which in his De Architectura's Book V, provides some geometric rules for theatre's architectural design. The Teatro has a "semi-elliptical" cavea with a Corinthian colonnade and an attic floor. In front of the cavea there are the proscenio and the frons scenae which introduced spectators to the illusory scenography and the solid perspectives built by Scamozzi to inaugurate the theatre. The work is thus characterized as a case study of great singularity, both in terms of the close connection with the design theory of such spatial solutions and the accurate analysis that can be made with the emerging technologies of 3D scanning and advanced content fruition workflow. The application of new technologies has made it possible to determine accuracy of geometry as compared to previous drawings, which has allowed to analyse many other aspects so far not considered.

Keywords: Andrea palladio · Teatro olimpico · 3D scanning · Modelling Roman theatre

1 Introduction

"*Non giugne Forestiere in questa Città, che non cerchi di vedere prima di tutto il Teatro Olimpico, invogliato dalla fama di un'Opera sì rinomata. Ma il maggior numero dei concorrenti privo di tali ajuti, e guidato da un qualche ignorante ciarliere, parte da questo luogo, pieno di false idee, e di pregiudicate opinioni, e seco porta solamente una rozza immagine della sua conformazione, la quale se non é rinfrancata dai disegni, poco appresso dileguasi intieramente*", wrote in 1804 Scamozzi (1804) which extensively contributed to the knowledge and the dissemination of Palladianism

C. L. Marcos (ed.), Graphic Imprints,
https://doi.org/10.1007/978-3-319-93749-6_35

through the measured drawings of all the works of Andrea Palladio and was also concerned about the prejudices that often accompanied Palladio's works.

The Teatro Olimpico is the last great project designed by Andrea Palladio, which unfortunately could not see finished because he died in the summer of 1580 when only foundations were completed. Prior to his death, Palladio submitted to the *Accademia Olimpica* both the "model" of the theatre that the design of the central solid perspective that would form the stage, extending the built environment behind the *frons scaenae*. After his death, his son Silla was commissioned to perform the construction of the theatre while Vincenzo Scamozzi took care of the illusory scenes for the first theatre performance scheduled by the *Accademia,* the Athenian tragedy *Oedipus the King* by Sophocles.

The restitution of Ancient theatre to Modernity, within Palladio's classicistic project, produced a constant inner turmoil: from the experiences in Vicenza and Venice in the Sixties well into the enterprise of Olimpico theatre, undertaken by the Master in his late years (Puppi 2013).

Licisco Magagnato, who deeply investigated on the genesis of such "eccentric" architecture, not conform to the classical type of Renaissance theatre, wrote that "The Teatro Olimpico, conceived by one of the greatest architects of the sixteenth century, breaks the laws that from the sixteenth century on govern modern stage design" (Magagnato 1951).

He also argued that "The new scene, worked out in the fifteenth century, from Alberti on, dominates the whole of the sixteenth, from this, and this alone, derives modern theatrical architecture and stage design. It has two main features: the ordering of the elements in terms of perspective; and fairly elaborate stage machinery; and these contribute equally to the creation of a setting that is naturalistically as well as rationally conceived. These innovations introduced a gradual transition (that lasted from 1480 to 1510) from the Alberti type of painted scene to the ones of Peruzzi-Serlio, a built practicable setting enriched by the perspectives" (Magagnato 1951).

Palladio was commissioned to design the *Teatro* from the *Accademia* after designing other theatres, but always for temporary installations, as usual, in palace' interiors. After the decision of the *Accademia* to have a permanent and indoor theatre he reacted by offering a solution that surpassed the precepts of the Medici theatres experimented in Florence by Giorgio Vasari and Bernardo Buontalenti. Certainly he knew scenography's fundamentals, *periactoi, scaena ductilis, scaena versatilis* and perspective tools but the archaeological experience of the many theatres he measured and his solid architectural formation made him a supporter of the geometric-structural model of the Roman theatres.

Magagnato brilliantly resumed this issue: "That Palladio's problem was an architectural one concerned with the organization of internal spaces is worth emphasizing: for this was the first time in the century that the making of a theatre had been seen in this way." Until Palladio the solution of making spaces for theatrical representations had been a specific concern for painters and scene-designers (Magagnato 1951).

