Giulia Pellegri, architetto, è professore associato di Disegno presso il Dipartimento Architettura e Design DAD, della Scuola Politecnica dell'Università degli Studi di Genova.

La Giornata di Studi, nata in occasione di Expo 2015, si pone come occasione di confronto e dibattito multidisciplinare nell'ambito di ricerche e pensieri che dalla Rappresentazione si apre a tutte le discipline che coinvolgono l'analisi, lo studio, la valutazione, il progetto, il design, il colore, dell'"Ambiente uomo".
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ISBN 978-88-94943-32-0

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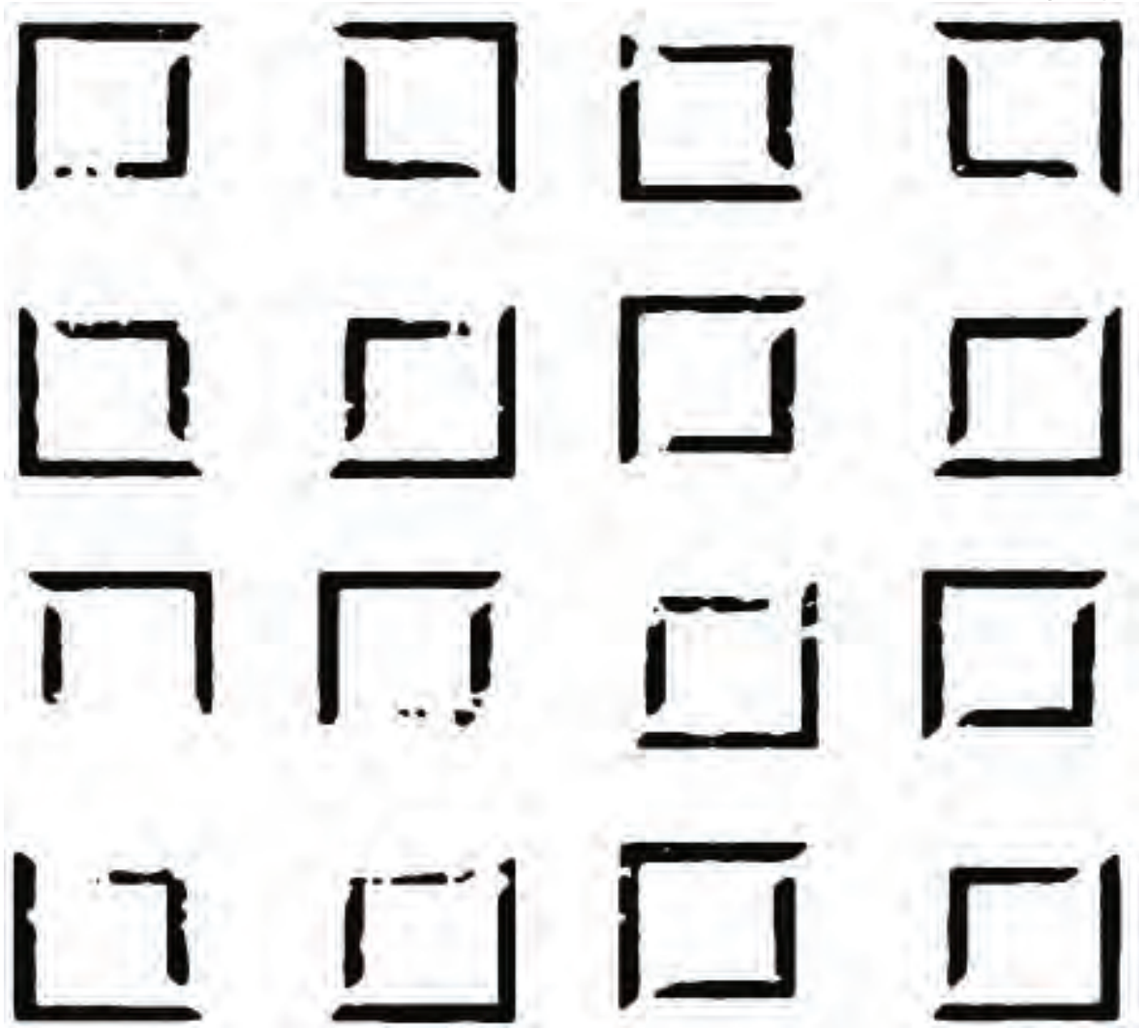
UNIVERSITÀ DEGLI STUDI DI GENOVA

De_*Sign*
Environment Landscape City

a cura di Giulia Pellegri

2018



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International Drawing Study Day/Giornata Internazionale di Studi
Genoa May 08- 09, 2018/Genova, 08- 09 maggio 2018
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De-*Sign* Environment Landscape City
International Drawing Study Day
Genova, 08- 09 maggio 2018
Dipartimento Architettura e Design DAD, Scuola Politecnica dell'Università degli Studi di Genova

Questo volume contiene contributi sottoposti a blind peer review per la Giornata Internazionale di Studi De-Sign Environment Landscape City, tenuta presso il Dipartimento Architettura e Design dell'Università di Genova, 08- 09 maggio 2018.

