“Science & Art”: a Portal to Divulgate Mathematics through Art

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Abstract: In the framework of a larger project aimed at the diffusion of “mathematical culture” (both for didactical, communicative and visualization purposes) through the use of “digital technologies” we shortly discuss the idea of a dedicated “portal of Mathematics and Art” that we have realized and we are currently implementing, by analyzing its scopes and its evolution through internationally based cultural projects.

Key words: Mathematics, Art, Digital Technologies, Web Portals

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0. Introduction

As is well known and as we have already stated in one of our recent papers on this subject [1] *“The task of Divulgating, Communicating and Visualizing the fundamental achievements of modern Science is by no means a simple one. Mathematics – the language for excellence of all forms of abstract human thought – does not escape from these difficulties. Even if Mathematics pervades, in a more or less recognizable way, most of the products of human experience […] still Mathematics is considered by the majority of mankind as a sort of <<Science for Initiates>>. A form of human thought that requires special abilities to be understood.”* Thanks to the new flexible tools provided by the Digital Era new didactical and communicating paths are fortunately spreading, with the explicit scope of introducing Mathematics to larger and larger portions of public, at various levels of knowledge and different ages, without renouncing to the essential rigor but relying on the many aesthetic and intuitive aspects that Mathematics share with most of the activities of the human mind.

1. Mathematics and Art in Interaction

Among them Art seems to be one of the most appealing disciplines, a field of human cultural activity in which Mathematics has been in the past and still is (sometimes explicitly and sometimes in an unconscious way) a major source of inspiration and at the same time an important tool for artists. Our research group is rather active in this direction and within it we have recently produced a number of papers to which we refer the reader for further information (see [2],[3] and ref.s quoted therein). Just to set an appropriate historical perspective, we should in fact recall that starting from Antiquity (when the structures of Euclidean space together with their symmetries become the standard paradigm for most of artistic expressions), passing through Renaissance (through the developments of theories able to treat points at infinity as ordinary ones and at the same time to “paint what the eyes see”,

wiz. Perspective and Projective Geometry), further sublimating into the revolutionary ideas of XIX Century (when the rigid paradigms of a flat Euclidean Space opened the minds to the triumph of curvature and higher dimensionality, both in "painting how the brain perceives" and in understanding a four-dimensional world in which Space and Time mingle into a single entity: Impressionism, Cubism, Futurism on one side, Einstein's Theory of Relativity, Fractals and Quantum Mechanics on the other) up to the new understandings of XX Century (from "metrical forms" to plastic and deformable "topological forms", with an insistent and renewed attention towards the evocative power of simple geometrical forms as central themes for "reducing reality to its fundamental constituents": we mean "Geometrical Abstractionism" as in Kandinskii and Mondriaan, but also "Mathematical Art" as in Max Bill, "Kinetic Art" as in Calder, "Optical Art" as in Vasarely and all new forms of Art that can be collectively called "Digital Art"). In its continuous struggle to represent and transcend reality in the most faithful way Art had in fact generated countless investigations about the best way to reproduce the "seen" (Perspective), about the ways to transfigure reality under the guidance of "impressions" and "deformations" (Impressionism), about the very nature of our vision of colors ("Pointillisme") and finally the understanding that our Universe is not "simple" but rather formed by simpler fragments from which "order emerges from chaos" ("Complexity"; [4]). With Cubism, as an example, paintings become "manifolds" able to embed a fourth spatial dimension into two-dimensional canvases and a similar revolution towards artistic multi-dimensionality was operated also in Architecture; and it should be of course mentioned the (not less relevant) fact that Photography first, Cinema later and eventually "Computer Art" have de-facto deprived of meaning all searches aimed at "reproducing reality" gradually substituting them with efforts aimed at "transfiguring reality"; also because of this Artists of the XX Century begun to use Geometry, and especially his "primordial forms", as genuine sources of inspiration to produce their artworks (see again [3]). In a sense, we see that Mathematics in particular and Science in general have become - at the turn of the Third Millennium - new bases for new forms of Art, in a "backward travel in time" towards a new aesthetics of "simple forms" (circles, straight lines, triangles, about which Galileo said in 1623 *"senza i quali mezi è impossibile a intenderne umanamente parola"*, i.e. *"means without which one cannot understand [the Universe]"* - [5]) and new ways of perceiving associated with the developments of Gestalt theory (see [6]).