2 The Geometric Cast and Its Genesis

Palladio, who had already designed some temporary theatres, was moved from his strong desire to erect a theatre in the Roman way according to the long tradition of the *Accademia*. His design purpose concluded a training course that took a fundamental experience in collaborating with Daniele Barbaro for the illustrated edition (with Palladio drawings) of the *De Arquitectura's Ten Books* by Vitruvio published in 1556 (Barbaro 1556). Magagnato explained that "We have ample evidence for Palladio's own archaeological studies on the theatre. We know, of course-we have Barbaro's own word for it-how he contributed to the latter's Vitruvius (1556). His illustration of the Roman theatre published here is exactly derived from the planimetry of the Teatro Berga in Vicenza: one of the London drawings that is even closer to the Teatro Berga shows that Palladio must have made measurements on the site; and similar drawings exist for the theatres at Verona and Pola" (Magagnato 1951).

These were the premise, the result of a long maturation, which led to the original proposal of its geometric layout, probably the last classical theatre built to combine the needs of the architectural space with those of perspective scenes. Ottavio Bertotti Scamozzi summed up the idea of Palladio for the *Teatro*: "The area assigned to Palladio is an irregular figure beyond which it could not dilate its grandiose and correct invention; so that if he wanted to build a theatre, whose shape was similar to the Theatre of the Romans, that is, perfect circular, and wanting the parts to be distributed according to the teachings of Vitruvio, he could not have contained a small number of spectators, and therefore he had to stick to the judicious turn of forming an elliptical shape; and without departing very much from the requirements of the Roman Architect, he was able to change with great devotion those fundamental rules" (Scamozzi 1776).

In fact, according to Barbaro's *Dieci Libri*, demonstration that Bertotti Scamozzi proposed to follow, Vitruvio recommends that the theatre be configured planimetrically as follows: a circle of the theatre magnitude has to be drawn and in this circumference have to be drawn also four equilateral triangles whose vertices belong to said outer circumference; the position of the *proscenio* is determined by the side of that triangle that cuts the circumference in the part where it was decided to place the scene while a line parallel to that of the *proscenio*, which passes through the centre, establishes the width of the Pulpit.

Bertotti Scamozzi describing Palladio's thought, which referred to an elliptical shape based on three circles, thus comments on the Vitruvian geometric scheme: "First I designed the outer elliptic circumference (AAAA), taking half the smaller diameter of the ellipse (AB), I formed a perfect circle (CCCC); inside this circle I drew the four equilateral triangles touching the circumference of the circle itself. Having done all this, notice that the triangle side (DD) would determine the proscenio, that the seven corners (EEEEEEE) would direct the stairs between the wedges, and the other five (FFFFF) would indicate the opening of the three doors in the proscenio and the versure (the side part of the proscenio)" (Figs. 1 and 2).

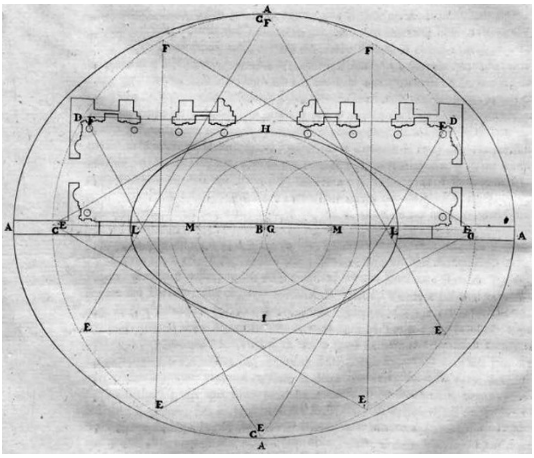

Fig. 1. Ottavio Bertotti Scamozzi, Vitruvian geometric layout for the Teatro Olimpico plan, from *Le fabbriche e i disegni di Andrea Palladio*, Vicenza 1776

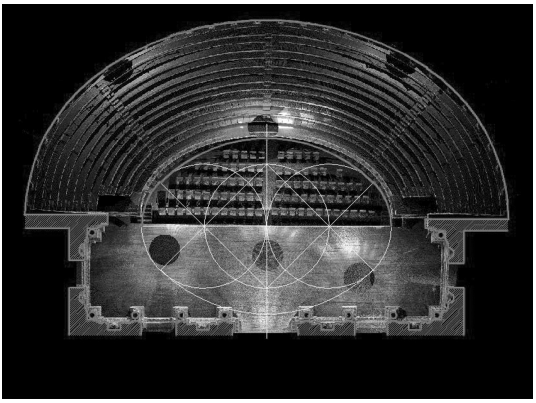

Fig. 2. Superimposition of the Vitruvian geometric layout on the 3D laser scanner survey presented by the research

As with Roman amphitheatres, whose form originates from an oval, in particular from a 4-centre oval or a polycentric oval (Golvin 1988) also for the Olympic theatre remains the uncertainty as to whether the geometric shape is to be attributed to an oval or an ellipse.

