Proceedings e report

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Electronic Imaging & the Visual Arts

EVA 2017 Florence

10-11 May 2017

edited by
Vito Cappellini

Firenze University Press
2017

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PROGRAM

Electronic Imaging & the Visual Arts

'The Foremost European Electronic Imaging Events in the Visual Arts'

Forum for Users, Suppliers & Researchers

The key aim of this Event is to provide a forum for the user, supplier and scientific research communities to meet and exchange experiences, ideas and plans in the wide area of Culture & Technology. Participants receive up to date news on new EC and international arts computing & telecommunications initiatives as well as on Projects in the visual arts field, in archaeology and history. Working Groups and new Projects are promoted. Scientific and technical demonstrations are presented.

Main Topics

- ❖ 2D – 3D Digital Image Acquisition
- ❖ Leading Edge Applications: Galleries, Libraries, Archaeological Sites, Museums & Historical Tours
- ❖ Mediterranean Initiatives in Technology for Cultural Heritage:
  Synergy with European & International Programmes
- ❖ Integrated Digital Archives for Cultural Heritage and Contemporary Art
- ❖ Management of Museums by using ICT Technology: Documentation, Access, Guides & Other Services
- ❖ The Impact of New Mobile Communications on Cultural Heritage and Modern Arts Area
- ❖ Cloud Networks
- ❖ Semantic Webs
- ❖ Ontology Systems
- ❖ Human - Computer Interaction for Cultural Heritage Applications
- ❖ Copyright Protection (Watermarking & Electronic Commerce)
- ❖ Culture and *e-government*
- ❖ Activities and Programmes for *e-learning*
- ❖ Digital TV and films
- ❖ 3D Developments and Applications in the Cultural Heritage Area
- ❖ Virtual Galleries and Exhibitions
- ❖ Digital Music
- ❖ Digital Theater
- ❖ Cultural Tourism & Travel Applications
- ❖ Impact of Culture in the Smart City
- ❖ Art and Medicine

WHO SHOULD ATTEND

THE CULTURAL SECTOR: The Visual Arts Community including Museums, Libraries, Archaeological Sites, Educational Institutions, Commercial Galleries and Dealers, Auction Houses, Artists & Collectors

THE HI-TECH INDUSTRY SECTOR: Multimedia Systems, Image Acquisition & Analysis, Data-bases, Display & Printing, ICT Industry, Telematics & Systems Manufacturing, On-line Information Services

MEDIA & RELATED SECTORS: Publishing, Press, Film, Television, Photography, Printing, Advertising, Graphics Design, Consumer Media

IMAGING SYSTEMS RESEARCHERS: Imaging Systems, 3-D Acquisition, Reconstruction & Representation Systems, Information Sciences

TOURISM & TRAVEL SECTOR: Tourism Agencies & Operators, Travel Agencies

THE GOVERNMENT SECTOR: Ministries of Culture and other Institutions involved in Cultural Heritage, Ministries of Industry, Education, Research and Science, Regional Governments

Co-Chairmen: Vito Cappellini, Enrico del Re – Florence University
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PROGRAM - PLANNING

Wednesday, 10 May

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Thursday, 11 May

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Venue: **Hotel Pierre**
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E-mail: pierre@remarhotel.com
www.remarhotels .com

WORKSHOP 1

WORKSHOP 1   INNOVATION AND ENTERPRISE – INNOVAZIONE E IMPRESA

(Italian Language)
9,00 – 13,00

Chairman: *Enrico Bocci, Vice-Presidente Confindustria Firenze, Firenze*

Technological requirements in the Cultural Heritage field are outlined and opportunities for Italian Enterprises and SME's working in the field, using new technologies, are presented.

Regional and national applied research Programs in Italy are described.

Activities by National Organizations and Firms working in the area of Telecommunications, Informatics, Environment and Infomobility are presented.

Funding by European Commission is considered, with particular reference to multimedia and telematics for Cultural Heritage. Special consideration is given to the new EC Plan HORIZON 2020.

Initiatives regarding the "know-how" transfer from Research Organizations to the Industrial Sector are described, in particular to create Start-Ups and new Enterprises.

Organizations and Companies present their activities and experiences.

Invited Speakers: *- Andrea Arnone, Pro-Rettore al Trasferimento Tecnologico e*
Presidente di CsaVRI, Università degli Studi di Firenze
- Laura Castellani, Responsabile del Settore Infrastrutture e
Tecnologie per lo Sviluppo della Società dell'Informazione,
Regione Toscana
- Paola Castellacci, VAR GROUP

Speakers include: *- Stefano Bartoloni, TELECOM ITALIA*
- Renzo Zampini, INFOCAMERE
- Riccardo Bruschi and Luca Bencini, T.T. TECNOSISTEMI, Prato
- Gianluca Vannuccini, Servizio Sviluppo Infrastrutture Tecnologiche,
Comune di Firenze, Firenze
- Claudio Tasselli, Qu.In. Srl, Calenzano, Firenze
- Claudia Del Re, Studio Legale Del Re - Sandrucci, Firenze
- Franco Guidi, NEUMUS, Firenze
- Massimo Canalicchio, Mentor Incubatore di Firenze, Firenze
- Massimo Galluzzi, Fata Logistic Systems Spa, Torino
- Carlo Quinterio Brentano, Philip Mazzei Association, Firenze

WORKSHOP 2

ROOM B

WORKSHOP 2   **eCULTURE CLOUD IN THE SMART CITIES CONTEXT**

9,00 – 13,00

Chairman: *Dirk Petrat, Director General for Central Services, Ministry of Culture, Hamburg, Germany*

Speakers include:
- *Cecilia Del Re, Assessore Sviluppo Economico, Comune di Firenze, Firenze, Italy*
- *Dirk Börnsen, Head of Department for Legal Affairs, Human Resources and IT, Ministry of Culture, Hamburg, Germany*
- *Peter Deussen, Fraunhofer FOKUS – Berlin, Germany*
- *Johann Bizer (CEO), Dataport, Hamburg, Germany*
- *Gianluca Vannuccini, Comune di Firenze, Firenze, Italy*
- *Carlo Francini, Comune di Firenze and UNESCO ITALY, Firenze, Italy*
- *Veronica Elena Bocci, Coordinator DITECFER, Tuscany, Italy*
- *Stefano Cinquini, TELECOM ITALIA, Italy*
- *Maurizio Del Buffa, VAR GROUP - SESA, Empoli (FI), Italy*
- *Marco Cappellini, Centrica Srl and VirtuItaly Srl, Firenze, Italy*

The Workshop will consider the architecture and the use of Cloud Systems to collect and distribute Cultural Data of all kind of cultural institutions. In particular the Project will examine the characteristics of a federated Cloud System for Culture on cities level and the creation of a joint database for collaboration. Special consideration is reserved to a Project of "eCulture Cloud", regarding "UNESCO WORLD HERITAGE SITES".

CONFERENCE

Wednesday, 10 May

Chairmen: *Vito Cappellini, University of Florence*
                     Enrico Del Re, University of Florence

14,15 *Opening:*   *Luigi Dei,*
                           Rector of University of Florence
                         Enrico Vicario,
                           Director of Department of Information Engineering –
                           University of Florence
                         James Hemsley,
                           EVA Conferences International
                         Gabriele Gori,
                           Direttore Generale Fondazione Cassa di Risparmio di Firenze
                         Paolo Castellacci,
                           President GRUPPO SESA

15,30   Coffee Break

ROOM A

15,45   **SESSION 1 – STRATEGIC ISSUES**
Chairman: *Paolo Blasi, University of Florence, Florence, Italy*

"GLAMs going digital: strategies, activities, and the support by Michael Culture Association"	Rossella Caffo President of the Michael Culture Association
"SmartCities4Culture The eCulture Cloud approach"	Dirk Petrat[1], Dirk Börnsen[2] [1]Central Services, Ministry of Culture [2]Head of Department for legal affairs, human resources and IT, Ministry of Culture, Hamburg, Germany
"Symbol Extraction and Restoration in Ancient Egyptian Papyri"	A. G. Constantinides, Cedric Ehrhart Imperial College London, London, U.K.
"Technologies Solution for Accessability to Cultural Heritage"	Francesca Velani Promo PA Fondazione, Lucca, Italy
"Visual silence: art and show business on the "Silk Road""	Jean Paul Carradori, Qing Li Shanghai International Interior Design Festival Europe area Direction

| "A Gesture Driven Application about Protestant Reformation in Torgau on a Large Touch-Display" | G. Görlitz, K. Konkol B.Sc., A. Vollmar M.Sc.
Beuth University of Applied Sciences,
Berlin, Germany |

ROOM A

17,45   **SESSION 2 – NEW SCIENCE AND CULTURE DEVELOPMENTS & APPLICATIONS**
Chairman: *Edoardo Calia, Istituto Superiore Mario Boella (ISMB), Torino, Italy*

"The Virtual Reality Technologies for Culture and Arts"	Nikolay Borisov[1,2], Artem Smolin[2,1], Denis Stolyarov[2] [1]St. Petersburg State University, [2]ITMO University Saint Petersburg, Russia
"Creativity in Art and in Problem Solving Tasks: a Comparative Analysis"	Raffaella Folgieri[1], Ludovico Dei Cas[2], Claudio Lucchiari[1] [1]Dipartimento di Filosofia, Università degli Studi di Milano, Milan, Italy [2] CdL Management Pubblico, Università degli Studi di Milano Milan, Italy
"The use of an electromagnetic real-time navigation system for distal locking of the intramedullary humeral nail"	Lawrence Camarda, Antonio D'Arienzo, Salvatore Morello, Michele D'Arienzo, Orthopaedic and Traumatology Department, University of Palermo, Palermo, Italy
"Re-Converging Scientific, Cultural and Art Practices at Art & Science Institute of ITMO University"	Konstantine Karczmarski Department of innovations, ITMO University, Saint Petersburg, Russia

Thursday, 11 May

ROOM A

9,00 **INTERNATIONAL FORUM ON "CULTURE & TECHNOLOGY**
Chairman: Vito Cappellini, University of Florence, Florence, Italy

The structure of the FORUM is presented.
Actual developments and perspectives are outlined, regarding *Culture* and *Technology.*

- Cooperation Groups
- Proposed Projects
- Funding Opportunities
- European Commission Plans
  (HORIZON 2020)

Speakers Include:

- Cristina Acidini, President Accademia delle Arti del Disegno, Florence, Italy
- Gaetano Scognamiglio, President PROMO P.A. FONDAZIONE, Lucca, Italy
- Franco Moretti, General Manager FONDAZIONE FESTIVAL PUCCINIANO, Torre del Lago Puccini, Viareggio (LU), Italy
- Edoardo Calia, Research Director, Istituto Superiore Mario Boella, Torino, Italy
- Alberto Del Bimbo, Director Centro per la Comunicazione e l'Integrazione dei Media, University of Florence, Florence, Italy
- Monica Carfagni, Full Professor of Industrial Engineering, University of Florence, Florence, Italy
- Umberto Donati, Director FONDAZIONE ITALIA GIAPPONE, Rome, Italy
- Carlo Francini, Florence Municipality, Florence, Italy
- Paolo Zampini, Director of Conservatorio di Musica Luigi Cherubini, Florence, Italy
- Francesca Gemma, Aracne editrice int.le, Rome, Italy
- Giovanni Gasbarrone, CIU Confederazione Unione delle Professioni Intellettuali, Responsabile Lazio, Italy

11,30 Coffee Break

11.45   **SESSION 3 – NEW TECHNICAL DEVELOPMENTS & APPLICATIONS**
Chairman: *Dirk Rieke-Zapp, AICON 3D Systems GmbH, Meersburg, Germany*

"Open Fiber: The Italian Strategy for   Franco Guidi, Roberto Piermarini
Broadband and Ultra Broadband"   Neumus SrL, Florence, Italy

"Framework of 360-Degree 3D Video"   Masayuki Tanimoto[1], Hirokuni Kurokawa[2]
     [1]Nagoya Industrial Science Research Institute,
     Nagoya, Japan
     [2]University of Aizu
     Aizu Wakamatsu, Japan

"Face to Face with Head Vases"   Dirk Rieke-Zapp[1], Elisabeth Trinkl[2]
     [1]AICON 3D Systems GmbH
     Meersburg, Germany
     [2]Institute of Archaeology
     University of Graz, Graz, Austria

"3D printing and copyright protection"   Vito Cappellini[1],
     Francesca Uccheddu[2]
     [1]University of Florence, INN-3D, Florence, Italy
     [2] INN-3D, Department of Industrial Engineering,
     University of Florence, Florence, Italy

"Generative Generation Design"   Gianpiero Alfarano
     Laboratory Design Model, DESIGN CAMPUS,
     University of Florence,
     Florence, Italy

13,25   Lunch Break

ROOM A

14,50   **SESSION 4 – MUSEUMS – VIRTUAL GALLERIES
              AND RELATED INITIATIVES**
Chairman: *Andreas Bienert, Staatliche Museen zu Berlin, Gemany*

"Portable computer vision for new   Alberto del Bimbo, Marco Bertini,
"intelligent" audio guides"   Lorenzo Seidenari, Tiberio Uricchio,
     Claudio Baecchi, Andrea Ferracani
     MICC-Media Integration and Communication
     Center, University of Florence,
     Florence, Italy

"Uffizi Touch® for Apple TV"

Marco Cappellini, Paolo De Rocco,
Paolo Romoli
Centrica Srl, VirtuItaly Srl,
Florence, Italy

"Interactive Digital Museum by Using Scientific
Analytical Data of Painting"

Kaori FUKUNAGA
Electromagnetic applications Laboratory,
National Institute of Information and
Communications Technology,
Japan

"Knowledge Promotion, Divulgation:
Experiments on the Virtual Reconstructions
of the Genoese Atheneum's Palaces"

Valentina Fiore, Lauro Magnani,
Gioia Quicquaro, Sara Rulli
D.I.R.A.A.S. Dept, University of Genoa
Genoa, Italy

"Truth and Method: the Art of Knowing how to
Comprehend and Management of Complexity"

Sara Penco
SMARTICON Project,
Rome, Italy

16,30   Coffee Break

16.45

"The Lumen Prize at EVA Florence 2017"

Charlotte Lee
The Lumen Prize
London, U.K.

"The Codex Dietrichstein – An Example of an
Illuminated Manuscript made in the Twenthy –
First Century, mix of Art, History, Adventure
and Encryption with the Support of New
Technologies"

Bruno Cerboni
Digital Visual Arts Lab
Sacrofano (RM), Italy

"From 2D to video: The new Alinari
Multimedia Museum in Trieste"

Andrea de Polo Saibanti
Fratelli Alinari IDEA SpA,
Florence, Italy

"On-Line Interactive Virtual Environment in
Blend4web. The Integration of Pre-Existing 3D
Models in Muvi-Virtual Museum of Daily Life
Project"

Beatrice Chiavarini, Maria Chiara Liguori,
Luigi Verri, Silvano Imboden,
Daniele De Luca, Antonella Guidazzoli
VisitLab Cineca,
Italy

"A Cultural Tradition in Italian Towns: The Banners for Yearly Historical Reenactments"

Paola Imposimato
Studio Creazioni di Design e Arti Grafiche e Pittoriche, Florence, Italy

"Copying as an Integral Part of Fine Arts and Architecture Education"

Tatiana Laska, Sergei Golubkov
Saint-Petersburg State University
Saint-Petersburg, Russia

ROOM C

14,50   **SESSION 5 – ART AND HUMANITIES ECOSYSTEM & APPLICATIONS**
Chairman: *Emiliano Degl'Innocenti, Consiglio Nazionale delle Ricerche, Italy*

"E-RIHS "European Infrastructure of Heritage Science: a new opportunity
for research and innovation in the field of cultural heritage""

Salvatore Siano, Luca Pezzati
Consiglio Nazionale delle Ricerche,
Italy

"Fostering sustainability and re-use in the Digital Research Ecosystem of Humanities Research"

Elisa Brunoni[1], Emiliano Degl'Innocenti[2]
[1]DARIAH-IT Funding Opportunities Hub,
Consiglio Nazionale delle Ricerche
[2]DARIAH-IT National Coordinator,
Consiglio Nazionale delle Ricerche
Italy

"Digital Research Infrastructures for the Arts and Humanities: DARIAH-IT"

Emiliano Degl'Innocenti[1], Elisa Brunoni[2],
Maurizio Sanesi[3]
[1]DARIAH-IT National Coordinator,
Consiglio Nazionale delle Ricerche
[2]DARIAH-IT Funding Opportunities Hub,
Consiglio Nazionale delle Ricerche
[3]Società Internazionale per lo Studio del Medioevo Latino (SISMEL),
Italy

"Comparison Between Virtual Reality Implementations for Cultural Heritage"

Riccardo Toppan, Mario Chiesa, Alberto Buzio
Istituto Superiore Mario Boella,
Turin, Italy

"Experimental Hypothesis for Art Teaching with ICT: some Developments for e-Learning"

Alessandra Scappini
SINCRESIS Cultural Association,
Empoli (Florence), Italy

16,30   Coffee Break

ROOM C

16,45   **SESSION 6 – ACCESS TO THE CULTURE INFORMATION**
Chairman: James Hemsley, EVA Conferences International, U.K .

"EU Data Protection Reform n. 679/2016 and Big Data: new rules?"	Claudia Del Re Ph.D. Intellectual Property Law Privacy Officer according to the ISO/IEC 17024:2012, Florence, Italy
"Hamburg – A Cloud for the City's Cultural Heritage"	Johann Bizer Strategische Unternehmenssteuerung, Dataport, Niederlassung Hamburg, Germany
"Please Touch this Harpsichord!"	Michael Petermann Hamburg Konservatorium, Hamburg, Germany
"Communication Strategies for the Cultural offer at Museo Galileo"	Marco Berni, Elena Fani, Alessandra Lenzi Museo Galileo - Institute and Museum of the History of Science, Florence, Italy
"A Systematic Approach To Crowdsourcing And Crowdfunding In Cultural Heritage Initiatives: the Heribits Project Factory"	Spadoni F. Rossi R., Tariffi F. Rigel Engineering Srl, Space Spa, Italy

SPECIAL EVENT

Wednesday, 10 May   19,30 – 22,00

Visit to Opera Medicea Laurenziana
Piazza San Lorenzo, 9, Florence

*In cooperation with **Antica Compagnia del Paiolo***
(President Anna Bini, President Sezione Artisti Riccardo Saldarelli)

*with "**Light Dinner**"*

EXHIBITION

Thursday, 11 May: 10,00 – 18,00

ROOM B

EXHIBITION OF ARTISTS OF THE "ANTICA COMPAGNIA DEL PAIOLO"
(President Sezione Artisti Riccardo Saldarelli)

EXHIBITION OF DIGITAL ART BY "THE LUMEN PRIZE"

For information on the Exhibition:
CENTRICA S.r.l.
Piazza della Madonna della Neve, 5 - 50122 Firenze - Italy
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Events Organization: INN-3D Srl, Empoli (FI)

Official Television TVL Spa Pistoia

NEXT EVA EVENTS

22-23 June 2017   **EVA 2017 SAINT PETERSBURG**

Website: http://evaspb.ifmo.ru/en

11-13 July 2017   **EVA 2017 LONDON**

Website: http://www.eva-london.org

PROCEEDINGS

STRATEGIC ISSUES

GLAMs going digital: strategies, activities, and the support by Michael Culture Association

Rossella Caffo

President of the Michael Culture Association

<rosa.caffo@beniculturali.it>

The Michael Culture Association (MCA) is a pan-European association based in Belgium with the mission of providing services to access cultural digitised resources and of promoting the progress in digitisation of cultural and scientific knowledge and the creation of on line services.

MCA is partner of the [Europeana](#) network with the mandate of fostering the participation of the museums and managing the over 7.2 million records already published in the European portal since 2008 in the in the frame of Athena, Linked Heritage, AthenaPlus, Europeana DSI and Europeana DSI2 European projects.

In frame of these projects MCA, working with hundreds of GLAMs, gained an important experience in understanding the status of the art, the criticisms and the needs of the museums and other cultural institutions about the challenge of DCH in terms of creation, discovery, management, and reuse for many different purposes: research, education, leisure and development of the creative industries.

Based on this pluriannual experience MCA has undertaken some activities following two lines: the creation of a museum expert hub and a plan for training.

MCA acts now as an expert hub (MUSEU HUB) for spreading expertise, information and tools on how to join Europeana and increase the visibility of the museum digital collections on the web.

Besides the MUSEU HUB MCA is launching a general plan of training activities for GLAMs professionals, researchers and students that covers, beyond others:

Digitization strategy, workflow and guidelines, digital cultural resources online and discovery tools, digital exhibitions, open data, IPR, copyright and Creative Commons, DRM, GLAMs and Research infrastructures in digital humanities.

It is very important in this ambitious initiative to set up cooperation agreements with Universities, Research Centres, Governmental Institutions, GLAMs and Associations representing museums, libraries, archives, European and international training Centres in order to organize training events across European countries according to different needs, requests, environments.

The first appointment was the training course recently organized in Florence in cooperation with DARIAH It, DARIAH ERIC and the international Master managed by the University of Parma and the University of Tallinn.

SmartCities4Culture

The eCulture Cloud approach

Dirk Petrat[1], Dirk Börnsen[2]

[1]Director General for Central Services, Ministry of Culture

[2]Head of Department for legal affairs, human resources and IT, Ministry of Culture

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Digital access to cultural assets offers the opportunity for a variety of actors to engage into a discourse on cultural identities, and to form and link city-level cultural communities in the fields of Tourism, Research, Creative Industries, Education and Learning. These SmartCities4Culture Communities foster the co-working and co-creation of citizens, researchers, students, tourists, pupils and enterprises on specific cultural heritage that, when interlinked, will create an eCulture eco-system.

Local aggregators or cultural offices of municipalities are driving forces in Smart City concepts and the funding of cultural activities. The aim of this initiative is therefore to form an expert forum of cultural policy makers to explore relevant areas of common interest, exchange best practice solutions and cooperate in joint projects.

SmartCities4Culture Communities require technical means to communicate and to collaborate, to exchange data, and to make cultural services broadly available. Federated networked solutions are needed that enable lightweight processes to incorporate new actors engaged in areas such as research, education, tourism, and creative industries, making contributions of both small and large communities possible and attractive.

This initiative will investigate, what kind of infrastructure (technical and soft) is needed to enable Smart Cities to work together and come up with workable solutions within the context of eCulture. This initiative

- **makes relationships visible between regions** with different cultural, societal, and economic characteristics by federating the access to digitalized cultural assets across Europe, ingesting as much as possible into repository for its reuse where needed,
- **enables exchange of cultural data and access to cultural services**: Integrate digital cultural activities of various cultural institutions to make it available for education, tourism, and research,
- **creates an engine to share city-based knowledge**: Makes content, best practices, processes, services available,
- **opens traces for a shared infrastructure:** A federated storage, access and service platform based on cloud computing principles.

The Hamburg organization model

- The Ministry of Culture of the Free and Hanseatic City of Hamburg brings together local aggregators.
- Dataport is the IT service provider for public administration in the northern part of Germany (Hamburg, Schleswig-Holstein, Lower Saxony, Bremen, Mecklenburg-Western Pomerania and Saxony-Anhalt). Dataport will host and operate the eCulture Cloud.
- The Fraunhofer Institute for Open Communication Systems will serve as innovation partner by proposing and evaluating technologies suitable to serve as a vehicle for the presentation of culture and history.

Symbol Extraction and Restoration in Ancient Egyptian Papyri

A G Constantinides and Cedric Ehrhart

Imperial College London, U.K.

Introduction: The Petrie Museum of Egyptology at University College, London, has an impressive collection of papyri from Egypt. Some of these are not in a state that would enable their content to be read and assessed in any academic depth. The aim of the work reported in this presentation is to describe a series of algorithms employed to form a possible framework to achieve the examination of the papyri for further academic studies. The paper contains description of the component algorithmic parts and includes results on the overall performance. The dominant driving aim has been to render the framework of use of the algorithms sufficiently flexible to enable archaeologists to use these novel techniques on new material.

In order to achieve the aims several areas of image and digital signal processing are employed. Some of the techniques are standard while others are novel. The new algorithms are described in the main paper along with their underlying mathematical support. The software implementation of the algorithms is carried out under MATLAB and is available on request.

In broad terms the approach involves initially the carrying out some pre-processing and data conditioning based on standard image processing operations which are typically histogram equalisation, morphological operations, and local blurring. These are necessary to condition the data for the next stage. The conditioned data are then processed further via a new transformation, the Poisson Transform, to prepare the data for edge and shape extraction.

The Poisson Transform is a novel, complex variable based operation, with significant features which, inter alia, facilitate the shape extraction process.

Subsequent to the data conditioning operations there follow operations for symbol region extraction and these involve thresholding and contour detection. Finally the symbol recognition stage follows

Examples are shown from real data to illustrate the effectiveness of the entire approach.

The Approach:

The original form of the data are in colour. In view of the constraints placed on having only monochrome pictures in the paper we reproduce below in monochrome form a typical example. The papyrus image is replicated with horizontal symmetry as needed for the Poisson Transform at a later stage.

First Stage Operations: These are very simple and standard image processing operations used as a preamble to condition the data necessary for subsequent processing. Specifically initially we use histogram equalisation to render the image uniform in intensity. There follows a morphological series of operations which involve options on the structuring element to be employed. The option was considered necessary in order to facilitate the manifold nature of possible symbols under examination in a specific papyrus. While the normal edge detection algorithms are included in the framework of the developed software it was felt necessary to examine alternative approaches that are not enhancing the noise content of an image.

A new Transform along with its differential form have been developed for this purpose. They are based on the fundamental properties of complex variables and their absolute values on the unit circle on the complex plane.

It can be shown that the effects of noise are considerably reduced while the significant features of the underlying data are not affected.

The general principle is applied to the one dimensional case as shown in the figures below.

As it is evident the underlying signal can effectively be differentiated without enhancing the noise content. The parameters R and r of the transformation provide effective control and balance between the effectiveness of differentiation on the one hand and the level of suppression of noise on the other. The Poisson Transform as employed in this work requires the data to possess even symmetry. The numerical values per row are the real pixel intensities and hence the symmetries are even for real data. For this reason the papyrus in Fig (1) has a horizontal mid-point symmetry.

The superposition of the original image with the output out the Poisson Transform can facilitate further the palaeographer/archaeologist in reaching intermediate conclusions about the nature of the symbols under examination.

Symbol Isolation and Extraction and Poisson Transform: At this stage the approach involves the location of potential candidate symbols for identification and extraction from a prescribed papyrus under study. Two different and direct techniques are available at this point. One relies on the use of the Fourier transform while the other is a space domain correlation approach. As a significant adjunct to the process is the use of the Poisson Transform. This a contour to contour complex variable transformation.

The basic principle is as follows. For simplicity we consider a single variable. The pixel intensity measurements are all positive. In order to facilitate the use of complex variables we need to specify a contour over which notionally the measurements have been taken. For closed contours we need to provide a symmetry artificially in such a way that the overall measurements can be considered as measurements on a closed unit circle. Under these circumstances the positive, and now symmetric pixel measurements can be seen as representing the noisy modulus of a complex and unknown function. The Poisson Transform then comes into play here. It is a computational means of evaluating the modulus function on another contour C2 given its values on a contour C1. The benefit is that any noise variations on C1 are implicitly reduced on C2 even when C2 is very close to C1. In our case we consider C1 as the unit circle and C2 a concentric circle of slightly smaller radius.

There is a further enhancement to this transformation in that the derivative of the measurements can be computed dejectedly through it, without enhancing the noise present in the original data.

Thus if the data are known on a circle of radius r and are computed on radius R the relationships pertinent are given below

$$\begin{cases} f(re^{j\theta}) = \frac{1}{2\pi} \int_{-\pi}^{\pi} f(Re^{j\mu}) P(R,\mu,r,\theta) d\mu \\ f(re^{j\theta}) = f_0 + \frac{j}{2\pi} \int_{-\pi}^{\pi} f(Re^{j\mu}) Q(R,\mu,r,\theta) d\mu \end{cases}$$

$$\begin{cases} P(R,\mu,r,\theta) = \frac{R^2 - r^2}{R^2 + r^2 - 2Rr\cos(\theta - \mu)} \\ Q(R,\mu,r,\theta) = \frac{2rR\sin(\theta - \mu)}{R^2 + r^2 - 2Rr\cos(\theta - \mu)} \\ f_0 = \frac{1}{2\pi} \int_{-\pi}^{\pi} f(Re^{j\mu}) d\mu \end{cases}$$

It is noted that the entire implementation is only a few statements based on the Fast Fourier Transform and its inverse.

In Fig 2 we show a specific example of Papyrus 32293 of the Petrie Egyptology collection, while Fig 3 shows an isolated symbol.

Figure 2

Figure 3

(a) Colour 1   (b) Colour 2   (c) Colour 3
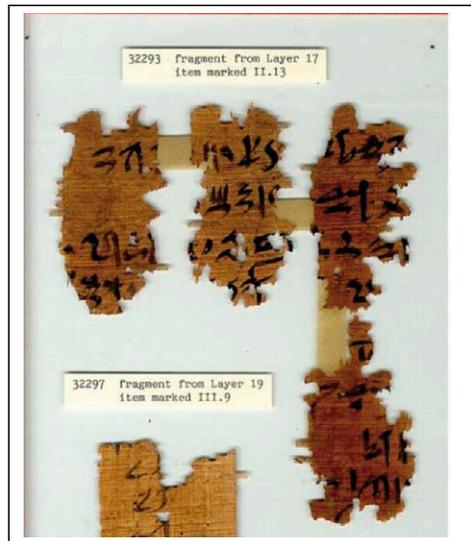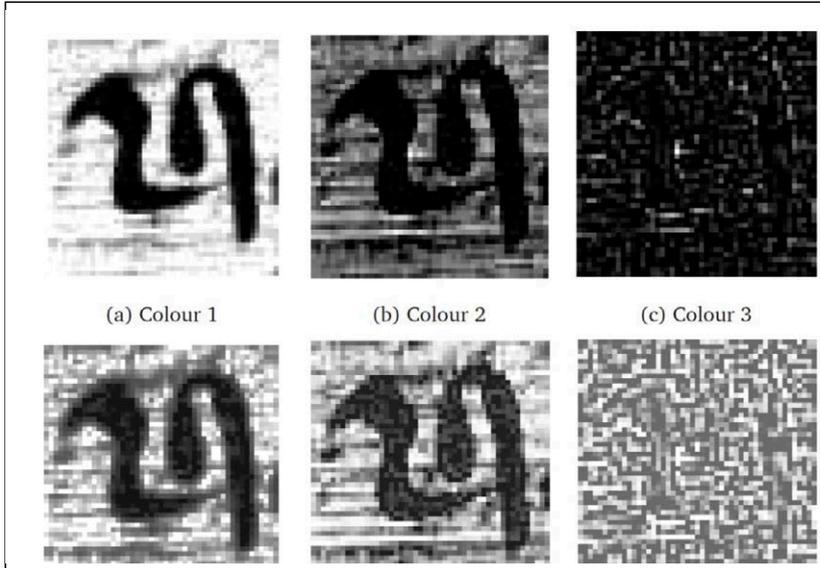
This is clearly well defined but is used here to indicate the results of the operations. Each colour is treated as a separate entity. Subsequent to contrast enhancement (not shown here) the contour extraction process is implemented with the results as shown in Figure 4 below

(a) Colour 1   (b) Colour 2   (c) Colour 3
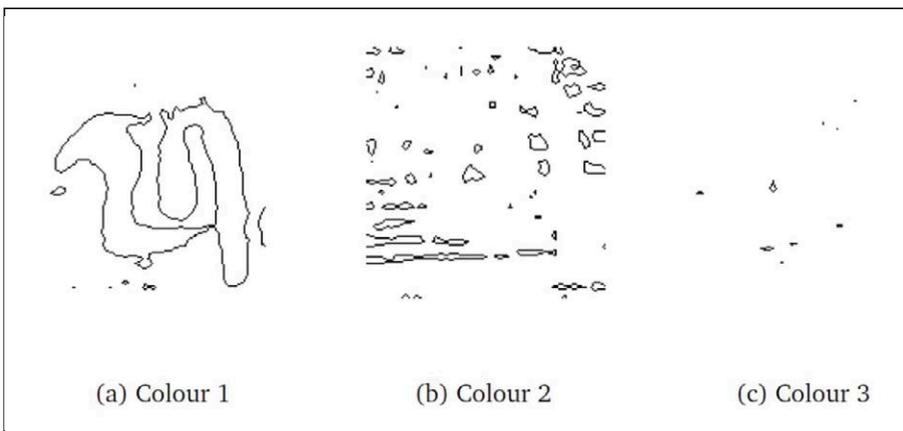
The archaeologist may decide at this stage to select specific images (masks) and the selection is further processed to produce a skeleton image. At this stage if the material under study is new one may wish to form a symbol database and hence the symbol skeleton can be saved in a dictionary.