2. Web Technologies and Digital Technologies for Mathematics and Art

Borrowing again from our previous paper [1] we can there fore notice that *"in order to obtain such a different and completely new perspective on Mathematics a clever use can and should be done of all the modern tools that new technologies provide us to represent, communicate and visualize Science: Digital Technologies, Digital Art, Computer Graphics, Computer Vision, Virtual and Augmented Reality, Multimedia and Web Technology"* (see also [7],[8]). Starting from the emotional and aesthetic side of our perceptions rather than from formalization and formulae it will be possible to better diffuse the understanding of Mathematics among non-specialists, to promote a broader attention of students to its beauty and even to help specialists to create new didactical pathways aimed at introducing deep mathematical concepts in more intuitive and more palatable way.

2.1 Artistic and Mathematical Scenarios: "Chronological" and "Diachronic" Views

Working in this direction we have first enucleated a number of possible "scenarios" in which one could sub-divide the long-lasting history of the interactions between Mathematics and Art, both in order to establish a firm temporal sequence of periods ("chronic" viewpoint) and to frame mental schemes for a coherent and homogeneous description of the topics ("diachronic" viewpoint). These do form a kind of a grid, in which vertical lines represent the flow in Time while the horizontal ones the flow of more or less homogenous knowledge. The historical perspective requires an understanding of the "diagonal" evolution, recognizing both the "permanence" of forms and ideas (that "transversally" pass and change from one scenario to another) as well as the drastic and abrupt appearance of new forms and ideas that correspond to radical revolutions in understanding, interpreting and visualizing "reality". Obviously the number of "temporal" sub-divisions depends on the taste and the necessity. Certainly one can think of a few "elementary" scenarios: 1) Prehistory; 2) Antiquity (Mesopotamian, Indian, Mediterranean Cultures up to Middle Age); 3) Renaissance (including Islamic Art); 4) Illuminism, Positivism and XIX Century; 5) XX Century and beyond. In a sense these correspond to: 1) implicit and emotional understanding of Science and recognition of forms and shapes at a primordial level; 2) development of Mathematics as a codified theory (Euclidean Geometry and Pythagorean Arithmetic, and its explicit use in Art and Architecture; 3) algebraic understanding of symmetries and projective extensions of the Space to codify and frame the canons of beauty and harmony; 4) the birth of so-called "scientific method" and the gradual freedom from the rigid schemes of Euclidean Geometry towards the new perspectives opened by Infinitesimal Calculus and new Physics: including Baroque and Impressionism up to the definitive triumph of curvature against linearity; 5) new Physics and new Mathematics dictated by Relativity, Quantum Theory and Complexity. These could of course be grouped or further subdivided according to specific needs and attitudes.

For the sake of simplification we have first chosen a "merged subdivision" into three main (somehow artificial) scenarios: a) ***"Geometry"***, i.e. classical Art and classical Mathematics (from Prehistory to Middle Age included) for the paradigm of "Euclidean Geometry": the reduction of reality to flat and static symmetry; b) ***"Symmetry"***, i.e. Renaissance and later developments up to XVIII Century included: symmetry as a canon for beauty and extensions from Euclidean Space to Projective Space; c) ***"Relativity"***, i.e. all new paradigms of XIX and XX Century: from linearity to curvature, from metricity to plasticity, from locality to globality, from static to dynamical symmetry, from 2 and 3 dimensions to higher dimensionality, from Space and Time to SpaceTime.

2.2 The Mathematical Scenarios of "Geometry", "Symmetry" and "Relativity"

In the framework of these three "scientific and artistic scenarios" we have envisaged a project aimed at a two-folded purpose: on one side to encompass mathematical and artistic knowledge into this scheme, with the purpose of introducing the beauty of Mathematics

