Events

Nexus Conference 2018
Relationships Between Architecture and Mathematics

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The several relationships between mathematical principles and configurative logic of architecture have made this research topic widely debated [William, Ostwald 2015].
They are apparently antithetical disciplines: on the one hand, architecture which makes explicit in the creative process the genesis of forms and constructive realities laden with artistic values; on the other, mathematics which, with precision and scientific method, measures space. Yet, they are expressions of human thought that find a reason for greater strength and growth in the continuous and mutual confrontation. If, on one side, the logic underlying the architecture gives it the rigor necessary to exorcise the arbitrariness of the formal choices, on the other, the use of precise compositional criteria for the conception of architectural spaces, even complex ones, shows how the rule frees the architect's imagination rather than forcing it [Botta 2003, p. 9].
The *Nexus Conferences*, organized since 1996 at two-yearly intervals and characterized by an international as well as interdisciplinary approach, have been focusing on the close link between architecture and mathematics–declined in various interpretations–for over twenty years.

The twelfth Conference was held this year in Pisa, from 11 to 14 June, hosted by the Department of Engineering of Energy, Systems, Territory and Construction (DESTeC) of the University of Pisa. For the occasion, a '*LOGO Design competition*' [1] was announced, with the aim of selecting an emblematic image of the event's themes (fig. 1). The organization of the conference is in particular by Marco Giorgio Bevilacqua, with the contribution of Stefania Landi, Lucia Giorgetti and Alessandro Ariel Terranova, as well as Kim Williams Books [2].
Moreover, for the first time, the event had the patronage of the *Unione Italiana per il Disegno* (UID) which, as the President Vito Cardone highlighted at the opening of the Conference, appreciated its strong international approach. In fact, taking up his words, the *Nexus Conferences* are the meetings with the highest level of internationalization, among the scientific ones attended by professors of the graphic representation area. For this reason, they are fully part of the cultural policies that the UID has pursued since its foundation.
Forty-three authors, selected on the basis of extended abstracts that were submitted to the evaluation of the Scientific Committee [3], presented their research, all in plenary session, during the first three days.

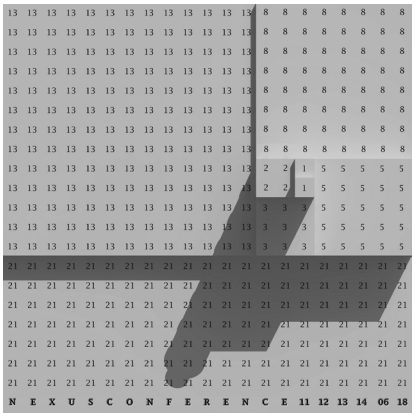

Fig. 1. The logo designed for the Nexus Conference 2018 by Ivan Mechkunov, winner of the 'LOGO Design competition'.

The conference opened with the introduction of Claudia Martini, Prorector for Research at National Level of the Pisa University, Umberto Desideri, Director of the DESTeC Department and Vito Cardone, President of the UID, as well as with the presentation of the event by Kim Williams; moderator was Marco Giorgio Bevilacqua, chair of the Conference together with Kim Williams.
The first day's working sessions, dedicated to *Perspective, Space, Dimension, Geometry*, included a first morning meeting

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entitled *Perspective and space*, coordinated by João Pedro Xavier (Portugal) and two afternoon sessions: *Space and Dimension*, coordinated by Sylvie Duvernoy (Italy)–who also was secretary of the Scientific Committee–and *Geometry*, coordinated by Mine Özkar (Turkey).
The presented interventions had as a common thread a reading of the architecture–or its elements–according to a rigorous theoretical-mathematical apparatus.
In many cases, the authors have investigated the relationships between perspective and architectural space, for example the paper presented by Agostino De Rosa and Alessio Bortot titled *Hunched Curves in the Vatican: the Vestibule Arch of the Pio Clementino Museum, between Stereotomy and Anamorphosis*.
In other cases, however, the illustrated papers have directly based on the treatises or have been addressed to architectural practices consolidated over the centuries. The common denominator for all interventions was the rigor of the graphic-geometric procedures at the base of the space's conformation or of the construction of the architectural images.
During the second day, four sessions were held, all on the theme of *Historical Analysis:* the first two, during the morning, coordinated by Roberta Spallone (Italy) and Kim Williams (Italy) respectively. The other two, in the afternoon, were coordinated by Anna Marotta (Italy) and Alessandra Capanna (Italy).
The day has therefore collected papers related to the analysis of historical architectures, which has been generally carried out through a mathematical-geometrical interpretation. The shown examples–referred in some cases to existing buildings in others to imaginary architectures–all highlight a careful research of the logic underlying the project.
The investigated spaces, as evident for example in the paper of Francesca Fatta and Domenico Mediati entitled *The Design of Roman Mosaics in North Africa and their Geometric References*, are described retracing the compositional idea. The aim is to identify their proportions, the not immediately perceptible geometries that define the volumes morphology. In this way, it's possible to understand their true significance, revealing the often hidden reasons of the magic that an architecture can express (fig. 2).
The third day [6], entitled *Contemporary Analysis, Structures, Techniques of Design, Algorithms, Rule-Based Design*, has instead marked the switch from history to modernity. The four planned working sessions have been addressed to different aspects of this broad theme.
During the morning two sessions took place, the first on *Contemporary Analysis*, coordinated by Maria Zack (USA), the second on *Structures and Techniques of Design*, coordinated by Marco G. Bevilacqua. The last two, during the afternoon, have both dealt with the theme of *Algorithm and Rule Based Design*, and have been coordinated by Cornelie Leopold (Germany) and Steve Wassell (USA), respectively.
The papers have sometimes focused on architectures designed by the most creative minds of today's architects and engineers; in other cases, although addressed to structures of the past, they have given new interpretations. The analysed architectures, in fact, have been described through the use of software and digital systems, today an integral part of the design and representation process. Thanks to these, an unprecedented decoding of the space investigated is possible, as illustrated by Manuel Alejandro Ródenas-López, Pedro García Martínez, Pedro Miguel Jiménez-Vicario, Adolfo Pérez Egea