Patrocinio:

Impaginazione grafica a cura di: Sara Eriche

In copertina:
Elaborazione digitale del disegno analogico di Maria Carratino
Corso di Fondamenti e Pratiche di Rappresentazione 2 a.a. 2017 - 2018

Realizzazione Editoriale
GENOVA UNIVERSITY PRESS
Piazza della Nunziata, 6 - 16124 Genova
Tel. 010 20951558
Fax 010 20951552
e-mail: ce-press@liste.unige.it
e-mail: labgup@arch.unige.it
http://gup.unige.it

ISBN 978-88-94943-32-0 (versione eBook)

Finito di stampare dicembre 2018

Stampato presso il
Centro Stampa
Università degli Studi di Genova - Via Balbi 5, 16126 Genova
e-mail: centrostampa@unige.it

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Preface

The International Study Day, born during Milan Expo 2015, is a multidisciplinary debate in the field of research that open up to the disciplines that involve analysis, study, evaluation, project, design, colour, of the "Human Been Environment".
The Drawing, universal language and communication of planning intentions is at the center also of this Fourth International Meeting organized on two days 8 and 9 May 2018.
The architect Massimiliano Fuksas opened the Conference with the Lectio Magistralis *Love will the World N. 4*. I thank the architect Fuksas who highlighted his expressive capacity and the founding role in the design vision of his drawings and paintings.

Massimiliano Fuksas of Lithuanian descent, was born in Rome in 1944. He graduated in Architecture from the University of Rome "La Sapienza" in 1969. Since the Eighties he has been one of the main protagonists of the contemporary architectural scene.
From 1994 to 1997 he was a member of the Planning Commissions in Berlin and Salzburg. In 1998 he was awarded for his professional career with "Vitruvio International a la Trayectoria" in Buenos Aires. From 1998 to 2000 he directed the "VII Mostra Internazionale di Architettura di Venezia", Less Aesthetics, More Ethics. In 1999 he received the Grand Prix National d'Architecture Française, the following year he was named National Academic of San Luca and was decorated Commandeur de l'Ordre des Arts et des Lettres de la République Française. In 2002 the Honorary Fellowship of the AIA – American Institute of Architects , Washington D.C. Three years later member of the Académie d'Architecture in Paris. In 2006 the Honorary Fellowship of the RIBA – Royal Institute of British Architects, London UK and was named Cavaliere di Gran Croce della Repubblica Italiana. In 2010 he was decorated with Légion d'Honneur by the French President. In 2012 the Medal of the Presidency of the Council of Ministers in Italy, and the Global Lithuanian Award, Art and Culture category in Vilnius, Lithuania. The following year the Idea-Tops Awards, Shenzhen Bao'an International Airport-T3, awarded Best Transportation Space in Shenzhen, China. In 2014 Architizer A + Award and Architizer A + Popular Choice Award, Transportation-Airports category in New York. From 2000 to 2015 he was author of the architecture column – founded by Bruno Zevi – in the Italian news magazine "L'Espresso" and from 2014 to 2015 he was, with his wife, the author of the Design column in the Italian newspaper "La Repubblica".
He has been Visiting Professor at a number of Universities such as Columbia University in New York, the École Spéciale d'Architecture in Paris, the Akademie der Bildenden Künste in Wien, the Staatliche Akademie der Bildenden Künste in Stuttgart.

Giulia Pellegri

New landscapes

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Abstract

Practice-based research is today at the forefront of research in architecture with the drawing its main tool.

Hence, the paper focuses on the drawing as a research tool and discusses the design experiences shared by practicing architects and academics from different cultural backgrounds that include, among others, the School of Architecture at the University of Portsmouth, the DICAR Department of the Faculty of Architecture of the Polytechnic of Bari and the New York Institute of Technology.

The case studies examined in particular investigate the design of architecture as a sensorial and phenomenological experience and the themes of contemporary architectural and metaphorical language, such as the "limes", or more prosaically "wall", in which "boundary" means "go across".

The research question of the paper is:

- What is the boundary between art and architecture in both the anthropized and natural landscapes?
- What will be the contribution of the new representation tools (among which are virtual reality and augmented reality), in the creation of the aforementioned landscapes?

In the context just described, the proposed design methodologies include integration with computation and digital fabrication for the development of the project interpreted as assembly of elements to be realized with non-conventional materials, including composite stone.