through its role and its development in connections with Art in the most variegated forms; on the other to stimulate its understanding from an aesthetic rather than strictly formal side, in order to provide a forum where the interconnections between Art and Mathematics can be cultivated in a synergic way by a large community including Scientists, Artists, Science Communicators and Public in a broader sense. For obvious reasons we have since the beginning envisaged a communicative path founded on the use of "new digital technologies", both in their aspect of "Digital Art" (seen also as a way to traduce in "emotional" images the "cold" notions of Science) as well as in their aspect of "web-based technologies" for an immediate and shared "dynamical" knowledge. Because of this we have foretold that the best instrument to both achieve the aforementioned goals and to meet the needs of our "Society of Motion, Light, Dynamism, Perception and Visualization" (whereby Art faces also the need to put its aims in relation with the way in which brain reacts to external stimuli; see [3]) is a clever use of an explicitly dedicated "portal of Art & Mathematics". As it was also recently remarked in [9] (pp. 322-323), in fact, *"Thanks to Informatics innovations we are rapidly approaching an <<always on>> society […] the <<global village>> theorized by Marshall McLuhan […] In the meantime visualization has assumed an increasingly important role: the language of images has become the true international jargon […] Photography, Cinema, digital and computer-aided reproductions [...] Television and Internet, have invaded scientific research and our daily life, drastically changing our ways of perceiving. […] Frontline artists have begun to use mainly and at the same time several techniques, neither one representing the only way of expression"*. This opinion is further enhanced by the words of Marvin Minsky, who has pointed out that "*the most powerful methods of human thought are those that help us find new kinds of representations"*, in full tuning with Stephen Wilson who in [10] claimed that *"the role of the artist is not only to interpret and spread scientific knowledge, but to be an active partner in determining the direction of research"*. In spite of reductive opinions that pretend an artificial separation of Art and Science as independent domains of Culture, their mutual and profound relation is instead due to the fact that Art and Science had always gained reciprocal impetus since the Antiquity, so that in the age of "New Science" a separation of Art from the impressive development of scientific knowledge is in fact impossible and sterile. Not casually the scientist that rightly occupies a pre-eminent position in "collective imagination", wiz. Albert Einstein, once said that *"The artist and the scientist each substitute a self-created world for the experiential one, with the goal of transcendence"*.

3. Web-Portals for Enhancing Mathematics through Art

In this Section we shall shortly discuss the idea, the development and the future perspectives of our project, as they resulted in the construction and development of increasingly efficient prototypes of web-Portals dedicated to diffuse mathematical knowledge through Art as well as providing mathematical tools at the direct disposal of artists.

3.1 The Project and Web-Portal "MArs"

The first preliminary structure was conceived in a prototype dedicated web-Portal on "Art & Mathematics" that took the emblematic name "MArs" (see [11],[12]). The portal was ideated

as a working tool to create a still "static" Internet ambient aimed at allowing the progressive understanding of Mathematics, at progressive levels of reasoning and abstraction, in which Art comes first *"touching the emotions"* so to stimulate the need and the desire to penetrate more intimately into the mathematical structures which are underlying our perceptions of "reality". Such a portal is intended therefore to present Art as a possible alternative way to approach Mathematics, to enjoy the beauty of the structures existing in our vision of the external World and eventually to reconstruct them. In this sense a "static" portal was also meant to include and exhibit a collection of specific texts and multimedia explicitly produced for the visualization of Mathematics, as well as a collection of writings on the interactions between Art & Mathematics and a collection of artworks that belong to these mainstreams.