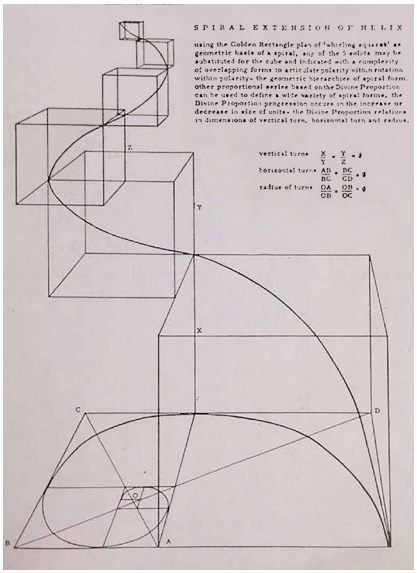

Fig. 2. Anne Griswold Tyng, 'Form finds Symmetry in Geometry', in Zodiac 19, 1969.

and Martino Peña Fernández-Serrano in the paper entitled *Parametric Design applied to Analysis and Optimization of Spatial Deployable Structures.*
The last day, organized in two consecutive sessions–the first co-ordinated by Michael Ostwald, the second by Kim Williams–was opened to the contributions of PhD students and PhDs who have achieved the PhD title in the 2016-2018 biennium in several schools from various countries of the world. Thirteen selected speakers illustrated, to a scientific community of international scope, the results of their research, all with a multidisciplinary approach and focused on issues related to the relationships between architecture and mathematics. It has been a day, therefore, particularly significant,

considering that, often, the research of young scholars remain at the edge of the scientific debate, deprived of an important moment of confrontation.
The Conference as a whole represented a precious opportunity for interaction between different knowledge and orientations of thought, laying the roots for a cultural exchange full of significant implications in the field of scientific research in general and, in particular, for the scientific-disciplinary field of Drawing.

In this regard it is important to highlight the significant participation in the Conference of professors and scholars of graphic representation, who contributed to the proposed research themes with about half of the one hundred and sixteen submitted papers.
This demonstrates the considerable interest that this interdisciplinary meeting has aroused within the area of Drawing, of which the UID is expression. Finally, it should be noted that the presented papers were further evaluated. Following the interventions held during the entire Conference, in fact, have been choosen the contributions considered by the Scientific Committee qualitatively more deserving, on the basis of the originality of the topics, the rigor of the used methodology and the clarity shown in the research proposal.
The selected authors are been invited to develop the extended abstract in in-depth articles to be published in an upcoming issue of the journal *Nexus Network Journal.*

Notes

[1] Fourteen competitors of different nationalities participated to the '*LOGO Design competition*'. The proposals received were evaluated by the Scientific Committee, which selected, as the winning logo, that of Ivan Mechkunov (Bulgaria).

[2] Kim Williams, which is in charge of the same publishing company that published the *Conference Book* [Williams, Bevilacqua 2018] for this meeting, is editor-in-chief along with Michael J. Ostwald of the *Nexus Network Journal*.

[3] Several was the fields of research in which it was possible to propose a contribution:
- *Design theory: mathematics as a design tool*;
- *Design analysis: mathematics used to analyse an existing monument or site*;
- *Geometry: Applications of geometry (descriptive, projective, fractal etc.) to architecture;*
- *Rule-based Design: Shape grammars; parame-tric design;*
- *Representation of architecture: perspective; modelling;*
- *Structures: architectural engineering application; statics related to form;*
- *Computer applications: morphogenesis, digital fabrication, virtual reality;*
- *Didactics: methods, approaches and projects in the classroom, at all levels of education.*

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Reference list

Botta, M. (2003). Presentazione. In N. Sala, G. Cappellato. *Viaggio matematico nell'arte* e *nell'architettura*, pp. 9, 10. Milano: Franco Angeli s.r.l.

William, K., Bevilacqua M.G. (eds). (2018). *Nexus. Architecture and Mathematics. Conference Book*. Torino: Kim William Books.

William, K., Ostwald, M.J., (eds). (2015). *Architecture and mathematics from antiquity to the future*, voll. 2. Birkhäuser: Springer.