In his writings Bertotti Scamozzi always speaks about ellipses, even if the given construction is the one of the *diagoneo* oval by Serlio (Serlio 1584).

The oval is a composite form, very close to the ellipse so that the difference between an ellipse and an oval is really minimal and manifests itself in the different construction of the two curves; oval is formed of circle arches with different ray that meet at points where these same arches share the same tangent. With a greater number

of circular arches and centres, the principle remains the same: arches have different rays and they meet at the point where all share the same tangent; plus the number of centres increases as the closed form of the oval recalls that of an ellipse.

Choice between the two curves, beyond the geometric genesis, is instead more influenced by constructive problems; oval is the most common solution since it is problematic to trace an ellipse for significant amplitudes, and in the case of ellipses, concentricity of the curves is not realized, a situation that does not fit the need to settle the *cavea* (Figs. 3 and 4).

Geometric models were compared with the survey carried out in June 2017 via scanning laser scanning technology; more details are provided in the following section on the measurement and the modelling of the *Teatro*.

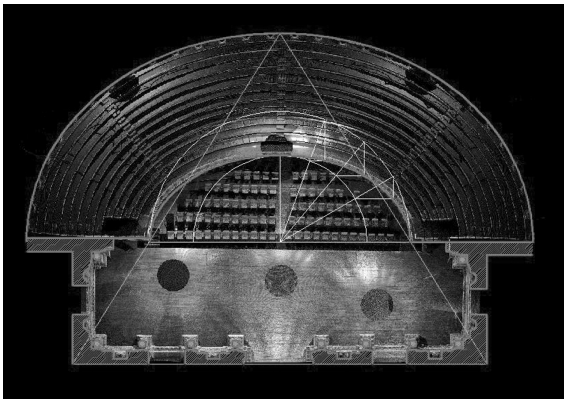

Fig. 3. Superimposition of the elliptical geometric layout on the 3D laser scanner survey presented by the research

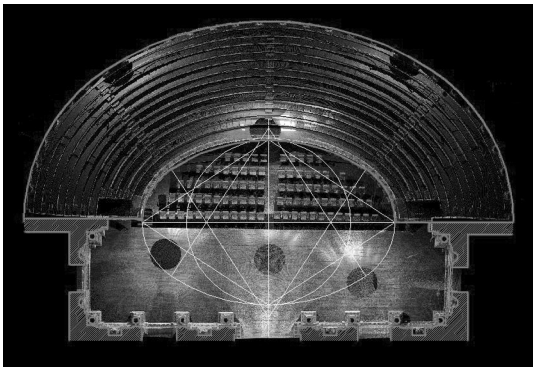

Fig. 4. Superimposition of the oval geometric layout on the 3D laser scanner survey presented by the research

3 The Palladian Theatre as Illusory Perspective Space

Licisco Magagnato argued that: "The central element of Palladio's solution is-in spite of certain in his handling of it which are perhaps decadent and symptoms of the masters old age-the great *proscenio* against which the auditorium opens and it is firmly linked. This is the key element that co-ordinates the working out of his composition. Its grandiose façade is the point of reference for the loggias that front it and for the auditorium; it reduces the perspectives minor and subordinate elements in stage-setting and in the total architectural composition. Its role is thus utterly different from that of the proscenium-arch which serves only to frame the stage in the modern theatre. Particularly illuminating for the understanding of Palladio's art is the study of the genesis of this central element in his theatre. In the formation of his conception of the *proscenio* we can distinguish two fundamental factors: both led him to a solution radically opposed to that already offered by the contemporary development of the proscenium-arch" (Fig. 5). Palladio, in his drawings for the Barbaro's Vitruvius (Fig. 6), seems to have had in mind, as he elaborated his idea of the *proscenio,* the type of the triumphal arch and behind this frame (Magagnato 1951), serving as one of the walls of this great enclosed space, it was possible to create the illusion of multiple and not practicable spaces. It is reported by historians that the *Accademia* asked to the *Commune* enough ground to build the theatre "*secondo il modello già fatto dal loro coaccademico Palladio e disegno parimenti delle prospettive*."

