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Experimental studies on the wooden support of the "Mona Lisa"

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IN SCIENCE AND TECHNOLOGY

**EUROPEAN
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SAFEGUARD OF CULTURAL HERITAGE

A CHALLENGE
FROM THE PAST
FOR THE EUROPE
OF TOMORROW

FIRENZE

11|13 July 2011

COST STRATEGIC WORKSHOP

SAFEGUARD OF CULTURAL HERITAGE

A CHALLENGE
FROM THE PAST
FOR THE EUROPE
OF TOMORROW

Università degli Studi di Firenze
COST - Cooperation in Science and Technology
European Science Foundation
Fondazione Florens

COST STRATEGIC WORKSHOP

July 11th- 13th, 2011
Florence, Italy

SUMMARY

INTRODUCTIONS

Marco Fioravanti	
A NEW VISION OF CULTURAL HERITAGE	9
Keynote	
Carsten Paludan-Müller <i>Cultural heritage - and the politics of conflict, poverty, peace and prosperity"</i>	10
Marc Caball <i>Individuals, societies, cultures and health</i>	11
Piero Baglioni <i>Science for the conservation of the cultural heritage</i>	12
Mario Santana-Quintero <i>Centering the role of documentation in conserving our built heritage</i>	13
Philip Cooke <i>Innovation, creativity, green economy</i>	14

Session 1 THE HUMAN DIMENSION IN CULTURAL HERITAGE

1.1 Cultural identity, landscapes and intangible heritage	
Agostino Paravicini Bagliani <i>Medioevo europeo. Medieval studies and technological resources</i>	19
Jozsef Laszlovszky <i>Monastic landscapes and the related historical and archaeological aspects</i>	21
Graham Fairclough <i>21st century lifestyles: landscape, heritage and urban identity</i>	23
Pavlina Misikova <i>Potential of co-operation of the pan-european platform on cultural heritage and landscape</i>	23
Jean-Paul Métaillié <i>"Facing the landscape": how cultural heritage is taken into account in natural parks of the french pyrenees</i>	25
Bas Pedrolí <i>Landscape - mirror of our culture. An interdisciplinary challenge safeguarding landscape values</i>	25
Amedeo Amedei, Rosa Valanzano, Mario Milco D'elios, Gianfranco Gensini, Donatella Lippi	
<i>Florence and medical humanities: intangible heritage of mankind</i>	26
Lages <i>Public space as cultural heritage</i>	26
Paolo Del Bianco <i>Discovering the past together, building a common future. The no-profit life beyond tourism® portal, to discover and promote local cultural biography</i>	27
Margherita Azzari, Camillo Berti, Paola Zamperlin <i>Wettus - wetlands atlas of tuscan</i>	27
Magdalena Bielenia-Grajewska <i>The role of cultural heritage in shaping symbolic corporate linguistic identity</i>	28
Tommaso Martino <i>The history of emotions and the safeguard of cultural heritage</i>	28
Carolina Capitanio <i>The historic urban landscape of Florence. Critical survey and redevelopment of the urban landscape</i>	29
Carsten Paludan-Müller <i>History and identity: "cultural heritage - and the politics of conflict, poverty, peace and prosperity"</i>	30
Fabio Lucchesi, Martina Angeletti, Francesco Monacci, Giovanni Ruffini, Nunziata Toscano	
<i>Persistence and metamorphosis in the settlements in Tuscany</i>	31
Luigi Zangheri <i>Remarks on landscape</i>	32
1.2 Arts, architecture & archaeology on material heritage	
Alasdair Ross <i>Tourism and recreation versus protecting cultural landscapes and heritage in the scottish highlands</i>	33
Claire McIlroy <i>The history of emotions: preserving europe's cultural heritage through interdisciplinary research collaboration</i>	35
Gert Melville <i>Medieval monasteries and religious orders as laboratories of innovation for modern times</i>	37
Camilla Mileto, Fernando Vegas <i>The role of restoration of heritage in the future europe: recovering the cultural landscape as an identity sign</i>	39
Ray Bondin <i>Heritage is a financial asset</i>	41
Paul Mironneau <i>History at museum, museum faced with history: a debate upon emotions</i>	42
Guido Vannini, Michele Nucciotti <i>Light and public!</i>	44
1.3 Written heritage, libraries, archives and other collection of social documents	
Cristina Blanco Sío-López <i>Preservation and valorisation strategies through digital humanities: the case of the CVCE's enhancement of research and education in european integration studies</i>	46
Simon Tanner <i>Preserving the past, imaging the future: how democratising access and generating measurable changes to people's lives is affecting preservation strategies for cultural heritage</i>	48
Worthy N. Martin <i>Thematic repositories of cultural heritage - case studies to inform future research and development</i>	50
Toby Burrows <i>Organizing digital resources for cultural heritage research</i>	52
Wendy Scase <i>Medieval manuscript heritage: digital research challenges and opportunities</i>	54