Abstract

La ricerca attraverso la progettazione, la cosiddetta "practice-based research", è oggi la frontiera più avanzata della ricerca in architettura. Il disegno ne è lo strumento principale.

Il paper oggetto del presente abstract ha come obiettivo quello di raccogliere riflessioni sul disegno come strumento per la ricerca, maturate nel corso di esperienze concorsuali condivise tra professionisti ed accademici provenienti da ambiti culturali che comprendono, tra gli altri,

la Scuola di Architettura dell'Università di Portsmouth, il Dipartimento DICAR della Facoltà di Architettura del Politecnico di Bari e il New York Institute of Technology.
I casi-studio presi in esame indagano, in particolare, il disegno di architettura come esperienza sensoriale e fenomenologica e i temi del linguaggio contemporaneo architettonico e metaforico come il "limes", o più prosaicamente "muro", in cui "confine" significa "attraversare".
La "research question" del paper sono:
- Qual'è il confine tra arte e architettura sia nei paesaggi antropizzati che in quelli naturali?
- Quale sarà il contributo dei nuovi strumenti di rappresentazione (tra cui, la realtà virtuale e aumentata), nella creazione dei suddetti paesaggi?
Nel contesto appena descritto le metodologie di disegno proposte comprendono l'integrazione con la computazione e con la fabbricazione digitale per lo sviluppo del progetto interpretato come assmblaggio di elementi finiti da realizzare con materiali non convenzionali tra cui la pietra composita.

Introduction

a. Premises

The present paper discusses the relationships between Arts and Architecture through Practice Based Research (PBR).
In the first part, we illustrate the relationships between art and architecture through the filter of the wall type interpreted as an architecture paradigm. This initial exploration also becomes an opportunity to discuss the metaphysical meaning of the wall, as a border element, and its opposite, the crossing.
The literature review here includes some precedents that interpret the theme both in the landscape scale (land art) and that of the urban installation.
The first part ends with the introduction and the description of the case study, the "AttrAVerso" project.
The second part of the paper illustrates the methodology that can be used in the construction of the wall. This methodology refers to innovative use of stone systems and derives from research led by Giuseppe Fallacara Chirico in recent years.
We have, therefore, focused on a recent project, as an emblematic PBR case study. "AttrAVerso" (Across) is its title and refers to the use of the wall as a link between arts and architecture and, contextually, as a crossroads between physical and virtual representations.

b. The wall as a vehicle of art

This part of the text speculates on the relations between art and architecture, and on the philosophical nature of the wall type in this specific area.
"Walls, boundaries, passages were the three selected categories of analysis to try to immediately transmit the duplicity (or ambivalence or ambiguity) of delimiting that, without exception, brings together its own double, the crossing. Other terms would have equal opportunities to increase the list, as well: borders, limit, threshold, line, barrier, fringe, edge, all associated, both as a cause and as an effect, together with categories such as overcoming, infiltration, permeability, bypass, entrance. And in other idioms, additional words could easily be added to complete and complicate

the overview[1].” Apparently an oxymoron, the aforementioned aim belongs to history since its origins. The wall is, in factt the first form of colonization of the landscape by humans. The roots of the design idea of the wall lie in megalithic architecture. The northern circles, such as the one of the Stone Age and the Mediterranean Tombs of the Giants, constitute the paradigm of crossing the boundaries from physical to metaphysical dimensions. Born as an extension of the Stone Age “trilete”, the crossing-wall becomes the foundation archetype of the Bronze Age settlements. The Mycenae walls and the Lion’s gate, the most advanced expression of ancient times, is then inherited by Romans that transform the threshold and the entrance into the so called “limes” separating civilization from barbarians. Hence, it is not surprising that the origins of art and architecture coincide with the stone artifacts of the Bronze Age. And still those massive archetypes seem to be the source of the proliferation of civilizations and vice versa.

Thus, this paper also offers the opportunity to reflect on the frail border territories between art and architecture declined through the idea of the wall.

The Treccani Encyclopedia defines “art” as, “in a broad sense, every ability to act or to produce, based on a particular set of rules, and cognitive and technical experiences, then also the set of rules and procedures. To carry out a human activity in view of certain results. The concept of art as a techne, a complex of rules and experiences developed by man to produce objects or to represent images taken from reality or fantasy, evolves only through a critical passage in the concept of art as an original expression of an artist, to reach the definition of an object as a work of art. In the context of the so-called theories of ‘beauty’, or aesthetics, we tend to give the term art a privileged meaning, to indicate a particular cultural product that commonly ranks under the name of the individual disciplines of production, painting, sculpture , architecture, as well as music or poetry[2].”