If the symbol dictionary is already in existence then a transcription can be put into effect. If the symbol does not exist in the dictionary then a facility exists to add it thereto.

For the papyrus in Fig 4 the transcription is shown in Fig 5.
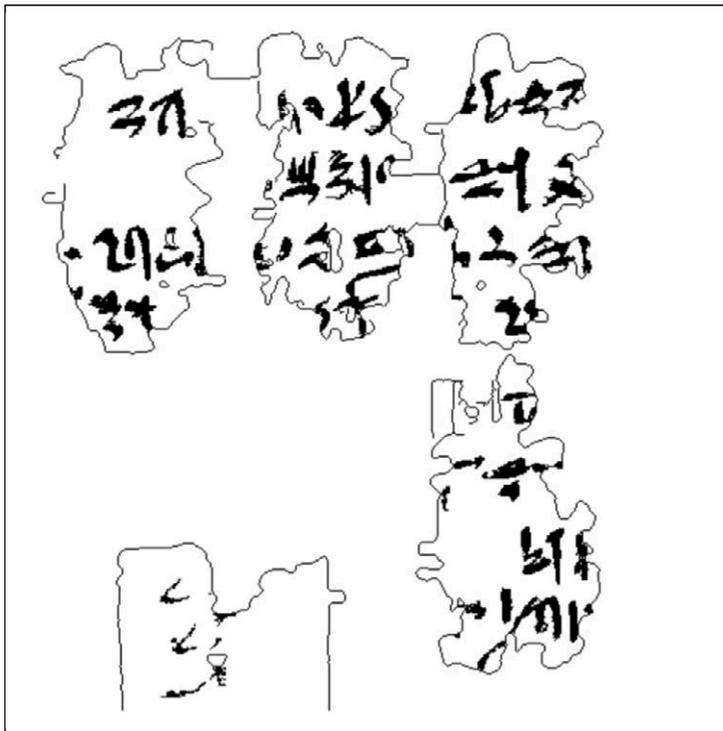
The software and the slides of the oral presentation which contain more examples can be obtained for academic use by direct application to a.constantinides@imperial.ac.uk.

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TECHNOLOGIES SOLUTION FOR ACCESSIBILITY TO CULTURAL HERITAGE

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Abstract

New technologies are a formidable means of broadening the accessibility to cultural heritage, and to stimulate the development audience.

If the technology is used in the correct manner can be a vehicle for dissemination of knowledge to all: they are, in fact, designed and built by man to create the disability.

The "digital revolution" has distributed and made accessible cultural products "4all", driving demand and transforming the public in "creator of content".

The innovation and technology that flow from it are a tool that allows us to:

• organize information

• reach different audiences types

• share knowledge

• stimulate learning

The solutions available today are many ... but how to orient our choices?

Visual silence: art and show business on the "Silk Road"

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INTRODUCTION

A brief report that tries to reflect on the concept of visual silence in our time with a particular emphasis on personal experience in China.

ABSTRACT

The path is rather complex and is inspired by the concept of silence in art. Art as a privileged way for understanding society today.
In fact today would be truer to speak of the loss of silence, the hypertrophic signs that we find in every social sphere (Gillo Dorfles 2006) [1] , and the overabundance of information (Dorfles 2006) an overinflated metalanguage (Anton Popovic)[2], noise pollution that makes hearing difficult (Roland Barthes) [3].
A verse from Dante's Divine Comedy (Inferno I, 63) [4] is our first point of reflection on art and its capacity of writing new rules of communication using its own structure: synesthesia is undoubtedly one of these new rules: "silenzio…fioco" (the hoarse silence) with this Dante describes so much more than we can imagine. Aristotle wrote: "Natura abhorret a vacuo" (Nature abhors silence) but today, on the contrary we have no time to breathe, or to pause (GILLO Dorfles). In the Middle Ages there was "horror vacui " (vacuous horror) today we have "horror pieni"(horror filled). In the last 50 years different artists have placed great weight on the meaning of silence as an important element in communication: J.Cage [5], Barnett Newman [6], Stanley Kubrick [7] Marina Abramovic' [8], the theatre group Mummershanz [9], Marcel Duchamp, Miles Davis (to name just a few). But more recently, digital art has filled the artistic "silences" again, we are facing a hypertrophy of signals (indicators?), immersive worlds fill the spaces of imagination more and more ("L'Art numerique est-il definitement mort?" The CREATOR project, France 2016) [10]
Synesthesia is replaced by a sensory numbness, the massive dose of input blocks any further critical reflection, Theodor W. Adorno (Dissonanzen 1949) [11] already spoke of the risk of a "gastronomic" art, i.e. an art which is "predigested". You tube is filled with short video clips, which have a transitory life, they are episodic and sensationalist, without a concept, without telling a story or giving meaning. The architectural mapping of extraordinary events in many cities has become an expression of great technical prowess - but lacking in content.
The various worldwide talent shows in Tv follow the format of 2-3 minute performances in which the technology is at odds with the values and content of the performance, therefore the setting becomes the content.   Most technological capacity does not correspond to reality,

resulting in poorer artistic quality. "Pictures at an Exhibition" (1971) [12] an album by the progressive band ELP (Emerson Lake and Palmer) was performed using early synthesizers and loses all its power in the 1993 version (despite having much more advanced instrumentation, very similar to the sounds of a real orchestra). It has taken away the element of the listener's imagination.

Chinese concerts and TV shows confirm this trend, a "rampant" use of technology, technical wizardry, big performance engineering and lighting, results in very little substance by our standards. But we are faced with a different cultural approach, the Chinese have a different kind of humor, and a different attitude in many things, they also have different tastes in colors, and their style favours a degree of graphic vividness and greater wealth of content. The vision of the artistic subject is different and that needs to be taken into account, as well the taste of the masses rather than the individual.

A clear example of this is the preparation made by CCTV on the occasion of the Chinese New Year 2017: 216 video layer in 4K of thousands of people in a giant immersive structure. Another example: the show offered at the G20 summit in Hangzhou: the entire city and lake became the stage, with a higher budget than there was for an Olympic Games[13].

Conclusion

The future offers two possible different directions: gigantism or return to minimalism.

Many large multinational companies are looking for, and are adopting a new communication strategy of minimalism "Less is more" (Getty images). Few examples are the new advertising campaign by Apple, HSBC,Emirates, Oakey and also new directions in theater, for example Simon McBurney's "The Encounter"[14] by Complicite', on Broadway. Even in China they are being born new sensibility. I want to appoint Zhaoliang Art [15]with his spectacular and minimalistic show: "The tea spell".

The artistic communication in the coming years will have to try to find a balance between technology and emotion.

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[13] 1 settembre 2016 Giulio Santevecchi (special correspondent in Hanzhou) "Corriere della Sera"

[14] Times 06/15/2016 " An immersive stage show that makes heavy use of binaural technology (3D-audio) for drama is coming to Broadway this fall after a sold-out in London and arts festival appearances throughout Europe.. "

[15] Zhao Liang, who lived in northern Europe before, has been trying in different spaces environmental and physical theater creation. He has also won numerous awards and won the first international modern dance competitions in Italy. He is using their bodies to create life and behavior and perception of the world in different areas and art collision, spending years travelling the inquiry, footprints all over the country and around the Tibet, Southeast Asia, India and Europe，which aims to create more artistic possibilities and experiences. He has founded ZhaoLiangART dance studio in 2012. In recent years, the studio has created "unlimited relations," "Man," "Unbelievable" and so on. Each show has caused great influences in the performing art industry.

A GESTURE DRIVEN APPLICATION ABOUT PROTESTANT REFORMATION IN TORGAU ON A LARGE TOUCH-DISPLAY

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Abstract - This paper introduces a complex application that conveys historical content of the Protestant reformation in Germany. The application is displayed on a large Touch screen in the German city of Torgau in Saxony-Anhalt. Best practices for gesture driven applications are being presented.

INTRODUCTION

The German town Torgau, as the historical residence of the Prince-Electors of Ernestine lands of Saxony in the 16th century, played an important role in the Protestant Reformation between 1517 and 1648. Today many tourists travel to the town to gain knowledge about the historical buildings and personalities of the reformation. Funded by the European Regional Development Fund (ERDF) the Beuth University of Applied Sciences Berlin has developed interactive applications for touch modules. Within this project the University, in cooperation with the Protestant youth education project "Wintergrüne" in Torgau, has realized a complex game-based web application to convey historical and religious content. There are many restored buildings of historical importance in Torgau, such as the Castle Hartenfels, which has applied to become a UNESCO World Heritage Site[1].

APPROACH

The application runs on a 100 inch touch-display using modern web-technologies and a 3D-panorama framework. It can be controlled by a variety of touch gestures and includes a wide range of media, such as video, sound and images. 360° panorama images of seven of the most important historical buildings in Torgau were turned into interactive modules. Each module comprises a set of mini-games that allow students and tourists to explore and interact with historical-theological content. An animated encyclopedia of 76 pages summarizes the information contained within each mini-game.

The application is displayed in the Historical Superintendency in Torgau, where Martin Luther, Philipp Melanchthon, Justus Jonas and Johannes Bugenhagen created theological reports in 1530, which are called the "Torgauer Artikel". The following table shows the modules of the application and their historical content.

Module#	Module	Content
1	Johann-Walter-School with church	The Protestant Reformation and its impact on the educational system
2	Spalatin house	World religions Important figures of the Protestant Reformation
3	Castle Hartenfels	Relations between church and state residence of the Prince-Electors
4	Chapel of the castle	Differentiation of Protestantism and Catholicism
5	Marien-church	„Fourteen Holy Helper" Cranach-painting, Music in church
6	Katharina von Bora's Death House	Family life in the late medieval / in the early Modern times The role of a woman
7	Hist. Superintendency	New administrative structures of the Protestant church
8	Town hall	Tasks of the city council, figures of the Protestant Reformation

Table 1: Modules of the application

TECHNICAL SPECIFICATIONS

A large touch-display and various computer- and audio-devices were acquired and installed in the so-called Luther-room in the Historical Superintendency prior to this project. The touch-display is a 100" mirror plate (2290 mm x 1320 mm) and the related computer (Intel Core 7 Processor) runs under Windows 8. The touch-display has a number of inherent

Figure 1: touch-display in usage

restrictions due to its installation height and the rather low sensitivity of the surface. Interactive elements have to be positioned in the lower part of the screen, so that children are able to reach them (see Figure 1). A thin plastic foil has been applied to the surface of the screen to avoid strong reflections. Unfortunately this further decreased the sensitivity of the touch-display, meaning gestures have to be performed with multiple fingers instead of one finger only.

This limits the minimum size of the interactive elements on the screen as well. They have to be recognizable while the user interacts with them, especially when one covers them with one hand. On account of the low sensitivity of the touch-foil, Drag and Drop gestures were likely to be interrupted causing elements to not move as the user would expect them to. The developer team decided to avoid long distance Drag and Drop gestures and altered the objects animation, so the moved objects would rest some time in their new position before moving back. Thanks to the connected hardware, the integration and amount of locally stored video and audio sources were barely limited.

DIDACTICAL CONCEPT

The basis of the didactical concept is user-centered design. In this context 19 different 3D-panoramas of the most important historical buildings of Torgau have been created to realize an immersive interface. The idea of users looking into the past and dealing with the impact of the Protestant Reformation on today's society comes to life. The software-components are built as modules, as shown in table 1, which can easily be extended. Interactive 2D-elements are integrated into these panoramas and allow for explorative learning. A modern screen-design targets the predominantly young audience. Gamification-elements (Zichermann and Cunningham[3]) serve as a template for the engagement of young adults.

The integration of excessive continuous text has been avoided. Due to the wide variation of basic knowledge of the users, an animated encyclopedia was developed to summarize historical content with short texts, audio, images and videos. The application for the multimedia touch-display is intended for guided workshops with students and tourists. Many components are designed for guided workshops while others are designed for independent use. If the users decide to use the touch-display on their own, the local staff will introduce them to the application first.

Figure 2: Start-Screen of the application

An aerial photograph with interactive elements serves as the main interface of the application (see Figure 2). The names of the historical buildings are shown as an overlay and can be switched off to create an explorative experience. The buildings and the nameplates are implemented as highlighted buttons. By clicking them, their respective module gets opened.

Some of these 500 year old buildings, like the Castle Hartenfels, have been restored only on the outer facade and serve for different purposes today. They are administrative offices as well as apartments. Other buildings, like the Historical Superintendency, continue to serve their original purpose. The respective modules have both outdoor- and indoor panoramas.

IT-CONCEPT

The research team decided to use 3D panoramas as the main user interface, since many historical buildings were restored. The JavaScript library Krpano[4] offers a wide range of tools that turn panoramas into virtual tours. Custom actions like hotspots can be added to the panorama to alter the view or add areas to interact with.

The application was developed with HTML5, CSS3 and JavaScript and optimized to run in Google Chrome browser. The event handling was implemented with jQuery, pictures and interface elements were animated with pep.js[5] (drag gestures) and Hammer.js[6] (touch gestures), both JavaScript libraries.

MARIENKIRCHE (ST. MARY'S CHURCH)

One example of these modules is the Marienkirche (St. Mary's Church), which will be explained in detail. The content of this module is the impact of the Protestant Reformation on the Church music. It deals with the "Fourteen Holy Helpers", a painting by Lucas Cranach the Elder, and the Epitaph of Katharina of Bora, Martin Luther's wife. Figure 3 displays a screenshot of the module, which shows the interior of the church. The arrows on the screenshot visualize interactable elements on the screen. The module inherits 6 mini-games and the encyclopedia.

Figure 3: Screenshot of module "St. Mary's Church"

„FOURTEEN HOLY HELPERS"

Figure 4 shows a screenshot of the mini-game "Fourteen holy helpers". The user has to explore the painting and deal with the saints and their religious meaning. A click on one of the names next to picture reveals written information about that saint's background story. By using this information, the user can figure out, which name belongs to which saint in the painting. The user can now proceed to click on one name and after that click on one saint in the picture. If he manages to combine the two matching elements, the saint will be highlighted by a golden glow. The name of the Holy Helper, that got revealed correctly, will receive a green checkmark. Whenever two selected elements don't match, the picture will glow red, indicating a false guess. The user is driven to deal with the meaning of each Holy Helper for Christianity, their name and appearance in the painting by Lucas Cranach the Elder.
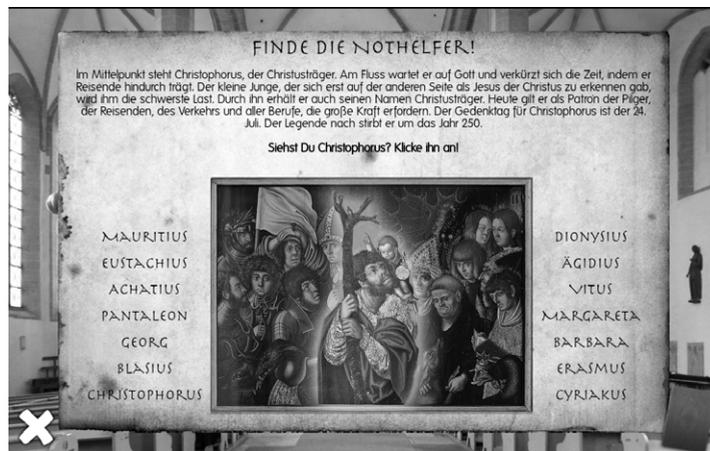

Figure 4: Fourteen Holy Helpers

KATHARINA VON BORA - EPITAPH

Another interaction in the church is located on the epitaph of Katharina of Bora, Martin Luther's wife. On the epitaph there are two hidden interactable elements, which reveal information about Katharina of Bora's life. The elements are not highlighted and provide an explorative experience. A click on her wedding ring triggers an animation of the ring falling to the floor. As shown in Figure 5, text containing a summary of the life of the former nun fades in. Another click on the ring reveals a summary of Martin Luther's view on marriage of clergies. This interaction is designed to make the user explore the epitaph.

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Figure 5: Katharina of Bora Epitaph

SONGS OF JOHANN WALTER

Johann Walter was a composer, cantor and friend of Martin Luther. He published the first choral songbook of the Protestant church, which contained both own compositions and compositions of Martin Luther. Figure 6 shows an interaction module, where the user can choose between five songs of this choral songbook. One click on the title will play recordings of the Johann-Walter-choirs of Torgau and Kahla, a town in Thuringia.
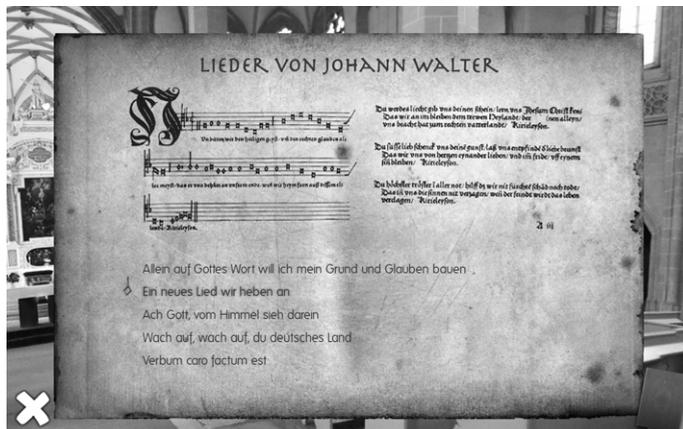
Figure 6: Songs of Johann Walter

SACRAMENTS

This interaction deals with the sacraments of the Catholic Church and discusses which of these sacraments were adapted by Martin Luther for Protestantism. Figure 7 shows a screenshot of this interaction. A click on an icon reveals a green check mark or a red cross, depending on the fact if the sacrament was part of the new confession. Each selected item will reveal information about its meaning. As soon as the icon for baptism and communion are selected a text fades in that differentiates Catholic and Protestant sacraments.

Figure 7: Sacraments in Protestant Church

COMPLEXITY OF THE APPLICATION

The application „Torgau – City of the reformation" comprises eight modules which contain a total of 40 interactions and mini-games. Each module is realized through at least one 3D-panorama. Some modules have a panoramic view for the exterior as well as the interior. All in all there are 19 panoramas of the most important historical buildings in Torgau. 220 images visualize the historical content, including paintings and etchings.

An animated encyclopedia of 76 pages summarizes the information contained within each mini-game or interaction.

CONCLUSION

This project shows the large potential of E-learning technologies working collaboratively with church historians and technology researchers. The modularity of the application as well as the variety of different interactions and mini-games enable the project partner to plan and coordinate workshops according to the needs and expectations of the visitors.

Direct interaction with the touch-display goes hand in hand with group discussions, since visitors often arrive as groups and have a lively exchange of preexisting knowledge or recently received information. The application has already been installed in the Historical Superintendency, one of the historical buildings in the old Torgau. Recent feedback from teachers and students shows that the application performs very well for learning purposes. Teachers are able to use some of the applications content for their teaching content as students received a new method to internalize new information.

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NEW SCIENCE AND CULTURE DEVELOPMENTS & APPLICATIONS

THE VIRTUAL REALITY TEHNOLOGIES FOR CULTURE AND ARTS

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ABSTRACT

The paper describes the possibility of using virtual reality technologies for presentation cultural heritage, virtual excursions and artistic performances. Using video technology for 360 ° it is possible to present the cultural activities (museum tours, musical concerts, sightseeing tours, theater performances, etc.) in virtual reality devices. The interactive 4D excursions which combines virtual tours, taken with the help video 360°, with interactive excursions in historically reconstructed virtual reality are described.

INTRODUCTION

At the present time virtual reality technologies and their applications have developed intensively. Using these technologies for Arts and Culture provide the user with the effect of presence in the very center of cultural events.

One of the most prospective approaches for creating content for virtual reality systems is the video 360° technology [1]. This technology allows the creation of panoramic videos with different grades of interactivity where the users changes an angle shot (a camera angle) of the video accordingly to their desire. The video can be viewed through virtual reality headsets (for example, Oculus Rift [2]) as well as on a smartphone, via a special app when the user rotates the video "around himself" by moving his head or turning a smartphone. The video can be watched on computers also. In this case, the user manages the foreshortening by using a mouse or a keyboard.

Fig. 1. Oculus Rift DK2 virtual reality headset

Many big companies (Facebook, Nokia, Samsung, Google and others) develop video cameras for shooting video 360°, virtual reality garnitures for different smartphones and personal computers.

At present, different video cameras for filming video 360° have been developed. We use one of the outstanding examples of this approach is the project 360Heros (http://www.360heros.com/) that offers special rigs (video gears) for GoPro cameras HERO 4. The amount of cameras dependent on the tasks in the rig is from 2 to 6. After a shooting video streams are combined into one spherical video with the help of the special software.

The panoramic video plays an important role for preservation and provision of access to cultural heritage. The technology provides the unique opportunity to see not only closed for public access archives of museums but also reconstructed historical monuments that were destroyed by time or circumstances (3D virtual reconstruction). Moreover, virtual reality provides disabled people a unique chance for exploring of cultural heritage to different parts of the planet.

The project of development and applying of the video 360° Technology to culture and arts has been started in the Center for Design and Multimedia of ITMO University [3, 4]. The team of the project has filmed more than 50 different events for virtual reality glasses such as concerts, musical festivals, excursions in historical places, performances in theaters and different cultural events [5].

PRESENTATION OF VIRTUAL EXCURSIONS VIA VIDEO 360°

Once the virtual reality headsets came to the market, shooting panoramic photos and videos became especially topical, same as the use of the video 360° technology in various spheres, from museums and interactive video tours to recording of music and drama. A concert recorded in this format leaves an unforgettable impression: once the user puts on the virtual reality headset, he joins the musicians and actors on the stage.

Video 360° of historical attractions in the city and excursions to museums provide a unique opportunity for users to see the main sights of the city at any time with effect of presence. Video 360° technologies have many fruitful applications for virtual cultural tourism. ITMO University has started the realization of the project 'The point of presence' with the State Hermitage. Within the frames of the project, the team will represent different events in halls of the museum with the help of the panoramic video. The first story of this series of video 360° films is 'The Peacock Clock' (Fig.2).

Fig. 2. The shooting in the State Hermitage — 'The Peacock Clock' in the format of video 360°

The special attention our team was paid to the filming of different events in the Solovetsky Monastery in the format of video 360° (Fig.3). The Solovetsky Monastery played the unique and

important role in Russian history and culture. The Monastery was founded in XV century as a place for religious reclusion of Sergius of Radonezh's ('the father of Russian monasticism') progenies. In a short space of time the Monastery has become the religious, cultural, political and economic capital of the Far North.

Fig. 3. Solovetsky Monastery

The Solovetsky Monastery was the main factor which attracted people to the region of the White Sea. The Monastery had the great influence on the development of economics of the Seaboard. It was the main prerequisite for Russian seafarers to explore the Arctic Ocean which turned Russia into the Sea Empire.

The location of the Solovetsky Monastery is the main obstacle for a vast majority of people to take part in its religious events and celebrations. The access to these events can be provided by the shooting them with the help of the video 360° Technology. By putting on the virtual reality glasses, the user can virtually visit the Monastery.

As a result of the team's work, more than ten shootings of video 360° were performed on Solovetsky Islands: the excursion in the Ascension church on the Sekirnaya Hill, the Celebration in the Solovetsky Monastery, the Christmas Liturgy, the Night Service, the Christmas celebration for children, the Religious Koledari (the Slavic tradition), different views of the Monastery and the Solovetsky Island (Fig. 4).

Fig. 4. The shooting of the Church Celebration in the Solovetsky Monastery in the format of video 360°

Special features of 360° video format require a different approach both to the technical and the creative part of filming and editing. It's imperative to keep in mind that the viewer of a 360° video is allegedly taking the place of the cameraman or his camera, and can thus encompass the entire surrounding space that the 360° video can encompass. It's essential to take this particular aspect into account while shooting a video in this technique.

All these virtual excursions in Solovky Monastery filmed with the help of the video 360° technology, are published in public access on web site solovky.ifmo.ru [6].

INTERACTIVE 4D EXCURSIONS

The main idea of interactive 4D excursions is to combine virtual tours, taken with the help video 360 in present time, with interactive excursions in historically reconstructed virtual reality.

Within work on the project «Ancient Fortresses of Russia's Northwest multimedia information system» [7, 8] the team of the Center for Design and Multimedia of ITMO University create a virtual 3D reconstruction of Korela Fortress in late 17th – early 18th cent. This particular fortress was selected, since its virtual historic reconstruction for the late 17th – early 18th century and its present-day exterior seemed to fit well together. Autodesk graphic environments were used for making the virtual models of the fortresses (Fig. 5).

Fig. 5. Virtual reconstruction of Korela Fortress in late 17th – early 18th cents

For realization of interactive excursions in historically reconstructed virtual reality of Korela Fortress the 3D objects were exported into Unity3d graphic system. The virtual tour was specifically designed for the use together with the Oculus Rift virtual reality headset. [4].

The project of 4D virtual reconstruction of Korela Fortress involved the combination of two technological challenges: a virtual 3D reconstruction of the Fortress and a tour in video 360° format. For realization this project several virtual excursions in Korela Fortress was filmed in video 360 (Fig. 6).

Fig. 6. Virtual tour of Korela Fortress in 360° video format

The goal was to design a virtual interactive privately guided tour of Korela Fortress, in 360° video format (the option of selecting the continuation of the tour at key points), with the option of moving from 360° video to 3D reconstruction format and back at all the key points [9].

The main challenge was to integrate a large number of fairly high resolution (4096x2048) video files into the Unity3d system, while ensuring their seamless switching and playback.

Fig. 7. Korela Fortress 4D interactive virtual tour using Oculus Rift virtual reality headset

CONCLUSIONS

Virtual reality crated using video 360 and 3D modeling technologies can be effectively used to present in virtual reality gadgets:
- excursions to museums and architectural attractions;
- tours on cities, rivers and canals;
- musical concerts;
- theatrical performances;
- festivals and cultural events;
- performances in projects of the modern art.

Virtual excursions can be made interactive, providing to the viewer detailed survey of separate monuments of culture in the course of excursion, and also viewing of reconstruction of these monuments during various historical periods. This excursions is provided with connection of multimedia 360° technology with technologies of augmented reality.

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CREATIVITY IN ART AND IN PROBLEM SOLVING TASKS: A COMPARATIVE ANALYSIS

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Abstract – As stated in our previous preliminary work [1], creativity can be considered a complex cognitive process, allowing our mind to find original solutions, new perspectives, further ways to organize the incoming data so as to give rise to an enriched reality [2]. In Cognitive Sciences, creativity is often studied as a part of a complex problem solving process.
In this work we propose a comparison of the two processes, analysing, through brain data, collected by a BCI (Brain Computer Interface) device, the effect on two selected individuals involved, respectively, in a creative process and in a problem solving task.

INTRODUCTION: AIMS AND MOTIVATION

Creativity is one of the key processes studied by Cognitive Sciences. Scholars focus on creativity because it represents a complex cognitive process involving consciousness and unconsciousness in a kind of "borderline state of mind, in which the thought seems to fluctuate in a fluid cognitive state" [1]. This means that creativity extends the individuals' mind possibilities, through a sort of "as if" experience, allowing to explore new frontiers and options. Cognitive Sciences study creativity by the investigation of the cognitive response of our brain to external stimuli, processing collected information as in Lindsay and Norman [3], in Leeb et Al. [4] On Neuro-motor abilities, and in several previous works we performed from different perspectives, investigating the stimulation of brain functions such as memory [5, 6], attention [7], language [8]. Gerald Edelman [9] names GoD (Generator of Diversity) the evolutionary process led by creativity that serves as the engine for the development of our mind. In this GoD, creativity plays a key role, because in a single act of creativity, we can find the evolutionary path of the human mind. In fact, while the evolution proceeds through a process of adaptations, or fitness, the human mind can invent a future, a world, a scenario where to give a sense of what we have created or what we are creating, or what we are simply imaging to create. Neurosciences, and particularly Cognitive Sciences, study creativity for the implications in understanding human and machine approach to problem solving. In fact, disciplines such as Cognitive Psychology, Brain Neurobiology and Artificial Intelligence, investigate creativity mechanisms related to the human brain and cognition. We can state that creativity is a part of every human daily activity, so that, to understand individuals' behaviour and abilities and the mechanisms of mind, we must start from the creative process, as, in general, the search of a different (innovative) solution to a problem.

In our work, we propose a comparison between a commonly defined "pure" creative act and a problem solving task, analysing EEG-data collected by a Brain Computer Interface (BCI) device to detect similar cognitive mechanisms in two selected individuals involved respectively in the two processes. To perform the experiment, we chose to register EEG (Electroencephalography) rhythms of an individual performing an invented drawing and an individual solving a popular game, the Rubik's cube, having in common also the involvement of gestures. Our aim is investigating if the EEG patterns collected from the two individuals show similar involvement of brain rhythms,

assuming the similarity between the two processes, demonstrating that creativity is, effectively, a problem solving task.

In the next paragraph we will introduce the experimental setting, while in the following we present the obtained results, concluding with our considerations.

THE EXPERIMENT: BACKGROUND, MATERIALS AND METHODS

Scientific investigation through new technological tools, such as Brain Imaging and AI (Artificial Intelligence) methods, opens a wide scenario on the opportunity in studying creativity. Brain Imaging techniques allow notable improvement in the study of the individuals' reactions and brain mechanisms involved in motor, cognitive or perceptive tasks. Thanks to devices and invasive or not methods, such as fMRI (functional Magnetic Resonance), MEG (Magnetic Electroencephalography), PET (Positron Emission Tomography), EEG (Electroencephalography), it is possible, in fact, to verify in real time the response of an individual to specific stimuli. Therefore, new cognitive technologies allow observing the brain in action (the so called "living brain"), moving the investigation from a subjective evaluation performed through observation to an objective measurement of elicited responses. Because of its low invasiveness and high time resolution, the EEG is the most used technique to investigate mechanisms such as creativity. Specifically, the high time resolution of the EEG makes this technique fundamental to measure the response in terms of time elapsed from the stimulation.

