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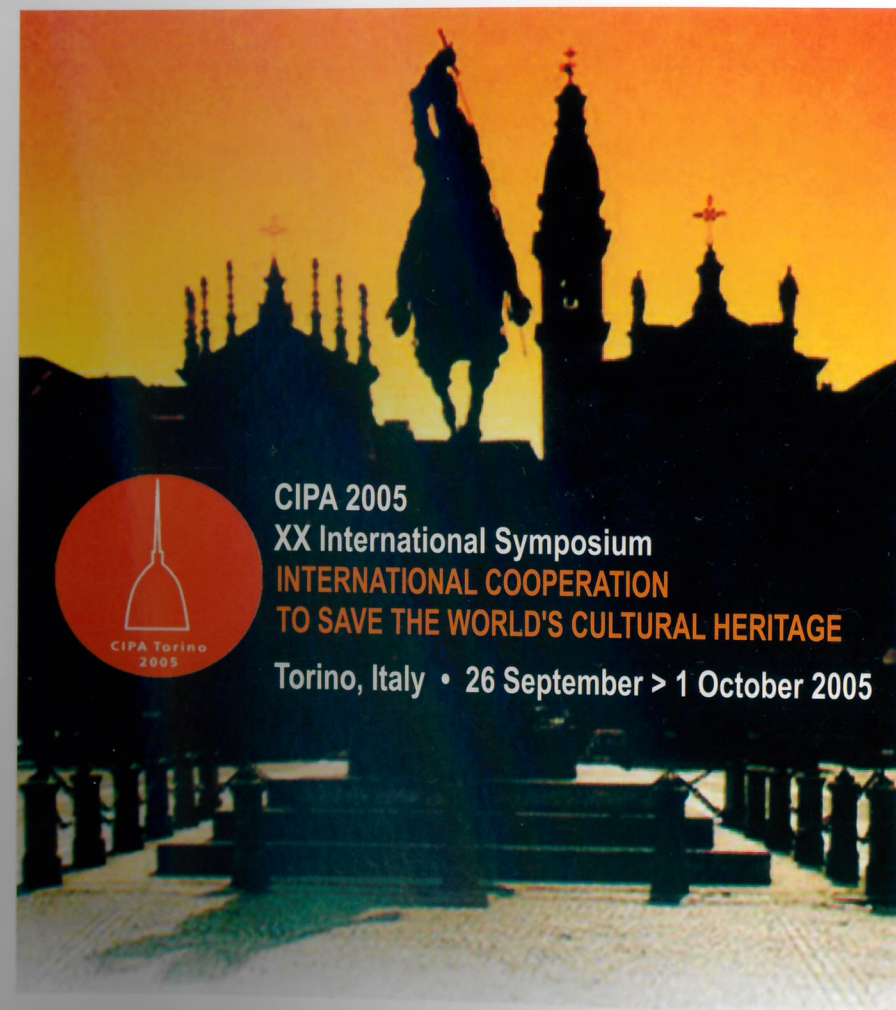


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Politecnico di Torino  
Land, Environment and Geo-Engineering Department  
Corso Duca degli Abruzzi, 24  
10129 Torino, Italy  
  
Tel.: +39 011 564 76 02  
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- CIPA Treasurer  
Prof. Pierre Grussenmeyer  
National Institute of Applied Sciences of Strasbourg  
Photogrammetry & Geomatics Group  
24, Boulevard de la Victoire, F-67084 Strasbourg Cedex  
  
Tel./Fax +33 3 88 14 47 33  
E-mail: [Pierre.Grussenmeyer@insa-strasbourg.fr](mailto:Pierre.Grussenmeyer@insa-strasbourg.fr)

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## TABLE OF CONTENTS

page

### CIPA NEW HONORARY MEMBERS – CURRICULA VITAE

|                 |    |
|-----------------|----|
| Dallas R.W.A.   | 27 |
| Erder C.        | 29 |
| Jachimsky J. J. | 31 |
| Waldhäusl P.    | 33 |

### WORKING GROUP I

#### DATA ACQUISITION AND RECORDING TECHNIQUES 35

|   |    |
|---|----|
| Achille C., Fregonese L., Monti C., Savi C. | 37 |
|---|----|

ADVANCED METHODOLOGIES FOR SURFACE ANALYSIS: METHODS, COMPARISON AND MONITORING OF THE MOSAIC SURFACE FLOOR OF THE ST. MARK'S BASILICA IN VENICE

|   |    |
|---|----|
| Achille C., Monti C., Monti C.C., Savi C. | 43 |
|---|----|