Fig. 5. Comparison between the laser scanner pointcloud (left) and the measured drawing by Bertotti Scamozzi and presented in his book *Le fabbriche e i disegni di Andrea Palladio*, Vicenza 1776

From the analysis of documents emerges the hypothesis that Palladio already designed (or proposed) three-dimensional perspectives for illusory scenes, but only for the *porta regia* (the large central opening) while for the other two side openings (known as *hospitalia*) he took a mannerist solution from the architectural repertoire: painted perspectives on *periactoi* as in the ancient Roman theatres (Fig. 7). Finally we may remember that Barbaro-who was so close to Palladio in matters concerning the theatre-insisted on theatre perspectives having a single focal point. The conclusion is

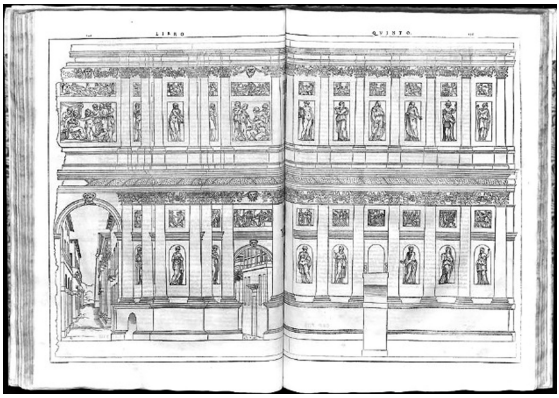

Fig. 6. Daniele Barbaro, *frons scaenae* of the roman theatre according to Vitruvius, from *I Dieci Libri*, Venezia 1556, 156. Drawing by Andrea Palladio

inescapable; some new element-a Buontalenti effect-has been introduced into Palladio's composition. This is one of the ways in which Scamozzi lightly retouched Palladio's scheme and made it more rigid. The important fact, however, is that Palladio envisaged his stage as holding space within space (Magagnato 1951). In a map of 1585 of the theatre site it is possible to notice that the *Academici* had incorrectly used a portion of property that was not initially available to Palladio, but was later affected by the construction of the walls by Vincenzo Scamozzi to include the seven streets of Tebe (according to his design for the scenes of the *Oedipus the King* tragedy), including the round apse concluding the visual axis in correspondence with the most extended central main street.

Fig. 7. 3D laser scanner survey of the *proscenio* showing also the innovative solution proposed by Palladio to settle the *versure* along both the sides

Documents and drawings by Scamozzi lead to describe his intervention as well integrated within the main ideal concept by Palladio. He introduced the opening of the side doors of the *proscenio* and the extension of the size of the central arch, *the porta regia*, that could have altered the illusionistic tricks designed by Palladio; this can't be

proven because, at the death of Palladio, he was designing the scenes for a pastoral representation and not for the Sophocles's tragedy.

Palladio, knew the critiques by Vitruvio resumed also by Daniele Barbaro on certain ancient Hellenistic settings that were realized without taking inspiration from reality but by favouring a fanciful representation, which Macagnato describes as between the "monstrous and the dreamlike". Therefore, with great motivation, he devoted himself to the invention of a classical theatre whose architectural structure was covered and no longer temporary as those he designed in Vicenza and Venice; in his ideal of theatrical space, there were be designed site-specific illusory installations and not those big painted canvases mounted on the *periactoi*.

The extraordinary result derives from the coherence of the *frons scaenae*, the first scenic plane, the architectural space and a precise functional relationship with the *cavea* and the peristyle, and that using the geometric rules of the Renaissance perspective (that of Bramante in Milan) has imagined a second scenic plane, built and perceived beyond that architectural diaphragm. To achieve this harmonic space, at the beginning of the initial project phase, he had provided enough space to build the solid perspectives, true scenery structures, convinced by the words of Vitruvio, which wrote on the existence of true illusory spaces behind the wall of the *frons scaenae* (the Barbaro translates the term *secundum* used by Vitruvio with the word *longo*, which meaning is *di seguito*, following *TN*).

4 Critical Issues in the Measurement and Modelling of the Teatro

3D-modeling methodologies are focused on the acquisition of three-dimensional geometry, with less accuracy than the one that is potentially achieved for small objects and close-range scanners or in a cheapest way with photogrammetry tools and cameras, but equally effective for the purposes of the typological and specific interpretation of the architectural space.