With the aim of collecting brain rhythms during the experiment, allowing individuals involved to feel in comfort and free in movement, we chose to use a BCI (Brain Computer Interface) device, a headset that is a simplification of the medical equipment for EEG [10], allowing to record cerebral rhythms and the direct brain-computer interaction. BCI devices are widely used in research, for the registration completely comparable to the medical EEG, but also for their low cost and high portability. BCI devices collect several brain frequencies, grouped in rhythms (alpha, beta, delta, theta, gamma). BCI devices have been used in research either to register the response to visual [1] and musical stimuli or creative acts [11] and recognize the emotions valence [12, 13, 14, 15], and to reveal the mechanisms of the visual creativity [6]. The objective of many researches, past and *in fieri*, is understanding what are the mechanisms triggering creativity or characterizing the creative process (the insight). In some experiments the objectives is to evaluate the emotive and cognitive response to visual-perceptive stimuli based on the concept of priming [5]. Other studies, investigate the mechanisms of response to colours [16], or to stereoscopy and monoscopy [7]. The obtained results show interesting correspondences among some cerebral rhythms and the creative activity.

Interesting enough, drawing represents a great opportunity in studying creativity. Drawing, indeed, represents an example of a complex mental process that requires the coordination of many neural and cognitive subsystems [17] and difficult to find in other domains of cognition. Particularly, the drawing improvisation seems to involve working memory and complex cognitive mechanisms [18, 19], comparable to a problem solving process mechanisms [20, 21].

As for the problem solving task to solve and compare to the results from the drawing experiment, we chose the Rubik's cube, a very popular game studied in research for both algorithmic aspects [22] and for the involvement of brain areas [23] and creative mechanisms [24, 25]. On the basis of these considerations and with the aim of comparing a creative act to a problem solving task through the collection of EEG rhythms, we set up our experiment as follows:
- a figurative artist was asked to create a drawing based on some inspirational images previously seen. Several images (abstract or not) were first seen by the subject who chose the one with which he expressed more confidence in order to be able to draw, inspired by it.
- Another individual was asked to solve a Rubik's cube after watching the presentation of a possible solution. The subject is a passionate of the Rubrik cube and, before the registration,

he has been invited to train in solving the puzzle, becoming able to solve it in an average of two minutes.
- During the experiment, the two individuals, separately, were placed in a comfortable and known environment, isolated from outside noise and distractions;
- EEG rhythms have been detected and recorded by the Emotiv Epoch EEG_based BCI device (bluetooth, 16 wet sensors positioned on the scalp of the individuals participating in the experiment).

The drawing experiment and the related collection of EEG data has been performed as follows:
1) 20 seconds registration of EEG data in absence of any stimulus or task;
2) 20 seconds registration of EEG data during the watching phase of the inspirational images;
3) 4 minutes registration of EEG data during the free drawing session, while the chosen image were watched by the artist;
4) about 4 minutes of registration of EEG data during the execution of a known drawing (copying an image).

The phase 4 was designed with the aim of having a baseline to differentiate a creative process by the execution of a phase implying similar gestures. Phases 1 and 2 have been repeated 10 times, alternatively and in sequence. The registration from phases 3 have been used to calculate the average of the signal during the creative drawing session.
We also calculated the average of the signal collected during the phase 4.

The problem solving task (Rubick's cube) and collection of EEG data has been performed as follows:
1) 20 seconds registration of EEG data in absence of any stimulus or task;
2) 20 seconds registration of EEG data during the observation phase (the subject has been asked to observe the cube and think of a possible solution strategy);
3) 4 minutes registration of EEG data during the solving session;
4) About 3 minutes of registration of EEG data during the execution of movements not finalized to solving the cube (just cube manipulation gestures).

Also in this case we adopted the same settings of the drawing experiment.
On collected data, we performed an ANOVA test on the electrical signal and on the different brain rhythms.
Considering that in literature, changes in the EEG revealing a creative process are reported in terms of power [26] and of activation of the entire range of cerebral and particularly in alpha rhythms [27, 28, 29], we focused our analysis on these two collected signals.

RESULTS AND DISCUSSION

In our analysis we were looking for individuating which tasks resulted different (deriving from different distribution) and which could be seen as derivative by a same distribution, considering the similarity (in distribution) at a change of the tasks. The comparison has been performed using average data, either for the global electrical signal and for the single brain rhythms.

The analysis partially confirms the expected results. We can state, indeed, that in the phases in which an individual think in a creative way, his/her EEG signals show a downgrade of the alpha rhythm and, in general an increment of the total brain activity.

The ANOVA test revealed that the phase 1 and 2 in both the experiments (during which, we could state, respectively the creative or the solving ideas born) are statistically significant, and the

result is confirmed also by the covariance analysis on the average of the general electric signal which results are shown in the following table 1 and figure 1.

Phase	Drawing experiment	Problem solving experiment
1	0,322466	0,319241836
2	0,401487	0,396474462
3	0,56236	0,61414
4	0,513128	0,767198369

Table 1: covariance analysis on the average EEG total signal collected in the two experiments.
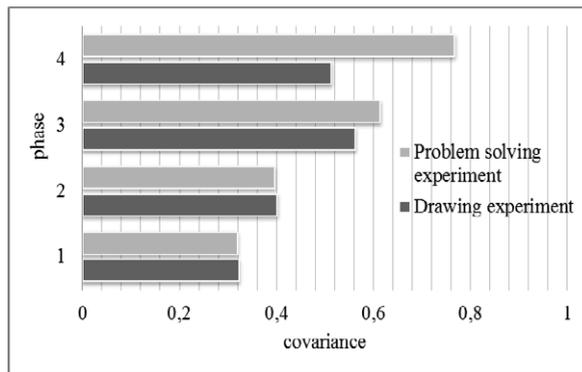

Figure 2: covariance analysis on the average EEG total signal collected in the two experiments.

We wish to recall that 1 and 2 are the phases in which the individuals participating in the two respective experiments were elaborating and forming the insight for the following execution, so, on the basis of the obtained results, we can hypothesize that, effectively, creativity presents similar brain mechanisms of problem solving tasks.

CONCLUSIONS

The aim of our study was to compare quantitative variations of the cerebral rhythms in different mental settings to test the hypothesis that problem solving cognitive and creativity share a similar cortical activation pattern. In fact, a creative act, such as drawing, recruites a number of cognitive processes that are equally involved in higher cognitive process. This is a not trivial consideration, implying that when an individual is involved in a ludic activity may also activate processes involved in intellectual activities, such as solving a problem or develop a complicated reasoning. However, ludic activities activate the brain in wider way and this activation is also sustained, but intrinsic motivational drivers also have, potentially, a positive impact on the emotional state. We argue that ludic and creative activities may then sustain higher functions, implicitly also training cognitive processes not directly involved. Thus, integrating creative and systematic mind pathways might contribute to the achievement of an empowered cognition.

The obtained results confirm, in general, that a creative task reveals brain responses similar to those observed during a problem solving task.

Anyway, we must consider these results as preliminary and indicative, because of the difficulties in separating pure creative moments from the others in each task and because we need to confirm our findings through a more extensive experiment on more individuals.

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The use of an electromagnetic real-time navigation system for distal locking of the intramedullary humeral nail

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Abstract

Intramedullary nailing (IMN) represents the most used techniques for treating humeral and long bones fractures. The main advantage of its use is related to the possibility to obtain an indirect reduction, preservation of fracture haematoma and soft tissue. During surgery, to obtain a rigid fixation the nail has to be locked proximaly and distally with screws. In the last two decades nail design has significant improved. However, the most demanding part of their implementation remains distal locking. In fact, the positioning of the distal locking screws remains a procedure that increase the overall surgical times and exposes surgeons and patients to high doses of ionizing rays. In fact, distal locking of IMNs accounts for the greatest proportion of the total radiation time in IMN procedures, reaching even 50%. Recently it was introduced a new distal targeting device (SURESHOT, Smith & Nephew) that was developed to help surgeon for an accurate targeting of the distal holes. The SURESHOT is radiation-free system that use electromagnetic tracking data to localise distal locking holes, providing a three-dimensional real-time feedback of location and orientation of the drill relative to the nail interlocking hole. It consists of three main parts:1) a computerized control unit, located within the display screen; 2) a shaped freehand pointer that produces a concentrated electromagnetic field; 3) a sensor probe that is inserted in the nail and transmits the position information to the control unit. During surgery, the computer-based calibrated software provides perfect circle targeting of the distal interlocking hole. Correct drill position (direction and angle) and screw placement are assured through a continuous visual real-time feedback.

From July 2012 to September 2016, 76 patients with a humeral fracture were treated with nailing using the SURESHOT targeting device. Correct placement of the distal screws were obtained without the use of fluoroscopy in all patient, reducing the overall surgical time of approximately 20 min for each surgery.

RE-CONVERGING SCIENTIFIC, CULTURAL AND ART PRACTICES AT THE ART&SCIENCE INSTITUTE OF ITMO UNIVERSITY

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ABSTRACT

Introduction. Among many others, we are witnessing two major contradictions in societal and individual development: a) contradiction between technological and human development; b) contradictions between immense amounts of information and human cognition. The Art&Science Institute's strategy is built around both creating innovative technologies for art and culture and using art to understand human developmental problems and find technological solutions for them.

Contents.

1.   Mission, objectives of the Institute and it's philosophy and ideology

2.   Model of the Institute and it's role in creating Art&Science clusters

3.   Two main cross-disciplinary divisions of the Institute: "Art – IT – Science" and "Art – Photonics – Science"

4.   Main technologies sectors of the Institute

5.   Key enabling technologies, disruptive models and "one step ahead" vision as the three main criteria for selection of major projects

6.   Commercialization aspects

7.   Main projects selected for 2017- 2020

8.   Educational principles: holistic approach to thinking, multi-disciplinarity, open platform, continuous talent and personal development,

9.   Current status and international cooperation

NEW TECHNICAL DEVELOPMENTS & APPLICATIONS

Open Fiber: The Italian Strategy for Broadband and Ultra Broadband

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On 3 March 2015, the Italian Government approved, in line with the European Agenda 2020, the Italian strategy for ultra-broadband with which it intends to cover by 2020:

- 85% of the population with infrastructure capable of providing services at a line speed above 100 Mbps
- 100% of the citizens access to the Internet at least with 30 Mbps.

A study commissioned by the Ministry of Economic Development has divided the Italian territory in four sets called "cluster". The Italian municipalities are classified in clusters according to their characteristics (presence of infrastructure, population density, presence of companies), in order to identify the type and cost of public intervention to bring the ultra-wideband. Four types of clusters (A, B, C, D), have been identified with similar characteristics but with increasing costs and complexity in terms of infrastructure. The infrastructure has to provide connectivity with at least 100 Mbps on clusters A and B, and at least 30 Mbps in the cluster C and D. The rules of technological neutrality (FTTH, FTTC, FWA) has to be followed.

Clusters A and B, are areas where live about 60% of the Italian population (15% in cluster A, 45% in cluster B).

These areas are defined as the best in terms of cost benefit for direct private investment. In these areas are already present telco infrastructure that can allow fast connections (albeit with limited capabilities).Here it is possible the quantum leap required by EU legislation bringing the connection speed from 30 to at least 100 Mbps connection by 2020.

Clusters C and D, by definition considered "areas of market failure", are instead relate predominantly rural areas where only a low speed Internet connectivity is possible. In these areas are required big investments and the infrastructure deployment is more expensive. The State support is necessary for telco broadband infrastructure construction

The creation of Open Fiber is a strategic choice that meets the objectives of the Digital European and Italian Strategy for ultra-broadband. It guarantees competitive costs and short execution times and allows Italy in recovering the delay in digitization with other European countries. The company is building a Fiber to the Home (FTTH) network architecture that can guarantee extremely high transmission speeds. This network is designed in order to allow the creation of an operator "wholesale only", i.e. an entity which sells, infrastructure and services offered through its network, to operators who have signed an agreement for access to passive and active services defined in the portfolio of Open Fiber.

The network construction plans for the ultra-wideband network , will involve more than 250 cities present in cluster A and B in which the company will invests directly. Added to this are the areas C and D that will be allocated by tender, organized by the State, in which is participating Open Fiber. In these tenders affecting areas of the country where private investment alone would not be able to bear the costs for infrastructure construction, public funding is expected.

To date, the network already covers the cities of Milan, Turin, Bologna of additional 9 cities - Bari, Cagliari, Catania, Florence, Genoa, Naples, Padua, Palermo and Venice. During this year will be started construction activities in other 40 cities and following to launch the network construction in the remaining 200 cities.

Figure 1: Cluster A and B

1.1 The optical access network

The optical fiber access network is at low cost due to the reuse of existing infrastructure of Networks available in the area, (electrical infrastructure, public lighting, of TLC etc.). The network has been designed to create a business model based on an open architecture "Open Network Model". The physical network access is realized by POP (Point Of Presence) that collect from 60- 80k HH (House Holders). In the POP are terminated a series of ring cables which represent the primary access network or cable area. Each cable area is organized in order to accomplish two access network architectures:

- A Passive Optical Network (PON) in which N users share one single fiber
- A Point to Point network in which each user has assigned a dedicated fiber

The architecture of the PON network is based on a splitting factor N = 64 Users . This sharing is made by using a PON trees structure based on two splitting levels: First splitting ratio 1: 4 and a second splitting ratio of 1:16, as shown in figure 2
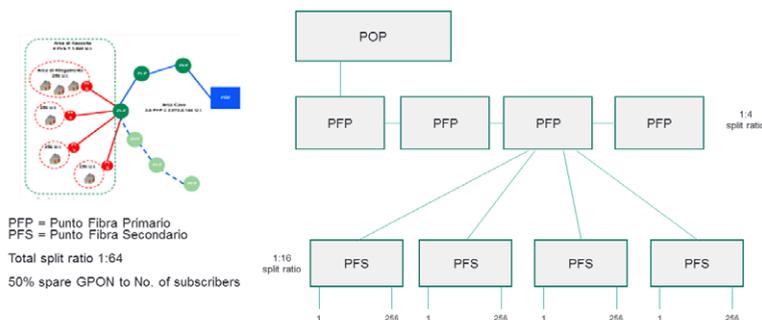
Figure 2: Open Fiber PON architecture

The first splitter (1: 4) is placed in the PFP. From each PFP depart four cables that cover an area of buildings that defines the collection area of HH associated with each PFP. This area is divided in 4 subareas of access that are defined by the number of possible connected users. This number was set equal to 256 HH. In each subarea is located a Box (PFS), that can accommodate the splitters assigned to operators who have requested access to the network, allowing easy management of various operational situations, while ensuring the maximum opening of the network to the Operators

Figure 3: The PFS Box

Thanks to the establishment of P2P connections from the PFS up to the customer premises, to connect a user to its operator is only necessary connect the user's fiber to the splitter assigned to the user's operator located in the PFS.

In the case the user would like to migrate from one operator to another, it will be enough to operate in the PFS disconnecting the user from the splitter, assigned to the old operator, and connecting the user to the splitter assigned to the new operator. To allow the customers growth of customers and their migration, will be added new splitters assigned to the various operators. the customers will be connected to the splitters assigned or will be moved from one splitter to another.

The Point to Point network is built using the connection cables between PFP and PFS where an appropriate amount of fibers are left available for connecting one customer with a dedicated fiber.

1.2 Dark Fiber Monitoring

To improve service levels provided, Open Fiber is installing, in each access POP, a centralized automated monitoring system, controlled by Service Operation Center (SOC). In this way the optical fibers in the access network are remotely governed for the testing and maintenance. This system is referred to as OTDR (Optical Time Domain Reflectometer). The introduction of this system allows to:

- Check, in a timely and systematic way, the fiber network both in the acceptance, in maintenance and operation phases ;

- Prevent critical situations which might lead to cable break or signal degradation, limiting or eliminating service disruptions;

- Identify in case of failure, with a high degree of resolution, the breakdown point, reducing the intervention time in field.
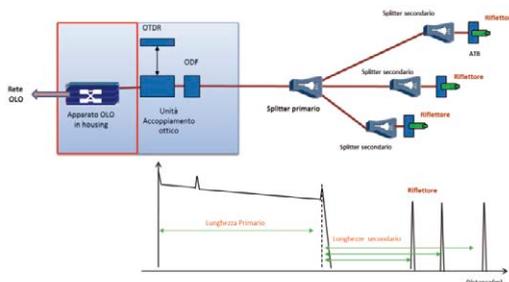
Figure 4: The monitoring system

The network and services management systems should provide the highest degree of automation both for the management of the infrastructure and the interfaces to the service providers. With regard to the interfaces to the SP, these systems allow you to:

- Activate and manage customers with the appropriate service levels;

- Monitor the performance level of the services delivered ;

- Invoking the service requests and trouble tickets at the Open Fiber attention

1.1. Passive and Active services

There are two types of service that OF is able to provide:

• Passive Services;

• Active services.

The first type is based on the rental of the access fiber connecting the customer to the POP of Open Fiber. The fiber can be used with or without constraints in the usage of the fiber optical spectrum. The Operator will provide its services to the customers through the equipment hosted in the PoP and interconnected with its network

The second type of service is based on the creation of an active optical transmission network where Open Fiber can provide, on wholesale model, L2 and L3 connectivity services to the Service Providers that are interested. The commercial offer takes place, on a non-discriminatory basis, with technical procedures clear and public. The customer's management remains in hands of the Service Provider that will use OF as a Network Provider.

All services provided by this network are defined as the Active Services of Open Fiber. There are no constraints to the migration from a service provider to another for both Passive and active services. The services provided by the PON network are mainly residential and business connectivity services with symmetric and asymmetric configurations. Depending on the evolution of the use of PON technology, it will be possible to deliver services today offered by point-to-point infrastructures(i.e. backhaul, front hauling and dedicated links).

The realization of these services will depend on technological developments and cost of operating the access platform of PON network. For the PON network, the technologies that are considered are those that refer to network technologies already established or in the process of consolidation.
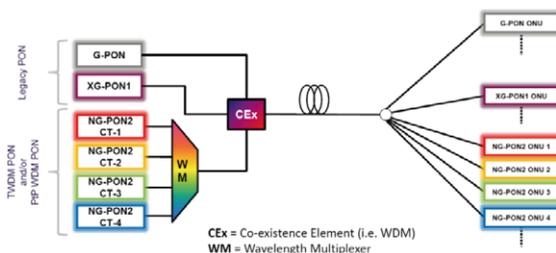
Figure 5: Systems Co-existence

On the same PON network can coexist most technological systems as illustrated in Figure 4.

- • ITU G.984.x for the GPON (2.5 Gb / s-1,25Gb / s);

- • ITU G.987.x for the asymmetric XG-PON technology (10 Gb / s-2.5GB / s);

- • ITU G.XGS-PON, the new standard for network-PON technologies with symmetric speeds to 10Gb/s;

- • ITU G 989x to the NG-PON2 technology (4 lambda> 8 Lambda, 10Gb/s symmetric x lambda);

The first two active services that will be offered are the VULA (Virtual Unbundled Local Access) and the Bitstream. VULA allows the Operator to connect to the OF access platform that collects traffic generated by the customers of the operator connected to the Open Fiber network. With the Bitstream, in addition to VULA, is possible to carry the collected traffic towards an a delivery point of the operator anywhere in the country. Leveraging this link a provider may offer broadband services to their end customers wherever the Network of Open Fiber is present. The Point to Point network will be used to provide Carrier Ethernet services at very high speeds that are often linked to WDM services.

This part of the network allows to prepare dedicated networks for the connection of nodes/sites with strong band demand. The connectivity services offered will provide large symmetric band capacity, required for important customers, and when are required links with an high reliability. Active services require, in addition to access networks, an optical transmission infrastructure allowing the operators to interconnect with their customers wherever the optical access network extends.

For this reason Open Fiber is building a national transport network that will connects more than 300 access POP in 250 cities . These pop are grouped into 14 regional clusters. Each regional cluster allows to collect the POPs of a limited geographical area (one or more regions), using ring topologies, towards a regional POP. The 14 regional POPs are connected in meshed configuration.

Figure 6: The Open Fiber network Architecture and the National Backbone

Figure 6 represents the overall Open Fiber network architecture and the extension of the national transport network.

Framework of 360-Degree 3D Video

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Abstract – Ray capture and view generation are analyzed for 360-Degree 3D video. A group of rays through one point in real space form a sinusoidal wave in spherical ray-space. This ray capture is denoted by "capture by point". It is extended to "capture by circle" for circular camera arrangement. Ray-space captured by circle forms a sinusoidal wave with width equal to the diameter of the circle. Ray-space data of such a sinusoidal band are obtained by setting divergent cameras densely on a circle. Then, 360 3D video with motion parallax can be generated by moving virtual camera position within the circle.

1 INTRODUCTION

FTV (Free-viewpoint Television) [1]-[7] is visual media that transmits all ray information of a 3D space and enables immersive 3D viewing as if we were there. FTV was developed based on ray-space representation [8]-[11].

MPEG has been developing FTV standards since 2001 [12]. The first phase of FTV was MVC (Multi-view Video Coding) [13] and the second phase of FTV was 3DV (3D Video) for multiview display application [14]. The current third phase of FTV targets SMV (Super-Multiview), FN (Free Navigation) and 360-degree 3D (360 3D) applications to revolutionize 3D viewing [15][16].

In the conventional 360-degree 3D video [17], views are captured by divergent cameras with circular configuration and stitched to generate 360-degree video. However, view information at different viewpoints is lost by stitching. This information is needed to realize motion parallax. In this paper, ray capture and view generation of divergent camera configuration are analyzed in the ray-space for 360-degree 3D with motion parallax [18].

2 RAY-SPACE REPRESENTATION

2.1 Orthogonal Ray-Space and Spherical Ray-Space

In the ray-space representation, one ray in real space is expressed by one point in parameter space. This parameter space is "ray-space". However, this 5D ray-space with parameters $(x, y, z, \theta, \varphi)$ is very redundant because all rays on a line along which the ray proceeds have the same magnitude. A reference plane is introduced to reduce this redundancy. All rays on a line are represented by one ray crossing the reference plane.

This 4D ray-space with parameters (x, y, θ, φ) is orthogonal ray-space. Though orthogonal ray-space is simple, it cannot represent rays parallel to the reference plane. Spherical ray-space is defined to represent rays of all directions.

Fig. 1 shows the definition of the orthogonal ray-space. As shown in Fig. 1, one ray in real space is expressed by intersection (x, y) and direction (θ, φ) on the reference plane. This ray is expressed by one point in the (x, y, θ, φ) 4D ray-space. Each point in the ray-space has an intensity f of the ray. Therefore, f is expressed as $f(x, y, \theta, \varphi)$. If we neglect vertical parallax, the ray-space becomes (x, y, θ) 3D ray-space.
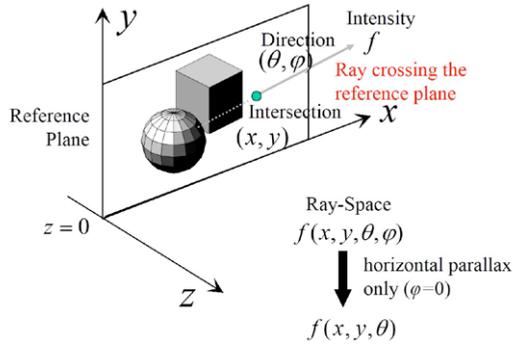
Fig. 1 Definition of orthogonal ray-space.

Fig. 2 shows an example of orthogonal ray-space $f(x,y,\theta)$ and its horizontal cross-section. The horizontal cross-section of orthogonal ray-space has line structures.
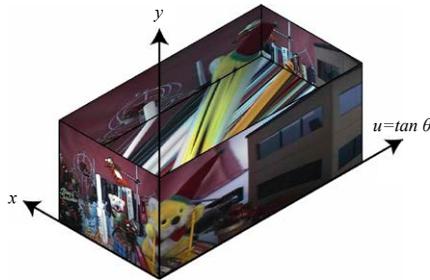

Fig. 2 Orthogonal ray-space and horizontal cross-section.

Fig. 3 shows the definition of the spherical ray-space. It has many reference planes each of which has different direction. One reference plane collects only rays normal to the reference plane. Therefore, one ray in real space is expressed by direction (θ,φ) and position (ξ,η) on the reference plane. This ray is expressed by one point in the $(\xi,\eta,\theta,\varphi)$ 4D ray-space. Each point in the ray-space has an intensity f of the ray. f is expressed as $f(\xi,\eta,\theta,\varphi)$. If we neglect vertical parallax, the ray-space becomes (ξ,η,θ) 3D ray-space.
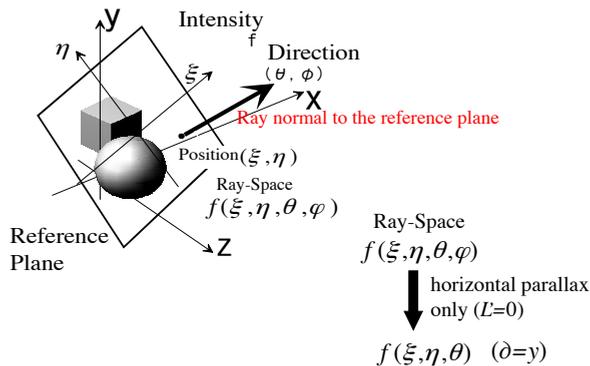
Fig. 3 Definition of spherical ray-space.

Fig. 4 shows an example of horizontal cross-section of spherical ray-space $f(\xi,\eta,\theta)$ for a fixed value of η. The horizontal cross-section of spherical ray-space has sinusoidal structures.
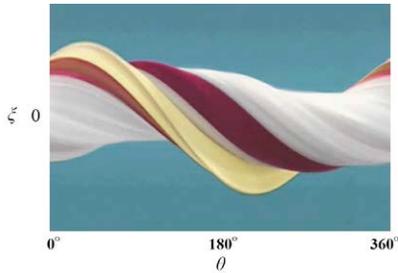

Fig. 4 Horizontal cross-section of spherical ray-space.

2.2 Concept of a Group of Rays through One Point

Fig. 5 shows concept of "a group of rays through one point". This concept is used in ray capture, view generation and ray interpolation.
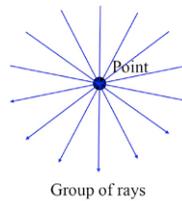

Fig. 5 Concept of "a group of rays through one point".

Fig. 6 shows relation between "a group of rays through one point" in real space and corresponding points in the orthogonal ray-space. As seen in this figure, the corresponding points form a line in the orthogonal ray-space. A plane is obtained by stacking the line vertically for different values of y.
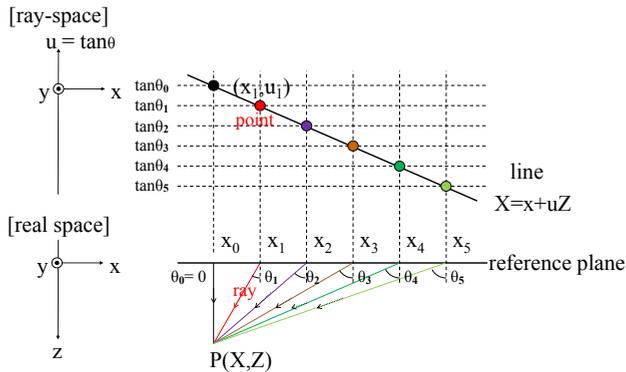

Fig. 6 "A group of rays through one point" in real space and corresponding points in orthogonal ray-space.

Fig. 7 shows relation between "a group of rays through one point" in real space and corresponding points in the spherical ray-space. As seen in this figure, the corresponding points form a sinusoidal wave in the spherical ray-space. The upward-sloping section of this sinusoidal wave corresponds to rays of the divergent view and the downward-sloping section corresponds to the rays of the convergent views. A sinusoidal plane is obtained by stacking the sinusoidal wave vertically for different values of y.
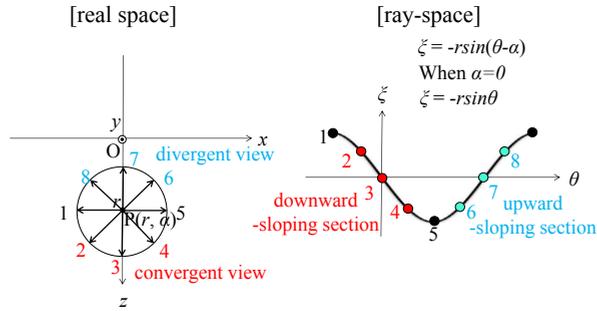

Fig. 7　"A group of rays through one point" in real space and corresponding points in spherical ray-space.

These planes are used for view generation. If we cut the ray-space with these planes, we can collect rays passing through one point and get view image at that viewpoint. Fig. 8 and 9 show view generation in orthogonal ray-space and spherical ray-space, respectively.
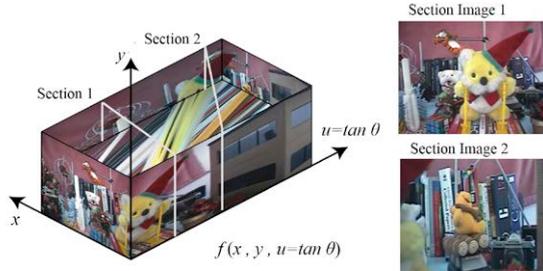

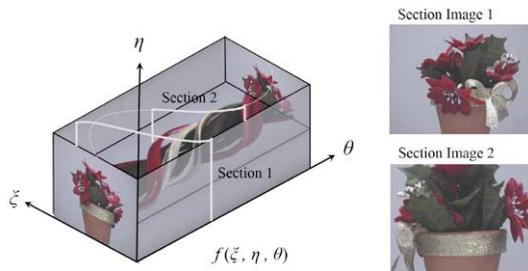Fig. 8 View generation in orthogonal ray-space.

Fig. 9 View generation in spherical ray-space.

3   SPHERICAL   RAY-SPACE   BY   CIRCULAR   CAMERA   ARRANGEMENT

3.1   Extension of "Capture by Point" to "Capture by Circle"

Let set an omnidirectional camera at a position P(r, α). When this camera collect a ray with direction θ, ξ is given by $\xi = -r\sin(\theta-\alpha)$ as shown in Fig. 10. This forms a sinusoidal wave for various values of θ. Therefore, a point captures sinusoidal data of the ray-space as described before. It is denoted by "capture by point".