SURVEY AND REPRESENTATION OF THE VILLA REALE DI MONZA TO SUPPORT OF THE INTERNATIONAL DESIGN COMPETITION

|                                     |    |
|-------------------------------------|----|
| Agnello F., Lo Brutto M., Lo Meo G. | 49 |
|-------------------------------------|----|

DSM AND DIGITAL ORTHOPHOTOS IN CULTURAL HERITAGE DOCUMENTATION

|                                     |    |
|-------------------------------------|----|
| Agosto E., Ardissonne P., Bornaz L. | 55 |
|-------------------------------------|----|

THE CASTLE OF GRAINES: DIFFERENT SURVEY METHODOLOGIES FOR THE DOCUMENTATION OF HISTORICAL BUILDINGS

|  |    |
|--|----|
| Agosto E., Ardissonne P., Maschio P., Porporato C., Ranieri P. | 59 |
|--|----|

A SURVEY OF "THE SALA DEGLI STUCCHI", AN ORNATE BAROQUE HALL

|                         |    |
|-------------------------|----|
| Agosto E., Porporato C. | 63 |
|-------------------------|----|

HISTORICAL COLONNADE COURTYARD SURVEYS: COMPARISON BETWEEN THE SEMINARIO MAGGIORE AND THE UNIVERSITY BUILDING

|                          |    |
|--------------------------|----|
| Alshawabkeh Y., Haala N. | 68 |
|--------------------------|----|

AUTOMATIC MULTI-IMAGE PHOTO-TEXTURING OF COMPLEX 3D SCENES

|   |    |
|---|----|
| Aminti P., Bianchini L., Chiaverini I., Ostuni D., Sacerdote F. | 74 |
|---|----|

MIGLIARINO-SAN ROSSORE NATURAL & ARCHEOLOGICAL PARK: EXPERIENCES IN MONITORING COASTAL LANDSCAPE EVOLUTION

|   |    |
|---|----|
| Andrews D.P., Beckett N.J., Clowes M., Tovey S.M. | 77 |
|---|----|

A COMPARISON OF RECTIFIED PHOTOGRAPHY AND ORTHOPHOTOGRAPHY AS APPLIED TO HISTORIC FLOORS – WITH PARTICULAR REFERENCE TO CROUGHTON ROMAN VILLA

|   |    |
|---|----|
| Andries P., Fasseur C., Debie J., Goossens R., Devriendt D. | 82 |
|---|----|

DIGITAL CLOSE-RANGE PHOTOGRAMMETRY OF STATUE-COLONNES APPLIED ON THE TOURNAI CATHEDRAL (BELGIUM)

|  |    |
|--|----|
| Ardissonne P., Bornaz L., Lo Turco M., Vitali M. | 86 |
|--|----|