3.2 The European Project "SCIENAR"

Out of the preliminary experience of "MArs" a European Project was thence established, in which the three aforementioned "scenarios" were given the status of leading themes and developed in view of further goals. This project was given the name *"SCIENAR"* with the acronym explicitly indicating the idea of "*SCIEN*tific *SCIEN*arios for *AR*t" (see [13]). The project has been funded by the European Commission in the two years 2009 and 2010, under the "Culture Agreement" 2008 - 2254 / 001 - 001 CTU MECOAN, and it was coordinated by the University of Calabria in Italy (ESG group). Besides the ESG of the University of Calabria the partnership included: I) the Virtual Image Co., based in Cambridge (UK) and directed by Nick Mee; II) the ITC (Institutul pentru Tehnică de Calcul) of Bucureşti, with a Unit coordinated by Gheorghe Samoila and a silent partnership in the UNARTE (Universitatea Nationala de Arte) of Bucureşti, with a sub-unit coordinated by Dragos Gheorghiu; III) the EMR (Electronic Media Reporting, based in Almere, Netherlands), directed by Jak Boumans; IV) the Faculty of Mechanical Engineering of the Slovak University of Technology in Bratislava, with a Unit coordinated by Monika Kovácová. The Project – born out of our preliminary work - was accompanied by the establishment of an authoritative "artistic and scientific board" including scientists, artists and other cultural operators from all over the World, chaired by the two of us: more specifically, MF was the Scientific Chairman of the Board, while MGL was its Artistic Chairman, although responsibilities were in fact shared on an equal and interactive footing. As early as February 2009 the Rumanian Unit posted an announcement on the Project together with its first scientific activities (that were also reported at the APLIMAT2009 Conference (see later) in the independent web site CULTINFORM (see [14]) dedicated to spreading of the Informatics culture. As we announced in May 2009 at the Conference FIM 17 devoted to "Interdisciplinary Mathematical and Statistical Techniques" (Seventeenth International Conference of the Forum for Interdisciplinary Mathematics, held in Pilsen, Czech Republic) [15] the Project SCIENAR aimed to *"creating three scientific scenarios concerning the theory of Relativity, the notion of Symmetries and the foundations of Geometry; starting from these a collaborative work between researchers, scientists and artists will allow the production of artistic objects; "SCIENAR" will also generate a fully innovative portal, whereby artists will find ready-to-use mathematical forms for their artworks and mathematicians will find inspiration for a better approach to mathematical teaching through emotional and aesthetic sides of our*

Culture. *Next steps will be aimed at fostering, stimulating and supporting the physical and the virtual mobility of artists and cultural players interested to use mathematical models for the production of artistic objects, improving links among single artists, cultural operators, scientists and experts in digital technologies."* In these two years the project has been able to stimulate an interactive collectivity working at the crossroad of Mathematics and Art and has produced a number of multimedia and events, among which we mention the following:

1) A DVD containing several multimedia, images, text and presentations on the topics of the Project, collected by Nick Mee (see [16]);
2) The public event "Conversations Across Art and Science" hosted by the University of Cambridge within the program of the "Cambridge Science Festival" 2010. This event was held on March 19, 2010, and included among other short presentations three lectures for large public: a lecture by the two of us on "Art & Mathematics", a lecture on "Every Image tells a Story" by John Barrow and a lecture on "Art and Astronomy" by Gary Gillmore. These three lectures were videoed and included in the aforementioned DVD [17].
3) The exhibition "Interferences" organized in Romania by ITC in cooperation with UNARTE. The event took place from May 31 to June 6, 2010. Announcements were posted on "YouTube", a report was broadcasted by Rumanian Television TVR1 and an interview was also given to Radio Romania International. Reports remain in Cultinform (see [18]) and an exhibition catalog was published [19].
4) The final event held in Amsterdam, at the KNAW (Koninklijke Nederlandse Akademie van Wetenschappen), on 14 and 15 October 2010. Reports of it appear in the new site "Science and Art" mentioned herewith later ([20]; see also [21]).

3.3 The Sessions on "Mathematics and Art" at the International Conferences "APLIMAT"

It should also be mentioned that the Project "SCIENAR" has gained impetus also from the strict and fruitful collaboration with the activities of the periodical series of Conferences "APLIMAT", that do form in fact a separate and long-lasting tradition of the Polytechnic University of Bratislava (Slovak Republic). These Conferences have reached in 2011 their 10^{th} edition. Since 2008 they include a Special Session on "Mathematics & Art" directly chaired by the two of us. These Sessions are aimed at presenting new trends in the domain of intersection of Mathematics and Art, with a preferential view on web-based and digital technologies. One can find more info at the APLIMAT website [22] as well as in the proceedings that since 2008 are regularly published in the APLIMAT Journal of Applied Mathematics (see [22] and [23]).