This text is, therefore, also an opportunity to reflect on some professional and research experiences on the idea of the wall as a cross-disciplinary paradigm.In the past years, artists and architects have often ventured into operations on the landscape through contamination between art, architecture and the environment, whose shared objective was the creation of unexpected and surprising landscapes[3].On a much more imposing scale, a precedent of the idea of crossing was “The Floating Piers” by Christo (Fig. 1), an onwater floating walkway, connecting Sulzano with the islands Monte Isola and San Paolo, that achieved an enormous media success, reviving the mass tourism in the geographical area of the Iseo Lake. In the works of Land Art (a term created by the artist Walter De Maria - Fig. 2 - author of the “Lightning Field” installation) “the accompaniment of natural phenomena is part of the work, it is its constructive and sensorial support”, and it is “impossible to identify the factors that contribute to form the work[4].”Communication is fast. The ephemeral prevails, so the temporary works of Land Art have also become more frequent, today.

According to Richard Long, his art work is rooted in the “concepts of movement, time, transience and permanence of the subject”: in short, it refers to “the reality of our earthly world [...] All good

[1] C. Flamingo, E. Giunchi, Muri, confini, passaggi: studi storico-politici e prospettive giuridiche, Giuffrè Editore, Milano, 2009, p. 2

[2] Treccani, Arte, http://www.treccani.it/enciclopedia/arte/ (Authors’ translation)

[3] Alain de Botton e John Armstrong, L’arte come terapia. The school of life, Guanda, 2013

[4] Germano Celant, The Lightning Field, Walter De Maria, https://www.domusweb.it/it/dall-archivio/2011/06/21/the- lightning-field-walter-de-maria.html

art is by definition, social[5].”Thus, temporary installations in urban centers and in open spaces become opportunities to allow multiple, and different, uses of the space and to generate new perspectives of the site. Moreover, non-invasive interventions, respectful of the heritage and of the environment, leave no trace in the landscape.

Fig.1 “The Floating Piers” by Christo

Fig.2 Walter De Maria in a 1968 photograph: it seems in contemplation of a border, waiting to cross it (http://www.artslife.com/2013/07/26/addio-a-walter-de-maria/)

[5] Richard Long. I nuovi sciamani e la Land art retrived from https://www.stilearte.it/viaggiatore-dellarte

c. "AttrAVerso" Wall: an emblematic case study of practice based research

In this section, we will introduce the "AttrAVerso" project as an emblematic case study of practice-based research in the interstitial space between art and architecture. We had the chance to develop this project for "The Wall" competition, organized by the CODE digital platform and the Con-Fine Art Association, in 2017, the year in which the term was dramatically associated to the controversies on the Mexican anti-immigration campaign promoted by Donald Trump (Fig.3, Fig. 4), the new cold war unleashed by North Korea, and the escalation of the Israeli-Palestinian conflict (Fig.5).

Fig.3 Kikito by French artist JR, to mock the dividing wall between the United States and Mexico (https://www.agi.it/estero/kikito_muro_messico_usa_artista_jr-2135749/news/2017-09-09/)

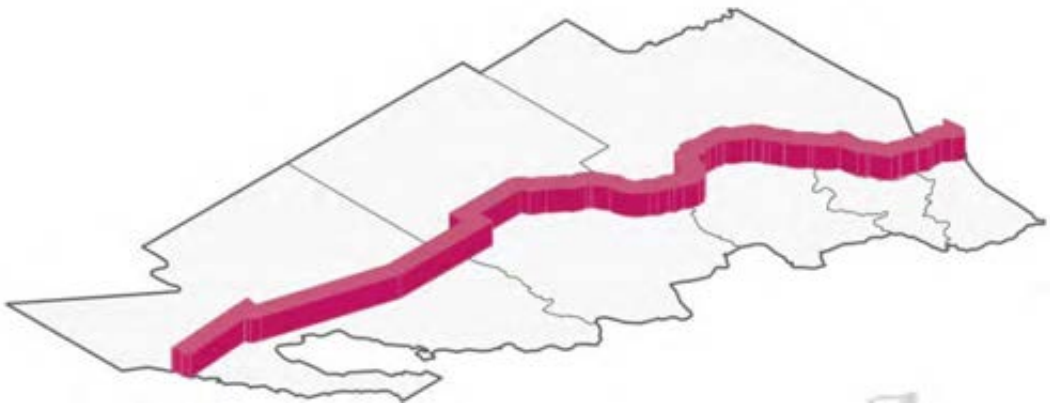

Fig.4 Prison-Wall: the Estudio 3.14 design studio in Guadalajara, imagined an intense pink boundary wall that extends for about 3,150 Km (http://www.syri.net/bote/115501/foto-projektuesit-meksikane-muri-shba-ndash- meksike-do-te-zgjase-16-vjet/)

Fig.5 The wall between Israel and Palestine (http://ruggerodaros.blogspot.it/2013/07/il-muro-della-vergogna-tra-israele-e.html

Thus, the design intends to reconnect with the origins of the wall phenomenology and to explore the genotype of the archaic crossing-wall without indulging in an eventual post-capitalistic interpretation. Hence, our main research question is: how can a contemporary reinterpretation of the masonry contribute to the reintroduction of the symbolic concept of the wall in which the crossing paradigm prevails over that of separation? Here, the concepts of crossing overlap the osmotic needs of a polymorphic, multi-ethnical and mobile hybrid society. Consequently, its definition, in our intentions, turns into a political statement: the separation is a mental map and the wall, therefore, becomes a bridge to the inclusiveness and the diversity, linking different layers of coexistence and culture.