THE RELIEF OF THE *PORTA PALATINA*: A COMPARISON BETWEEN DIFFERENT SURVEY METHODOLOGIES AND REPRESENTATIONS

|  |     |
|--|-----|
| <b>Artese G., Achilli V., Boatto G., Fabris M., Salemi G., Trecroci A.</b><br>PETER BERNINI IN CALABRIA: THE SCULPTURES OF THE "SS. PIETRO E PAOLO CHURCH" IN MORANO CALABRO   | 91  |
| <b>Balletti C., Guerra F., Mander S., Manzin M.</b><br>SURVEY OF MODERN ARCHITECTURE   | 95  |
| <b>Balsarno A., Chimienti A., Grattoni P., Meda A., Nerino R., Pettiti G., Rastello M.L., Spertino M.</b><br>ARCHITECTURAL SURFACE MONITORING BY MEANS OF THE ACTIVE VISION SYSTEM "AVS"                                   | 101 |
| <b>Bianchini L., Bartoli G., Chiaverini I., Costantino F., Ostuni D.</b><br>TOPOGRAPHIC AND PHOTOGRAMMETRIC STUDIES OF THE BEARING STRUCTURES OF THE CAPPELLA DEI PRINCIPI OF FLORENCE                                     | 107 |
| <b>Biasion A., Cina A., Pesenti M., Rinaudo F.</b><br>AN INTEGRATED GPS AND TOTAL STATION INSTRUMENT FOR CULTURAL HERITAGE SURVEYING: THE LEICA SMARTSTATION EXAMPLE   | 113 |
| <b>Biasion A., Lingua A., Rinaudo F.</b><br>ANALYSIS OF JPEG2000 QUALITY IN PHOTOGRAMMETRIC APPLICATIONS   | 119 |
| <b>Bitelli G., Girelli V.A., Tini M.A., Vittuari L.</b><br>INTEGRATION OF GEOMATIC TECHNIQUES FOR QUICK AND RIGOROUS SURVEYING OF CULTURAL HERITAGE  | 124 |
| <b>Bonino R., Gasco G., Massa A., Rossi S.</b><br>PHOTOGRAMMETRIC METHODS APPLIED TO THE REPRESENTATION OF CURVE FACADES: AN EXPERIMENT CONDUCTED ONTO PALAZZO CARIGNANO IN TURIN  | 130 |
| <b>Bonora V., Colombo L., Marana B.</b><br>LASER TECHNOLOGY FOR CROSS-SECTION SURVEY IN ANCIENT BUILDINGS: A STUDY FOR S. M. MAGGIORE IN BERGAMO   | 136 |
| <b>Bosch R., Külür S., Gülch E.</b><br>NON-METRIC CAMERA CALIBRATION AND DOCUMENTATION OF HISTORICAL BUILDINGS   | 142 |
| <b>Brumana R., Fassi F., Fregonese L., Monti C., Potenza A., Colizzi L., De Pascalis F.</b><br>SIDART-A NEW INTEGRATED SYSTEM FOR DIAGNOSTIC OF THE CULTURAL HERITAGES   | 148 |
| <b>Brumana R., Fregonese L., Fassi F., De Pascalis F.</b><br>3D LASER SCANNER POINTS CLOUDS AND 2D MULTI-SPECTRAL IMAGES: A DATA MATCHING SOFTWARE FOR CULTURAL HERITAGE CONSERVATION                                      | 154 |
| <b>Brumana R., Monti C., Monti G., Vio E.</b><br>LASER SCANNER INTEGRATED BY PHOTOGRAMMETRY FOR REVERSE ENGINEERING TO SUPPORT ARCHITECTURAL SITE AND RESTORATION OF THE MOSAIC FLOOR INSIDE ST. MARK'S BASILICA IN VENICE | 159 |
| <b>Campanella C., Bondani M., Toscani G.P.</b><br>QUICK SURVEY SYSTEM  | 165 |

|  |     |
|--|-----|
| <b>Campanella C., Tessori M., Bortolotto S., Ciocchini E., Zangheri F.</b><br>BASILICA OF SAINT PETER MARTYR FROM VERONA IN S. ANASTASIA (VERONA): STRUCTURES<br>GEOMETRIC SURVEY AND PHOTOGRAPHIC CAMPAIGN FOR THE PRESERVATION PROJECT | 171 |
| <b>Campanella C., Tessori M., Bortolotto S., Macchi A.</b><br>METHODS FOR DATING HISTORICAL BUILDINGS AND VERTICALITY CONTROL OF THE BARONALE<br>PALACE AT AVIO'S CASTLE (TN)  | 177 |
| <b>Capra A., Costantino D., Rossi G., Angelini M.G., Leserri M.</b><br>SURVEY AND 3D MODELLING OF CASTEL DEL MONTE   | 183 |
| <b>Çay T., Inam S., Işcan F., Cagla H.</b><br>INVENTORY STUDIES FOR TOURISM INFORMATION SYSTEM OF OBRUK LAKE IN KONYA/TURKEY   | 189 |
| <b>Chandler J.H., Fryer J.G.</b><br>RECORDING ABORIGINAL ROCK ART USING CHEAP DIGITAL CAMERAS AND DIGITAL<br>PHOTOGRAMMETRY  | 193 |
| <b>Cordera L., Ricciardi Venco R.</b><br>THE HATRA PROJECT. A PROPOSAL FOR THE CREATION OF DATABASE COMPRISING THE WHOLE OF THE<br>CITY'S ARCHAEOLOGICAL RECORDS   | 199 |
| <b>Crescenzi C., Magi A., Porporato C., Rinaudo F.</b><br>THE SURVEY OF THE BAROQUE INTERIOR OF THE SAN LORENZO CHURCH IN TURIN  | 203 |
| <b>Crespi M., De Vendictis L., Fabiani U., Luzietti L., Mazzoni A.</b><br>THE ARCHAEOLOGICAL INFORMATION SYSTEM OF THE UNDERGROUND OF ROME: A CHALLENGING<br>PROPOSAL FOR THE NEXT FUTURE  | 209 |
| <b>D'Amelio S., Emmolo D., Lo Brutto M., Orlando P., Villa B.</b><br>3D TECHNIQUES FOR THE SURVEY OF CULTURAL HERITAGES  | 215 |
| <b>Dezzi Bardeschi M.</b><br>GEOMATIC FOR CONSERVATION: "THE SHADOW AND THE REALITY"<br>READING THE SPERIMENTAL AND THEORETIC EFFORTS OF WORLDWIDE RECOGNIZED GENIUS: LEON<br>BATTISTA ALBERTI   | 220 |
| <b>Doneus M., Neubauer W.</b><br>3D LASER SCANNERS ON ARCHAEOLOGICAL EXCAVATIONS   | 226 |
| <b>Ebrahim M.A.B.</b><br>STUDYING THE EFFECT OF SOME IMAGE ENHANCEMENT FEATURES ON THE ACCURACY OF CLOSE<br>RANGE PHOTOGRAMMETRIC MEASUREMENTS USING CAD ENVIRONMENT   | 232 |
| <b>Eisenbeiss H., Lambers K., Sauerbier M., Zhang L.</b><br>PHOTOGRAMMETRIC DOCUMENTATION OF AN ARCHAEOLOGICAL SITE (PALPA, PERU) USING AN<br>AUTONOMOUS MODEL HELICOPTER  | 238 |
| <b>Elwazani S., Fellah A.</b><br>A PROGRAMMED PROCEDURE FOR SELECTING MEASURED SURVEY METHODS  | 244 |