If we set 8 cameras on a circle, phase-shifted sinusoidal data are captured as shown in Fig. 11. Therefore, all rays in a region of $-\pi \leq \theta \leq \pi$ and $-r \leq \xi \leq r$ are captured by dense circular camera arrangement as shown in Fig. 12. It is denoted by "capture by circle".
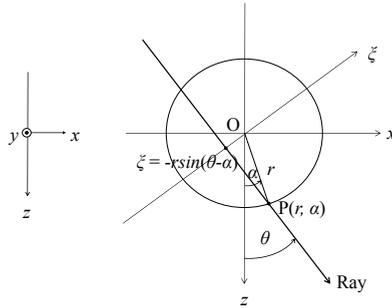

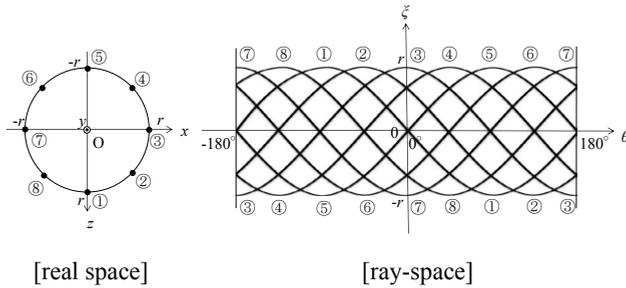Fig. 10 Spherical ray-space expression of a ray.

[real space]   [ray-space]

Fig. 11 Circular arrangement of 8 cameras and captured ray-space.

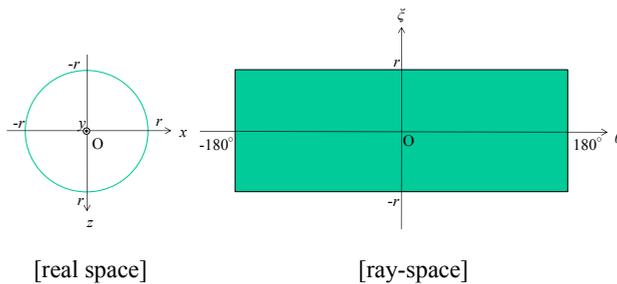[real space]   [ray-space]

Fig. 12 Dense circular camera arrangement and captured ray-space.

Here, "capture by point" and "capture by circle" are compared. Fig. 13 (a) shows "capture by point", where a point captures rays crossing the point. Fig. 13 (b) shows "capture by circle", where a circle captures rays crossing the circle.

Fig. 14 shows two examples of "capture by point" and Fig. 15 shows two examples of "capture by circle" with radius r_0. The center of the circle in Fig. 15 is set at the same position of the point in Fig. 14. As seen from these figures, the fundamental shapes of captured ray-space are the same for both point and circle cases. The difference is width. Ray-space captured by circle has width $2r_0$.

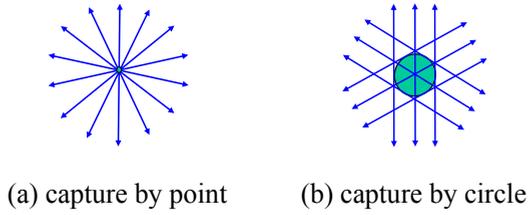(a) capture by point   (b) capture by circle
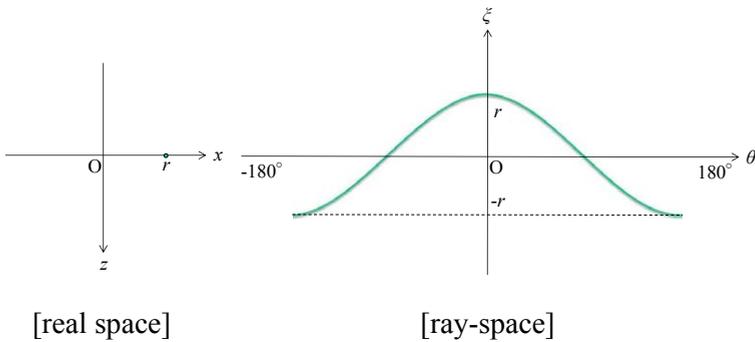
Fig. 13 Ray capture by point and circle.

[real space]   [ray-space]

Fig. 14 Example of "capture by point".
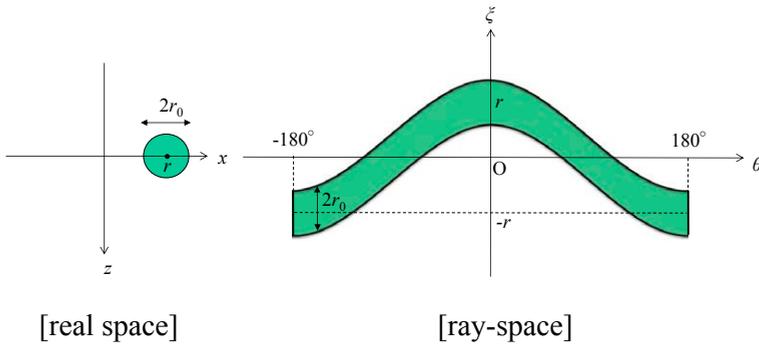

[real space]   [ray-space]

Fig. 15 Example of "capture by circle".

3.2 View Generation in Circular Camera Arrangement

Views are synthesized by collecting ray-space data by sinusoidal wave. If the viewpoint P is set inside the camera circle as shown in Fig. 16, all parts of sinusoidal wave are inside the captured ray-space. Therefore, views can be generated at any viewpoint inside the camera circle.

Views can also be generated outside the camera circle. However, FoV of generated views is limited because the amplitude of the sinusoidal wave is large and some parts of the sinusoidal wave are outside of captured ray-space as shown in Fig. 17.
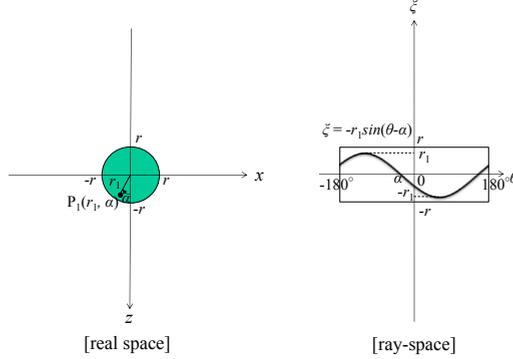

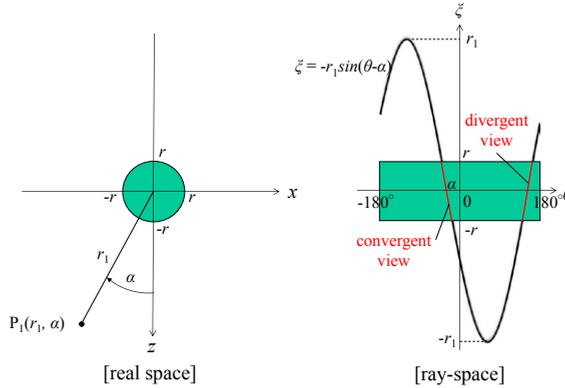Fig. 16 View synthesis inside camera circle.

Fig. 17 View synthesis outside camera circle.

4 CONCLUSION

Ray capture and view generation by circular camera arrangement are analyzed in the ray-space. A concept of "a group of rays" is used for ray capture and view generation. A group of rays through one point from all directions in real space form a sinusoidal wave in the spherical ray-space. The downward-sloping section of the sinusoidal wave corresponds to rays of the convergent view and the upward-sloping section corresponds to the rays of the divergent view.

As for ray capture, "capture by point" is extended to "capture by circle". The fundamental shapes of captured ray-space are the same in both cases. The difference is width. Ray-space captured by circle has width equal to the diameter of the circle. Ray-space data of sinusoidal band are obtained by setting divergent cameras densely on a circle. 360 3D video with motion parallax can be generated by moving virtual camera position within the circle.

ACKNOWLEDGEMENTS

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FACE TO FACE WITH HEAD VASES

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ABSTRACT

In this contribution we focus on Attic productions of pouring vases (oinochoai) of late archaic and early classical times which bodies are shaped as a human head, mostly female heads. We owe their classification to the fundamental paper of Sir John Beazley [1], written in 1929. Since then numerous vessels have been published, but Beazley's groups are still relevant. Beazley categorized the vases in the form of human heads in twenty groups (Group A-W) and a miscellaneous list, according to the depicted figure and the stylistic development of the face, based on an art historic methodology. This method grounds on a comprehensive knowledge of stylistic development and was criticized in the recent decades because of its subjectivity and lack of transparency. We focus on Beazley's groups N and Q. The biggest group of all, the Cook Class (group N), has more than 225 known vases worldwide with various human heads in which women's head are commonest. The small group of the Vienna Class (group Q) holds approximately 14 samples, so far all of them are female heads. The vast majority of the Attic pottery is thrown by the spinning wheel. Concerning the head vases the potters used the same technique only for the upper part of the vessel whereas the head of the head vase was made by two moulds, one for the face and a second for the rear; finally some facial details, like eyes and eyebrows, are painted by hand. The process of production interconnects head vases and terracotta figurines. 3D scan models of several vases were selected for comparison. Data was available in PLY and OBJ format and was imported in OptoCat 3D scanning and analysis software [2]. Placing models next to each other allows for a quick comparison of the 3D data. Please note that only 3D models were used for the geometric comparison and that no texture data was used. We are convinced that Beazley's groups are principally correct. Nevertheless, recent computer technology and visualisation systems can help to further refining and consolidating the original groups, in respect to chronology and production process. Conventional archaeological methods are inappropriate for these three dimensional comparisons. Digitization of several head vases with fringe projection systems in Kunsthistorisches Museum Wien, Staatliche Antikensammlung München, Antikensammlung Berlin allowed for digital comparison of vases. Calculating the difference of the resulting 3D models after co-registration revealed very little differences between the head areas of several vases. Differences are so small that it is likely that the same mold was used for several preserved head vases. Scaling the digital models by 10-15% in order to simulate the volume loss during production of a head vase, i.e. due to drying and oven burning, allowed comparison of smaller to larger head vases. Comparing results, it is not unlikely that molds were taken as negatives from oven burned head vases to produce a generation of smaller head vases.

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3D printing and copyright protection

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 ABSTRACT

When objects are copied without permission, there is a distinct possibility of infringing third party rights.

Although many patents are for sophisticated objects, there are some simple patented products that are capable of being produced by a 3D printing process. For instance, simple items where the invention is the combination of several features, could be manufactured by 3D printing. 3D printing can produce complex items with moving parts which could have patent protection for instance certain medical devices. In addition, small parts could be 3D printed and then assembled to form a patented product or used to replace broken parts from a larger patented product.

Unauthorised commercial production of products by 3D printing may constitute an act of legality infringement by the user of the printer.

Whilst it seems clear that the manufacture of a whole patented product, for instance the plastic laboratory equipment described above, will constitute patent infringement, the position regarding the manufacture spare parts and their incorporation into patented products, regardless of whether they were produced by 3D printing or by traditional manufacturing methods, is not as clear-cut.

Copyright gives a bundle of rights to the rights owner (usually the creator or the creator's employer) to prevent other people from copying, using or exploiting their works (works which involved intellectual creation).

In response to the growing emergence of 3D file sharing and the intellectual property risks therein, the research community are developing methods to protect digital data from being mistreated. These include for example, mechanisms such as Technological Protection Measures and encryption software. This describes a range of access control technologies used by those (manufacturers, publishers, rights holders) who wish to protect an asset through limiting the use of the information or digital device. This protects rights holders from having their intellectual property or digital assets copied or converted without permission and is typically applied to music and films. These

technologies have to be developed however in conjunction with all printer manufacturers under a mandate that ensures all printers have the correct decryption protocols and software to stream legitimate 3D files. It also allows for enforceable liability warranties to be created, giving consumers the confidence that content of high quality or providence can be 3D printed.

GENERATIVE GENERATION DESIGN

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ABSTRACT

Today it is increasingly essential to fully understand the potential of the software, now able to let us hire more awareness in the control of the project, but especially in the potential of new forms of development.

Evolved codes and programming languages are already available and, as well as giving many ideational possibilities, place their flexibility as a selection criterion for new challenges. The personalization of the machining processes and their acceleration of the calculation allow new exploration frontiers and new responsibilities for action.

In reference to these new operating horizons the "Laboratory Models for Design" at the University of Florence, pertaining to the department Dida, is introducing, between experimentation for 3D digital modeling, the generative modeling as exploration's field between the cognitive shape and form processed by the calculation.

If we look at modeling such an object represented in space, to fully understand and design it, we must always consider the object's logical articulation and deal with geometrical and mathematical problems. This technique needs application capable of simulating the geometry and control their properties to create algorithmic projects. To work with complex objects, the design process starts from a first level to which are added new layers to create more detailed and specific hierarchies. From some years the Models for Design Laboratory of Design Campus of Calenzano is dedicated to these new frontiers of digital plasticity. It is a scientific and educational laboratory that provides the opportunity to acquire the skills necessary to create three-dimensional models to verify the real volumes and proportions of objects, studying their inclusion in real space, giving substance to the presentation of the project, assisting students, teachers and researchers in their activities.

It's a very important place for the students in which they can test materials, proportions and practicality of the project which are designing, but at the same time it is a place to meet and exchange ideas for the students and teachers so they can broaden their knowledge and have the satisfaction of seeing the true made product they have designed.

The laboratory makes use of equipment such as 3D printers FDM to PLA and ABS - Gimax3D, 3D printers SLA Stereolithography - FormLabs, CO2 laser cutting, electrical tunnel for polystyrene, specialized work equipment of manual modeling and numerical control.

The Models Design Laboratory it's affecting to new materials that are placed on the market for these printers, which are becoming increasingly sophisticated, such as those that simulate the architecture materials such as marble, concrete, brick etc.

The fortune of these machines, as is well known, is to give the possibility to create very complex shapes thanks to the additive method, or proceeding to the sum of thin layers of material.

MUSEUMS - VIRTUAL GALLERIES AND RELATED INITIATIVES

Portable computer vision for new "intelligent" audio guides

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This paper discusses the role of computer vision to bridge the experiential gap between the cultural and emotional experience of the Visitors in museums or cultural heritage sites. We believe that this technology can be deployed already in real contexts and support concrete applications with interesting results that will open the door to valuable future applications. Among them, we present a smart audio guide based on computer vision that adapts to the actions and interests of museum Visitors, while perceiving the context and interacting with Visitors in an appropriate fashion. The system is capable to work in real-time on a mobile device and uses Convolutional Neural Network (CNN) technology to perform object classification and localization. The system has been deployed on NVIDIA Shield Tablet K1, and tested in a real world environment.

"Uffizi Touch® for Apple TV"

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A specific version of Uffizi Touch® has been designed and developed by Centrica.

For the very first time Uffizi Gallery masterpieces in your livingroom! You can explore details of worksof art at the highest resolution, choose a virtual painting or view a slideshow of your favourite artworks.

The Uffizi Touch® for Apple Tv has been conceived thinking of the usage at home, for example in the living room.

Masterpeices like "Primavera" by Botticelli, "Annunciation" by Leonardo da Vinci, "Battaglia di San Romano" by Paolo Uccello, "Venus" by Tiziano, "Lucrezia Panciatichi", by Bronzino, become part of the home experience.

The layout of the application has been designed following tvOS guidelines as well as, whenever possible, SDK templates (see https://developer.apple.com/tvos/human-interface-guidelines/visual-design)

With the remote controller it is possible to choose between the following choices:

1. Works of art
In this screen view it is possible to browse the works of art catalogue, choosing through a grid of preview thumbnails, provided with title and author of the work of art.
First thumbnails are the ones owned, the other ones, highlighted in a different manner, are the ones that can be bought. If chosen an in app purchase screen view is opened.
The owned works of art can be explored at high resolution, using the remote controller for zoom&pan actions.
The touchpad can be used for swipe up/down, left/right. To obtain works of art info (description, title, author, datation, dimensions) is sufficient a tap on the touchpad.

2.Virtual Gallery
In this screen is possible to compose a slideshow using the owned works of art. Once the selection is ended you can start the slideshow.

3. Video
Here the user can find a set of brief video animations.

4. Preferences
In this screen the user can set various options: the music to be played as soundtrack, visual effects and more.

Uffizi Touch® for Apple Tv is based on Centrica Platform.

INTERACTIVE DIGITAL MUSEUM BY USING SCIENTIFIC ANALYTICAL DATA OF PAINTINGS

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Abstract - We have developed a multi-layer display system that allows users to compare large digital image files in parallel, wipe, and superposition functions. Users can register images simply by drag and drop, and the software adopts various types of hardware.

INTRODUCTION

High resolution digital images of paintings have been recognised as a useful tool, not only for digital museum exhibition to public, but also examination of painting by conservators, historians and heritage scientists.   Hitachi Ltd. developed a method of automatic divisional image acquisition system, and image processing system that adjusts colour and composition.   The high definition digital imaging data has been displayed by using a dedicated touch screen display system that allows users to zoom smoothly even if an image exceed more than 1 billion pixels. "Uffizi Virtual Museum" exhibitions have been held in Japan and some overseas countries, and gained public favour, by using these digital technologies.

INTERACTIVE MULTI-LAYER DISPLAY SYSTEM

NICT used the zooming software technique, which was developed for digital museum, to display large scientific data, such as land observation images by using electromagnetic wave as well as infrared images of paintings. However, it was difficult to compare related images, such as visible and infrared images of the same object, at the same zoom ratio at the same time.   Thus we developed a user-friendly, and multi-layer display system. Users can register images simply by drag and drop, without special programming skills, and the software adopts various types of hardware. Figure 1 shows an example of visible and infrared images of a Japanese wall painting in ca 700 CE.

Fig. 1 Comparison of visible and infrared images by using wipe function.

ACKNOWLEDGEMENTS

We thank all efforts of members of Digital Imaging System Project of Hitachi Ltd. We hope the technology will be inherited by museums.

KNOWLEDGE, PROMOTION, DIVULGATION: EXPERIMENTS ON THE VIRTUAL RECONSTRUCTIONS OF THE GEONESE ATHENEUM'S PALACES

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Abstract - The genoese Atheneum possesses a vast and important patrimony to manage, safeguard and preserve. In recent years its activity has been focused on both scientific research and divulging and presenting this heritage to the general public. In the historical and artistic context there already have been studies and experimentations on reconstructing the rich collections of the paintings that were once in the University's palaces.

Through virtual 3D reconstruction techniques pictorial and sculptural artefacts, now lost or outplaced in other museums, have been put back in their original sites. This experiment, which in the future will be further expanded, will allow the public to understand the unity and complexity of the ambient's decorations and focus on the presence of important artefacts (eg: Tiziano, Caravaggio, Van Dyck) and frescos through the use of state-of-the-art technology.

INTRODUCTION

The Atheneum possesses a vast and important patrimony to manage, safeguard and preserve. In recent years its activity has been focused on both scientific research and divulging and presenting this heritage to the general public through the *Rolli Days*, an event in which both Genoa and its University collaborate to promote the "Sistema delle Strade Nuove e dei Palazzi" acknowledged by UNESCO as World Heritage in 2006.

The ten-year-long research of the DIRAAS and DITEN departments on the promotion and study of Cultural Assets, which also finds in opening the sites and palaces to the public a moment of stimulating confrontation, divulgation and examination of the academic investigations, is very useful in this regard.

The innovation of this kind of research consists in keeping a tight bond between the scientific aspect with the divulgative one, always keeping in mind that without knowledge there is no promotion nor divulgation.

In recent years the focus has been on Palazzo Balbi Senarega and Palazzo Balbi Cattaneo, with interesting 3D reconstructions of the artefacts' different architectural phases. The virtual reconstructions of the palaces' furniture is also very interesting. Even if the actual artefacts are scattered throughout private and public collections, the virtual experience and in particular 3D reconstruction allows to place items in their frames and stucco contours, despite being very different from a simulation, highlighting the constructive trace of the renderings and using colours that are different from the original ones. The use of the Atheneum's palaces is instrumental to breathe life into a multimedia educational offer that could teach both Italian and foreign students

about the city's historical, cultural and artistic layers, better explain utilized but not always understood spaces, and provide a more in depth knowledge of the historical and artistic dynamics.

Scientific divulgation in occasion of the opening of the UNESCO Palaces

Opening the palaces that are at the same time on the UNESCO lists and parts of the Atheneum to the general public creates the need to think about how to present spaces and items, keeping in mind what studies are conducted on them on an academic level, divulging them to a vast and diverse public without lowering the quality of the contents. The students become the providers of this information, coordinated by researchers, graduates, and professors from the involved departments, aided by re-elaborations of the research that allowed an intuitive communication through the use of virtual 3D reconstructions. Information technology has thus become a medium to efficiently show the complex series of transformation that regarded the University's palaces and their ancient collections.

A good example would be Palazzo Balbi Senarega, which allowed to provide the user with a 3D virtual reconstruction of the architectural situation at the beginning of the XVII century, then modified and expanded at middle of the same century with the addition of the garden and the nymphaeum that characterize the palace. The initial phase of the project - testified by Rubens' drawings from the second edition of *I Palazzi Moderni di Genova,* published in Antwerp in 1652 - is thus presented to visitors and compared with the new spatial values of the mid-century renovations, allowing them to immediately understand the importance and dimension they had meant for the building and its relationship with the medieval city. The architectural extensions and the new decorations have shifted the residence's style to purely baroque. In this case, the potential of 3D reconstruction will allow visitors to experience the genoese architectural dynamics and the different choices of the assignors. In this phase the focus was mainly on the choice of layout for the final rendering of the reconstructions: avoiding the use of a "mimetic" approach that can be confused with reality, the choice fell on a more "abstract" version excluding explanations regarding the use of materials, which can easily appear as a virtual "maquette", a study model of a reality that doesn't exist anymore.

The study that subtends the virtual reconstruction of the collections of paintings and sculptures in the palace of Francesco Maria Balbi in the XVII century (explained later) was divulged to the public through a real-scale projection on the now bare walls of the paintings scattered among different museums, so that the palace could "re-live" its past as it was seen by travellers up until the XIX century.

The results have had a dual role: an impact of lessons and seminars to form students of art history and history of architecture of the Atheneum and the divulgation of information to the genoese population and foreign tourists during the opening of the palaces. The extraordinary potential of a live Museum that is not only used to preserve but also actively make use of this heritage through study, scientific competence and concrete observation.

In the light of these experiences, the conference "La valorizzazione del patrimonio culturale delle Università: I beni artistici e architettonici. Il patrimonio culturale accademico come strumento didattico e campo di ricerca/ Raising Awareness of Universities' Heritage: a Focus on Art and Architecture. Academic Cultural Heritage as a Teaching Tool and as a Research Field", whose records, edited by Lauro Magnani and Laura Stagno, have recently been published (Genoa, 2016), was organized in Genoa in November 2014.

The reconstruction of the palaces' architecture and the collections' spaces

3D models are considered a very important and useful tool to explain the situations of the past to historians, students, and common people. Its aim is to reconstruct, analyse, and illustrate relations between architectonic space and paintings. For example, the case studies addressed by the research conducted at the University of Genoa in collaboration by both the Faculty of Arts and the Faculty of Engineering focuses on the reconstruction of the history of the building of Palazzo Balbi Cattaneo, attempting to place the paintings of its owner, the Cattaneo Della Volta Family, in the Lecture Hall, and on the reconstruction of the apartment of Francesco Maria Balbi a mid 17th century noble Genoese to put his now missing collection of paintings back in the original rooms by using 3D model.

The reconstruction of the whole collection, displayed in a number of rooms, is problematic because the structure of the apartment is still preserved, as well as the decoration of the vaults, but not all the wall decorations survive, and none of the paintings are in situ any more. After Camilla Pallavicino, Guido Balbi Piovera's wife, died in 1946, the collection was divided among the heirs. The research on which the 3D model is based included a comparison of Francesco Maria Balbi's wills, which do not give measures nor precise descriptions of the works of art that could help recognise the paintings and their fitting in the quadrature. Moreover, many paintings are not mentioned in the wills. Through historical guides, and thanks to a survey of the photographic archives of Palazzo Rosso and of the "Soprintendenza per i Beni storico artistici ed etnoantropologici della Liguria", further data about the collection has been gathered, but the research is still in progress. The 3D model can also be a useful tool for verifying the interpretation proposed on the basis of research in order to investigate the placement of an art collection in an architectonic space and to analyse the relations between the quadrature and the paintings fit in. Moreover, the 3D model can also be a tool for people interested to know facts, history of buildings with cultural interest that it is impossible to discover now due to the transformations of urban city or the destruction of rooms ordered after a change of owners.

Further development

A project focused on making access to contents possible for people with disabilities through the elimination of architectural obstacles is currently under development. Audio, video, and textual devices will also allow people with motor, visual, and hearing impairments to fully experience every artefact, even the normally inaccessible ones.

All content will be displayed on totems positioned in the atrium of every single palace or in the most accessible location. These totems, with a very innovative design organised horizontally, could show 3D models that communicates with touch, speakers, and headphones, allowing users with visual impairments to enjoy the information regarding the palace's structure (architecture and outer decoration). On one side of the 3D model there will be a plant of the palace's most important floor that upon touch will project images of the interiors on a screen, even those not normally open to the general public. All visual content (images and text) will have a multilingual voice-over to grant access to all kinds of users.

A recent grant from the MIBACT department for the renovation of Palazzo Chivari De Ferrari Belimbau, nowadays part of UNIGE's administration offices, has created the occasion to put into practice the idea of a live Atheneum museum divulged through different media. The Ministry of Cultural Heritage And Activities and Tourism and the "Ministry of Infrastructures and Transports"

have allocated 120 million euros to the realization of 75 works of conservation, maintenance, and promotion of cultural assets on a national level.

For Liguria, beside the Lighthouse, the focus will be on this very palace: 1,400,000 euros will be dedicated to structural repairs and, most importantly, to the renovation of the extraordinary frescos of Lazzaro Tavarone (early 1600) decorating the atrium and the *Piano Nobile*.

ACKNOWLEDGEMENTS

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Fig. 3 A view of a *Salotto* of the second *Piano Nobile* of Palazzo Balbi Senarega with the ancient collection.
Fig. 4 Another view of a *Salotto* of the second *Piano Nobile* of Palazzo Balbi Senarega with the ancient collection.
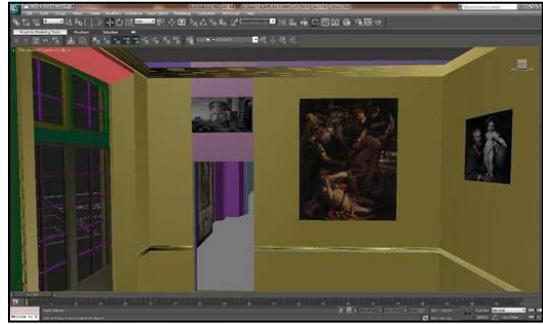
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TRUTH AND METHOD:
THE ART OF KNOWING HOW TO COMPREHEND
AND MANAGEMENT OF COMPLEXITY

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Abstract

Every masterpiece of art history, to ensure it is really understood, must be interpreted in the scenario from which it itself originates.

The recovery of the path of history, affected today by the inexorable passage of time, it can and should represent an essential objective to preserve the roots of man, for he was its creator and it has forged its civilization.

For these reasons it is necessary to face and manage the complexity, namely that set of non univocal obstacles, that stand between the recovery of the truth and the traps of all that is false.

"A man doesn't learn to understand anything unless he loves it." (Goethe).

INTRODUCTION

What is Art?

Art represents the most effective tool in order to communicate, in a timeless space without borders!

Through the centuries humans have shaped their cultural origins and have satisfied the desire to pass on the knowledge through this extraordinary tool.

Art has enabled man to sculpt the indelible imprint of every civilization and ethnicity, in the most varied forms and diversity, marking the history of the origins of every man; regardless of the race to which he belongs.

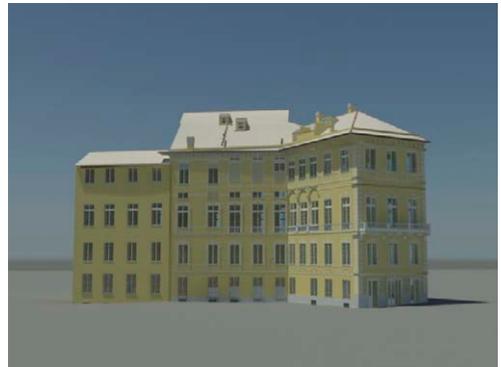In the silence marked by the passage of time, the art ascends to an absolute truth: all men, despite the ethical and religious conflicts, forged in it by the times of their origins to the modern era and it is to this reminiscence that they owe the awareness of what we recognize in today.

Artistic expression is witness to the fact that the very existence of humanity establishes a common origin for all men, where fate and civilization represent the univocal path of the existence of man: a common root that leads to a planetary humanism .

The recovery of the knowledge passed on through figurative art, therefore, represents a precious treasure and the instrument elected for the codification of the language interpreted in it.

But the actual comprehension of the Cultural Heritage, realizes itself in the definition of a variety of components, each of which originates from the context in which the good is shaped and by the artist's life which has forged its expression.

Art can be compared to a "discourse" and its correct interpretation is subject to the reconstruction of a set of grammatically correct prepositions.

The complexities arise largely from the fact that the passage of time, inevitably, has often led to the fragmentation of the original integrity of such "discourses"; exposing them to that disorder which, not infrequently, represents the cause and the first obstacle that precludes its correct, authentic and proven interpretation.

Today the "state of the art" places us in front of a multiplicity of discourses that, despite the efforts of numerous and authoritative experts, still present a reconstruction of phrases and

prepositions that, under the morphological, syntactic and logical aspect, bring inside themselves syntagmas, semantics and conjugations from the wrong construct.

To aspire to the correct encoding of this language represents the challenge of the modern era which, through to skills of the experts and the aid of technology, today can aspire to the recovery of all those "rules", "norms" and "codes" that represent the tool in charge of the encoding of the lost language, as it will allow to reconstruct the grammatically correct "discourse".

The scientific survey, finally, represents the instrument designed to confirm what is investigated and its relevant validation by the experts, so that it becomes an objective reality " proven and reliable".

"I have striven not to laugh at human actions, not to weep at them, nor to hate them, but to understand them." (Baruch Spinoza).

There is no knowledge without comprehension: Smarticon Project

The "state of the art" can be compared to an agglomeration of fragments of a "puzzle" that not only go through chaos, but which belong to the most diverse contexts: the most varied iconographic representations, historical periods and geographical areas.

Therefore, if the recovery of the lost knowledge represents the challenge of the present era, it also responds to the basic need *to place an order*.

Smarticon is a method in charge of the reconstruction of a grammatically correct *"discourse"* and projected towards *the search for the "truth"*.

Therefore, each fragment of the "puzzle" must first acquire and assume in itself the "*imprinting"* of all the features (status and nature) that determine its identity.

In a second phase it will have to "propel" in search of *its original context*, through the verification of compatibility with the nature and the structure of the other fragments scattered in the disorder.

Such procedure gradually, will begin to generate a *sorting* mechanism in constant evolution and the information will assume an increasingly autonomous structure, which will allow them to be *reunited* with the state of belonging from which they were generated.

Such procedure will be a prerequisite to the recovery and reconstruction of a grammatically correct *"discourse"*.

This logic can not be separated from the need to give life to a flexible and dynamic instrument, which is capable to confer to the information the structure of *enunciates*, so that they can assume the properties of generating mutual relationships and correlations and define a finite number of " steps "that make it possible to verify whether a given hypothesis is provable or not within the *nominal syntagma* of a specific" *discourse* "(in structural linguistics the nominal syntagma or" phrase "is a unit of variable proportions, which is an integral part of the syntactic structure of an enunciate).