3.4 The International Web-Portal "Science and Art"

The Project "SCIENAR" has been officially terminated in November 2010. The web-based International Web Magazine "Digilarti" has dedicated to it a short resumptive description [24] written by Veronique Godè, based explicitly on the outcome of the final event held in Amsterdam (see above). However, according to its goals, the outcomes of the Project will live longer. One of its main tasks was in fact "to promote the establishment" of an innovative

website dedicated to Mathematics and Art, explicitly turned towards the diffusion of the results in this area obtained both in the Project and much beyond its scopes and limits. A new portal in which interactivity is much stronger, based on the most sophisticated techniques of the web; not only containing a repository of ideas, images, writings, multimedia and digital artworks, but also allowing an hands-on activity by its visitors, that can participate in enhancing its contents and creating their own work. This "diffusion portal" has been given the name "Science and Art" (see [20]); it has been registered and inaugurated at the beginning of 2011. It is hosted by the Polytechnic University of Bratislava (Faculty of Mechanical Sciences) and directed by a number of researchers that include the two of us, together with Monika Kovácová (Bratislava) and Gheorghe Samoila (Bucureşti). It is still under completion and its full efficiency will be reached by the summer of this year 2011. It contains, in particular, several innovative sections in which shapes and other forms of artistic value can be directly constructed with the aid of sophisticated mathematical software belonging to webMathematica © (for reviews see the papers [25] and ref.s quoted therein).

All these activities tend, eventually, to help re-creating that fruitful *"constructive and internal interaction"* that existed between Mathematics and Art in several occasions of the past (as, for example, in Renaissance or during the season of Dutch Painting in XVII Century). Although Art and Mathematics had in fact maintained a dialogue that extended up to recent times (as we discussed in our paper [4]) such a fruitful liaison has been replaced by "external" interactions, at a marginal, secondary and less promising level of efficiency.

References:

[1] **M. Francaviglia, M.G. Lorenzi, P. Pantano**, *Art & Mathematics – A New Pathway,* in: Proceedings of the Conference "Communicating Mathematics in the Digital Era, Aveiro 15-18 September 2006" (CMDE2006); Chapter 21; J.M. Borwein, E.A.M. Rocha & J.F. Rodrigues Eds.; A.K. Peters Ltd. (Wellsley, Mass., 2008), pp. 265-278

[2] **M.G. Lorenzi, M. Francaviglia**, *Arte per una Matematica Divertente* in: Conferenze e Seminari dell'Associazione Subalpina Mathesis 2007-2008, Seminario di Storia della Matematiche "Tullio Viola"; F. Ferrara, L. Giacardi & M. Mosca ed.s (Kim Williams Books, Torino, 2008), pp. 53-82

[3] **M.G. Lorenzi, M. Francaviglia**, *The Role of Mathematics in Contemporary Art at the Turn of the Millennium,* APLIMAT - Journal of Applied Mathematics, **4** (2011) – ISSN 1337-6365; in: "Proceedings 10th International Conference APLIMAT 2011" (Bratislava, February 1-4, 2011); M. Kovácová Ed.; Slovak University of Technology (Bratislava, 2011), pp. 997-1018 - ISBN ISBN 978-80-89313-51-8 (book and CD-Rom)

[4] **P. Érdy**, *Complexity Explained (Springer Complexity),* Springer Verlag (Heidelberg, Germany, 2007) – ISBN-13: 978-3540357773

[5] **Galileo Galilei***, Opere di Galileo Galilei*, edited by Francesco Brunetti, UTET (Torino, Italy, 1964) – in Italian

[6] **R. Arnheim**, *Art and Visual Perception*, University of California Press (Berkley, California, USA, 1974; 2nd edition) – ISBN 978-0520026131

[7] **M. Francaviglia, M.G. Lorenzi, C. Senatore, A. Talarico**, *Agents and Multimedia Technologies for an Innovative Didactics of Mathematics and Physics*; in: Atti del Convegno "Didamatica 2007" (Cesena, 10-12 maggio 2007); A. Andronico e G. Casadei

Eds; parte I, Soc. Ed. Asterisco (Bologna), pp. 302-311.