|  |     |
|--|-----|
| <b>Erwes H., Prado W.S., Stelle C.A.</b><br>THE LAST OF THE WORLD'S OLD ZEPPELIN HANGARS IN RIO DE JANEIRO/BRAZIL. DOCUMENTATION OF AN ENGINEERING HERITAGE  | 250 |
| <b>Ethrog U.</b><br>3D MAPPING OF DARK AND COMPLICATED OBJECTS BY RASTERSTEREOGRAPHY   | 255 |
| <b>Fangi G., Malinverni E.S., Schiavoni A.</b><br>INTEGRATED SURVEYING TECHNIQUES FOR THE ARCHAEOLOGICAL PARK OF CHAN-CHAN IN PERU   | 259 |
| <b>Fastellini G., Grassi S., Marrucci M., Radicioni F.</b><br>MICHELANGELO'S DAVID: HISTORICAL IMAGES FOR THE PRESERVATION OF A MASTERPIECE  | 265 |
| <b>Fernández-Martin J.J., SanJosé J.I., Martínez J., Finat J.</b><br>MULTIRESOLUTION SURVEYING OF COMPLEX FAÇADES: A COMPARATIVE ANALYSIS BETWEEN DIGITAL PHOTOGRAMMETRY AND 3D LASER SCANNING   | 271 |
| <b>Fiani M., Siani N.</b><br>COMPARISON OF TERRESTRIAL LASER SCANNERS IN PRODUCTION OF DEMS FOR CETARA TOWER   | 277 |
| <b>Fregonese L., Prandi F., Taffurelli L.</b><br>THE LASER SCANNER ANALYSIS AND MORFOLOGICAL TRANSFORMATION OF ENVIRONMENTAL ANTHROPIZED SITES: THE CASE STUDY OF GOVERNOLO'S ANCIENT DAMS   | 283 |
| <b>Galizia M., Andreozzi L.</b><br>THE SURVEY OF DECORATIVE ELEMENTS WITH LASER SCANNER  | 289 |
| <b>Genovese R.A.</b><br>ARCHITECTURAL, ARCHAEOLOGIC AND ENVIRONMENTAL RESTORATION PLANNING METHODOLOGY: HISTORIC RESEARCHES AND TECHNIQUES OF SURVEY AIMING TO CONSERVATION  | 295 |
| <b>Georgopoulos A., Makris G.N., Dermentzopoulos A.</b><br>AN ALTERNATIVE METHOD FOR LARGE SCALE ORTHOPHOTO PRODUCTION   | 300 |
| <b>Gianinnetto M., Giussani A., Roncoroni F., Scaioni M.</b><br>INTEGRATION OF MULTI-SOURCE CLOSE-RANGE DATA   | 304 |
| <b>Girelli V.A., Tini M.A., Zanutta A.</b><br>TRADITIONAL AND UNCONVENTIONAL PHOTOGRAMMETRIC TECHNIQUES FOR METRICAL DOCUMENTATION OF CULTURAL HERITAGE: THE EXAMPLE OF THE "ROLANDINO DEI PASSAGGIERI" TOMB (ST. DOMENICO SQUARE) SURVEY IN BOLOGNA | 310 |
| <b>Giuffrida A., Liuzzo M., Santagati C., Andreozzi L.</b><br>THE LASER SCANNER FOR ARCHAEOLOGICAL SURVEY: "LE TERME DELL'INDIRIZZO" IN CATANIA  | 316 |
| <b>Giunta G., Di Paola E., Mörlin Visconti Castiglione B., Menci L.</b><br>INTEGRATED 3D-DATABASE FOR DIAGNOSTICS AND DOCUMENTATION OF MILAN'S CATHEDRAL FAÇADE  | 322 |