Cristina Dondi <i>The integration of provenance data for the reconstruction of the dispersed european book heritage</i>	57
Margherita Azzari, Irene Calloud, Paola Zamperlin <i>ARCES project - digital archive of italian scientific expeditions and colonial cartography</i>	59
<i>CLIEO centro di linguistica storica e teorica: italiano, lingue europee, lingue orientali</i>	59
Angela Frati <i>Accademia della Crusca</i>	60
Nicoletta Maraschio <i>Accademia della Crusca</i>	61
Patricia Engel <i>Common strategic framework for future eu research and innovation funding consultation</i>	63
W.N. Martin <i>Safeguard of cultural heritage: a challenge from the past for the Europe of tomorrow</i>	67
Massimo Moneglia <i>Spoken language archives at the lablita lab of the university of Florence. Projects and resources</i>	69
Gabriele Rossi Rognoni, Donatella Mitolo <i>Recovery and conservation of musical heritage: the music of grand prince Ferdinando de' Medici</i>	70
Session 2 SCIENCE FOR CONSERVATION OF CULTURAL HERITAGE	71
2.1 CONSERVATION METHODS AND MATERIALS SCIENCE	
Lars Ivar Elding <i>Conservation of the Vasa warship</i>	73
Matija Strlic <i>Historic paper - Degradation and non-destructive testing</i>	75
Luca Uzielli <i>The material sciences applied to wood restoration: future perspectives</i>	77
Philippe Colomban Ladir <i>The on-site Raman analysis of cultural heritage artefacts, paintings, rock art, pottery, glasses,... drawbacks and success!</i>	79
Linda Cocchi, Paola Mazzanti, Luca Uzielli <i>The trittico di San Pietro Martire by Beato Angelico: a panel painting deformation behaviour</i>	81
Michela Grimaldi <i>Selection and characterization of biosurfactants for the bio-cleaning application to surface deposits on stone artwork</i>	82
Irene Natali, Martina Naldini, Emiliano Carretti, Piero Baglioni, Luigi Dei <i>Nanocomposite systems composed by teos and ca(oh)₂ nanoparticles for the conservation of architechtonic surfaces</i>	82
Irene Natali, Federica Marinelli, Emiliano Carretti, Piero Baglioni, Luigi Dei, Lora Angelova, Richard G. Weiss <i>Low impact polymeric aqueous systems for the cleaning of painted surfaces</i>	83
Mariangela Potenza, Giuseppina Sabatino, Francesca Giambi, Luca Rosi, Luigi Dei and Anna Maria Papini <i>Diagnostics of egg-based paintings in cultural heritage: an innovative combined dot-elisa and uplc-based amino acid analysis approach</i>	83
Federica Acciai, Francesca Donnarumma, Antonio Frandi, Lucia Liccioli, Massimiliano Marvasi, Giorgio Mastromei, Irene Padovani, and Brunella Perito <i>Characterization of yeast-like strains isolated from deteriorated areas of two marble statues</i>	84
2.2 ARCHAEOOMETRY: METHODS AND GEOMATERIALS	
Vincent Serneels <i>The archaeology of iron production</i>	85
David Bougarit <i>On the utility of experimental simulation towards the understanding of ancient technological processes: the example of brass cementation</i>	87
Aurelio Climent-Font <i>Lustre ceramics. A sophisticated decoration method unravelled with the contribution of IBA techniques</i>	89
Vivi Tornari <i>The outcome of two EC projects (FP5 LASERACT and FP6 MULTIENCODE) in new instrumentation design of laser coherent metrology implementation for on-field implemetation. New applications and perspectives for cultural heritage research, education and training</i>	91
J. La Nasa, S. Orsini, F. Di Girolamo, F. Modugno, I. Bonaduce, M.P. Colombini <i>Characterisation of synthetic varnishes and paint materials by analytical methods based on pyrolysis and mass spectrometry</i>	92
C. Lofrumento, D. De Feo, E.M. Castellucci, M. Ricci, L. Bachechi, E.M. Castellucci <i>Spectroscopic analyses on rock art paintings from east central Ethiopia</i>	93
E. Pecchioni, E. Cantisani, F. Fratini, R. Quaresima <i>Ancient and modern mortars: knowing the past to plan the future</i>	94
E. Platania, C. Lofrumento, M. Ricci, M. Becucci, E.M. Castellucci <i>Micro-invasive textile sample treatment for sers analysis</i>	95
A. Salvini, G. Cipriani, M. Malavolti, R. Oliva, P. Baglioni, M. Fioravanti, G. Di Giulio <i>Design and synthesis of new consolidants for their use in wood conservation</i>	96
Uzielli Luca, Cocchi Linda, Dionisi Vici Paolo, Goli Giacomo, Mazzanti Paola, Gril Joseph, Colmars Julien, Jullien Delphine, Marcon Bertrand, Dureisseix David, Rémond Romain <i>Experimental studies on the wooden support of the "Mona Lisa"</i>	97
2.3 CLIMATOLOGY AND OUTDOOR/INDOOR ALTERATION OF MONUMENTS/ARTIFACTS (Plenary with session 3)	
Carlota Grossi Sampedro <i>Future climate and pollution pressures on stone heritage</i>	98
Koen Janssens <i>Imaging and spectroscopy of altered pigments in oil paintings</i>	100
Giovanni Pratesi, Fabio Sciurpi <i>Microclimatic monitoring for artefact conservation in natural history museum of Florence</i>	102