Tools and techniques assessment considered a series of factors according to the quality of data and the degree of detail starting from the final 3D model. Briefly these criteria were: the site features, designed as a theatre stage with figures (statues) and painted surfaces as scenes; the maximum overall dimensions and other features related to the different typologies of architectural surfaces and decorative elements; the minimum detail and the artistic technique; type and condition of materials, (considering surfaces and materials as Lambertian); sensors features, photographic camera and laser scanner operating conditions and 3D modelling software; site conditions and accessibility; the overall aims of the survey and following steps. For what concerns the instruments of acquisition it was deliberately used a set of mid-range products, with good performance, excellent flexibility and versatility during the work on site and especially with a low cost profile, considering the best practice framework and further applications for cultural heritage and digital archives of architecture. (Amoruso and Sdegno 2013).

Indoor measurements of the *Teatro* were operated with a FARO Focus S350 HDR laser scanner. The specific lighting conditions influenced the choice of the built-in

HDR-camera instrument to achieve a high detailed data capture while providing a natural colour overlay to the 3d point-cloud scan data. The Faro Focus sensor is an optical-mechanical devices that measures the spatial position of points according to the variety of surface physical characteristic; this instrument embodies a phase measurement active sensor and measures the phase shift between the emitted signal and its return phase through the emission of an optical radiation with a wavelength corresponding to the infrared $l = 0.78$ mm.

The *Teatro Olimpico* indoor architecture and decoration is characterized from a large spectrum of materials dealing with architectural solutions for classical orders, painted and plastered surfaces, perspective illusory scenes and a collection of statues of *Academici* who funded the project contributed to the construction of the building. Material surfaces can be considered with a Lambertian behaviour, estimating a high level value of reflectivity (ρ), equal to 94%, where the above parameter is valid for a laser with a wavelength of $\sim$0.9 microns (Fig. 8).

Fig. 8. The 3D laser scanner survey of the *cavea* and of the perspective' stage along the main and central visual axis of perception

The main features of Faro sensors are the high-speed shooting and the measurement rate up to 976,000 points/sec; the distance accuracy up to ±2 mm with a range from 0.6 to 350 m.

According to these operating conditions and working at a short shooting distance, accuracies of the order of a few millimetres was achieved. The workflow provided a first set of measurements according to a sequence of 13 stations. A second set of measurements is scheduled (Fig. 9).

After completing the data collection, point clouds (range map) were registered through a process of alignment and integration mitigating the impact of noise and reflectivity of different surfaces. In this phase it is eliminated the instrumental noise that could create false surface definition and geometric uncertainty. Data correction and harmonization of point clouds is more important to achieve a very high level of accuracy and therefore to generate point clouds having more geometric consistencies.

Illustrations are visualizations of the 3d point-cloud after its registration and alignment; the 3D model was visualized both in a subjective way, with perspective views of interior spaces to simulate the panoramic projection, and with orthogonal or oblique views of the master floor and of the main elevation and section planes (Fig. 10).

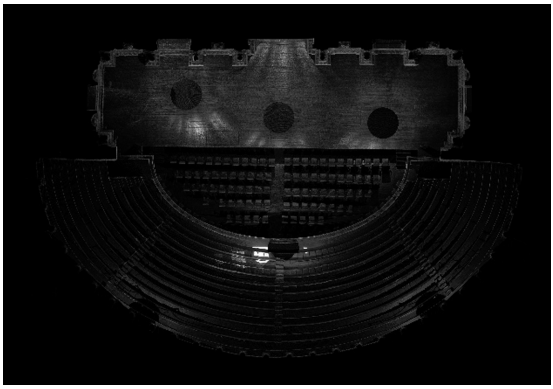

Fig. 9. 3D laser scanner survey of the *cavea*

Fig. 10. The *cavea* laser scanner survey: the architectural transect describes the *cavea-peristilio* including the orchestra's area and the *proscenio-frons scaenae*, with the solid perspectives at the rear

In this first phase of the survey, laser scanning tools were used to set up an operating procedure; it is planned to integrate the process also using digital photogrammetry techniques verifying the combinations of different 3D modeling techniques with the use of the High Dynamic Range photography.

5 Conclusions

The new graphical studies presented here, through an accurate 3D measurement, allow to propose further researches on the many questions that remain unsolved and challenging, even after have analysed historical documentation and the numerous writings on the subject.