|   |     |
|---|-----|
| <b>Giusti M.A., Tucci G.</b><br>FOR THE CONSERVATION OF LORENZO NOTTOLINI'S AQUEDUCT IN LUCCA: SURVEY AND REPRESENTATION OF HISTORIC INFRASTRUCTURE   | 328 |
| <b>González G. S.H., Díaz R. B.D., Mederos V., Olivera R.</b><br>CURRENT STATUS AND PERSPECTIVES FOR THE CONSERVATION, REHABILITATION AND DOCUMENTATION OF THE CUBAN'S ARCHITECTURAL HERITAGE | 334 |
| <b>Gruen A., Remondino F., Zhang L.</b><br>MODELING AND VISUALIZATION OF LANDSCAPE AND OBJECTS USING MULTI-RESOLUTION IMAGE DATA  | 338 |
| <b>Guerra F., Pilot L., Vernier P.</b><br>THE FACADES OF GOTHIC BUILDINGS IN VENICE: SURVEYS VERIFYING CONSTRUCTION THEORIES  | 344 |
| <b>Haddad N., Akasheh T.</b><br>DOCUMENTATION OF ARCHAEOLOGICAL SITES AND MONUMENTS: ANCIENT THEATRES IN JERASH   | 350 |
| <b>Hadjimitsis D.G., Themistocleous K., Ioannides M.</b><br>THE USE OF SATELLITE REMOTE SENSING FOR THE MANAGEMENT OF CULTURAL HERITAGE SITES IN CYPRUS                                       | 356 |
| <b>Hemmler M., Weritz F., Maierhofer Ch.</b><br>DAMAGE DETECTION ON BUILDING SURFACES WITH MULTI-SPECTRAL TECHNIQUES  | 361 |
| <b>Henze F., Wulf-Rheidt U., Schneider D., Bienert A.</b><br>PHOTOGRAMMETRIC AND GEODETIC DOCUMENTATION METHODS AT St. PETRI CATHEDRAL, BAUTZEN   | 366 |
| <b>Ioannidis Ch., Demir N., Soile S., Tsakiri M.</b><br>COMBINATION OF LASER SCANNER DATA AND SIMPLE PHOTOGRAMMETRIC PROCEDURES FOR SURFACE RECONSTRUCTION OF MONUMENTS                       | 372 |
| <b>Ioannidis Ch., Katopodi C.</b><br>A COMPARISON TEST OF METHODS AND TECHNIQUES FOR THE GEOMETRIC RECORDING OF A BYZANTINE CHURCH  | 378 |
| <b>Iuliano L., Minetola P.</b><br>RAPID MANUFACTURING OF SCULPTURES REPLICAS: A COMPARISON BETWEEN 3D OPTICAL SCANNERS  | 384 |
| <b>Kalisperakis I., Karras G., Petsa E.</b><br>ESTIMATION OF CAMERA PARAMETERS FROM STEREO PAIRS WITH NO EXTERNAL CONTROL INFORMATION   | 390 |
| <b>Karabork H., Yildiz F., Yakar M., Karasaka L., Yilmaz H.M., Ozgan R.</b><br>EXTRACTING OF STONE PLAN OF HARBOUR STREET IN KNIDOS ANCIENT CITY  | 395 |
| <b>Karabork H., Yildiz F., Yakar M., Karasaka L., Yilmaz H.M.</b><br>PHOTOGRAMMETRIC METHODS FOR RESTITUTION OF SMALL OBJECTS EXTRACTED BY ARCHAEOLOGICAL EXCAVATIONS                         | 397 |
| <b>Karras G.E.</b><br>IS IT REALISTIC TO GENERATE CONTROL POINTS FROM A STEREO PAIR?  | 399 |