The "attrAVerso" Wall, intended as an installation for Piazza Santo Stefano, a representative site in the city of Bologna (Figure 6), is made of modular bricks realized thanks to the Architectural Hypar System.

The A-shaped and V-shaped bricks also recall the words "attrAVerso".

The installation is conceived in full respect of the surrounding architectural landscape. In fact, as stated initially, in our design the context is relevant in a historic perspective (archaic origins of the wall) as well as in a site-specific perspective. The matrix combination of units from which a holistic architecture derives, represents the link with the location context. Bologna is a city of massive brick walls and porches, where the unity is the result of a masonry composition. The use of a smart brick represents, therefore, our effort in providing today's declination of the Bologna's "topos". In addition, the choice of warm colors is intended as a way of blending with the background colour palette.

The "attrAVerso" project, in addition to integrating and, at the same time, emerging in a historical and urban context, such as Piazza Santo Stefano, has the function of a catalyst: a generator of new sensory experiences, able to attract mass tourism and attentive to art and architecture, both stimulated by the playful aspect of experimenting with new sensations , while the virtual aspect is characterized by the use of augmented reality. The immersive experience of the installation begins with the construction process: visitors have the opportunity to see the evolution of the site and enjoy the fabrication process (Figure 7).

Fig.6 The "attrAVerso" installation: context

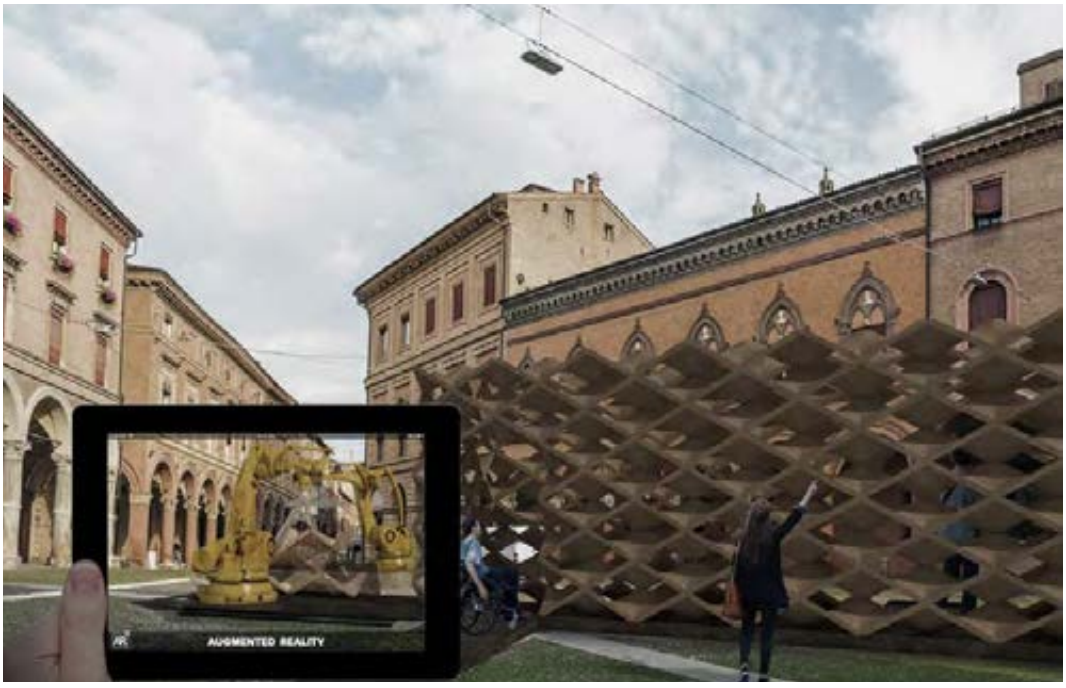

Fig.7 The "attrAVerso" project: virtual and real

To maximize the effectiveness of the immersive experience of the visitors, our installation is designed to frame an outer space as well as an "in-between" space in which the three accesses are conveyed. This interstitial space will provide the visitors with a unique and memorable sensorial experience made of lights. Those features are representative of potentially different sensorial devices that can be applied to the wall and controlled in remote, thanks to Arduino technology. The void spaces of the wall can have multiple uses.