3.1 Architectural conservation and traditional knowledge systems	
Donatella Fiorani <i>Diagnostics for restoration. Scenarios, issues, and an exemplification</i>	105
Stefano Musso <i>Innovation of conservation of architectural monuments</i>	106
Marielle Richon <i>Innovative systems for the conservation, development and management of local knowledge systems</i>	108
Alberto Giretti <i>Ontologies and traditional knowledge management</i>	110
Massimo Coli, Giorgio Lacanna, Emanuele Marchetti, Maurizio Ripepe <i>Geo-seismic characterisation of outstanding cultural heritage monuments: first applications at Firenze, Italy</i>	111
Letizia Dipasquale, Natalia Jorquera Silva <i>Learning from local seismic cultures, as a strategy for reducing the risk of cultural heritage</i>	112
Letizia Dipasquale, Natalia Jorquera Silva, Saverio Mecca <i>An interdisciplinary approach to a cultural and architectural heritage: earthen dome architecture in Syria</i>	113
Luca Giorgi, Pietro Matracchi <i>Seismic risk in monumental structures. the San Gimignano risem case</i>	116
Alberto Giretti <i>Securart. large scale management of cultural assets</i>	117
Giuseppe Lotti, Ilaria Serpente <i>Design for the global south: a Mediterranean perspective</i>	118
Giuseppe Lotti, Saverio Mecca <i>Local and indigenous knowledge safeguarding and innovating: the INN-LINK-S research center</i>	119
Marco Masera <i>Energetic issues for the architectural heritage domain</i>	120
Saverio Mecca <i>Traditional architectural knowledge systems: from past to sustainable future</i>	122
Saverio Mecca <i>Web-based codified and tacit knowledge management and conservation of vernacular architecture heritage</i>	124
Andrea Fiaschi, Luca Matassoni, Giovanni Pratesi, Gilberto Saccorotti <i>Microtremor: from the container to the contents</i>	126
Luisa Rovero, Ugo Tonietti <i>Criteria for the use of composite materials in the consolidation of historical heritage</i>	127
Valeriano Sandrucci, Enrico Vicario <i>Combining ontologies and social networking in the collection of cultural heritage information resources</i>	128
3.2 Geomatics and Multimedia Technologies	
Lysandros Tsoulos <i>The role of geomatics in safeguarding cultural heritage</i>	129
Mario Santana Quintero <i>Safeguarding the significance and integrity of architectural heritage: the role of recording, documentation and information systems</i>	131
Fabio Remondino <i>Digital 3D recording for heritage documentation and preservation - latest developments and perspectives</i>	133
Alberto Del Bimbo <i>Multimedia technologies for cultural heritage</i>	134