|  |     |
|--|-----|
| <b>Kaufmann V., Ladstädter R.</b><br>ELIMINATION OF COLOR FRINGES IN DIGITAL PHOTOGRAPHS CAUSED BY LATERAL CHROMATIC ABERRATION  | 403 |
| <b>Kulur S., Yilmaztürk F.</b><br>3D-RECONSTRUCTION OF SMALL HISTORICAL OBJECTS TO EXHIBIT IN VIRTUAL MUSEUM BY MEANS OF DIGITAL PHOTOGRAMMETRY                                    | 409 |
| <b>Lazaridou M., Patmios E.</b><br>PHOTOGRAMMETRY AND IMAGE INTERPRETATION ON THE STUDY OF ARCHITECTURAL AND NATURAL CULTURAL HERITAGE   | 412 |
| <b>Leroy T.</b><br>SAVING VOSKOPOJA, COMPLETE PHOTOGRAMMETRIC COVERAGE OF THREE ALBANIAN PAINTED CHURCHES  | 414 |
| <b>Letellier R.</b><br>WHAT IS RecorDIM ?  | 420 |
| <b>Linsinger S.</b><br>"3D LASER" VERSUS "STEREO PHOTOGRAMMETRY" FOR DOCUMENTATION AND DIAGNOSIS OF BUILDINGS AND MONUMENTS (PRO AND CONTRA)                                       | 425 |
| <b>Lönnqvist M., Lönnqvist K., Whiting M.S., Törmä M., Nunez M., Okkonen J.</b><br>DOCUMENTING, IDENTIFYING AND PROTECTING A LATE ROMAN-BYZANTINE FORT AT TABUS ON THE EUPHRATES   | 427 |
| <b>Manea G., Calin A.</b><br>THE ADVANTAGES OF DIGITAL APPROACH IN ARCHITECTURAL PHOTOGRAMMETRY  | 433 |
| <b>Manzoni G., Rizzo R.G., Robiglio C.</b><br>MOBILE MAPPING SYSTEMS IN CULTURAL HERITAGES SURVEY  | 437 |
| <b>Martínez J., Finat J., Fuentes L.M., Gonzalo M., Viloría A.</b><br>A COARSE-TO-FINE CURVED APPROACH TO 3D SURVEYING OF ORNAMENTAL ASPECTS AND SCULPTURES IN FAÇADES             | 441 |
| <b>Martínez Rubio J., Gómez Lahoz J., González Aguilera D., Finat Codes J.</b><br>IMAP3D: LOW-COST PHOTOGRAMMETRY FOR CULTURAL HERITAGE  | 447 |
| <b>Matsuoka R., Kobiki H., Iwakura M., Shirasawa A., Murai S.</b><br>ORTHOIMAGE CREATING SYSTEM FOR DOCUMENTATION OF RELICS USING ORTHOIMAGER 300                                  | 452 |
| <b>Menze B.H., Ur J.A., Sherratt A.G.</b><br>TELL SPOTTING-SURVEYING NEAR EASTERN SETTLEMENT MOUNDS FROM SPACE   | 458 |
| <b>Miranda Duarte A.A., von Altrock P.</b><br>THE CLOSE RANGE PHOTOGRAMMETRY IN THE DOCUMENTATION OF THE ROCKS ART. STUDY OF CASE ARCHAEOLOGICAL SITE SANTINHO NORTE I -SC/ BRAZIL | 463 |