The use of stone also shows ecological advantages. In fact, despite its relative higher embodied energy, if compared to certain organic materials, and though lower than that of other high weight materials, a vast literature shows how the stone provides the longest life span to construction.

Even the use of artificial stone, and its casting in situ, offer a consistent reduction of power generation and transportation energy. Considering the installation and uninstallation potential of the structural components, the final result is consistent with the idea of a closed loop system ("cradle to cradle"), the engineering version of the circular economy.

According to our LCA, taking into account the re-use of the elements, for the installation and for future adaptation, the environmental footprint of our stone wall will be lower than its alternative in timber, also taking into account a relatively short life span (less than 20 years), proving the lack of effectiveness of commonplaces about the ecology of organic materials.

The stone, as an ideal material for the installation, will be the main focus of the Methodology section.

Methodology

The design methodology of the "attrAVerso" is based on the Stereotomy.

The Stereotomy is the discipline of the art of building in cut stone. Stereotomy is the technique (or rather the art) of removing material, in order to create stone blocks, geometrically refined, that allow the construction of elements and architectural systems of triple value: aesthetic, static and functional. Modern Stereolithography, on the other hand, is the technique that makes it possible to create objects, by means of appropriate machines, by adding material (originally liquid resin solidified by UV rays) by overlapping layers. The term Stero, in common between the two techniques, indicates the purpose of the technique or the creation of solid-volumetric objects created mutually: by removal of matter (cut - tomia), or by addition of matter. The two techniques, viewed from a bio-compatibility point of view, in the sense of exploitation of the raw material, could theoretically be complementary and integrative. Specifically, if, by Stereolithography, we mean, in a broader sense, the technique of additive manufacturing or 3D printing through the stratification and solidification of semi-fluid material composed of specific mortar, it is useful to reason on the reuse of stone processing waste for the inert part of the mortar. To do so, Giuseppe Fallacara has conceived the AHS-Architectural Hypar System6[6] as one of the possible processes of updating the ancient stereotomic discipline in the triple aesthetic, geometric and constructive aspects.

Fallacara's AHS modular construction system was initially designed in 2016 and presented, with the prototype HyparWall, for the first time to the public on the occasion of the exhibition titled

6 Giuseppe Fallacara, Architectural stone elements. Research, design and fabrication, Paris:Presses des Ponts, ISBN: 978-2-85978-508-6, 2016, pp. 26-35

"New Marble Generation[7]", curated by Raffaello Galiotto and Vincenzo Pavan for the 51st edition of Marmomacc in Verona (Veronafiere, 28 September - 1 October, 2016) (Fig. 8). The research on geometric-modular construction refers to the "Modular constructivism", a sculptural trend developed between 1950 and 1960, whose founders are Erwin Hauer and Norman Carlberg.

The AHS-Architectural Hypar System is a modular construction system that allows the construction of many types of wall with the use of "bricks-blocks" of complex shape resulting from the geometry of the hyperbolic paraboloid from which derives the term Hypar (Hypar Hyperbolic Paraboloid). From the geometric point of view, the "type brick" is a solid deriving from the extrusion of a saddle surface (with rectilinear edges) inscribed in a parallelepiped with a square, rectangular, trapezoidal and parallelogram base. The "type brick", based on its topological variation, can be used for the construction of multiple building wall systems composed of discrete elements subjected to compression: walls, vaults, domes, etc. (Fig. 9).

Fig.8 The prototype HyparWall, for the 51st edition of Marmomacc in Verona (Veronafiere, 28 September - 1 October 2016)

Figg.9-10 Composition of multiple systems and cut blocks

7 The annual exhibition is part of the project The Italian Stone Theater, created by Marmomacc with the support of the Ministry for Economic Development (MISE), ICE-Italian Trade Agency and Confindustria Marmomacchine, as part of the Extraordinary Promotion Plan for Made in Italy for the enhancement of the excellence of the national lithic and technological sector

The system is part of the broader research relating to the updating of construction techniques, of a stereotomic nature, whereby the static, the aesthetics and the geometry are part of a unique inseparable designing and constructive thought.

From the material point of view, AHS, it has been conceived for the use of natural stone and / or recomposed stone, according to a triple constructive possibility focused mainly on the elimination of excess processing waste and for the complete recovery of them, in a logic of eco-compatibility of the product and respect for the raw material:

1. Natural stone: CNC cutting with robotized diamond wire;
2. Artificial stone: Realization through appropriate mold;
3. Artificial stone: Realization through large size 3D printing.

In the first case, the use of natural stone required the study of a specific construction and cutting technique that reduced to a minimum the waste of material due to the particular shape of the "saddle brick". The hyperbolic paraboloid, being a striped surface, can easily be made with a diamond wire cut and, in this case, with a computerized numerical control cut by an anthropomorphic robot with a diamond wire head.