In the Smarticon method, the paradigm of the logic that governs all processes reveals to be particularly coherent with the formulation of a *"discourse",* as happens in the construction of a preposition or a phrase (in fact you consider syntagma the structural constituents composed of elements belonging to different lexical categories or parts of a discourse).

The syntagma, in the Smarticon method, correspond to the enunciates and are elements that may be in common to different artistic representations.

However, their peculiarity is to be able to generate specific and targeted relations and correlations, that allow to reconnect to the artefact that has to be encoded all the *enunciates relevant to it*.

It is through these *objective connections* that the method becomes *scientific* and makes it possible to aspire to the *encoding* of an artifact, the recovery and the traceability of all the information related to it and to its approval by the experts: that is the achievement of a higher level of *comprehension*.

Smarticon, in fact, is a *cognitive* method, since the syntagma are intuitively identified and then validated according to the belonging of each "word" to certain "knots" of reference(this happens thanks to the repetitive and methodical processes that characterize the logic, inductive, deductive and empirical phases).

When the "knots" of reference are multiple and complex (structural constituents composed of elements belonging to different lexical categories or parts of discourse), also the enunciates of Smarticon become structured: as well as a sentence or a preposition, so to be correct, has to bring a discursive formation grammatically structured, so every structured enunciate will have to prove to be coherent with the discourse of work of art in question.

The nature of these processes is the core of innovation, because only through the capacity of the enunciates of occurring to one another it is possible to reach a *hermeneutic ordering*, preparatory to the identification of hypotheses and theories reliable and oriented to the recovery of the lost truth.

"All truths are easy to understand once they are revealed" Galileo Galilei

The complexity and the art of knowing how to comprehend

The complexities represent all of those obstacles which interfere with the encoding of the truth.

Managing complexity means being able to examine, in a global context, the scenario from which originates the single fact that we are going to observe.

To really be able to "comprehend" it is fundamental to overcome every reductionist criterion, since it is essential to aim for a truth that shapes itself on the recovery of any interaction happened at the time and in the time around the object of our interest or the event that we are examining.

The lines to follow will be dedicated to the examination of one of the most famous masterpieces in the world, in search of the "recovery" of the profound reality in which the work has been forged: the self-portrait by Albrecht Dürer (May 21, 1471- April 6, 1528) , stored at Monaco of Bavaria and exhibited at the Alte Pinakothek.

The context in which this masterpiece has been created, coincides with an era heralded of radical philosophical changes and of profound changes in the expression of the historical iconographic and iconological meanings in the world of art.

The European Renaissance was particularly steeped in events that, along the way of winding roads and partly forgotten ... between the paths impervious by centuries of history, may lead to the discovery of an extraordinary context that liberates wit towards the intuition and comprehension of fascinating mysteries and extraordinary assumptions still to be revealed today.

"You do not own what you do not understand" (Johann Wolfgang Goethe)

The Renaissance in Europe: A forged environment in the passage between Platonism and Neo-platonism

The artistic expression that characterized the Renaissance was forged contextually and consequently with the affirmation of the effects of an event that would have changed the history of philosophy: the Latin translations of Plato's texts by the philosopher, humanist and astrologer Marsilio Ficino (1433 - 1499).

This innovative reinterpretation of Plato's texts sealed the passage between Platonism and Neo-Platonism.

A fundamental issue of this transition was the fact that Platonism in the medieval interpretation of the texts of Plato affirmed the existence of a higher truth: that the sensible world originates from the ideas, the eternal ideal forms, immutable and incorruptible like we perceive them. They are subject to becoming, corruption and death.

Neo-Platonism, even though it takes origin from Platonic philosophy, thanks to some connotations putted in evidence in the translations of Ficino, highlights the *metaphysical aspects* (search of authentic and fundamental aspects of reality) and *religious aspects*.

The perception of the truth, therefore, passes through the empirical enlightenment: **God, returned man, reveals to humanity the divine source** (*divino numine revelata*).

As previously theorized during humanism of the first half of the century, the man was seen as *"copula mundi",* that is that harmonic interaction between soul and body in which each is master of his destiny.

That was how Neo-platonism settled down in a social context in which the man, driven by a deep internal crisis, felt intensely the lapsing of sensible reality.

With these steps a crucial step in the history of humanity was accomplished, which reconciled its highest expression in the artistic representation of the Renaissance.

The absolute classic beauty thrust itself to a Christian theological message that rejoins to the perfect beauty that finds its highest expression in God and in transcendence.

According to the Neoplatonists, the world was organized in concentric spheres whose extremes were the Hyperuranium, intended as divine world and matter, intended as the animal world.

Thanks to philosophical speculation the noblest and elected spirits can experience happiness and reach the knowledge of the true after death.

The man, endowed with reason, may choose whether to rise to the divine world or go down towards the animal one, or even maintain an equidistant balance.

This choice is accomplished through the mediation of love and beauty.

Ficino wrote: "Love is the desire for beauty" and it is the love, in the various forms of bestial, human or divine, that lead man in the path of ascent towards God, considered the source of true and perfect beauty.

In the history of thought the Renaissance neo-platonism became the link between classical philosophy and Christianity.

In this social, philosophical and cultural context the artists became ambassadors delegated to the interpretation of the doctrine of the Academy of neo-platonism, where the research for beauty was intended as the achievement of the proportion and aesthetic harmony.

The representations of mythological subjects started to spread reinterpreted in a Christian perspective and bearers of arcane truth or witnesses of a lost harmony.

The theme of the struggle between an upper and a lower principle (divine and animal world, such as Mars tamed by Venus or monsters knocked down by Hercules), expressed the continuous tension of the human soul, suspended between *virtues* and *vices*: man, basically turned towards the good, was unable to achieve perfection and was often threatened by the danger of falling back into the irrationality dictated by instinct.

From this awareness of his limitations derives the existential drama of the neoplatonic man, aware of having to chase for life a seemingly unattainable condition.

"Joy in looking and comprehending is nature's most beautiful gift " (Albert Einstein).

The self-portrait of Albert Dürer: the true icon of Christ

The self-portrait of Albert Dürer enshrines a profound innovation in the iconography of the portrait, because it introduces the frontal pose of the figure.

It is not difficult to imagine how, at the time of its execution, this new conception of the portrait has been able to surprise the observer leaving him dazed and stunned.

The imposing representation of such a moral authority, confirmed by the fact that it is the artist's own effigy, could lead to an interpretation of the figure aimed at expressing an excessive, ostentatious and almost extreme and contemptuous narcissism.

But the "veils" that conceal time can reveal the truth destined to broaden the horizons towards quite different intriguing hypothesis.

Oil on canvas cm. 67 x cm. 49

The translations of Ficino, which gave origin to the neo-Platonic movement, date back to 1463.

The Self-Portrait of Monaco dated 1505, is therefore reasonable to assume that Dürer had intensely lived the early days of the neo-Platonic philosophy current.

The fundamental steps of this school of thought are focused on two essential cornerstones.

The first is inherent in the fact that the Neo-platonism forged man about the awareness of his own limitations, from which his deep existential drama arises.

The second and immediate step, unfolds in the identification of the remedy in charge of the salvation of the soul: with the affirmation of new philosophical principles the Platonic man, until then defenceless in front of temptations, forges an intense spirit of Christianity that will indicate him the path to salvation relieving the tensions of his tormented soul.

In the Neo-Platonic man, the seed of deep and intense love for Christ germinates, a harbinger of the courage and determination necessary to face the snares of sin and to illuminate with wisdom the tortuous path that leans toward eternal salvation.

This deep feeling of hope and faith, explicating itself by becoming aware of being able to overcome the snares and temptations of sin, arouses hope to aspire to elevate the soul to the **divine perfection**.

It is from this conviction that the need to express the concept of *"God and transcendence",* through the research of the perfect being, arises : the meeting point between reason and faith that is expressed through the *"will"*.

To seal this new ideal form, and thus to contribute to its affirmation it is the attitude of Thomas Aquinas, who assumes a key role when he establishes the compatibility of metaphysics and theology.

In the representation of Dürer's frontal portrait he deals with these themes with extraordinary ease and expresses his belief processing the representation of the self-portrayal from a frontal point

of view: the soul of the neo-Platonic man, who aspires to reach the *divine perfection*, expresses his own determination to rise to the deepest Christian impulse through the representation of his effigy reinterpreted as the *true icon of Christ.*

He who, in the silence of the traits that depict his own face, through the authoritative posture which reveals the vigorous dignity of the neo-Platonic man, in the intense and deep gaze that safely meets the one of the observer; with a natural gesture he brings his right hand to his heart, as if to seal his promise of faith.

The effigy, which captures in itself all the more complex and profound steps that characterize this particular historical period, transmits an impetus of deep innovation and, in the silence of the image seemingly resolute that depicts in detail the features of his own face, the artist delegates to the deepest, most extraordinary and superb artistic expression the task of witnessing to the involving feeling of Christianity that pervades the soul of Albert Dürer.

It almost seems that the portrait wants to begin by saying: "I ... man endowed with *will*, express my purpose to elevate to God and to divine perfection through the image that portrays me as a*" true icon of Christ. "*

The frontal portrait of Dürer is not only an iconographic parallelism that aims to overlap the divine figure, but expresses the desire of man to overcome the obstacles that stand between the weakness of the flesh and the will to rise to the perfection of God.

Finally, it will not seem reckless to assume that, within the bud of such a radical philosophical - religious maturation and thanks to the decisive position taken by Thomas Aquinas, the stylistic connotations that led Dürer to design the frontal portrait overlapped to the historical and religious relief of the figure of Christ in the Holy Shroud.

The most well known face of history, imprinted in the precious and delicate fine linen fabric, testifies the image of Christ and, above all, it makes its existence tangible in the eyes of the most suspicious.

The Holy Shroud, where the image appears frontal, could testify meaningful relationships and connections attributable to a close interdependence with the complex iconography that permeates the elaboration and design of the self portrait of Monaco.

Just in those years, moreover, the Shroud was located in Chambèry and in 1502 the Savoia family built a chapel used for its conservation. In 1506 they obtained permission from Pope Julius II for public worship with Mass and a proper office.

This event reveals to be particularly decisive, because it switched on a spotlight on the importance of the Holy relic precisely at the moment in which the transition of social, cultural, religious and philosophical ideals was taking place and which resulted in neo-Platonism and reached the maximum interpretation in the artistic expression of European Renaissance.

The hypothesis suggested in this study represent the testimony of what may turn out to be a strategic recovery of lost truths through the aid of method and technology: a fundamental combination to aspire to the encoding of a complex scenery foreclosed and forgotten by the inexorable passage of time.

Consider how, over the centuries, the language of art has lent itself as the "elected" tool to spread the ideals of the Church precisely through the majestic and impressive artistic commissions and how the recovery of this extraordinary knowledge represents a unique path to project our civilization toward a planetary humanism.

Ficino wrote "In our time the divine Providence loves to make religion rest on the rational authority of philosophy, until at the appointed time, as it did once, it will confirm it anywhere with miracles. For inspiration of Providence we have interpreted the divine Plato and the great Plotinus.» (Marsilio Ficino, Introduzione alle Enneadi, 1492).

Joy in looking and comprehending is nature's most beautiful gift (Albert Einstein).

THE LUMEN PRIZE AT EVA FLORENCE 2017

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Now in its sixth year, The Lumen Prize celebrates the very best art created digitally by artists globally. As a not-for-profit, Lumen's goal is to focus the world's attention on this exciting genre through an annual competition, a global tour as well as workshops, seminars and special events. The Lumen Prize is delighted to join in on the discussion about the future of art and technology at EVA by presenting a showcase of works from the 2016/17 Global Tour.

INTRODUCTION

The Lumen Prize for Digital Art is presenting highlights of its 2016/2017 Global Tour at EVA Florence, following their collaboration at EVA London and EVA Berlin in 2016.

Since 2014 The Lumen Prize has been collaborating with the UK's Computer Arts Society, and with the help of its Chair, Dr Nicholas Lambert, also a Director of Lumen Projects Ltd, Lumen has continued to increase the understanding of digital art.

About Lumen

Now in its sixth year, The Lumen Prize celebrates the very best art created digitally by artists globally. As a not-for-profit, Lumen's goal is to focus the world's attention on this exciting genre through an annual competition, a global tour as well as activities including workshops, seminars and special events.

Since its first show in London's Cork Street in January 2013, Lumen has staged 30 shows and events around the world, including New York City, Shanghai, Athens, Amsterdam, Riga, Cardiff, Hong Kong, Leeds and London. In collaboration with its academic partners, which includes the Computer Arts Society and EVA London, Lumen advances the understanding of digital art at seminars, artist talks, workshops and symposiums.

The 2016 Lumen Prize

A selection from the 2016 competition will be shown at EVA including this year's winning piece, the work of Italian duo Fabio Giampietro and Alessio De Vecchi, *Hyperplanes of Simultaneity.* A dialogue and a comparison between the painted canvas and the digital illusion *Hyperplanes of Simultaneity* brings down the barriers between art and technology.

Melding the tradition of painting with the most innovative technologies, *Hyperplanes of Simultaneity* uses virtual reality to annihilate the contemplative distance between the voyeur and the work of art. Removing the painting from the confines of its frame, the painting on canvas is exploded into three dimensions allowing the spectator to step inside and voyage across the mind of the artist.

Figure 1: Hyperplanes of Simultaneity (2016) by Fabio Giampietro and Alessio De Vecchi. Winner of the 2016 Gold Award.

The recipient of this year's Founder's Prize, *The Selfie Drawings Book* by American artist and digital art professor Carla Gannis, will also be exhibited. Using Blippar Augmented Reality Gannis embraces and explores the significance of the selfie. A collection of 52 digital drawings, completed over 52 weeks and shared via social media channels, have been brought together in a book to dissect the selfie phenomenon.

Responding to artistic developments The Lumen Prize introduced several new awards this year including the Mixed Reality and Web-based Award. In *Farm Tableaux*, winner of the web category, Sylvia Grace Borda and her collaborator John M. Lynch utilise Google Street View to illustrate Canadian food culture in a way that moves us beyond lifestyle magazines and TV reality shows. While *Nature Abstraction*, a work by Matteo Zamagni, Ben Hur and David Li transports you into an immersive sensory experience that explores the arcane forms of fractals - the mathematical visual representation of natural and biological forms.

The Lumen Prize will close its 6th annual call for entries on June 1.

THE CODEX DIETRICHSTEIN - AN EXAMPLE OF AN ILLUMINATED MANUSCRIPT MADE IN THE TWENTHY- FIRST CENTURY, MIX OF ART, HISTORY, ADVENTURE AND ENCRYPTION WITH THE SUPPORT OF NEW TECHNOLOGIES

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Abstract - **This paper shows an example of an illuminated manuscript made today, published recently. The author illustrates the combined actions for its implementation, from the research and historical context to the development of innovative promotional actions on Social Media. The author also dwells on the differences between traditional artists and digital artists, illustrating the tools available to digital artists focusing on new-type "alchemical" processes. Finally, the author gives the example of new projects, aimed at enhancing the artistic/artisanal tradition of mosaics and stained glass windows, dealt with the development of new digital processes of "alchemical" type.**

INTRODUCTION

European history has left us priceless masterpieces from Roman times to the Middle Ages, the Renaissance, the modern era. The works of art that we have inherited not only the architectural, sculptures, paintings, but also those that have created jobs related to art and real districts in which the skills were enriched by territorial homogeneity and handed down for generations. I refer for example to the mosaics for which Ravenna is a significant emblem, to the masters of Murano glass, the stained glass, the "commesso fiorentino" that produced semi-precious stones mosaic of incomparable beauty sponsored by the Medici family, the "mosaici minuti romani" micro-mosaics with which they were realized the paintings that can be seen in St. Peter's in the Vatican, to the illuminated manuscripts result mainly of work of monks with know-how and tradition. We can do many other examples, such the "cosmateschi" floors, the wooden inlaid, the artistic ceramics and so on. In the times of greatest splendor of the "thematic clusters" were hundreds of artists / craftsmen such as in Florence for creating beautiful inlaid with semiprecious stones or in Rome where the Borgo district, there were over five hundred micro-mosaics shops, intended not only to St. Peter, but also as a precious work of art to foreign visitors on the Grand Tour. The ecosystem was formed by Big patrons like the Medici family, the popes, the kings, from architects which integrated wonderfully and harmoniously in the works complexes of great prestige and a system of competences and art / craft skills based on precise rules and able to regenerate and transmit capabilities over time. These balances are skipped in the modern era, with the risk of losing assets, skills and characteristic elements of our culture also had negative consequences on youth employment. There remain a few bulwarks to keep alive the torch, such as the Opificio delle Pietre Dure in Florence and the Laboratory of the Vatican mosaics, mainly oriented to the restoration, rather than to the production of wide-ranging works as in the past.

The technology offers us today still enormous potential to realize digital works of art, can be used as models for embodiments with traditional techniques or printable directly on each type of material, from wood to marble, to the glass or on the newest type materials, such as the fiberglass, the plexiglass, etc. with which decorate interiors or think of a new kind of

urban decor. I focused on this type of challenge, achieving interesting results that I report at the end of the paper.

To still reach high flow objectives must contribute to build a new supply chain which includes some essential pillars: the public or private lenders, the digital approach to art schools / traditional crafts, cooperation with "thematic clusters" that still exist , collaboration with the world of Architects for the harmonious integration of the works in complex accessible by the public. I don't hide the complexity of such a task, which requires the support and the availability of a variety of subjects, but that seems like a sensible approach to prevent the decline and try to rebuild on a new basis, but supported by a centuries-old tradition.

In this circumstance I focus on an example, it could by its nature, create relying only on my own strength, without the conditioning of external factors, namely the creation of an illuminated manuscript, the Codex Dietrichstein.

THE CODEX DIETRICHSTEIN

The Dietrichstein Codex was published in March 2017 by Aracne Editrice. Following is a brief summary of the Codex. Figure 1 shows the cover of the book.
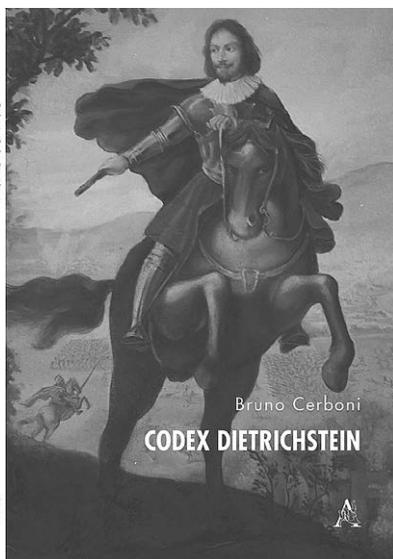

Fig. 1. Cover of the book

The setting of the Codex Dietrichstein

The story is set at the turn of 1500 and 1600, the time of the Emperors Rudolf II, Matthias and Ferdinand II at the threshold of the Thirty Years War. Rudolf II was tied in Prague, a city that lived a golden age with Rudolph, imbued with tolerance, beauty, art, and science, but also of magic and esotericism that characterized thereafter. As well as in Rome the papal orders favored the growth of the art, also the Rudolph's propensity towards art, Science and Alchemy favored the attraction of some enlightened minds which artists, scientists, alchemists, astronomers, scholars, antique dealers, collectors. Rudolf's court was frequented by artists such as Arcimboldo, by scientists from the Tycho Brahe and Johannes

Kepler caliber, but also most discussed characters like the Kabbalist and astrologer John Dee and Edward Kelly magician, counterbalanced by the presence of the Klementinum, the large complex of the Jesuits with his Astronomical Tower and the rich library, which also contains works from outside Europe. There were many libraries to which Rudolph could draw, from the Rudolph's personal library to that of Klementinum, to that of the Strahov monastery, to those scattered throughout the empire, from Vienna to Olomouc Monastery, to those of the Lords in the castles that were part of the Empire. The richness of the works contained in them gave testimony to the number of authors and miniaturists able to illustrate them.

The manuscripts sources of inspiration of the Codex Dietrichstein

Rudolf II owned the Voynich Code and the Code Mira Calligraphiae Monumenta, inspiring elements of our Codex. The Voynich Code, now kept at the Beinecke Rare Book and Manuscript Library, Yale University, contains elements of botany, astronomy, biology, pharmacology, and is written with a character even today not decrypted, called "Voynich".

At the Getty Museum in California, it has preserved a precious manuscript, made by two authors who have never known, after thirty years. It is "Mira Calligrapiae Monumenta", which presents a part written in 1561 by the top of the scribes, Georg Bocksay, on commission of Ferdinand I of Habsburg, embellished with countless characters like gothic, rotunda, antiqua, italic and many others and illustrated by Joris Hoefnagel, of Rudolph II Committee in 1591-1596 with miniatures representing elements of nature such as animals, plants, flowers, fruits. Admiring it now seems that the author is unique, given the perceived congruence between the written and the one illustrated. In reality, the two authors have created a truly exemplary virtual relationship, each wanting to enhance the infinite forms which can be declined writing, the other by merging the writing in the images to create a unique work that exalts the complexity and complementarity of the two different artistic expressions.

A copy of the manuscript was given to me at the end of the last century by Chris Hudson, Publisher of the Museum of Modern Art in New York, at the time of the Publisher J. Paul Getty Museum, which I visited in Malibu, California, home of the original museum that now is located in Los Angeles, after meeting him in one of the first conferences of EVA Florence. I was very impressed by the beauty of this manuscript, which has been one of the sources of inspiration of the Codex Dietrichstein.

The example of "Mira Calligraphiae Monumenta" shows that ancient manuscripts of the sixteenth and seventeenth century, composed of texts and images, which we now perceive as the result of a single author, could actually have been made by different authors, in time and space. The beautiful images of the illustrators could well be added to encrypted texts, containing secrets. A recent study by the National Geographic documents such as the use of encrypted codes by Antonio Averlino for purposes of industrial espionage against the Venetian Republic and in favor of the Ottoman Empire.

The ecosystem of the Codex Dietrichstein

The story highlights an organization in the sixteenth and seventeenth centuries aimed at conveying the secrets via encrypted manuscripts, transported from one part to an other of a Europe full of dangers. The Cardinal Franz von Dietrichstein and my ancestor, Thomas Cerboni were also part of this organization.. The encryption system of the manuscript is the same as that present in the Voynich Code, believed it unique up recently. The actors of this organization were:
- End users with the highest levels of the valuable information contained in the codes (e.g. popes, kings, emperors or similar) which were then also the lenders;

- The miniaturists and the illustrators;
- The editors of the part written in encrypted form which contained the artistic secrets or spying or esoteric;
- Those who physically moving the codes in contexts so often hostile to the distances and the hazards involved;
- The librarians who preserved for a period of time the manuscripts waiting to be moved by those who had originated them to who should benefit from them.

The Dietrichstein Codex brings real texts, encoded in the Voynich. We are inviting the readers to decode the manuscript. It is really an hard, but not impossible challange.

The contents of the Codex Dietrichstein

The Dietrichstein Code consists of several bound manuscripts with each other for a total of 136 pages, lavishly illustrated and realized on goat parchment. Their particularity is to be written with two types of absolutely hermetic character, a more elegant, the other more complex.

The eleven sections that compose it are: Botany - 10 pages, Mythology - 4 pages, Hybrids - 10 pages, mosaics of animals -16 pages, Fish, Birds, Nature - 24 pages, Maya -12 pages, Architecture - 12 pages, Costumes vintage - 20 pages, military Uniforms - 6 pages, famous people - 16 pages, Battle of White Mountain - 6 pages.

THE REALIZATION OF THE DIGITAL IMAGES

I avoid here to go into a debate against the traditional art with digital. The complexity of the modern world and the new tools are revolutionizing the art world and an increasing number of artists are experimenting and taking new roads in search of expressive new generation mode.

The modern artist needs a workstation which can be a computer connected to the Internet, a graphic tablet and a graphic pen (Figure 2), or of a tablet with a graphic pen (Figure 3), or a specialized hardware that replace the canvas and the brush (Figure 4). As an example we have included an Apple computer, an iPad Pro with graphics pen and some Wacom tablet models.

Fig. 2. A typical workstation of   Fig. 3: iPad Pro   Fig. 4. Wacom Cintiq
     the digital artist

The complexity takes over when you want to get accurate results. The wisdom of the traditional painters was to get to know their means and their techniques, such as that of mixing oil paints on canvas to create effects can stir emotions on the work of art users.

Today, instead of colors and brushes have a number of software programs used on fixed position or App can be used on tablets, which cover a wide range of needs. In Figure 5 are some of the most interesting programs available for digital artists. In addition to the better known ones I also inserted the category of Artificial Intelligence, which is gaining momentum also in the art world.

Fig. 5. The digital artist's tools

Continuing with the comparison between traditional artist and modern artist, we can say that the problem of the subject of the painting is common to both, and concerns the artist's aesthetic sensibility in relation to what we want to communicate the work to the recipients and is a crucial element.

The "alchemical" processes in the Digital Art

As regards the transformation of the subject in the work of art involved the technical capabilities of the artist. In the case of oil painting the skills involved are physical choice of colors, their mix, the style adopted, the ability to make harmonious and recognizable the end result. Digital artist's skills are creating digital brushes with the aid of programs known to him. Realization can be completely manual creation of computer graphics pen or the realization of a complex process. In this case results a mix of manual and used programs, to work brushes chosen to achieve the desired result and achieve the result which is the same between traditional and digital artist, or what the work creates emotions and is pleasing to users. There are traditional artists into digital using only basic programs and continue to operate in the same way, or simply replacing the graphics pen to brush to realize their painting.

There are also digital natives artists that use a mix of manual and programs to work. Typically they must create a series of processes, different for each category of painting, by adopting a mix of operations of pre-treatment, dexterity, use of chains of programs, post-treatment actions. In the event that the artist poses very complex objectives to be achieved creating process, which I call "alchemical" for the analogy with the alchemists of the Renaissance, or the ability to define the tools, to establish a process, measure each component in the right way. If most of these conditions are not calibrated the risk is to achieve a sloppy work instead of a masterpiece, as is the case for trainee cooks in comparison with the great Chef. In many cases the level of complexity is very high and can be compared with traditional skills to determine which of the two technical approaches is more difficult to learn, especially, as happens in most human activities with the school and with the direct experience that brings to fruition.

One consideration is that of the trend, which sees the relationship between digital and traditional artist's soul move in favor of the digital thanks to the technological transformation of the era in which we live.

THE IMAGES OF THE CODEX DIETRICHSTEIN

For the Codex Dietrichstein I realized high-definition scans of blank scrolls of ancient books to create the basis of the manuscript. I switched to the choice of the eleven sections, already described in the previous section "The contents of the Codex Dietrichstein" and I made a bibliografical search for inspiration in images of the time, creating new subjects that they still relevant to the treated period. The processes used were different for each treated section, with the creation of images that were then reported over the scrolls scans. I then chose some texts, which I keep secret, and I scrambled into Voynich code and Dietrichstein code. I went then to the final composition of the scrolls including in them the scrambled texts in addition to the images produced. Each parchment, besides the original editable, has a high-resolution digital master in TIFF format at 300 dpi A3, from which one can derive the smaller sizes. A short descriptive text in Italian accompains the work explaining the context and the ecosystem of the Codex. All this is also a FORMAT that can be developed for the preparation of adventure books and Illuminated Manuscripts by creating a line of publications.

Postponing the complete vision of the Book published by Aracne Editrice, in the Figure 6 and in the Figure 7 you can find two examples of parchments.
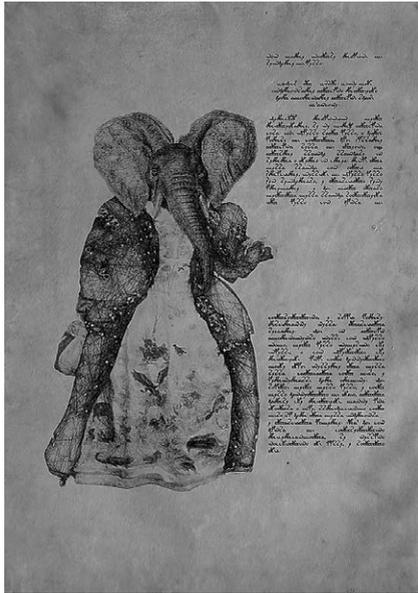
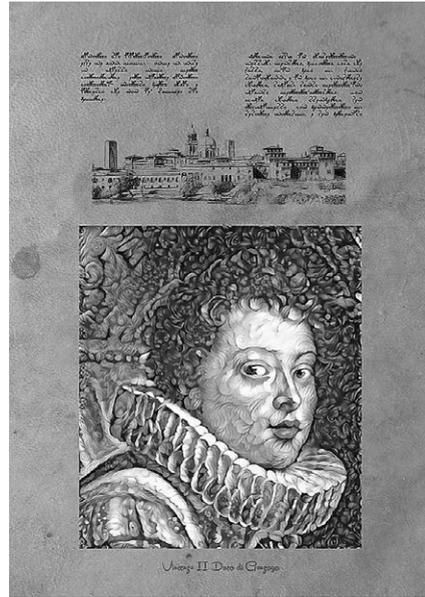Fig. 6. Sample page of the Codex   Fig. 7. Sample page of the Codex

PROMOTING THE CODEX DIETRICHSTEIN ON SOCIAL MEDIA

Apart from the development of traditional promotional activities through conferences in physical places, we have already activated some promotional activities on the Internet and on Social Media.

Creating a group on Facebook

It was created a group on Facebook. The Group is open to all and you can just get to by typing in the search: Codex Dietrichstein.

Fig. 8. Photo shoot inside the 3D Virtual Gallery

Virtual Museum with parchments of the Codex Dietrichstein

It 'was created a 3D Museum, a 3D Gallery of modern setting, within which some of my works and some of the parchments of the Codex Dietrichstein were included. The 3D model of the Gallery is navigable and Figure 8 shows a picture taken inside the Virtual Gallery.

Figura 8

Movies on Youtube

Movies were created, in Italian and in English, to promote the Codex Dietrichstein, and were uploaded to Youtube.

These movies are accessible at the following addresses:

Youtube Channel Bruno Cerboni – Codex Dietrichstein

https://www.youtube.com/channel/UC2p3oYQLvgL8hRYzvUI0HnA

Gallery Bruno Cerboni

https://www.youtube.com/watch?v=bQ6z3mU1h8U

Codex Dietrichstein – Presentazione in italiano

https://www.youtube.com/watch?v=bV0NvigkXPE&t=49s

Codex Dietrichstein – Presentation in english

https://www.youtube.com/watch?v=D9JAWREcTng&t=54s

In the realization of movies we have been used:

- Original works of art;

- The navigation movie within the Virtual Gallery;

- Animations themes;

- Films processed into moving graphics, animations with sequences of 25 graphic works per second, as in the case of the duel which is the difficulty of moving the Codex Dietrichstein in a Europe full of dangers. Note that in a minute of animation needed 1500 works of graphic to have a fluid movement and that total in the various film products, between the animations choices and those not used, were produced approximately 10,000 elementary graphic works;

- Superimposition of the animations on other films, as in the case of animations of animals and dancers inside the Virtual Gallery, creating a real "installation" alive, avoiding the coldness of moving inanimate environments.

These movies have also been subsequently replicated on Facebook Channel, in the Group Codex Dietrichstein.

This as regards the initial promotional actions. Further action will be activated over time.