Francesco Algostino, Laura Bucalossi, Alessandro Conti, Alessia Nobile <i>Mare nostrum: a heritage trail along the phoenician maritime routes and historic port-cities of the Mediterranean sea</i>	135
Fabio Anfossi, Giulia Bebi, Flaviano Fanfani, Giovanni Pratesi, Valentina Bonora, Daniela Cini, Alessandro Conti, Lidia Fiorini, Grazia Tucci <i>Experiences of natural heritage 3d surveying and physical reproduction</i>	137
Daniela Cini, Alessia Nobile <i>The 3D digital content production for virtual archaeology: models for conservation archives and models for interactive exhibitions</i>	138
Alessandro Conti, Lidia Fiorini, Marco Pagliai <i>3D survey for the knowledge and conservation of the Pratolino Park</i>	139
Valentina Dante, Naida Di Nino, Fiorella Gaudio, Luigi Mussio and Alice Pozzoli <i>3D gis modeling for safeguard of cultural heritage</i>	140
Gabriele Fangi <i>The spherical photogrammetry for cultural heritage</i>	141
Nora Lombardini, Valentina Bonora and Nadia Guardini <i>The survey of the dome of the basilica of St. Vitale in Ravenna</i>	142
Valentina Dante, Naida Di Nino, Fiorella Gaudio, Luigi Mussio and Alice Pozzoli <i>3D gis modeling for safeguard of cultural heritage</i>	143
Vito Cappellini <i>2D - 3D ch images for ict systems</i>	145
Marco Scaioni, Elisabetta Rosina <i>IRT-photogrammetric procedure for 3D rendering</i>	146
E. Sonnino, A. Iaccarino Idelson, M. Callieri, M. Dellepiane, R. Scopigno, M. Fabbri <i>The Madonna of Pietranico: a testbed for advancing computer-aided restoration methodologies</i>	147
Grazia Tucci, Valentina Bonora and Francesco Algostino <i>Building the virtual memory of the holy sepulchre in Jerusalem: metric survey and 3d modeling</i>	148
Grazia Tucci, Alessia Nobile, Maria Riemma, Valerio Tesi <i>The Basilica della Madonna dell'Umiltà in Pistoia: 3D survey and study of geometry and structure of the dome</i>	149
Grazia Tucci, Valentina Bonora and Alessia Nobile <i>How can geomatics help?</i>	150
Grazia Tucci, Francesco Algostino, Valentina Bonora and Daniela Cini <i>Cultural heritage between 3D digitization and 3D reproduction</i>	151
3.3. Novel non-destructive techniques for diagnostics (Plenary with session 2)	
R. Cubeddu, D. Comelli, A. Nevin, A. Brambilla, G. Valentini, L. Toniolo <i>Spectral and time resolved laser induced fluorescence imaging as a diagnostic tool in cultural heritage</i>	152
Motoyuki Sato <i>New challenges of ground penetrating radar for archaeological survey</i>	155
L. Alparone, M. Benvenuti, P. Costagliola, F. Garfagnoli, S. Moretti, E. Pecchioni, S. Vettori, M. Camaiti, L. Chiarantini <i>Hyperspectral instruments as potential tools for monitoring decay processes of historical building surfaces</i>	157