The anthropomorphic robot, being able to control more movements during the cut, compared to a static diamond wire cutting machine, is able to realize segments with a rectangular, trapezoidal and parallelogram base, allowing ample freedom of action in the design of complex shapes. In this way, starting from a parallelepiped block, it is possible to easily obtain many identical segments contained in series inside the parallelepiped (Fig. 10).

The loss of raw material, due to the excavation of the tool, is almost zeroed, except for the material removed from the thickness of the diamond wire diameter. The cut blocks are also perfectly stackable for transport and storage. During the assembly phase, the segments can have different configurations that allow both porous and completely closing walls.

In the second case, the waste powders of the stone processing become the aggregates of a specific cement-based mortar to be used as raw material for the filling of the "hypar-bricks" molds.

In this way, in the production process, it is necessary to produce the molds (traditionally made of cement or fiberglass) for the purpose of mass production of the brick (Fig. 11).

Inside the mold, during the filling phase of the mortar, it is possible to insert fiberglass fibers and / or light metal reinforcements in order to make the brick very resistant.

The production of molds can take place after the production of the basic plaster hypar-brick, using traditional manual techniques, or in wood or high-density polystyrene cut with CNC machine tools.

The chromatic appearance and superficial roughness of the brick can vary due to both the specific chromatic qualities of the stone or marble powders used, and the surface treatment of the internal surface of the mold.

In the third case, as well as in the previous case, the raw waste material of stone processing, i.e. residues and stone powders with different granulometry, can be usefully reused to form the aggregates of specific mortars for large 3D printers (Fig. 12).

Thanks to this, the mortar, composed of binder and inert, would have a more natural color and the appearance of an artificial stone. In this regard, the mortars and binders based on geopolymers would be optimal for this purpose.The research, in this third case, focuses on two fundamental aspects: the

mortar composition and the molding technique related to specific machines or anthropomorphic robots and extruders for large-scale 3D printing. At present, the limits of these technologies concern three aspects: the aesthetic quality of the printed product, the difficulty in moving the machinery for the printing and for the continuous production of mortars on the construction sites, and the risk of non-homogeneity of the mechanical qualities of the printed product on the basis of the different climatic exposure during the construction in open places (parts more or less exposed to atmospheric agents could react differently to the maturation of the mortar). Another very important aspect related to this construction technique is related to the geometry of the element to be printed, which is produced by the sedimentation, for successive horizontal layers, of mortar, which solidifies in the compatible times to support the subsequent layer of material without global and local variation of the shape of the element itself. It is, therefore, easily understandable that all the shapes which imply a cantilever overhang of the mortar during printing, beyond the allowed angles, are prohibited or strongly limited. The construction system, AHS, thanks to its geometry, is compatible with the 3D printing process without the use of supporting elements, becoming interesting for large molding systems. In addition, it allows the printing of both bricks, in a single way, and the continuous wall, as a whole, given by the aggregation of several bricks without interruption.

Fig.11 - Fig. 12 Production of the brick and construction with large 3D printers

The experimental phase, concerning the real-scale realization of the prototypes deriving from the three construction techniques previously described, was organized with a diachronic scan starting from the second constructive system, then moving on to the first system and, finally, to the third system currently in progress.

The first prototype of the AHS, created for the exhibition “New Marble Generation” with the aim of creating new high quality lithic design products aimed at mass production, is called HyparWall. This is a sinusoidal modular diaphragm wall, made up of segments of hyperbolic paraboloid. The segments are made using the waste from the Pietra Leccese stone-work, using specific binders able to create a sort of reconstructed Pietra Leccese, very similar to the original.

The research has involved the collaboration of a leading company in the sector, PiMar (Lecce), and the contribution of Tarricone Prefabbricati of Corato (Bari). The production cycle of natural stone, in addition to cutting the elements, ues waste materials in a sustainable and innovative way.

The aim of the research was to extend the production cycle of natural stone in addition to cutting the elements, using waste materials in a sustainable and innovative key. The overall geometry of the whole wall is constituted by the mutual aggregation of two "type-bricks" (specular), which, in an appropriate manner, can be used to create:

- Straight wall, full or pierced;
- Curvilinear and cylindrical wall;
- Sinusoidal wall;
- Barrel vault.

The HyparWall prototype, exhibited in 2016 in Hall 1 of the Marmomacc fair, was selected in 2017 for the exhibition outside the fair, in the heart of the city of Verona within the "Marmomac & the City" format. The second prototype phase, currently underway and developed since 2017 in collaboration with the French company SNBR (Sainte Savine Troyes), has produced two prototypes in natural stone, referring to two different construction systems: the sinusoidal wall and the reinforced barrel vault. The first prototype, very similar to the sinusoidal wall made of artificial stone through the use of the previously described molding construction technique, was realized with the diamond wire cutting technique moved by an anthropomorphic robot (Fig. 13).