THE NEXT CHALLENGES

The world of Digital Art is immense and everywhere digital artsts do new experiments to reach new goals. In my Laboratory I'm moving in multiple directions concerning concerning innovative approaches.

Circumscribing the perimeter and referring back to what was said in the Introduction, one of the most interesting projects that I am developing is to create works of art with contemporary subjects declined with art/handycraft ancient techniques, such as various types of mosaics, trencadis (as in the Gaudì's Parc Guell - Barcelona), glass mosaics, stained glass, "commesso fiorentino", sculptures and inlaid wood and other techniques in this field.

From 2D to video: The new Alinari Multimedia Museum in Trieste

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In the memory of Jean Barda, a leading Frenchman expert in the field of Jpeg2000, digital imaging, wavelet and pyramid image compression, IPR and image security.

Abstract:
This year, citizens across the globe will take one trillion photos, flooding an already saturated market. Also, there are millions of 19 th and 20 th C. photos preserved in memory institutions worldwide, that offer irreplaceable cultural and historical content. Unfortunately, many are not stored digitally, nor publicly shared and they often lack provenance documentation and content annotations, hence, only the tip of the iceberg can be efficiently accessed, understood and enjoyed.

The new Alinari Image Museum (AIM) http://www.imagemuseum.eu which just opened in Fall 2016 in the city of Trieste, Italy targets the huge market that hypermedia has to offer through a deep integration of visual perceptual technologies and machine learning interfaces, to enable anyone to convert their photos into hypermedia. These nonlinear media objects are 'semantical connected' to others via semantic overlaps, enabling unique exploration.

Trieste has been chosen as a city with a long-standing photographic tradition and a strategic geographic and cultural position overlooking the Mediterranean but also as a virtual bridge to Central European culture.

The main objective of the AIM project is to establish a leading international cultural and photographic center. The idea is to introduce through the museum a solution that galvanises mature, affordable and easy to use ICT technologies to generate 2D+ assets from 2D photos. This proposed solution aims to attract to the Italian museum located in the city of Trieste, Italy, near the Slovenian border, an attractive solution to help students, historians, photographers, artists, tourists, citizens, to enjoy multimedia content in a novel way.

Leveraging on the cross-fertilization of different technologies, it aims to unleash laboratory tools based on machine learning and computer vision algorithms in the video production environment, thus creating a new class of products. To maintain context and human sentiment, we will take care to keep users central in the conversion process, to enable users to fine-tune results, mediate ambiguities and create optimum short or long video clips to be used over a plurality of distribution channels. The platform will provide a flexible interface to enable smooth workflows over different service platforms. Our idea is to create a cost-effective set of tools for the swift generation of audio/video footage from collections of images covering cityscapes, sporting, religious ceremonial, political, construction, etc. Generated content can be exported for further editing or post-production, stored locally or fed directly to video distribution platforms. Several standardized interfaces will be integrated, including high quality video feeds for direct contribution and transcoding for distribution and content production.

The basic assumptions are: (i) the quality of digitised vintage photos is good enough for computer vision algorithms to provide a sufficiently rich output, at 4K video resolution and correct colors; (ii) photos contain enough content to create useful tags, as those tags come as complete full description sentences metadata from the content providers; the minimum footage length of 30 seconds is considered long enough to be sell (and watched) as documentary video-clip; (iv) the trend of web or cloud-based processing continues; (v) the TTS text-to-audio conversion quality is acceptable by TV and media; pricing business model and licensing schema is attractive; (vii) the usability and workflow will find many satisfied clients; (viii) the pan and zoom effects.

Photography will not be anymore seen as an old static paradigm but rather as a living and revitalize item that can provide real interactivity with the visitor.

Below a schema of the proposed 2D to video-clip solution that could be implemented into the Alinari Image Museum in the near future. Thanks to important technical solutions already running into the Museum it will be possible to touch and enjoy photography and culture into a fully immersive way. The Museum of the Image is a real space where the user can immerse himself in the virtual, a physical space where the virtual can be seen and touched. The objective is to go beyond the simple scenic representation of a multi-media exhibition and to construct an interactive system, in which the

visitors can interact with their senses, moving their bodies as within a real space."
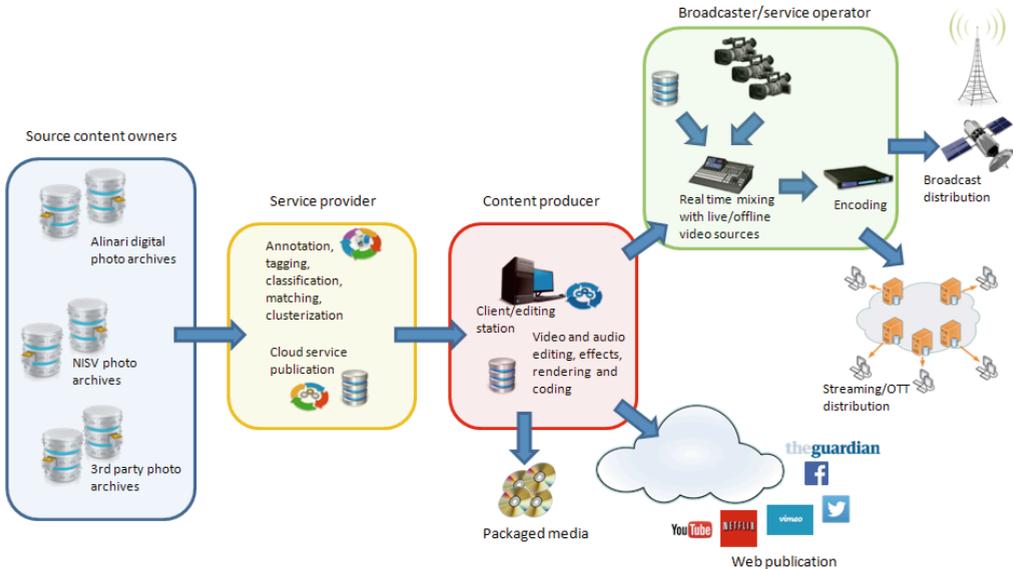
The conversion process workflow is outlined below:

Step 1: Photo content analysis, Region of Interest detection and walkthrough selection

● High-level visual analysis of an image, using smart cropping algorithms, looking for structured areas that indicate potentially detectable objects.

● Application of algorithms (based on saliency) to generate image-wide semantic tags.

● Application of region segmentation algorithms (based on deep learning), directed towards the potentially rich content areas previously identified, to assign semantic tags to regions and pixels.

● Ranking/categorising semantic tags generated by the above algorithms (combined with existing metadata tags) to create a logical walkthrough (or rendering script) for single or multiple photos. Human intervention via the intuitive interface is also possible here, to customise the result.

Step 2: Audio and metadata creation

● Text To Speech (TTS) on the 'photo descriptive sentence' (text already embedded inside the photo's metadata, this

was generated by hand when the original photo was digitised/scanned).

Reinsert the new tag descriptors back into the original file's metadata to create a richer and more relevant set of tags/metadata for future retrieval and indexing.

Step 3: Authoring 2D+

● Authoring of lossless 2D+ video clips using the rendering script (average clip will be 30s, although this will relate to personal preferences, tags located and TTS length). Longer video-clips (up to several minutes and longer) using photos clusters will be also possible.

Step 4: Delivery

● A wide variety of video formats will be produced to suit the needs of the consumers:

● Reinsert the new tag descriptors back into the original file's metadata to create a richer and more relevant set of tags/metadata for future retrieval and indexing.

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Step 4: Delivery

● A wide variety of video formats will be produced to suit the needs of the consumers:

VoD end-users, video sharing networks (Vimeo, Youtube, Facebook, etc.), etc.

Below some images representing the layout of the AIM in Trieste:

The idea is to deploy mature image recognition technologies into the authoring workflow, composed of image classification and object detection elements. These involve the system being taught how to recognize object categories in images. The algorithms are derived from state-of-the-art computer vision algorithms taken directly from research, in the field of deep-learning. By integrating these powerful technologies into the asset authoring pipeline, we believe that we will markedly accelerate conversion operations that traditionally took hours of skilled labour down to a matter of minutes performed by amateurs. By creating Enterprise and cloud-based solutions for the Creative and Cultural Heritage sectors we will, for the first time, provide a consolidated solution to valorize archives of vintage photos. Other project advancements will address market stimulation, penetration, and acceptance of this new way of generating modernised assets.

Environments and technologies devoted to the digital image will be tested and shown to the public so as to transform AIM into a "**High-Tech Laboratory**".

Our main projects for the future:
  ➢ *The history of 3D (in collaboration with MIT)*
  ➢ *Trieste seaport (in collaboration with*
 the University of Trieste)

A permanent exhibition space devoted to the image and visual communication where the visitor will have access to an interactive itinerary, via consultation and navigation in digital images, thanks to avant-garde technological infrastructures (**three-dimensional image, moving image, virtual image**) has been created and the photo to video solution will become soon available to tourists and visitors.

The aim of this solution is:

  • **Innovation (ICT real icon)**
  • **Scientific partnerships & technological experimentation**
  • **Education**
  • **"Virtual bridge" from the Italian cultural network to the East-European culture**

AIM has a simple philosophy - that art's joy, power and creativity are not contained in paintings and sculpture. They lie in the eyes, hearts, hands and minds of artists and audiences. "Our new home will provide an inspiring venue for bringing artists and audiences together to see, explore and make art."

AIM hosts special sessions on living photographers and create unique debates with students and local art schools.

ON-LINE INTERACTIVE VIRTUAL ENVIRONMENTS IN BLEND4WEB. THE INTEGRATION OF PRE-EXISTING 3D MODELS IN THE MUVI - VIRTUAL MUSEUM OF DAILY LIFE PROJECT

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Abstract – Virtual Heritage resources are developing on a daily basis, increasing the opportunities for merging 3D models coming from different projects. This is the case of the "MUVI - Virtual Museum of Daily Life" project and a MA thesis in architecture, now joined in a 3D Web application on Blend4Web.

INTRODUCTION

The growing number of 3D resources developed in the Digital Heritage world is leading to an increase in opportunities for merging assets coming from different projects which share a common topic or object. For example, the MUVI project (Virtual Museum of Daily Life in 20th century Italy - http://muvi.cineca.it) has recently largely benefited from a MA thesis in Architecture, whose innovations, combined with the existing assets of this project, led to the development of a large 3D architectonic environment, which includes an entire district built in Bologna during the 1930s and a completely furnished house of the time. This virtual environment, which also features the historical description of many items and places, can be interactively navigated online through Blend4Web (https://www.blend4web.com/).

THE MUVI PROJECT MEETS AN MA THESIS IN ARCHITECTURE

The MUVI project (Virtual Museum of Daily Life - http://muvi.cineca.it) was born in 2000, when VisitLab Cineca reconstructed the first domestic environment, related to the 1950s, with the purpose of showing the changes in the daily life of the 20th century Italy.
In 2008 a new funding enabled the reconstruction of two more domestic environments, related respectively to the 1930s and the 1980s [1, 2]. Historical records were pinned to each significant object shown in the virtual scenes, visible in a real-time application developed for Cineca virtual theatre. The website of the project had been conceived to host a light HTML version, with renderings showing the domestic environments from different perspectives, and an on-line 3D environment. The 3D application was first developed using the OSG4Web plug-in [3] but, due to the hard work needed for programming inside this framework [4], this part of the project did not go beyond a prototype stage. It had to wait until 2016/2017 to finally go online (this time, using the Blend4Web framework – www.blend4web.com),

thanks to the internship of an architect whose graduation thesis was dedicated to the *Village of Fascist Revolution*. This residential area, built in Bologna in 1936-38, was the very same place that had provided the plan of the house modelled for the MUVI project and its domestic environment dedicated to the '30s.

This paper analyzes some of the problems arisen during this last stage of development, with regards, in particular, to the relation between two projects created for different aims and in different periods, which have been merged for a common purpose.

MERGING THE MUVI PROJECT AND THE THESIS IN BLENDER

During the years, many different modelling software were used for the MUVI project, such as Multigen Creator (http://www.presagis.com/products_services/products/) for the 1950's, and 3DStudio Max for the 1980's and 1930's. Furthermore, since the 3D models were used inside the Cineca Virtual Theatre (which is powered by a workstation) there was no need to optimize the size of the geometries. The MA thesis – titled "Il Villaggio della Rivoluzione Fascista a Bologna: proposte per la tutela di un quartiere del Novecento" ("The Village of Fascist Revolution in Bologna: suggestions for preserving the integrity of a 20th–century district") – on the other side, is focused on the preservation of the Village and its buildings, so it features mainly 2D reconstructions, with little use of 3D models, limited to volumes and wire frames [5], which provide just a schematic, non-realistic view of the spatial configuration of the district.

Images 1 – 2: A photo of the *Village of the Fascist Revolution* district in Bologna at the time of its construction (Archivio fotografico ACER) and a render view of the virtual environment from the same perspective.

Immediately after the end of the second stage of the MUVI project (2008-2009), an Open Source production pipeline, mainly based on Blender [6], was introduced at VisitLab Cineca. At the time, most of the projects concerned the production of educational movies; recently, however, there has been growing interest in cross–mediality and a strong web fruition for a wider public, not limited to the controlled environment of the Cineca Virtual Theatre. This new interest, combined with the now-prevalent Blender-based production pipeline, led in 2014 to the immediate experimentation of the brand-new Blend4Web framework.

In order to enable the Blend4Web output, the conversion and adaptation of the 3DStudio Max (MUVI project [1][7]) and AutoCAD 3D (MA thesis) original 3D models into a common format, suitable to be imported into the Open source modelling software Blender (www.blender.org), was required.

The first step of this process was the conversion of these models into the *Wavefront.obj* format*,* quite versatile and compatible with several 3D modelling software. The 3D models of the interiors were divided into furnishings and architectural elements. Each model had therefore to be neatly arranged with its own resources (such as the textures) and referred to a single spatial point (the origin of the global XYZ axes in Blender). Furnishings were kept as separate files while the architectural elements were gathered in a single one. Instances have been used as much as possible in order for the objects to be easily modified wherever necessary, and to optimize the final size of the application. A material library has been created to gather all the materials used by multiple objects.

As for the exteriors, the initial simplified models had to be upgraded in order to be matched with the detailed interiors. The studies on the buildings' materials and original colors, originally part of the thesis, greatly contributed in creating the additional textures and materials necessary to faithfully recreate the appearance of the neighborhood as it was at the time (September 1939).

The cross media aims of the application led to the development of a double set of materials, designed respectively for Blender Internal render engine – to create still images for the HTML pages – and for Blend4Web and the online real-time navigation. In this case, node–based materials achieved a greater level of complexity, improving realism and enabling a dynamic navigation.

Once the differences between MUVI and thesis 3D models were removed, it was possible to merge the assets of the interiors and of the exteriors into a new file linked with all the different models, so as to keep the original structure of the source files unchanged and ensure an easier management of the final model. The lighting process started once the unified model was ready. All the models being in the same file, it was possible to immediately assess how they would influence each other and, therefore, to implement the lighting accordingly.

Subsequent phases of the work, related to the development and the study of navigation inside the environments and to user interactions, are explained in detail in the next chapter.

THE ON-LINE NAVIGATION IN BLEND4WEB

Blend4Web was preferred over Unity due to the need of creating an application suitable for both desktop and mobile devices [8] and accordingly to the previous experiences carried out at VisitLab Cineca (www.cineca.it) that led, using Blend4Web framework, to the development of the serious game prototype "Back to the Middle Ages" (goo.gl/oxXn0e), the MUVIR project (http://visitlab.cineca.it/?p=1432), and the Terrae Motus Virtual Exhibition (goo.gl/tLF0kQ). In these projects different kind of navigation had been experimented, ranging from point and click third or first person perspective (total freedom of movement) to click on icons (virtual pad) or point to point movement (suggested path).

The navigation in MUVI should have been easy and intuitive, suitable also for touch screens. In order to improve the immersive experience it was important that the elements that guide the navigation, as well as those of the interface, obstructed as little as possible the field of view on the screen. Despite the different spatial and intrinsic characteristics of the interior and the exterior environments, the kind of navigation had to be the same for both and had to provide the integration with the historical information sheets. The first-person view with point and click navigation mode, chosen for MUVI, should be as free as possible but has to simulate the physical behavior that a person could experience inside a real environment and, consequently, its inability to pass through walls or objects. As for the exteriors, the viewer has to be kept inside boundaries that avoid the perception of the end of the modelled world. The point and click mode was therefore limited to a sensible area drawn on the floor. The point and click interaction, suitable for touch screen devices, was coupled with the arrow keys. The use of WASD keys is expected to be developed in the near future and, in order to confine this kind of navigation, *bounding boxes* are provided for the models: collisions between physical boundaries and a not rendered character placed behind the camera are enabled through the physical simulation system available in Blend4Web.
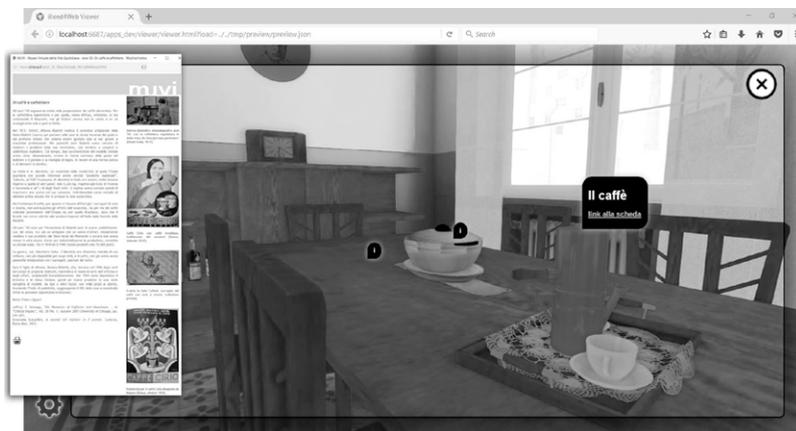

Image 3: Inspection of an object with its historical description.

A further navigation modality was set to see the significant objects placed inside the house from different and more detailed perspectives. It consists in a focus on each object so that it can be observed all around at the preferred distance. An icon marked with an eye, which hints quickly and intuitively to its function, accesses this interaction modality. The presence of these icons avoids the direct click on the objects that would disturb the navigation. A direct click on every object, by greatly increasing the width of the "sensitive" screen portions, proportionally increases the possibility to click by mistake something you would not want to, making navigation, especially on touch-screen devices, more chaotic and less fluid. Once inside the "inspection mode", the info icons that redirect to the historical fact sheets appear. The choice of showing the info icons only inside the "inspection mode" is dictated by the desire to limit as much as possible, during the navigation, the presence of elements foreign to the historical reconstruction.

For the development of the navigation mode, the export to .json and .bin formats enabled the use of both a visual programming language, through the logic nodes provided by Blend4Web and its logic editor, and the JavaScript programming language combined with Blend4Web framework supported by its APIs. The JavaScript scripting was fundamental for developing the part of the point and click navigation mode.
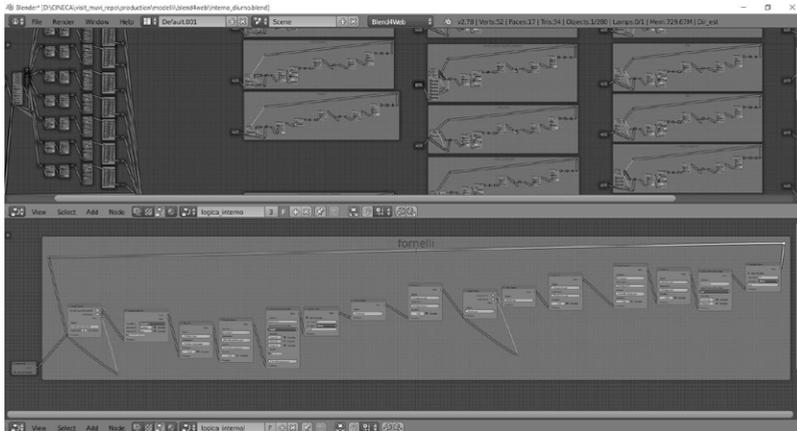

Image 4: Visual programming using the logic editor of Blend4Web. Two different groups of logic node trees: to inspect a single object and to control other interactions with the model.

For a better user involvement and a broader educational impact, besides the historical fact sheets, the logic nodes in Blend4Web have been used also for enabling some interactions with the virtual environment. The user can peep inside the cupboard, flip the magazines, turn on the radio and the radiogram and hear some music. The interiors have also a night version, with artificial lighting, triggered by the light switch in the hall, for experiencing what is described on the sheet about domestic lighting in the 1930's.

Image 5: An example of interaction: opening a cupboard.

The size of the final file is still large but it underwent an optimisation process that impacted also on the use of the resources during the navigation. Textures were reduced and compressed, the model was subdivided in three smaller models (exteriors, daylight interiors, night-time interiors) and *LOD* (*Levels of Details)* were defined in order to show only the objects in camera's field of view.

THE APPLICATION

The navigation metaphor proposed by MUVI is a point and click first person game mode, i.e. with a first-person perspective, to explore environments from multiple angles and search for information, with a fluid and spontaneous interaction [9], further favored by the homely and everyday environment which can limit the sense of alienation inherent in virtual reality applications.
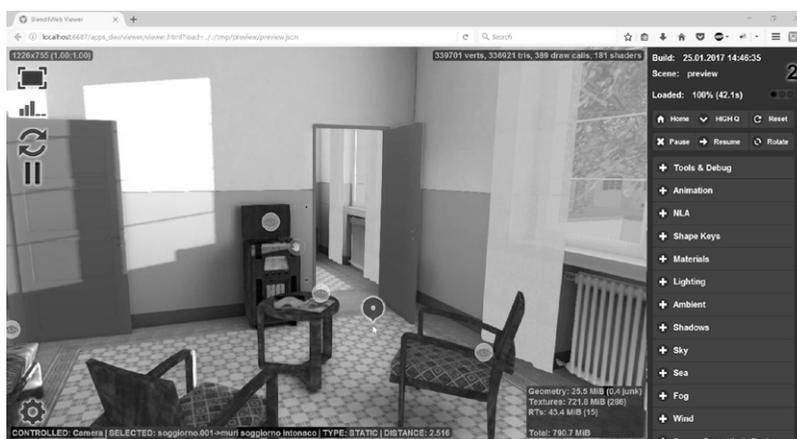

Image 6: WebGL navigation debug in Blend4web in the interiors of the 1930's house.

The virtual environment can be considered as an access point towards primary and secondary sources, such as information and documents coming from archives and historiography and MUVI visitors can have at a glance a fairly realistic effect of how could have appeared the newborn *Village of the Revolution* in 1939. The virtual reconstruction, even if there had not been significant changes in the asset of this area since its construction [5], cleans the small district up of all the additions, such as bins, billboards, further buildings, vehicles, etc. and returns the original colors of the plaster. The indications given in the MA thesis by photos and floor plans, combined with information on colors and materials can be explored spatially, and the experience is further deepened by the modelling of the interiors of one of the houses.
The 3D modelling performed during the 2008 phase of the MUVI project has now been enriched with new objects, mainly related with food, linked to new explanatory sheets; a dual display, day / night mode, has been enabled and interactions are now possible. Whether in 2008 only the night mode was possible, since no outside model was available, now the display in daylight mode opens up over a properly rebuilt and placed view. The exteriors, with respect to the modelling done for the thesis, has been integrated with lampposts and

trees placed in their original sites, in order to restore the original look of the district, whereas, at the present time, those lamppost had been replaced with modern ones and some of those trees had been cut down. Cars and bicycles were added for the sake of a bit of realism.

CONCLUSIONS AND FUTURE PERSPECTIVES

The virtual environment now available online offers quite a wide historical-architectural reconstruction, also featuring many fact sheets which can be appreciated not only by scholars but also by a wider audience. While architectural 3D reconstructions are becoming far more common - particularly in preservation–related works - those related to contemporary history are largely underrepresented. It is easier to find a good historical reconstruction in a movie, such as "Una giornata particolare" ("A special day" by Ettore Scola, 1977), than in an academic or educational project. So this project represents a rare example of online available reconstruction related to contemporary history, something unfortunately not so common yet – especially for what concerns the 20th century (for the 19th century, see for example: 10, 11, 12).

The recent perspectives considering HVW (Historical Virtual Worlds) as tools for historical research and the involvement of the masses in the interpretation of the past [13] pushes the MUVI project towards further evolutions. The online application related to the 1930s environment can be considered as a preamble to future developments for MUVI that foresees immersive navigation with cardboard and a serious game app. In order to make this project available to a larger audience, a room will be set up inside Sketch Fab, as a teaser towards the rest of the project.

ACKNOWLEDGEMENTS

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A CULTURAL TRADITION IN ITALIAN TOWNS: THE BANNERS FOR YEARLY HISTORICAL REENACTMENTS

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A Cultural Tradition in Italian Towns is represented by the Banners ("Palii"), which are realized at least one time in the year, in connection with "Historical Reenactments" ("Palii di Rievocazioni Storiche").

One of the most famous Banners is indeed the "Palio di Siena", which is created every year by two different artists for the very well known "Palio", which is organized in July-August any year, with two historical competitions of "Horses Race": the Winning Horses and Drivers give the year Leadership" to two parts of the Town ("Contrade"), connected to these Horses.

About Sisty Banners ("Palii") of Historical Reenactments for many important Italian Towns were created by our Studio. In each Banner ("Palio") creation, oil paint or acrylic gouache on canvas, or suitable tissue are used.

Careful attention to the local Town Historical Tradition is considered, enclosing in the "Palio" many aspects of these Traditions.

In several Towns the Banner Celebration was connected to an Exhibition of our Paintings, enveloped with specific "links" to the Town.

In the Italian Contemporary Art, the development of Banners and Exhibitions in Historical Towns represents a very important link to the Historical Tradition, with connections to the Renaissance, on the line of a "New Renaissance".

 Indeed in our Art paintings and works we maintain some fundamental references to the Creative "Renaissance" Period.

One important connection of Contemporary Art is to "Fashion". Indeed Creative Designs and Paintings can be enclosed in different Fashion fields: dressing, leather, jewellery, etc..

Some creative works are presented, developed by our Studio for Fashion Firms (Cavalli, Prada), which enclosed them in the more refined "leather products".

Copying as an Integral Part of Fine Arts and Architecture Education

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ABSTRACT:

This work addresses problems of study and conservation of monumental painting ensembles, which are partially lost. Copying has always been an integral part of understanding an author's work of art. Since the Renaissance, apprentices have copied works made by their teachers, thus studying the laws of visual arts. To that end, copying can be called the most efficient way to penetrate an author's work.

Scientific copying is, first of all, a method of study and analysis of a painting, of all of its specific features, starting from the groundwork and the undercoat and ending with the manner of working the finest details.

Keywords: architecture, monumental art, education, preservation of cultural heritage

INTRODUCTION

At present, it is more urgent than ever before to preserve cultural heritage. The effective achievement of these goals can only be imagined by means of reviving centuries-old traditions rooted by the internationally renowned Russian scientists.

Despite the constant efforts of the restorers, it is impossible to stop the natural process of the works of art destruction. The monumental works of art are the most exposed to the relentless effects of time. Wall painting is impossible to hide or to put to the favourable environment, like works of easel or decorative fine arts. The painting is mostly exposed openly and subjected to mechanical damage. Natural environment of the monument causes negative effects of temperature and humidity. These and other reasons are leading daily to the destruction of the work of art.

This work addresses problems of study and conservation of monumental painting ensembles, which are partially lost. Copying has always been an integral part of understanding an author's work of art. Since the Renaissance, apprentices have copied works made by their teachers, thus studying the laws of visual arts. To that end, copying can be called the most efficient way to penetrate an author's work.

Russian museums possess collections of the best copies of frescoes, created at different times by the artists of reproduction workshops of the Old Russian painting. Copies made in the temples before their loss, can give an insight into the original system of painting of these monuments.

One of the most important schools of art reproduction in Russia was the school of Lidia Alexandrovna Durnovo[1]. It was formed on the basis of the museum of frescoes copies and a special reproduction workshop, headed by N.I. Tolmachevskaya[2] which were established at the Russian Institute of Art History in 1921. Her successor, L.A. Durnovo in the course of many years of work has developed a method of scientific copying of monuments. This method gave an opportunity to create very precise and documented authentic copies of ancient paintings, which was not previously possible.

From 1921 to 1925 mainly by efforts of students, employees of the Institute of Art History, as well as students of the Higher Courses of Art on the basis of the Institute a significant number of copies of wall paintings of churches in Novgorod, Pskov, Kiev, Vladimir, Chernigov and other ancient cities of Russia were created.

According to L.A. Durnovo 'own interests, special training, conditions of service, enabling to explore the finest details of the works of both easel and miniature painting and architectural monument locally, put forward in the first place the question of the material and texture of all three types of the Old Russian painting and their relationship with the age style and conditions. All my classes and work are carried out mostly in this area and the obtained results are recorded in the messages and with a large number of copies of frescoes from Novgorod, Vladimir, Staraya Ladoga, Kiev and Chernigov. Since 1919, I have been working in the reproduction workshop of the Russian Institute of Art History. While directing classes, I use as the basis the detailed knowledge of the monument texture, which is absolutely necessary, as has been proved by my many-years' experience, for the study of ancient Russian painting as well as the scientific basis for the documentary copying of monuments of this type. Same experience has forced me to replace the old methods and techniques of copying, often associated with insufficient attention to the monument, with the new independently developed techniques".[3] In the process of creating these copies L.A. Durnovo developed the method of the scientific copying of fresco painting.

Amidst all previously created series of copying sketches, which possess a certain historical value, copies of L.A. Durnovo are distinguished by a higher level of detail, being executed with the utmost care and precision that allows perceiving these works as a "painting document". The author managed to achieve high reliability and authenticity of the color and tonal proportion, the accuracy in working the finest details, realistic reproduction of the material form of the work up to the implementation of all the lost parts and the undercoat details and the wall texture.

There is one more significant difference in the methodical approach of L.A. Durnovo. The aim of the copying is to show characteristic paint features of not only a particular painting, but the entire painting ensemble. Therefore, by selecting fragments L.A. Durnovo sought to identify the most characteristic ones for each monument.

Copying is physically draining, long and laborious, demanding job that requires a great deal of attention, patience and the utmost dedication, high professional skills of the performer, a great amount of knowledge in the history of art, and in painting techniques and technology. Besides making copying in the church and supervising copyists at the workshop of Institute of Art History, L. A. Durnovo was engaged in in-depth study of the paintings iconography together with the experts of the Academy of Material Culture History[4]. Because of this integrated approach, works L. A. Durnovo gained value both as copies of the Old Russian painting, being at the same time the works of art, and as a unique material for studies and restoration of the lost ensembles.

Since the mid-1920s, research and practices for the conservation of ancient Russian painting declined sharply. Academy of Material Culture History did not get funding for research and in the late 1920s, the Higher State Courses of Art of the Institute of Art History and Courses on Russian Painting Type of the State Academy of Material Culture History ceased their activities[5.] After that, on the initiative of N.P. Sychev and L.A. Durnovo materials of long-term studies of the Old Russian painting are kept in the Russian Museum. In the early 30s, many employees of the Russian Museum were arrested as a result of political repression, including such scholars as the N.V. Malitskyi, N.P. Sychev, and leading members and apprentices of L.A. Durnovo in the reproduction workshop and Higher Courses of Art at Institute of Art History[6]. Thereafter, research and copying of the Old Russian painting have been stopped for several decades.