|  |     |
|--|-----|
| <b>Kaufmann V., Ladstädter R.</b><br>ELIMINATION OF COLOR FRINGES IN DIGITAL PHOTOGRAPHS CAUSED BY LATERAL CHROMATIC ABERRATION  | 403 |
| <b>Kulur S., Yilmaztürk F.</b><br>3D-RECONSTRUCTION OF SMALL HISTORICAL OBJECTS TO EXHIBIT IN VIRTUAL MUSEUM BY MEANS OF DIGITAL PHOTOGRAMMETRY                                    | 409 |
| <b>Lazaridou M., Patmios E.</b><br>PHOTOGRAMMETRY AND IMAGE INTERPRETATION ON THE STUDY OF ARCHITECTURAL AND NATURAL CULTURAL HERITAGE   | 412 |
| <b>Leroy T.</b><br>SAVING VOSKOPOJA, COMPLETE PHOTOGRAMMETRIC COVERAGE OF THREE ALBANIAN PAINTED CHURCHES  | 414 |
| <b>Letellier R.</b><br>WHAT IS RecorDIM ?  | 420 |
| <b>Linsinger S.</b><br>"3D LASER" VERSUS "STEREO PHOTOGRAMMETRY" FOR DOCUMENTATION AND DIAGNOSIS OF BUILDINGS AND MONUMENTS (PRO AND CONTRA)                                       | 425 |
| <b>Lönnqvist M., Lönnqvist K., Whiting M.S., Törmä M., Nunez M., Okkonen J.</b><br>DOCUMENTING, IDENTIFYING AND PROTECTING A LATE ROMAN-BYZANTINE FORT AT TABUS ON THE EUPHRATES   | 427 |
| <b>Manea G., Calin A.</b><br>THE ADVANTAGES OF DIGITAL APPROACH IN ARCHITECTURAL PHOTOGRAMMETRY  | 433 |
| <b>Manzoni G., Rizzo R.G., Robiglio C.</b><br>MOBILE MAPPING SYSTEMS IN CULTURAL HERITAGES SURVEY  | 437 |
| <b>Martínez J., Finat J., Fuentes L.M., Gonzalo M., Viloría A.</b><br>A COARSE-TO-FINE CURVED APPROACH TO 3D SURVEYING OF ORNAMENTAL ASPECTS AND SCULPTURES IN FAÇADES             | 441 |
| <b>Martínez Rubio J., Gómez Lahoz J., González Aguilera D., Finat Codes J.</b><br>IMAP3D: LOW-COST PHOTOGRAMMETRY FOR CULTURAL HERITAGE  | 447 |
| <b>Matsuoka R., Kobiki H., Iwakura M., Shirasawa A., Murai S.</b><br>ORTHOIMAGE CREATING SYSTEM FOR DOCUMENTATION OF RELICS USING ORTHOIMAGER 300                                  | 452 |
| <b>Menze B.H., Ur J.A., Sherratt A.G.</b><br>TELL SPOTTING-SURVEYING NEAR EASTERN SETTLEMENT MOUNDS FROM SPACE   | 458 |
| <b>Miranda Duarte A.A., von Altrock P.</b><br>THE CLOSE RANGE PHOTOGRAMMETRY IN THE DOCUMENTATION OF THE ROCKS ART. STUDY OF CASE ARCHAEOLOGICAL SITE SANTINHO NORTE I -SC/ BRAZIL | 463 |

|   |     |
|---|-----|
| <b>Murphy M., McGovern E., Olwill R., Pavia S.</b><br>IDENTIFICATION OF HISTORIC METHODS OF CONSTRUCTION USING DIGITAL PHOTOGRAMMETRY AND LASER SCANNING  | 466 |
| <b>Neubauer W., Doneus M., Studnicka N., Riegl J.</b><br>COMBINED HIGH RESOLUTION LASER SCANNING AND PHOTOGRAMMETRICAL DOCUMENTATION OF THE PYRAMIDS AT GIZA  | 470 |
| <b>Nickerson S., Chapiro A.</b><br>ASRix : A SIMPLE DIGITAL IMAGE RECTIFIER   | 476 |
| <b>Núñez R., Ramil L., Gil M.L.</b><br>STATISTICAL COMPARISON OF PHOTOGRAMMETRY CLOSE RANGE EQUIPMENTS AT LOW COST  | 481 |
| <b>Ortiz J., Núñez R., Rego T.</b><br>USE OF VOLUMETRIC TARGETS TO IMPROVE ACCURACY IN ARCHITECTURAL PHOTOGRAMMETRY AT LOW COST   | 485 |
| <b>Perfetti N., Pellegrinelli A., D'Urso M.G., Russo P.</b><br>A COMBINED SYSTEM OF DIGITAL PHOTOGRAMMETRY AND 3D LASER SCANNING  | 491 |
| <b>Popescu Al., Bogdea D., Giurginca M., Popescu A., Stoleriu S.</b><br>THE ROLE PLAYED BY THE SCIENTIFIC TECHNIQUES USED IN THE EXAMINATION AND ANALYSES OF THE MURAL PAINTING OF WOODEN ROMANIAN CHURCHES           | 495 |
| <b>Ringle K., Nutto M., Teschauer O., Mohn C.</b><br>INTEGRATION OF HISTORICAL PLANS INTO A MODERN FACILITY MANAGEMENT SYSTEM TAKING THE CASTLE OF HEIDELBERG AS AN EXAMPLE   | 499 |
| <b>Romeo E., Tucci G.</b><br>INTEGRATED SURVEY TECHNIQUES FOR THE STUDY AND THE RESTORATION OF THE ARCHEOLOGICAL HERITAGE   | 505 |
| <b>Salemi G., Achilli V., Bragagnolo D., Menin A., Ruzzon F.</b><br>DATA FUSION FOR CULTURAL HERITAGE DOCUMENTATION: FROM THE PANORAMIC IMAGING TO 3D LASER SCANNING  | 511 |
| <b>Salonia P., Negri A., Valdarnini L., Scolastico S., Bellucci V.</b><br>QUICK PHOTOGRAMMETRIC SYSTEMS APPLIED TO DOCUMENTATION OF CULTURAL HERITAGE: THE EXAMPLE OF AOSTA ROMAN CITY WALL                           | 517 |
| <b>SanJosé J.I., Finat J., Fernández-Martin J.J., Martínez J., Fuentes L.M., Gonzalo M.</b><br>URBAN LASERMETRY. PROBLEMS AND RESULTS FOR SURVEYING URBAN HISTORICAL CENTRES: SOME PILOT CASES OF SPANISH PLAZA MAYOR | 523 |
| <b>Scherer M.</b><br>PHOTO-TACHEOMETRY AND INTELLIGENT SCANNING. AN ALTERNATIVE TO 3D-LASER SCANNING  | 529 |
| <b>Schneider D., Pöttsch M., Maas H.G.</b><br>ACCURACY AND APPLICATION POTENTIAL OF THE 94 MEGAPIXEL RGB MACRO-SCANNING CAMERA PENTACON SCAN 5000   | 534 |