Andrea Palladio invents a classical, covered and permanent theatre that build the shape around the solid perspective illusory scenes according to the geometric layout by Vitruvius; he also consolidates the tradition on perspective's knowledge, coming from ancient sources and masters, but projecting its influence on a modern and innovative space and giving it the responsibility to deal with a solid and illusory stage settlement.

The analysis of the *frons scaenae*, *proscenio* and *cavea* system confirms the evaluations edited by scholars who have long researched on the theatre, first of all Ottavio Bertotti Scamozzi and more recently Licisco Magagnato and Lionello Puppi. The geometric shape used to connect the *proscenio* to the *orchestra* is the "elliptical circumference"; at a constructive level, the use of ovals or circular arches allows some geometric corrections, for example for the *cavea* stairs and to solve constructive issues too.

A further step in the investigation will highlight the ultimate tools for fruition of physical cultural resources and assets beyond the digital reconstruction of the analogue model after the survey. Because often outcome of digital reconstructions is frequently provided in formats that are not interoperable, and therefore cannot be easily accessed and/or re-used by scholars or those working in cultural and heritage industries and neither from people who want to learn more about different and embodied sciences within the cultural heritage.

The research's aim is also to extend the fruition through dedicated contents visualization (like video animations) or interactive platforms for augmented reality (visiting the secret corners of the theatre) or physical haptic replicas too for children and disadvantaged categories.

This first benchmarks has to be classified as experimental testing for the development of an operating procedure, including the chromatic accuracy assessment from HDR camera datasets and further developments will be dedicated to the geometric analysis of solid perspectives. These are built, according to Palladio wish, as a true architectural space beyond the *frons scaenae*, emphasizing its perceptual nature in relation to the ideal spectator position and the engagement of audience.

The research will present soon an application of altimetric and planimetric representation or restitution of the pictorial image, coming from the observation of the stage, to reconstruct its spatiality and its ideal reference model through the realization of physical and digital models.

References

Amoruso G, Sdegno A (2013) Le prospettive nel Sacro Monte di Ossuccio. Il rilievo strumentale con il laser scanner 3D e note sul trattamento dei dati analitici. In: Conte A, Filippa M (ed) Patrimoni e siti Unesco. Memoria, misura e armonia. Atti del 35° Convegno Internazionale dei docenti della Rappresentazione. Matera 24–26 ottobre 2013, Gangemi Editore, Roma

Barbaro D (1556) Vitruvius Pollio: I dieci libri dell'architettura di M. Vitruvio tradutti et commentati da Monsignor Barbaro eletto patriarca d'Aquileggia. F. Marcolini, Venezia

Golvin J (1988) L'amphithéâtre romain. Essai sur la théorisation de sa forme et de ses fonctions. De Boccard, Paris

Magagnato L (1951) The Genesis of the Teatro Olimpico. J Warbg Courtauld Inst 14(3/4):209–220
Puppi L (2013) Verso l'Olimpico. Dionysus Ex Machina 4:267–279
Scamozzi OB (1776) Le fabbriche e i disegni di Andrea Palladio: opera divisa in quattro tomi con tavole in rame rappresentanti le piante, i prospetti, e gli spaccati. G. Rossi, Vicenza
Scamozzi OB (1804) Origine dell'Accademia Olimpica di Vicenza con una breve descrizione del suo teatro. Vendramini Mosca, Vicenza
Serlio S (1584) Quattro modi per tracciare l'ovale, in Tutte le opere di Architettura et Prospettiva di Sebastiano Serlio. Venezia: I, ff 13v e 14r

Giuseppe Amoruso Associate Professor of drawing at Politecnico di Milano, is graduated in Civil Engineering and was awarded with a Ph.D. in Representation and survey of built heritage. He is the Chair of INTBAU Italia (intbauitalia.org), a registered charity that promotes traditional architecture of Italian regions. He practices in the field of measured drawing, documentation of architecture, places and cultural heritage.

Alberto Sdegno graduated in architecture, is Associate Professor of drawing at University of Trieste—Dipartimento di Ingegneria e Architettura. He is exclusively dedicated to research, teaching and dissemination of applications and best practices in the field of architectural representations. He is deputy chair of the Ph.D. Programme in Civil Engineering and Architecture at University of Trieste and University of Udine.

Andrea Manti graduated in architecture, he was awarded with a Ph.D. in Survey and architectural representation from the Università Mediterranea di Reggio Calabria. He was visiting Ph.D. Student at the Universitat Politècnica de Catalunya in Barcelona. Recently he published on 3D survey, drawing, representation and valorization of archeological sites and cultural heritage.