SUMMARY

Ilaria Bonaduce, Maria Perla Colombini, Marianne Odlyha, Mikkel Scharff, Rene Larsen, Dorte Vestergaard Poulsen Sommer, Elin Dalin, Terje Grøntoft, Susana Lopez-Aparicio, David Thickett, Guillermo Andrade López, Ana Tabuenca García, Antonio Ortega, Stephen Hackney, Joyce Townsend, Peter Vandenabeele, Antje Potthast, Ute Henniges, Octaviana Marincas, Colette McDonagh, Dorota Wencel, Philip Bowe, John J. Ackerman, Paul Bellendorf, Johanna Leissner, Alexandra Schieweck, Karin Drda-Kühn	<i>New challenges of ground penetrating radar for archaeological survey</i>	158
Costanza Cucci, Andrea Casini, Marcello Picollo, Marco Poggesi, Lorenzo Stefani	<i>Hyper-spectral imaging for diagnostics on polychrome artworks: state-of-the-art and recent advances of the research based on the ifac-cnr hyper-spectral scanner</i>	159
Riccardo Fanti, Deodato Tapete, Giovanni Gigli, Nicola Casagli	<i>Terrestrial laser scanning for advanced analysis on historic hilltop sites affected by geohazards</i>	160
Kaori Fukunaga, Iwao Hosako, Costanza Cucci, Marcello Picollo	<i>Terahertz imaging methodologies applied to the investigation of artworks</i>	161
Massimiliano Pieraccini, Matteo Fratini, Carlo Atzeni, Michele Betti, Gianni Bartoli	<i>Assesment of vibration reduction on the Baptistery of San Giovanni in Florence (Italy) after vehicular traffic block</i>	162
Elisabetta Rosina	<i>Modihma: innovative techniques for moisture detection in historical masonry</i>	164
Deodato Tapete, Nicola Casagli, Riccardo Fanti	<i>Diagnosis of deterioration in cultural heritage sites: promising perspectives for monitoring at different scales by radar interferometry techniques</i>	165
U. Zammit, F. Mercuri, N. Orazi, M. Marinelli, S. Paoloni, F. Scudieri	<i>Active irt applications to the cultural heritage analysis</i>	166
Session 4 SOCIETAL FUNCTION OF CULTURAL HERITAGE		167
4.1 CONSERVATION, ENHANCEMENT OF HERITAGE AND CULTURAL TOURISM		
Luis Cesar Herrero Prieto	<i>Measuring economic value and social viability of cultural heritage and institutions</i>	169
Xavier Greffe and Francesca Cominelli	<i>Why and how should intangible heritage be safeguarded?</i>	172
Francois Colbert	<i>The marketing of cultural heritage: some topics to be explored</i>	174
Magda Antonioni Corigliano	<i>Sustainable cultural tourism in urban systems</i>	176
Derya Altunbas	<i>Local administrations and immovable cultural heritage in urban areas in Turkey</i>	182
Francesca Cominelli	<i>Conservation of cultural heritage: a research on traditional building craft skills in France</i>	183
Elena Livi	<i>ITC and museums: the role of web sites in creating knowledge</i>	184
Ludovico Solima	<i>Agenda for museums: the next future</i>	185
Barbara Sibillio	<i>Policies and management of the heritage museum in the different perspectives of value: methods and tools of measurement and communication through ICT</i>	187
4.2 CREATIVITY AND INNOVATION FOR INDUSTRIES		
Fernando Alberti	<i>Cultural heritage, tourism and regional competitiveness</i>	188
Fiorenza Belussi	<i>Business models and networks of creativity in historical industrial districts and low-techsectors</i>	190
Joan Trullèn	<i>Knowledge city strategy: the case of Barcelona.</i>	193
Lisa De Propriis	<i>Cultural and creative industries: a research agenda</i>	194
Francesca Imperiale	<i>Environmental and cultural system (ECS), Lands of Lupiae, "Natural areas, archeology and culture in Apulia on the Messapia coast"</i>	197
Anne Lorentzen	<i>Experience economy</i>	198
4.3 BRIDGING CULTURE, SOCIETY AND CREATIVE SPACES		
Masayuki Sasaki	<i>Urban regeneration through cultural creativity and social inclusion in Japan</i>	200
Allen J. Scott	<i>Emerging cities of the third wave: cognitive-cultural capitalism in the urban process</i>	202
Sharon Zukin	<i>Preserving urban cultural heritage: authentic local shops</i>	203
Annarita Lapenna	<i>The inter-milieus city</i>	205
Luciano Pilotti	<i>Urban ecology and cultural heritage values for a new emergent european city</i>	207
Jose' Prada	<i>Urban regeneration and social cohesion. using cultural heritage for urban regeneration against shrinkage: the case of Aviles, Spain</i>	212
Chris Younés	<i>Regeneration of inhabited milieus</i>	213