[8] **M.G. Lorenzi, M. Francaviglia**, *Art, Mathematics & Cultural Industry: new Trends in the Digital Era*in: "Proceedings of the ICIAM Minisymposium C/MP/171/H/208 on e-Learning and Applied Mathematics – ICIAM 2007 (Zürich, 2009)" – PAMM, Proceedings in Applied Mathematics and Mechanics, Volume **7**, Issue 1, Pages 412009 - 20700004 (December 2007) - published online: Dec 12 2008 7:37AM http://www3.interscience.wiley.com/journal/117925717/issue

[9] **A. Vettese**, *Capire l'Arte Contemporanea dal 1945 a Oggi*, Umberto Allemandi & C. (Torino, Italy, 2006; X reprint, 2010), 398 pp. – ISBN 978-88-422-0849-5

[10] S. Wilson, *Art + Science Now,* Thames & Hudson (London, UK, 2010) – ISBN 978-0500238684

[11] **L. Fatibene, M. Francaviglia, M.G. Lorenzi, S. Mercadante, P. Pantano**,*"MArs", a Web Portal on "Mathematics & Art" – a New Approach to Introduce Mathematics through Art*, in: Atti del Convegno "Didamatica 2007" (Cesena, 10-12 maggio 2007); A. Andronico e G. Casadei Eds; parte I, Soc. Ed. Asterisco (Bologna), pp. 1-10.

[12] **L. Fatibene, M. Francaviglia, M.G. Lorenzi, S. Mercadante, P. Pantano***, Art & Mathematics – Educational Multimedia and Web Technologies: the Projects "MArs", "SCIENAR" and "ARTEMA"*, in: Proceedings of the Conference ED-MEDIA2007, World Conference on Educational Multimedia, Hypermedia and Telecommunications; C. Montgomerie and J. Seale Eds.; (AACE, Vancouver, 2007), abstracts book and CD-Rom, pp. 4280-4285

[13] M. Francaviglia, M.G. Lorenzi, P. Pantano, *Art & Mathematics – The web-Based Project "SCIENAR",* APLIMAT - Journal of Applied Mathematics, 2 (1), 187-202 (2009) – ISSN 1337-6365; in: "Proceedings 8th International Conference APLIMAT 2009" (Bratislava, February 3-6, 2009); M. Kovácová Ed.; Slovak University of Technology (Bratislava, 2009), pp. 489-504 - ISBN 978-80-89313-31-0 (book and CD-Rom)

[14] http://www.cultinform.ro (*"an independent web site dedicated to spreading the Information culture")*

[15] **M.G. Lorenzi, M. Francaviglia**, *Art & Mathematics at the Crossroad: Scientific Scenarios and Art in the European Project "SCIENAR"*; in: IMST 2009 – FIM 17, Seventeenth International Conference of Forum for Interdisciplinary Mathematics on Interdisciplinary Mathematical and Statistical Techniques, Pilsen, Czech Republic, May 23-26, 2009; Book of Abstracts; J. Benedikt et al. Eds.; Vydavatelsky Servis (Pilsen, 2009), p. 93 – ISBN 978-80-86843-26-1

[16] **N. Mee** Editor, *SCIENAR DVD*, produced and distributed by Virtual Image Co. (Cambridge, 2010) -
online version at http://www.virtualimage.co.uk/SCIENAR/index.html

[17] http://www.virtualimage.co.uk/html/scienar.html - web page advertising the event in Cambridge (accompanied by a printed leaflet)

[18] http://www.cultinform.ro/istoria39.htm

[19] **G.S. Samoila** (Ed.), *SCIENAR – INTERFERENTE, Catalog*, Institutul pentru Tehnică de Calcul – ITC (Bucureşti, 2010), 48 pp.

[20] http://www.scienceandart.info

[21] **J. Boumans** (Ed.), two DVD's *"SCIENAR – Seminar Amsterdam – 15 October 2010"* and *"Presentation Files – 15 October 2010"*, produced by Electronic Media Reporting (Almere, 2010)

[22] http://www.aplimat.com

[23] M. Kovácová (Ed. in chief), APLIMAT - Journal of Applied Mathematics, **1** (2008), **2** (2009), **3** (2010), **4** (2011) – ISSN 1337-6365

[24] **V. Godè**, *Art & Science: an Interrelationship*, Digilarti (The International Digital Art Magazine) n.o **5**, pages 12-13 (2011)
http://www.digitalarti.com/files/Digitalarti-5_UK-site-internet-MD.pdf

[25] **M. Kovácová**, *Random Walking on Scienar webMathematica Pages*, APLIMAT - Journal of Applied Mathematics, **4** (2011) – ISSN 1337-6365; in: "Proceedings 10th International Conference APLIMAT 2011" (Bratislava, February 1-4, 2011); M. Kovácová Ed.; Slovak University of Technology (Bratislava, 2011), 953

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