Despite the difficulties of the postwar period, strong school of restoration in our country was able to rise again within the shortest period: monuments of Novgorod, Pskov, and other Russian cities have been restored to their historical architectural forms in a fantastically short period. Significantly, restoration process began even before the end of the war, immediately after the liberation of the occupied territories. Referring to the documents, we can understand how much time, money and professional efforts have been spent on the early restoration of the monuments.

However, by the 1990s, this process has undergone severe degradation, and by now dozens of unique monuments of the Old Russian art are on the verge of loss. We know only a few specialists engaged in copying Old Russian painting in the 60-70-ies of the XX century. They are artists and restorers Adolf Nikolayevich Ovchinnikov, Nikolai Vladimirovich Gusev, Alexander Petrovich Grekov, and Alexander Konstantinovich Krylov.

The loss of traditions of the Russian school of monumental art has led to serious problems of contemporary fine art such as the decline of its spiritual and moral orientation, the substitution of the true and eternal values by imaginary and momentary ones, lack of style and aesthetic guides. The Russian school of monumental art has been destroyed for ideological, political and social reasons. This led to interrupting deep traditions and continuity of generations for several decades. We know very few examples that can adequately represent the

Ill. 1

Russian school of monumental art. At the same time, in countries such as Serbia, Bulgaria and Italy modern school of monumental painting naturally continues its own tradition.

Currently, in Russi copying of works of easel and monumental painting is practiced only in a few, mostly profession-oriented art universities and art workshops: I. Repin St. Petersburg State Academic Institute of Painting, Sculpture and Architecture (Faculty of Painting workshop of monumental painting, workshop of church-historical painting), St. Petersburg Orthodox Theological Academy (icon painting department), V. Surikov Moscow State Academic Art Institute (workshop of monumental painting). Copying teaching methodology is not systematized and learning activities are designed only for a superficial acquaintance with the iconographic, stylistic, coloristic characteristics of different schools of monumental painting. Scenic copies created in the framework of educational tasks are performed as sketch designs, without complying with the technical and technological features. Works are carried out without prior research training and not based on the accurate documentary data. These works are not published or used in scientific and research activities. At the same time, there are some well-known restoration methods developed by specialists of museums and restoration workshops. The works of such specialists as T.A. Romashkevich and V.D. Sarabyanov concern actual restoration of the ancient paintings and do not include the copying stage. In light of the foregoing, there is an obvious need for revival of the traditional school of copying that existed in Russia at the beginning of the XX century, and its corresponding modernization.

Ill. 2

The purpose of this study, conducted at the St. Petersburg State University is to develop methods of copying works of the monumental art of the Old Russia, allowing reproducing as nearly as possible the system of ancient paintings ensembles. Implementation of this aim entails the revival and development of traditions of the Russian copying school of the beginning of the XX century, as well as their enrichment with the newest technologies. Part of the work is carried out within the project "Development of theoretical and methodological aspects of research-backed copying of monumental painting" (the authors express their gratitude to St. Petersburg State University for Research Grant 30.23.1051.2015).

Results of works can ensure achieving a fundamentally new level of artists and architects education. Practical results may lead to forming a large-scale system of art workshops, aimed at preserving the existing monuments and creating contemporary works of art. Besides, it will help to replenish the collection of scenic copies presented in Russian museums and to provide uniquely complete visual material for the research of the Old Russian art and the continuity of its traditions.


Ill. 3

Continuity of excellence is the foundation of any school of the fine arts. Since ancient times we know examples of artistic collectives, author's workshops where the main learning principle was the copying of the master's works by the apprentices. The effectiveness of this method is obvious. By studying and copying great works of Russian art, we can get closer to the highest spiritual and artistic level of the ancient works.

At present, there are no any free accessible methodological and information resources containing systematized materials on monumental painting copying methodology either in print or in digital format. Among existing publications in this sphere we can be find a sufficiently large number of modern techniques of painting, drawing and copying the works of old masters.

Basically, these are separate, so-called "author" techniques, which do not meet the requirements of science. Most often, it is aimed at non-specialist audience or commercial educational publications created for school or children's programs. Such sources cannot be used in research, museum and educational fields. Moreover, they would not be applied in practical restoration activities.

Due to the great experience, gained by St. Petersburg State University team of experts, a considerable amount of historical archives, art descriptions, restoration and archaeological records, archival and modern graphic materials, drawings, photographs, paintings and drawings copies has been assembled and studies of the monuments iconography has been made.

The developed technique is applied at the Faculty of Arts of St. Petersburg University in the course of training of architects, painters and restorers.
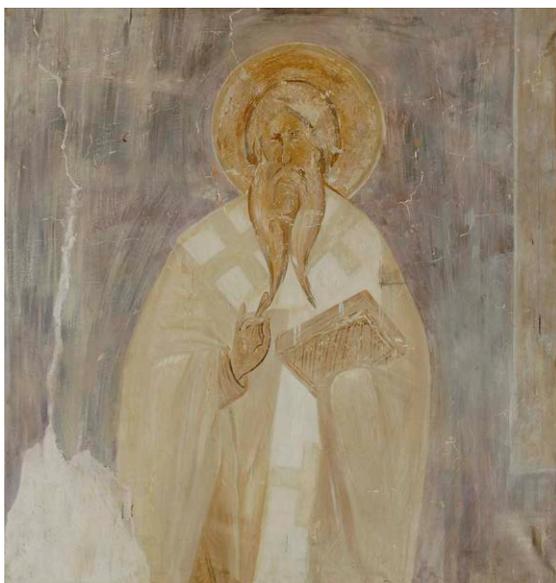
Ill. 4,5

Generalized results of the studies are available in the form of public lectures and electronic information resources and they are included in the system of distance learning as well.

Students are directly involved into work on some sections of the project. In cooperation and under the guidance of experts in archeology, history, restoration, museum professionals, students have the opportunity to familiarize themselves with the applicable procedures. The presence of diverse, experienced and qualified teachers allows working at a high scientific, artistic and technical level. Some invited experts are world-renowned specialists, successors of the beginnings of the Soviet school of art and restoration founders.

Conclusion.

Taking into account the rapid development of modern computer and digital technologies in recent years, it is possible not only to revive the lost tradition, but also to go on a fundamentally new level. Research suggests the revival of school of science-based copying as the most organic, precise and reliable method of fixing the paintings. While the existed copying school was based only on the well-built methodical process and individual skills of the performers, at present we can add up all available modern technology.

The achieved results will let to go on a fundamentally new quality level of painters, architects and restorers education.

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5. Structural division of the Academy of Material Culture History called Russian Painting Type in July, 1924.
6. Starting from 1933, many leading staff members of the Russian Museum were arrested, exiled and shot, including employees of the Department of the Old Russian art who were held liable for issues of ideology.

Illustrations:

1. Peter Alexandriskiy, the picturesque copy. The Church of the Saviour on the Nereditsa, Novgorod the Great.
2. The process of copying painting
3. The process of copying painting
4,5. Images Of Saints, the picturesque copy. The Church of the Savior on Ilyina street, Novgorod the Great. The Frescoes Of Theophanes The Greek.

ART AND HUMANITIES
ECOSYSTEM & APPLICATIONS

E-RIHS "European Infrastructure of Heritage Science: a new opportunity for research and innovation in the field of cultural heritage

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Following a sequence of successful projects dedicated to the promotion of a research infrastructure for cultural heritage, which were carried out within FP6, FP7, and H2020, on March 2016, E-RIHS was included in the Roadmap of the European Strategy Forum on Research Infrastructure (ESFRI). Its proposal was born within IPERION CH (*Integrated Platform for the European Research Infrastructure ON Cultural Heritage*), which is the last of the mentioned projects that promoted such an important recognition of the heritage science.

E-RIHS is a RI including fix and mobile laboratories, physical and digital archives, distributed in 21 countries (16 partner, 5 observers), and over 80 institutions. It aims at providing access to advanced instrumentation and methods for knowledge, conservation, and valorization of cultural and natural heritage, as well as at fostering the innovation and promoting best practices in the corresponding productive sectors.

Last March, the National Research Council (CNR) and the Fondazione Cassa di Risparmio di Firenze, presented the candidature of Florence to host the Central Hub of E-RIHS, which will harmonize the activities of the other national hubs and promote collaborative European and Worldwide project initiatives. This candidature is supported at local and national levels by a number of research, conservation, and valorization institutions, such as MiUR, MiBACT, CNR, INFN, ENEA ICCROM, and other.

Here, after a general overview of E-RIHS, the motivations that support the mentioned candidature and the potential of the Infrastructure in promoting the development of novel technologies and bests practices at a local and European levels will be discussed. Despite private enterprises are not included in the partnership, a strategy for supporting their innovation capacity is foreseen within a perspective of a long term positive return for the scientific and productive communities, as well as sustainability of such an important initiative.

Fostering sustainability and re-use in the Digital Research Ecosystem of Humanities Research

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The role of Research Infrastructures in the Humanities and Cultural Heritage is growing year by year. The ESFRI report on Research Infrastructures states that "the increased availability of digital resources and the development of advanced digital research methods have heralded remarkable changes in the scale and scope of Research in these disciplines". Research Infrastructures allow Researchers to rapidly access large amounts of data, that in our disciplines consist of texts, lexicological datasets, archival records and digital libraries as well as three-dimensional images, archaeometric analysis and digital imaging measurements.

DARIAH is one of the 2 ERICs in the field of Digital Humanities – aiming at shaping the European Digital Humanities landscape, by playing a political role towards the EU, and providing concrete short-term services to the research community.

The biggest part of the Research data produced in recent years (and much more in past years) isn't immediately available to the scientific community. Accessibility, re-usability and trust are key elements for the establishment of a Digital Research Infrastructure for the Humanities: data must be accessible for research purposes and have good quality metadata, methods to extract and interpret the information have to be implemented and there should be clarity about how the data have been generated. In this perspective, DARIAH-IT - the Italian node of DARIAH-ERIC – provides services to allow the unique identification of researchers and research assets, as well as promotes strategies to manage the chain of trust (i.e.: identification and documentation of the source, proper identification of responsibilities and affiliations, citation etc.) to allow data and tools re-use within the DARIAH infrastructure.

Key factors for the development of any digital ecosystem are sustainability and social innovation, actually occuring only when new services, tools and/or methodologies meets 3 criteria:

-   effectiveness ("Does it solve the problem?")
-   sustainability ("Does it cost right?")
-   trust ("Is it universally accepted?").

The issues of long-term sustainability of Research Infrastructures (RIs), was launched in the European arena in 2014, since then a number of surveys and studies have tried to clarify what does sustainability means and what actions can be carried on to fulfill this goal. A good definition is the one given by EUDAT: "sustainability means having the **resources** and the **policy** framework to deliver services and support **users** into the future". In different words, sustainability is the ability to generate scientific excellence and unlock innovation potential – with its resources and policies - in order to maintain the support of the scientific community and its commitment to use, re-use and provide data, keeping alive the RI. At the same level, measuring the impact of RI is necessary to assess its vitality.

DARIAH-IT supports the development of strategies to bring stability to the resources in the Digital Ecosystem, and to stimulate methodological innovation in research, through the provision of innovative tools and services (searching, selecting, visualizing, importing, presenting data) to humanities scholars, adopting their own research workflows and also capitalizing on the work being done by other initiatives in the ESFRI landscape.

DARIAH-IT is also working towards bringing financial sustainability to the Humanities Digital Ecosystem, by creating a funding opportunities hub. The Hub – part of the Humanities at Scale H2020 project - supports partners in finding national and international funding occasions: from finding the right call to drafting the proposals.

Digital Research Infrastructures for the Arts and Humanities: DARIAH-IT

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As a consequence of the large availability of digital datasets spanning different periods, languages and documents types (i.e.: sources in manuscript and printed form, secondary literature and bibliographical records), with more and more being created as a result of the increasing use of IT in historical research and releated disciplines, there's a compelling need to bring together and integrate existing digital assets, so that researchers in the humanities can use the various distributed resources as an integral component of their research methodology, overcoming lack of accessibility, interoperability and re-usability.

In the current Scholarly Digital Ecosystem for the Humanities, researchers are dealing with a plethora of information islands, not allowing a truly cross-domain research approach, This situation is due to several facs, i.e.:

- there are different actors involved in the data creation and management such as research groups and individuals, research and memory organisations, and others;
- the data are created and/or need to be consulted in different phases of the historical research practice, ranging from primary sources finding to publication of data analysis and interpretation;
- relevant data may be embedded in, or attached to, descriptions, records, documentations etc. produced and managed in different research contexts and domains;
- the data/content types are various and comprise, for example, textual descriptions, maps of diverse scales, multimedia objects, grey literature and academic publications. Moreover, as the amount of historical datasets is continuously increasing , a "big data" issue in data management and access is raising, as discussed in the 2007 Big Data report from English Heritage & ADS and confirmed by the reference literature in the field;

DARIAH-IT the national node of DARIAH-ERIC, the Digital Research Infrastructure for the Arts and Humanities, fosters a FAIR (Findability, Accessibility, Interoperability and Reusability) approach, to:
- reduce the fragmentation of the Digital Humanties Ecosystem;
- drive the shift from data to knowledge;

- allow researchers to engage in access, participation and co-creation; involve research communities; create trust in the infrastructure through aggregation and evolution, rather than abrupt revolution.

This integrating activity will enable seamless access to digital resources and provide new Web-based services and tools as well as common interfaces to data repositories. DARIAH also fosters the availability of reference datasets and promotes the use of innovative technologies and methodologies in humanities research. DARIAH will contribute to the establishment of a new community of researchers, ready to exploit the contribution of Information Technology and to incorporate it in the body of their established research methodology.

To achieve this result we'll use a number of integrating technologies that build on common features of the currently available datasets, and on integrating actions that will build a vibrant community of use.

The overall objective outlined above will be achieved through subordinate goals, which altogether will enable the provision of advanced Integrated Infrastructure. In this paper we will present the main entry point for the Italian DARIAH Digital Research Ecosystem: the DARIAH-IT National Registry of Digital Resources (http://it.dariah.eu/registro/en/). The registry is the core component of the infrastructure, gathering information about partners (universities, research centres, enterprises active in the Digital Humanities), tools (in-kind contributions of DARIAH-IT and other valuable resources), funding opportunities of potential interest for the partners - both at European and national level – and allowing the creation of services (access, interoperability etc.) on top of the resources registered in it, also in collaboration with other ESFRI initiatives (EGI, Indigo Data Cloud, European Open Science Cloud, etc.).

COMPARISON BETWEEN VIRTUAL REALITY IMPLEMENTATIONS FOR CULTURAL HERITAGE

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ABSTRACT

The goal of this paper is to investigate if the introduction of recent technologies as head-mounted displays can add actual value to cultural heritage exhibitions than already use visualization systems like desktop and stereoscopic displays. In the paper, after a brief description of the technologies used for VR in the cultural heritage domain, we introduce the different experiences and related applications, devices and solutions implemented for our tests: large displays, stereoscopic displays and immersive experiences. At the end of our study we report the results of the tests session and experiences, aiming to evaluate if the implementation of new technologies and devices can be valuable for visitors and museums. Some of the concerns emerged from the evaluations can be avoided with the future introduction of a new category of devices and controls, with better features and technical specifications. For this reason, a future session of implementations and tests is already in the plans.

INTRODUCTION OF VIRTUAL REALITY TECHNOLOGIES

Howard Rheingold [1] defines Virtual Reality (VR) as an experience in which a person is "surrounded by a three-dimensional computer-generated representation, and is able to move around in the virtual world and see it from different angles, to reach into it, grab it, and reshape it". This definition can include both specific and more generalist technological implementations, from those properly immersive to those using traditional displays. The first ones attempt to hoax and engage the users' senses (mainly sight and hearing) and replace the physical world with a virtual world. We call them 'Immersive Virtual Reality'. In the second ones, the virtual environment is experienced by the users through a sort of window on the virtual world, with a first-person perspective. We call them 'Non-immersive Virtual Reality', since the users still have the ability to see what's around the display in the actual environment. Both these implementations require specific devices.

Immersive VR devices

The first category, immersive VR devices, includes technologies like Cave Automatic Virtual Environment (CAVE) and Head Mounted Display (HMD).
The CAVE is a limited space where projectors are directed to walls: from three, in 180 degrees implementations, to six, in full implementations. The first CAVE was shown in the 1992 and it composed by 5 screens (three walls, a ceiling and a floor) [2] and it introduced a new concept of virtual reality. Applications developed for this device guarantee a fair level of immersivity, available for small group of visitors at the same time. Users are in the middle of the space and can explore the virtual environment within the space constraints of the room, and, in the most recent versions, can interact with the system. CAVE projections can be 3D or 2D; 3D implementations are experienced by a single user, since the system can adapt projections for each of the eyes of a single visitor, while 2D implementations can be experienced by groups of people.
HMD technology was developed between the 1950s and 1990s but didn't make a commercial breakthrough. Today VR devices have seen an explosion of interest and commercial offer.

Some of the most popular VR headsets are Oculus Rift, HTC Vive, Sony PlayStation VR, Razer OSVR, Samsung Gear VR, Google Cardboard. Thanks to the availability of these devices on the consumer market the VR is a reality for a new generation of users, applications and businesses. From the economic point of view last year (2016) globally VR equipment revenues are projected to reach $895 million. 77% of that value consists of newly launched devices from Oculus, HTC, and Sony [3].

The VR headsets can be also divided into two main categories: those using an external equipment like smartphone as computational resource and display, and those using a dedicated hardware that needs to be connected to a console or pc.

The devices that use smartphones for VR can be very different from each other. Google Cardboard (Figure 1) represents the most essential device to experience VR content, it can fit many different types of smartphone, and it's very cheap (less than 10 Euro), but its ergonomics and interactivity are poor. The Samsung Gear VR (Figure 2) solution is based on the same basic principles of the Google Cardboard, but it is more comfortable and integrates additional UI elements like a touchpad, a back key, and volume controls, and for this reason is more expensive (about 100 Euro) and it is compatible only with few Samsung series smartphones.

Figure 1 - Google Cardboard   **Figure 2 - Samsung Gear VR**

The most known and distributed devices that use dedicated hardware and a PC are Oculus Rift, HTC Vive, PlayStation VR. These devices have a cost between 400 Euro and 1000 Euro but they need to be integrated with a PC for gaming or a videogame console. On the other hand there is a better quality and stability of the VR system and they also include external controllers to allow a strong interaction with the virtual environment.

Non-immersive VR devices

Non-immersive VR technologies visualize the three-dimensional computer-generated representations by common device such as monitors and TV display. Consumer displays can have impressive dimensions with a very high image quality (more than 4K of resolution). TV displays can also have the ability to visualize stereoscopic images that can increase the sense of presence, but users need to wear custom glasses to see the stereoscopic/3D content. To visualize stereoscopic multimedia contents the 3D TV screens can use two different techniques: liquid crystal shutter glasses or use glasses with polarized lens. With first one, the left and right images are alternated rapidly on the monitor and the shutters are synchronized to occlude the right eye when the left-eye image is displayed on the monitor, and vice versa. The second technique has glasses with one lens polarized horizontally and the other one vertically. TV displays can visualize 3D images with interlaced lines, using different polarizations for odd and even lines on the screen, and using odd lines for one eye's image and even lines for the other eye's image. Since polarized lenses can transmit only one of the two images (the one with the same polarization), this make possible for each eye to see the right image and the observer can have the stereo perception.[4]

VIRTUAL REALITY IN THE CULTURAL HERITAGE CONTEXT

Museums are often structured and organized as a sequence of small rooms or spaces logically connected into paths or sections, where visitors can follow or not a suggested storytelling, at different levels (kids, tourists, enthusiasts, professionals, etc.). Museums enrich their

exhibitions with the help of technology. The introduction of Virtual Reality (VR) technologies allows new ways for organizing and visualizing information and for improving visitors' overall experience. VR can add value to the artworks exhibited, making them more accessible, adding descriptions and narrations, and overcoming existing physical constraints and conservational requirements.

"The Magical World of Byzantine Costume" (Figure 3) is an example of projects running on a CAVE, and it is the first in a series of educational virtual reality programs related to the exhibition on the 4000 years of Hellenic costume [5]. The aim of this application is to create an experience inside a museum with a high level of interactivity, rather than a high level of details or an accurate reconstruction. It prompts students to search for missing accessories of clothing and find the appropriate owner among the virtual characters. Users interact with the

Figure 3 - The Magical World of Byzantine Costume

environment asking questions and actively participating in the learning process. Through the game, young visitors learn the different aspects of the Hellenic culture.

The "Städel Time Machine" (Figure 4) is an example of projects for remote experiences using VR headsets, it is developed for the Städel Museum (Germany's oldest museum foundation) and provides fascinating insights into the architecture of the art museum and how it presented its collection in 1878. This application is the digital representation of the historical Städel and shows how time-bound our ways of viewing artworks are.

Figure 4 - Städel Time Machine

OUR STUDY

Our purpose was to prototype applications to test the impact and value of VR technologies and devices that are nowadays affordable and available for any museum. Therefore an important constraint was to select technologies that can allow sustainable models for their adoption, management and maintenance, so we excluded the use of expensive technology as CAVE. Moreover the selection of devices and platforms can also affect the effectiveness of such implementations and the success of the virtual experience.

Setup and development

To investigate pros and cons in terms of engagement, usability, and other features/attributes we

tested the prototype apps with three different sets of output devices that provide different level immersivity. In particular the output devices used are:

1. a 55" TV display ("Display")
2. a 40" 3D TV display and glasses with polarized lens ("3D Display")
3. an Oculus Rift DK2 ("Oculus Rift")
4. a Google Cardboard ("Google cardboard")

For the prototype applications content we considered a real exhibit of the last existing Venetian boat (Figure 5) of the eighteenth century that was used during ceremonies and parades, called "Bucintoro dei Savoia".

Figure 5 - Venaria Reale, "La Barca Sublime" exhibit

The Venetian boat, now placed inside the Reggia of Venaria in Turin, presents a cabin for the passengers, called "Tiemo", and it is the inner, covered part of the boat. The Tiemo is a not accessible part of the exhibition, because of its fragility. Therefore the visitors can just walk around the boat, but they cannot physically enter into the Tiemo and, in consequence, they can appreciate the decorations only partially from a considerable distance.

The applications were designed as "on-site installations", to be used in the museum environment, near the actual artifact of the exhibition, in order to get more details and add value to the exhibition and the artwork itself.

In our setup we previously digitally reconstructed the boat, then we choose to put the virtual visitor in an inaccessible point of view: inside the Tiemo. Therefore visitors can explore the Tiemo as if they were inside the boat itself, with the possibility to rotate and move the user's point of view to explore in all directions the 3D virtual environment.

The table below (Table 1) summarizes the technologies used to recognize the gestures and in particular shows the input tracking devices in relation to the categories of experiences and the output devices.

	Display	3D Display	Oculus Rift	Cardboard
Exploration by	Keyboard	Kinect	Oculus Rift	Smartphone

Table 1 - Our Virtual explorations grid

'Exploration by' means the possibility for the user to orientate him/herself into space, move around in the environment and find and experience information and artifacts using the appointed input devices.

The keyboard implementation use WASD keys on the keyboard to control movements in the environment. The Kinect sensor is an off-the-shelf device which captures the users' body and tracks the position of the joints in order to map different gestures that can be associated with

events, like key press in our case. The Kinect detects gestures that are defined by the distance between the right hand and the right shoulder. In our experience, if the hand:

- is on the left of the shoulder more than 20 cm, the camera will rotate left
- is on the right of the shoulder more than 20 cm, the camera will rotate right
- is above the shoulder more than 20 cm, the camera will rotate upward
- is below the shoulder more than 30 cm, the camera will rotate downward

We also defined a default position which stops the camera movement, to activate this gesture the user has to put his right hand in front of his right shoulder. (Figure 6)

Figure 6 - Visitors' instruction for exploration gestures (right, left - up, down - stop)

With the Oculus Rift the virtual camera rotates accordingly with the user's head rotation, thanks to the gyroscope sensor integrated within the Oculus device. Along with the headset comes a position tracking camera, that has to be mounted in front of the user in order to track the translation of the user's head.

The Cardboard uses the same user interaction of Oculus Rift but to detect head rotation uses the embedded sensors of smartphones and it cannot track the user head translation because there is not an external camera.

It is shown below the visualization of the Tiemo virtual environment for 55" TV display (Figure 7), 40" 3D TV display (Figure 8), Oculus Rift and Cardboard (Figure 9).

The applications with the keyboard and the Kinect sensor as input devices use Blender to manage the interaction with the user, mapping keyboard keys or gestures to move the virtual camera. In order to use the Kinect during the experience, we used FAAST (Flexible And Articulated Skeleton Toolkit) v. 1.0 to map some body gestures and link them with the key hold event. Essentially, when the Kinect captures the gesture, the FAAST software emulates the key pressure and this activates the camera movement into the virtual environment.

For the experiences that use Oculus Rift and Google Cardboard as input devices, it is used the Unity 3D game engine instead of Blender because the configuration is easier and more stable. After importing the 3D model of the Tiemo into the Unity environment we used the Oculus Rift Unity and Google Cardboard packages to control stereo rendering and head tracking.

Figure 7 - View of the Display experience

Figure 8 - View of the 3D Display experience

Figure 9 - View of the Oculus Rift and Google Cardboard experiences

Test sessions

The experiences were tested with 20 visitors, 10 men and 10 women, with the age between 26 and 52, with different cultural knowledge and different familiarity with the technology. In particular the gender distribution for range of age was: 4 women and 4 men between 26-35 years old, 4 women and 4 men between 36-45 years old, 2 women and 2 men between 46-55 years old.

In our test sessions, we invited visitors to experience the four different experiences: "Display", "3D Display", "Oculus Rift", and "Google Cardboard" offered in random order.

During the sessions, visitors were not allowed to assists other visitors' experiments. Within each session, after a brief introduction about the Tiemo, we introduced visitors about what they would experience, and the available features and controls for exploring, and then allowed them to freely get in contact with the experience, before the actual test. During the practicing, we ask for some specific actions to be executed, like to search for a specific decoration on the wall, for better understand their orientation ability.

The test consisted of a free exploration of the Tiemo, with no time limitations, to allow users (visitors) to see the whole inside, focus more on specific details, go back to what already explored, as if they were actually during a visit in the museum. The test took place in a dedicated room in our labs; during the "Display" and "3D display" experiences the users stood up in front of the displays, while during the "Oculus Rift" and "Google Cardboard" experiences they were suggested to remain seated, to avoid falls. In the virtual scene, users are positioned in the middle of the Tiemo, and they could move the head in all directions to explore the entire inside, but they were not able to move on the floor.

During the tests, visitors gave feedbacks about what they were experiencing (as in the think-

aloud technique), and after the tests we asked them few questions.
- • How do you consider the sight comfort and the wearability for:
  - o 3D glasses?
  - o Oculus Rift?
  - o Google Cardboard?
- • What experience:
  - o was more immersive?
  - o was more stressful?
  - o was more enjoyable?
  - o do you prefer more?
- • What experience is more appropriate for a museum? Why?
- • What do you think about VR experiences for Cultural Heritage inside a museum?

Results

16 testers out of 20 said that the 3D glasses had a good wearability, 4 testers found some issues for 3D glasses because the sight comfort was low and caused headache. The wearability of Oculus Rift and Google Cardboard for 12 testers was questioned by respectively 10 and 2 users because the devices were evaluated a bit heavy on the nose. Sight comfort of Oculus Rift and Google Cardboard was declared by respectively 6 and 5 testers that declared issued related with the visible artifacts of screen's pixels (low resolution). (Figure 10)
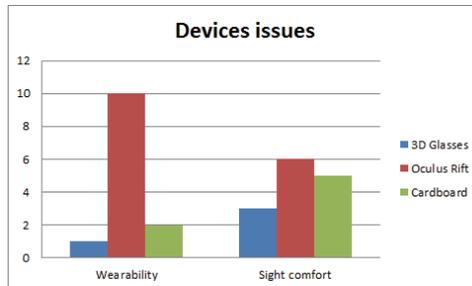
Figure 10 – Wearability and sight comfort issues for devices

16 testers out of 20 confirmed that immersivity is an important value and preferred the Oculus Rift and Google Cardboard experiences. They considered these experiences more immersive, intuitive for the navigation, and more effective to give the sense of presence into the virtual environment. All testers said that the resolution of the Oculus Rift and Google Cardboard was lower in comparison with the experiences with the TV, so they could not appreciate the details of the artwork and it created stressful experience for 2 testers. However the preferred and most enjoyable experiences were the HMDs thanks to the most realistic point of view (Figure 11).

Figure 11 – Results for the questions about what experience was more…

Questions about the experience of the Tiemo itself demonstrate a particular interest for virtual experience in cultural exhibitions. All would experience a virtual reality installation in an actual museum environment, but only if this will give more information compared with the real elements, or more details about the quality of the real artwork.

During the test sessions we observed some common patterns. 6 subjects out of 20 had orientation difficulties because they didn't reach a goal task like to find a specific decoration on the virtual environment. Four of them had orientation difficulties during the Kinect interaction, and two with the Oculus Rift. All the testers that performed the Oculus Rift experience first had no orientation problems also with the other experiences.

CONCLUSIONS and NEXT STEPS

The results provide several insights for design and development of virtual reality implementations for the cultural heritage. According to the results, the best interaction, between the experiences tested, is the one with the Oculus Rift/Google Cardboard, where users can feel the space around them, understand the dimensions and the distances and the orientation in the virtual environment, and appreciate the beauty of the artwork. In fact the Display and 3D Display experience were rated less interesting, because they have an interactivity that required some training for users without gaming skills, and the lack of immersivity reduces visitors' engagement.

The main concerns related with the low resolution issues of the Oculus Rift DK2, that emerged from the test results and that are less visible but still present in the Google Cardboard setup (due to a better resolution of the smartphone screens), will be avoided with the adoption of the next generation of Oculus, HTC Vive and smartphones, with a more improved resolution. This improvement, according to the results, will allow users a better sense of immersivity.

To reach a better users' immersivity the HMDs can be also integrated with new Natural User Interfaces (NUIs) implementations, that allow an interaction more natural and intuitive, but require some learning and training time. Future studies can be focused on how the immersivity provided by the new NUIs can improve the understanding of the cultural objects and help the user's orientation, enhancing the perception of the virtual space, independently from the screens' resolution, and if and how those new NUIs require a reduced learning and training time. To this purpose, a set of tests is planned for the next months, with a revisited set of experiences and new devices, like the new Oculus device ("Rift" only) and the new Google Daydream platform. The studies will also investigate the new interactions available directly from the new solutions, with new joysticks and controllers.

While the costs of the devices are changing, on a general basis we can say that very probably also in the future the cost of installation and ownership of devices like the Oculus Rift will be more expensive for a museum, than for other HMD implementations for mobile, especially considering the implementation of BYOD (Bring Your Own Device) solution, where the institution provide only the visors, while the visitors provides their own smartphones. To this purpose, the new Google Daydream platform will be investigated using different smartphone solutions, to verify what requirements will be necessary to allow a good overall experience.