EXPERIMENTAL STUDIES ON THE WOODEN SUPPORT OF THE "MONA LISA"

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The "Mona Lisa" (Louvre Museum, Paris) has been painted during the period 1503-1514 by Leonardo da Vinci on a panel of Poplar (*Populus alba* L.) ~79 x 53 cm, ~13 mm thick.

The panel, which features a complex double curvature, is affected by a ~11 cm-long crack, possibly dating not long after the painting was made, running through the whole thickness, tightly connected with the pattern of permanent curvature. The panel is inserted in an Oak frame ("châssis-cadre"), and is slightly forced against it by means of four cross-beams, which hold it flatter than it would be if unconstrained.

Since the "Mona Lisa" was going to be moved in a new display case in the "Salle des États", in 2004 the Curators of the Louvre Museum asked us the main following questions:

- evaluate climatic specifications for the new display case
- assess the risk of crack propagation
- suggest possible modifications to the frame ("châssis-cadre")
- improve the monitoring procedure (the display case gets opened yearly, to check the conditions of the painting).

Our group studied the panel's geometry, the anatomical and physical properties of the panel's wood, and evaluated the constraint conditions produced by the frame. We also designed and implemented, among others, techniques and equipment:

for manual measurements, to be performed on the panel, on the occasion of the yearly opening (weight, shape, forces exerted by the cross-beams).

for automatic monitoring deformations and forces exerted by the cross-beams, during the normal stay of the panel in the display case, where the climate is tightly controlled, but however some slight variations of T and RH inevitably occur and produce some very small distortions.

In 2006 a Book was published, summarizing the results of the several researches carried out on the "Mona Lisa" in that period.

Among several other results, the following were obtained and described in such book.

The observed trend for deflection of the Panel could be well predicted by a heat & mass transfer + hygromechanical computer model.

The risk of crack propagation has also been assessed, on the basis of the computer model and by means of Griffith theory.

This study keeps ongoing, every year we are present at the opening of the display case.

Data obtained so far provides valuable information on this Panel's behaviour; data analysis and mechanical modeling provide promising results also for Panel Paintings in general – work is still in progress.

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