Fig.13 Prototype realized with the diamond wire cutting technique moved by an anthropomorphic robot

The starting parallelepiped-shaped lithic block, based on isosceles trapezium, was "sliced" in serial succession by the diamond wire according to a specific spatial direction. The production speed of the blocks and the almost total lack of processing waste made the prototype very interesting from an economic and constructive point of view.

The second prototype, named Hypar Vault, is a perforated barrel vault made of the same two type blocks used for the sine wall geometry.

The structure, while being able to withstand the only condition of natural compression of the stone

elements, has been reinforced and prestressed by the post-tension of harmonic steel wires passing through the linear axis of the individual segments in correspondence with the median axial arc of each row of the barrel vault. For the construction of the vault, it is necessary to have a wooden rib which is removed for the purpose of the assembly of all the segments constituting the entire vaulted structure and of their prestressing (Fig. 14).

Fig.14 Hypar Vault

The constructive system can also be used for the construction of other geometric types of vaulted and dome structures. It is possible to equip the extrados with vaulted structures of a glass or plexiglass covering system, completely integrated into the overall geometry.
The third prototype phase of AHS refers to the development of a research, still in progress, deriving from a recent international architecture award (www.printarch.net - Architectural Hypar System) based on the development of technologies and building components created with the additive technique of the 3D robotic print currently being tested. In general, the priority research themes in this area are exemplified by the application of additive manufacturing to the building elements and systems of architecture (Fig. 15).

Fig.15 Examples of architectural systems

The development trajectories include the research on innovative and environmentally friendly materials and on waste treatment.
The aim, as already underlined, is to manufacture and build on a large scale using additive manufacturing methods and using powders and waste deriving from the stone working process as a printing material.
This application would, therefore, result in a transformation of waste from a cost element to an economic resource, from unusable processing by-products to raw materials for environmentally friendly services and products, in a cyclic process of environmental and economic regeneration.
From this basic concept, the large-scale project Anthill Tower was born, an "anthill" tower inspired by nature and the manufacturing phenomena of the animal sphere, by which it is possible to build large vertical structures thanks to the sedimentation and stratification of small grains of soil (Fig. 16). In this specific case, the incessant and methodical work of the ants is carried out by anthropomorphic robots, coordinated in series, which extrude mortar on parallel horizontal levels developed vertically according to the logic of 3D printing. The specific geometry of the tower, created as aggregation of Hypar-seamlessly maxi blocks, allows the mortar to settle according to the optimal angles of vertical growth of the tower. The interior spaces of the concave-convex tower give a new housing dynamic wherein the sequence of shared spaces and labyrinthine connections is greater than the aggregation of individual private housing cells. The anthropomorphic landscape of the city, thus, returns to reflect on the nature and the biological life that surrounds us.

Fig.16 Anthill Tower project

Conclusion

The present paper has introduced the concept of the wall as an architectural type capable of interpreting the instances of separation and crossing, meant as an archetype of relations between art and architecture from the beginning of civilization.

In accordance with the PBR premises, the text reported a series of reflections related to the AttrAVerso project, the main case study of research. This project object of the wall competition is a hollow and porous wall, which can be walked through thanks to two opposite openings that allow entry into an axial corridor. In this specific case, the wall provides a space for a totalizing experience, taking place both outside and inside. The need of light permeability, as well as the concepts of continuity/ infinity and closed loop, suggested a configuration of the base components that recalls a portion of the Moebious strip, the well-known topologic surface usually associated to the idea of infinity. The construction system designed by Giuseppe Fallacara based on the Stereotomy was the ideal technical solution for this project. To address the research objectives, we have started cultivating the idea of the stone component, as a symbolic representation of continuity with the past, that unfolds in the invention of a contemporary smart brick. The latter is our interpretation of the principle of architecture beyond time and space, able to reconnect "homo" to "humus".

In fact, despite its futuristic aesthetic value, the wall is built with the aggregation of blocks-brick similar to that of a traditional brick or stone blocks wall. The distinctive aspect of the wall is given by the particular geometry of the single modular block that, in its serial aggregation-repetition, recompose a perforated texture of complex and continuous surfaces. Those aspects have been illustrated in the methodology section.

In conclusion, we have demonstrated how it is possible to challenge the idea of separation usually associated to the wall, through an unconventional approach to design. The use of advanced technologies, such as the digital fabrication, allow, in fact, to generate an "atomic" framework that provides the same structural strength as the traditional masonry as well as unconventional attributes, such as transparency and crossability, difficult to achieve through the use of traditional technologies. In addition, the use of a system made by modular components can lead to potentially infinite matrix configurations and adaptation to different sites.

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