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Experimental Hypothesis for Art Teaching with ICT: some Developments for e-Learning

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Within the scope of applications of new information and communications technology an important aspect to consider is the design of new quality models for training oriented towards teaching art in e-learning and in any case multimedia materials can be integrated in the educational processes for teaching - meaningful and effective learning.

Seeking new forms of knowledge Jürgen Habermas distinguishes three levels: the objective world, the social world, the expressive subjective world, developable through the circulation of knowledge and communicative action, implemented through the media. Designing teaching units in electronic mode of thematic courses as deepening in chronological order, monographic, contextual and intertextual in relation to temporary exhibitions or collections in museums and spaces dedicated to art exhibitions in our area can afford the spread knowledge and appreciation of our Cultural Heritage. In the form of "e-book exploded" can be set according to different target users and can be experienced in the context of workshops conducted by mediators of an education section in museums or in a virtual classroom with a tutor, and during the activities carried out by teachers in a real classroom in the schools. These multimedia materials are characterized as formative studies based on clear objectives and general guidelines on which to conduct the experimental investigation, which can increase generative and creative processes based also on the user's production.

We are presenting two examples as case studies of multimedia materials, in Epub editor format, articulated in the form of testable teaching units with students of secondary schools of second degree or university designed with reference to institutional itineraries of contemporary art in the area, one of which is designed in relation to the Bill Viola exhibition *Electronic Renaissance* present at the Strozzi Foundation in Florence, while the other is built according to the choice of a work present in the Alberto della Ragione Collection at the Novecent Museum in Florence.

ACCESS
TO THE CULTURE INFORMATION

″ EU Data Protection Reform n. 679/2016 and Big Data: new rules?"

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On April 14, 2016, the European Parliament approved the *EU regulation on the protection of individuals with regard to the processing of personal data, and on the free movement of such data*, which will come into force on May 25, 2018 and will replace and annul the old EU Directive 46/95.

In this context, it should be noted that, given its regulatory nature, the Regulation requires direct applicability, without Member States being given the opportunity to further change the text, as happens in the case of the transposition of directives. It is also true, however, that the Regulation on data protection will leave little room for Member States to introduce ad hoc national legislation, but where there is leeway, the differences may continue to be significant.

Any attempt to understand whether the EU Regulation involves significant changes from the Italian Consolidated Act on privacy currently in force must start from the effect of changes introduced by the European legislature.

Apart from the innovations already mentioned, it will be a Regulation replacing EU Directive 46/95 and Italian law; the first major change lies in the title of the law itself.

There is no longer a mere reference to "protection of personal data," but also to "free movement of data," as if to signify that the protection of confidentiality goes along (before or after) with the protection of rights and the free movement of goods and persons within the European Union (EU).

Evidently, the second major innovation of the Regulation lies in the new geographical area to which its application extends: the Regulation applies to the processing of personal data carried out in the context of an establishment's activities by a data controller or supervisor in the EU, regardless of whether or not the processing takes place in the EU. The principle of the applicability of EU law is also enshrined in the processing of personal data not performed within the EU if it is related to the supply of goods or services to EU citizens, or allows the monitoring of the behavior of EU citizens, for instance.

Further, while leaving unchanged the categories of players involved in the chain of privacy responsibility from the data controller to the data supervisor, the Regulation introduces a mandatory role for public administrations, and in certain circumstances for individuals, of a Data Protection Officer, which is not to be confused with the role of a data processing supervisor; all data processing controllers will be required to keep a register of processing operations, a sort of "old" DPS; an evaluation of the "privacy impact" will need to be conducted before applying a new technology or procedure to data processing; the level of so-called "accountability" will be raised, which marks a quantum leap in data management systems, namely the transition from a purely formal conception of mere compliance to a substantive approach to the protection of data and of people themselves; *privacy by design* and *by default* will be obligatory, which implies the obligation on everyone to design new goods and services, always keeping in mind the prerogatives of minimizing data processing, in addition to any other provision of the law on privacy; a certification mechanism for the privacy management system (the details of which should be better defined by European Accreditation Bodies which, in the case of Italy, is Accredia) as well as data protection seals and a marking system for demonstrating compliance with the Regulation will be introduced; and, finally, an unprecedented sanctioning mechanism will be established.

Therefore, although some processes have been rationalized and simplified, such as through the substantial de-bureaucratization of some requirements, the danger level has been raised for the protection of data at the European level by standardizing procedures and sanctions that have been very different to date.

In any case, given that Italian legislation and the Data Protection Authority have followed the EU's lead starting from EU Directive 46/95, there do not appear to be significant differences in terms of principles between the two systems. We could almost dare to say that in some cases, the EU Regulation reiterates the statements already expressed in the Italian Consolidated Act, and in others it undeniably enshrines the content of the measures and guidelines already shared by the Data Protection Authority.

The rules imposed by the Italian Consolidated Act and the Data Protection Authority to date thus remain valid, although they have been reformulated with less objective criteria: in fact, EU legislation continues to apply to natural persons; the distinction between ordinary and sensitive personal data remains intact (although the definition employed to date by the Consolidated Act is not used but the freedom/discretion to rule on sensitive personal data is left up to the States); the disclosure requirements remain unchanged, as does the obligation to obtain consent for unnecessary treatments or for particular types of data processing.

At the digital level, although the requirements contained in the Regulation do not expressly use the terms Web 3.0, Internet of Things, or Big Data, the new European Regulation on the Protection of Personal Data cannot avoid having a major impact on the global digital market and will dictate new rules that prevail all for the web and for electronic communications. In addition, with the introduction of the principle of privacy by design, the right to be forgotten, data anonymization and pseudonymization processes, and the time limit for the storage of data, the European legislature has sought to introduce never previously envisaged guarantees for users of interconnected "smart" devices with the ability to cooperate in order to respond in real time to dynamic and complex situations and to monitor the movements and behavior of their users.

In conclusion, it can therefore be said that, rather than protection of privacy in terms of new content, the new EU Regulation involves a new approach in the procedural organization of privacy, namely, a new corporate *compliance* that will thus bring about a subsequent change of mentality in companies.

Small- to medium-sized Italian businesses will be forced to change their approach to privacy, especially those that process sensitive or judicial data. Technical measures such as the use of passwords and anti-virus software, for example, will no longer be sufficient; organizational and technical measures to protect data will change from "minimal" to "adequate." In fact, the new Regulation does not define requirements for security measures in precise terms, but shifts the responsibility for defining appropriate measures to the data controller or supervisor after a thorough analysis of risks. Here again, it is a question of strong recognition at the regulatory level of a recognized principle, that of "accountability," already present at the contractual level and in models similar to those used in application of Legislative Decree 231/2001 concerning the administrative liability of companies: data controllers must be able to demonstrate that they have adopted an overall process of legal, organizational, and technical measures for the protection of personal data, including through the development of specific organizational models. They must show in a positive and proactive way that the data processing carried out is adequate and compliant with the European regulations on privacy.

In this way, the new EU Regulation appears to come closer, *mutatis mutandis*, to the regulation provided for in the UNI EN ISO/IEC ISO 27001 standard and the UNI EN ISO/IEC 27002 guidelines with the aim of proceduralization, rationalization, and simplification (for example, some administrative burdens envisaged by the Consolidated Act disappear such as the obligation to notify special processing, or to subject processing considered "at risk" to the Data Protection Authority).

Hamburg – A Cloud for the City's Cultural Heritage

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Creating the opportunity for the cultural heritage and stakeholders of Hamburg to showcase themselves to the 21st century in an appropriate manner is a must. The realisation of this task thus plays a special role within the city's ambitious digitisation programme. Based on the order by Hamburg's First Mayor (head of the regional government of Hamburg) to fundamentally restructure public administration – „digital first" – a particular focus has been set on culture and education.

The Challenge

Hamburg is home to approximately 350 cultural institutions comprising – on display and in their archives – collections of millions of works of art and cultural assets. So far, any digitisation and visualisation effort regarding these exhibits have been made by the individual institution or by associations of similar institutions.

Now, Hamburg's objective is to create a platform on which all objects of cultural value can be showcased and accessed and which supports the work of museums, collections as well as theatres alike. The following points are under consideration:

a. Provide tools to digitise the cultural assets of the City of Hamburg

b. Provide instruments for the systematic use of keywords and metadata

c. Provide scalable storage which is both highly performant and meets the requirements for long term storage

d. Create a platform on which cultural institutions will exchange data, create (joint) virtual expositions, provide these to third parties and have the opportunity to create their own solutions

e. Provide digital images of cultural assets for the city's schools and universities

f. Imbeded solutions which enable the cultural institutions to provide internet services and to manage customer relations and events.

The Concept for a Solution – Phase Model for the Digitisation of Hamburg's Cultural Assets

The Culture Authority of the City of Hamburg has commissioned Dataport with this task. Dataport - who provides IT services for six German regional governments – will act as prime contractor. They will join forces with a variety of partners from research (e.g. Hamburg universities, Fraunhofer Institute), private IT companies (e.g. Google, Microsoft), companies owned by the City of Hamburg (e.g. Port Authority) and of course different cultural institutions (e.g. museums, radio channels).

A taskforce has been specifically created to meet this challenges under working title "Hamburg.Kultur.Digital.

The challenges at issue are being structured in a phase model. In phase I the prerequisites for the necessary infrastructure will be provided: concept and operation of a cloud, service requirements for customer management and hosting. Phase II will see the digitisation of cultural assets: existing and new digital images of cultural assets will be joined together. In phase III new services will be created; the services will be linked with services of cultural institutions outside of Hamburg.

PLEASE TOUCH THIS HARPSICHORD!

Michael Petermann

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This is ancient music on an experiential level for everyone with no "Do Not Touch" signs on period instruments. After the successful „moving" of Florence's Uffizi to Hamburg, the Hamburg Conservatory would now like to bring to Florence some of the most renowned ancient keyboard instruments located at the Hamburg Museum for Arts and Crafts (Museum für Kunst und Gewerbe, MKG), starting with Johannes Dulcken's harpsichord of 1755.

Presentation of a sampled copy of the above mentioned instrument as a virtual instrument in a music learning and production environment. High resolution audio files, original sounds of each single note of each single stop, a MIDI keyboard and any computer with a small audio system open up the possibility to acquaint oneself with an instrument no one who is not an expert would ever be able to touch. Presentation includes prepared MIDI files as well as a short live performance.

Subsequently, more instruments will be sampled and thus made available for both playing and teaching. With more instruments at hand, such as other ancient claviers from Hamburg as well as from the Firenze/Pistoia area, a greater variety of subjects can be implemented in curricula and concert programs

Partners:

- **Hamburger Konservatorium** providing a virtual copy of the celebrate instrument via KON-Plugin

- **Conservatorio di Musica „Luigi Cherubini" Firenze** providing MARTLab and faculty

- **Museum für Kunst und Gewerbe Hamburg** providing Period Instruments for sampling and playing

- **Hamburg Ministry of Culture** providing framework and partly financing

Title:

Harpsichord by Johannes Dulcken, Antwerp 1755, Museum für Kunst und Gewerbe Hamburg

Foto Copyright:

Angela Franke / Museum für Kunst und Gewerbe Hamburg

COMMUNICATION STRATEGIES FOR THE CULTURAL OFFER AT MUSEO GALILEO

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Abstract – Nowadays effective communication strategies are essential to maintain the visibility of an institution in the enormous amount of information available on the web, while preserving at the same time a reliable and trustworthy image of the organization within the community. This can be accomplished at two different levels, through human collaboration between individuals or institutions and through the exchange of information in automated systems that rely on machine-readable standards. In particular, share metadata and release the copyright or grant the license for the publication of proprietary content on platforms of great social impact, such as Wikipedia, Google Cultural Institute and Europeana, proved to be a winning strategy for the Museo Galileo.

1 DIGITAL COMMUNICATION STRATEGIES

Nowadays institutions and museums no longer consider the issue of whether to be or not on the Internet but rather with what digital services present themselves to the public. In a phase in which economic and human resources are shrinking, the challenge is to optimize the tools and the communication strategies in order to provide adequate cultural offering.

There are many tools available to museums to give visibility to their content and their own initiatives and include not only the classic website but also social media, apps, specialized sites and partnerships with other networks.

For cultural institutions now the challenge is to be reached by their target audience and to be found in the enormous amount of information available while ensuring adequate reliability (trust) and structured content appropriately differentiated according to platforms.

The concentration and specialization of services makes it more convenient for users to go looking directly into resources provided by known providers such as Wikipedia. It is well known that there is no real guarantee on the accuracy of information retrieved from Wikipedia, but it is indubitable that it is constantly verified by a very active and large community that will eventually ensure a good reliability on the quality of the data.

The first problem for the user is to find the information, and in this regard Google helps a lot, but then comes the problem of reliability of the retrieved information. Even the website of an institution, no matter how reputed and prestigious, but little known outside its domain, may be perceived as not completely trustworthy to the user's first visit. For this reason the contribution of Wikipedia is essential, not only for the control of the information, but also for the standardization of the presentation format that it guarantees.

Another benefit of the presence of cultural institutions on platforms of great social impact like Wikipedia is the exponential growth of data visibility. It should not be forgotten that an existing information that is not retrieved or that takes too long to be sought in the digital world is almost equivalent to a non-existent information. Moreover, the presence on platforms

with different characteristics and user base allow not only to reach a wider audience but also a diversified one in terms of knowledge, interests and skills.

For an institution that counts among its primary missions the dissemination of the history of science, it is crucial to reach an increasingly wider audience: this entails the involvement of an ever new and diverse public, not only limited to domain experts.

Regarding cultural institutions, collaboration can take place either with other similar entities or with complementary ones. Collaboration can take place both at the institutional level and at data archive level. The latter type is relatively new and is made possible by a series of standards (e.g. LOD) which allow to automatically create a connection among datasets. Data integration in a wide network provides the user with a significantly better service than that provided by a single institution.

2 COOPERATION BETWEEN MUSEO GALILEO AND WIKIMEDIA ITALIA

For what reason an institution such as Museo Galileo, with an institutional site already rich in content [1], should feel the need to release its own data on a platform like Wikipedia? The question arises because, if there is an obvious advantage for Wikipedia, the benefit is less evident for those who have to release, and then somehow 'give up the ownership' of their content.

In fact the advantage exists. Free the content on Wikipedia means making the data available and 'open' to integration and improvement. The results can then be searched and read by more people who, perhaps precisely because of the additions in the Wikipedia page, will approach those contents and from there will 'transit' to the institution that produced them. Furthermore, in this way content becomes available for translation or versions in other languages at no cost (e.g. if the Museo Galileo's page had not been in Wikipedia, now there would not be its Georgian and Greek versions).

Museo Galileo has been chosen, together with the Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci in Milan, with MUSE–Science Museum in Trento and with the Fondazione Mansutti in Milan, to welcome a "Wikipedian in Residence" for a three-month stay (from April to June 2016) and in-house working [2]. The Wikipedian in Residence is someone especially skilled in Wiki Projects who works in-house at an organization with the aim of bringing its collections out in the Wikipedia world. Museo Galileo was selected on the basis of the cultural and historical value of its collections and because of the rich documentary materials and iconography it owns.

As a result of the project, over 450 Italian and English records from the Museo Galileo website which are pertinent to entries not yet included in Wikipedia, about 130 pictures and some videos have been shared with the Wikipedia community. Moreover, training workshops enabled the museum staff to work by themselves in the Wikipedia world after the Residency ended.

This project notably implemented the topics related to the history of science in the most visited online encyclopedia. Not to forget that this is a new "chapter" of a dialogue with Wikimedia Italia that began in 2009 through the sharing of some biographies from "A Thousand Years of Science in Italy" website and continued in recent years with the creation of entries related to the museum collections and library.

From the museum's point of view, the benefits of this collaboration did not take long to show. In fact, the visualizations of the page related to the Museo Galileo, now available in 15 languages on Wikipedia [3], have grown significantly over the course of 2016: 9.196 from January to March, 10.383 from April to June, up to 11.620 from July to September, with an increase of over 10% for each trimester. During the year 2016, the "Museo Galileo" page has been viewed 41.133 times; the English version is the most visited, but at the same time a significant increase in visualizations has been registered also for the French, Spanish and German editions [4].

The Museum will continue to work on the GLAM project with Wikipedia thanks to the contributions of its staff and the researchers who collaborate with the Institution.

3 MUSEO GALILEO ON GOOGLE CULTURAL INSTITUTE AND STREET VIEW

Always with a view to expand its visibility on the web, Museo Galileo has partnered with Google for the realization of some services presented on Google sites. Contrary to what happens with Wikipedia, in this case it is not even necessary to release the copyright, but simply to grant the license for publication on Google's servers. On the other hand, it is easy to see how the visibility offered by Google can be a very interesting opportunity for a small or medium institution.

Google Art Project

Google Art Project is the Google's initiative which collects multimedia stories made by a number of prestigious cultural institutions all around the world. Museo Galileo has developed some themes [5] in order to present its own collections, the main topics of the exhibitions, and the activities carried out by the Institute. In particular, on the platform, users can find the Medici and Lorraine collections -which are the backbone of the museum tour- the Library of the Institute, and a study on Galileo and space exploration which connects the museum exhibition with the astronomical discoveries of the scientist.

Google Street View

Another opportunity to reach new audiences, and at the same time to provide a useful service, is Google StreetView. In this case the virtual tour of the Museum and part of the Library is made available both by the Art Project and Google Maps. The high quality of the images allows a real virtual tour of the Museum, while presenting at the same time the descriptions for the most significant objects.

The service has both a contingent and a long-term value, since it depicts the Museum at a given moment, thus constituting a precious testimony for future reference.

4 MUSEO GALILEO AND LINKED OPEN DATA (LOD)

In addition to human data sharing that takes place in Wikipedia and other similar platforms, data exchange can be performed in a more automated way thanks to the LOD (Linked Open Data) technology, a set of best practices for publishing and connecting structured data on the Web. Since it is based on open standards that make data easily

accessible and interpretable, LOD enables a more effective human-machine communication, and improves interoperability between information systems.

This results in a series of benefits, such as the reduction of duplicated information and the generation of important links among web pages, leading to an improved user experience as well as the enrichment of metadata.

In particular the technologies of the semantic web and the LOD applied to historical and cultural materials allow to enhance and enlarge the information heritage, connecting it with different datasets and thus creating a basis for an open, shared and continually expanding knowledge.

Datahub and OpenData

With this in mind Museo Galileo, with the collaboration of @CULT, took part in the project titled Museal Innovation - New ERgonomic Visit Approach (MINERV@), which led to the creation of a dataset according to the principles of the Linked Open Data (LOD).

The data selection was made among the bibliographic and authority records from the Museo Galileo collective database, originally produced in MARC21 format. According to the principle of common interest, all relevant information to end users, such as title, author, publisher, year of publication etc. have been extracted and deeply analyzed in order to select the best suited ontologies to represent the data. Finally the data have been converted in RDF (Resource Description Framework). The Museo Galileo dataset includes the catalogue of the scientific instruments displayed in the Museum, the library catalogue, the database of the archival and photographic materials, the Italian Bibliography of the History of Science and the Galileian Bibliography.

In order to put our RDF triples in the so called Web of Data and to allow their use and their interlinking with data of other providers, the Museo Galileo dataset has been published as Linked Open Data in Datahub [6] and in OpenData (Regione Toscana) [7].

Europeana

Europeana is an EU digital library that brings together the contributions - including artworks, artefacts, books, manuscripts, videos and sound recordings - of more than 3.000 cultural heritage institutions across Europe. While the digital objects that users can find on the platform remain on the networks of the cultural organizations that created them, Europeana collects the metadata of those items mapped to a single common standard, the Europeana Data Model (EDM), that makes them more easily accessible and searchable. The adoption of this model, that followed the previous Europeana Semantic Elements (ESE), also allows Europeana to enrich its providers' metadata by automatically linking text strings found in the metadata to controlled terms from Linked Open dataset or vocabularies, such as Geonames for places, or DBpedia for person names and concepts. Furthermore, the release of the Art and Architecture Thesaurus (AAT) by the Getty Research Institute as Linked Open Data made it possible for Europeana to offer an unambiguous reference to a controlled, trustable subject representation for concepts related to art, architecture, and other types of cultural heritage and conservation.

Realizing the huge potential of the project, Museo Galileo has been involved in it since its beginning when the European Digital Library Network (EDLnet) launched a prototype of cross-domain, user-centered, multi-lingual portal on November 2008. Since then, the museum

has provided Europeana with metadata of its own Catalogue of scientific instruments and the application 'Scientific itineraries in Tuscany', periodically updating and enriching the semantics of the digital objects.

In this case the information provided have a different value, because they are intended both for the end user and for the re-use by automated systems via APIs. It should not be forgotten that the value of this information is multiplied by the fact that these datasets can be found along with those of other similar European institutions, so as to form a common catalogue the value of which is much greater than the sum of the individual parts.

Recently, Museo Galileo has produced on behalf of Europeana a virtual exhibition on Leonardo's Horse, an unrealized project of the great artist that has been reconstructed thanks to the author's notes, in which the technical and scientific aspects of the production are dealt in details. In this case too, the use of a wide-spread platform allows the museum to obtain its purpose of dissemination of scientific culture, while reaching a new and wider public at the same time.

FIGURES AND TABLES

Fig. 1 - Museo Galileo Street View available on Google Cultural Institute
and Google Maps. User can virtually walk in the Museum and is provided with a visual list of available instruments.
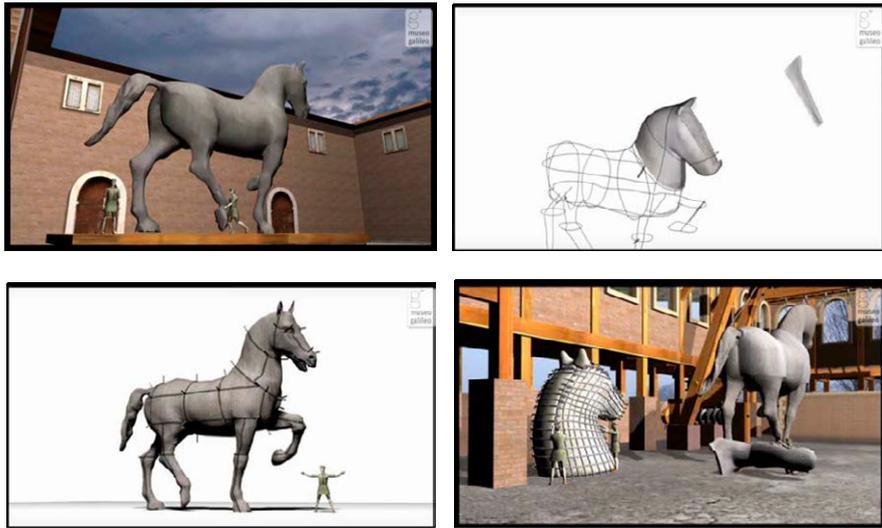
Fig. 2 - The Colossus of Leonardo da Vinci on the Europeana website. A series of chapters narrate the vicissitudes of the project with texts and animations.
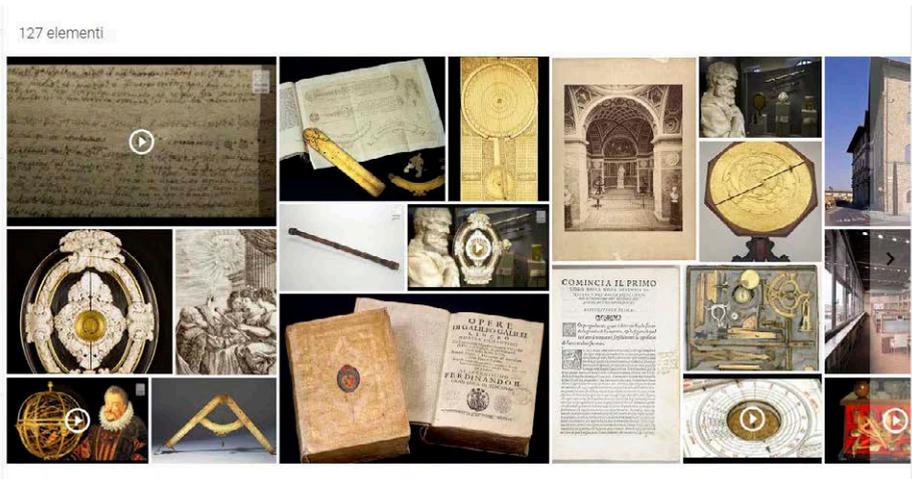
Fig. 3 - Presentation of the semantic elements of Museo Galileo on the Google Cultural Institute portal. Each element is available as stand-alone information or as part of a story.
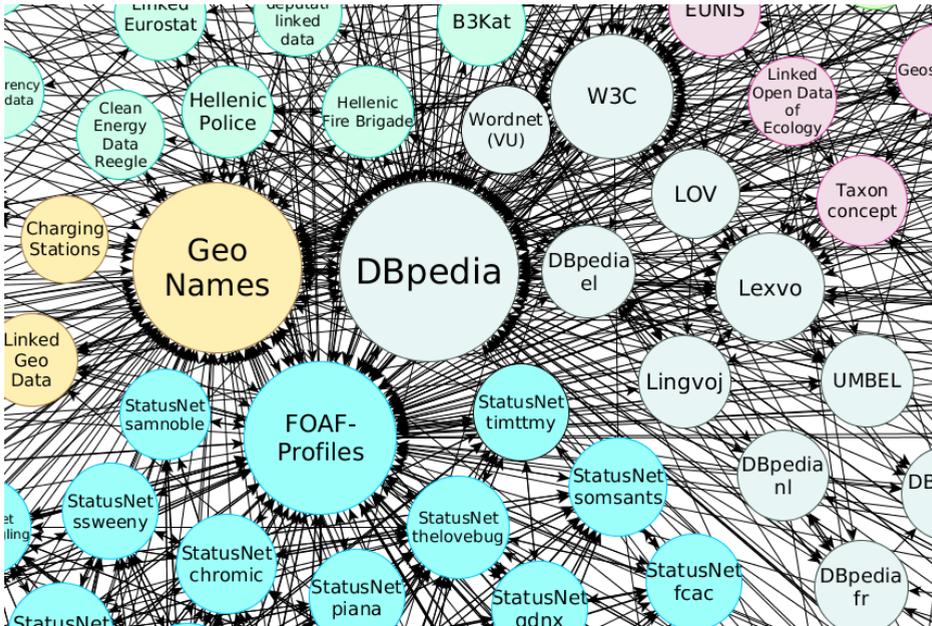
Fig. 4 - A section of the LOD cloud as described in the W3C. The huge amount of interconnections between datasets is an indicator of the potential knowledge that can be automatically inferred.

6 CONCLUSIONS

In recent years the Museo Galileo, in collaboration with other institutions, has participated in several initiatives designed to broaden its outreach to a diverse audience, always focusing on its mission. These initiatives were not only addressed to the public, but also aimed at metadata sharing, making information usable by machines and other content producers. The balance of these activities, which led to the presence of the museum on highly sought-after platforms, is very positive: as shown by the Wikipedia case, the increase in visibility has been significant. It is worth noting that it is not only the amount of people reached that counts, but also the fact that new users coming from other fields of knowledge were involved, who would not have been reached through usual channels.

For the future, in addition to continuing on the current path in collaboration with the same institutions and other sharing platforms, we expect an extra effort in at least two new directions:
- start collaborations and create consortia with institutions of the same type to make the resources of each organization available in a wider search system that can provide an aggregate service to the end users
- ensure an active presence of the Museum on social platforms in order to effectively advertise the educational activities of the institution.

ACKNOWLEDGEMENTS

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[5] Museo Galileo entry on Google Cultural Institute. Available at https://www.google.com/culturalinstitute/beta/u/0/partner/museo-galileo (accessed 9th March 2017).

[6] Museo Galileo dataset description on the Open Knowledge Foundation http://datahub.io/organization/museogalileo (accessed 9th March 2017).

[7] Museo Galileo dataset description on the Tuscany Region website http://dati.toscana.it/dataset/banca-dati-museo-galileo-strumenti-libri-fotografie-documenti (accessed 9th March 2017).

A Systematic approach to crowdsourcing and crowdfunding in Cultural Heritage initiatives: the Heribits Project Factory

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Summary

This paper introduces the objectives and first outcomes of the research project Heribits, co-funded by the industrial research program "Bando Unico della Ricerca" issued by the Tuscany Region. The project proposes an innovative methodology as well as advanced technologies enabling a new paradigm of collective awareness in the planning, sourcing and execution of Cultural Heritage initiatives.

Cultural initiatives often suffer of a chronic inability to effectively engage and spend substantial community and national resources for underdeveloped areas, a large part of which addressed to themes such as the protection and enhancement of cultural heritage, the promotion of local identities and the impulse to cultural tourism.

In fact there is virtually a lack of structured methodologies that provide: (i) the correct time to market of planned initiatives; (ii) the alignment of projects to industry best practices; (iii) the reduction or at least the coordination of cost centers, avoiding duplication and lack of critical mass; (iv) civil society *seeding* models in which the public investment catalyze processes bottom-up where and where beneficiaries of innovation shares the investment burden.

The objective of the project is to prototype a software platform able to support effectively the process of selection, design and implementation of initiatives of cultural innovation, ensuring: (i) timing; (ii) sharing from the bottom; (iii) the quality of project management by comparison with certified success cases; (iii) the socio-economic effectiveness by effective and objective methods of rating; (iv) sustainable integration in the social fabric, through a direct participation of the stakeholders involved; (v) sharing between regions, adopting proper communication and sharing initiatives.

To this end, the project will develop techniques for: (i) crowdsourcing and sentiment analysis, (ii) project analysis and matchmaking, (iii) rating of socio-economic impact and social crowdfunding of project ideas, (iv) adapting and refining the existing methodologies, and (v) integrating them in an original way for the aims of the project.

To demonstrate the method, the Heribits project is developing an innovative web platform that will integrate several application modules (to crowdsource a project ideas, to optimize them both technically and structurally, to asses their impact, for crowdfunding and stakeholders participation) in a user interface oriented to usability

and characterized by a sharp style of organizational communication. This platform is a sort of *project factory* based on sharing models of proven effectiveness, integrating crowdsourcing tools as well as assessment techniques to evaluate the socio-economic impact of the initiatives to be implemented.

By implementing *matchmaking* techniques for candidate initiatives to find relevant success cases, the project factory strongly focuses on clustering and re-use of certified existing solutions in contrast to the current state of obsolescence, mediocrity and duplication of projects, amplified by the multiplicity of centers of public spending. In addition this platform provides a mechanism of project management based on *social revenue crowdfunding* solutions involving circles of "social investors" clearly identified as indirect beneficiaries of the innovation projects, in a context of *accountability* and effective communication of the initiatives implemented.

The most relevant areas of innovation are the deployment and integration of different *artificial intelligence* technologies (machine learning, neural networks, text analytics, ontologies) to analyse unstructured data and find meaningful relationships (i.d. the so called matchmaking of projects ideas and solutions).

The Heribits project is also developing solutions of socio-economic analysis of the cultural projects dropping at the project factory, in order to determine their priorities according to their expected returns and to their contribution to higher level development policies. In addition, financing management solutions are adopted based on a crowdfunding engine able to connect the investment projects to stakeholders who will benefit directly or in terms of visibility.

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