|  |     |
|--|-----|
| <b>Seinturier J., Drap P., Papini O., Vannini G., Nuccioti M.</b><br>A MERGING DATA TOOL FOR KNOWLEDGE BASED PHOTOGRAMMETRY: THE CASE STUDY OF THE<br>CASTLE OF SHAWBAK, JORDAN                | 538 |
| <b>Sgrenzaroli M.</b><br>CULTURAL HERITAGE 3D RECONSTRUCTION USING HIGH RESOLUTION LASER SCANNER: NEW<br>FRONTIERS DATA PROCESSING   | 544 |
| <b>Singh B.</b><br>INTEGRATED SURVEY TECHNIQUES: NEED FOR REDEVELOPMENT PROJECTS: EXPERIENCE OF AN INDIAN<br>CITY AMRITSAR   | 550 |
| <b>Stylianidis E., Patias P., Liapakis C., Balis V., Philotheou G.</b><br>VISUALIZATION OF FRESCOS BY MEANS OF PHOTOGRAMMETRY AND LASER SCANNING   | 556 |
| <b>Tack F., Debie J., Goossens R., De Meulemeester J., Devriendt D.</b><br>A FEASIBLE METHODOLOGY FOR THE USE OF CLOSE RANGE PHOTOGRAMMETRY FOR THE RECORDING<br>OF ARCHAEOLOGICAL EXCAVATIONS | 561 |
| <b>Unver R., Binan C., Erdogan S.</b><br>IMPORTANCE OF COLOR RECORDINGS DURING DOCUMENTATION PROCESS BEFORE CONSERVATION<br>AND RESTORATION APPLICATIONS; THE CASE STUDY ON ASPENDOS THEATER   | 566 |
| <b>Vatan M., Arun G.</b><br>USING PHOTOGRAMMETRIC DATA FOR ESTABLISHING 3D FINITE ELEMENT MODEL OF A MASONRY<br>AQUEDUCT   | 571 |
| <b>Visintini D., Fico B., Crosilla F., Guerra F.</b><br>A 3D VIRTUAL MODEL OF THE GORIZIA DOWNTOWN (ITALY) BY MATCHING AERIAL AND TERRESTRIAL<br>SURVEYING TECHNIQUES                          | 575 |
| <b>Von Altrock P., Loch C.</b><br>CLOSE RANGE PHOTOGRAMMETRY IN THE DOCUMENTATION OF THE WORK OF SILVA PAES' BRIGADIER,<br>CENTURY XVIII   | 581 |
| <b>Warden R., Al Ratrouf S.</b><br>MOIRÉ CONTOURS FOR DOCUMENTING PETROGLYPHS AT MONTEZUMA CASTLE  | 584 |
| <b>Yakar M., Yildiz F.</b><br>DIGITAL PHOTOGRAMMETRIC METHODS IN DOCUMENTATION OF CULTURAL HERITAGES AND BEYSEHİR<br>EXAMPLE   | 590 |
| <b>Yakar M., Yildiz F., Yilmaz H.M., Ulvi A., Karasaka L., Karabork H.</b><br>PHOTOGRAMMETRIC SILHOUETTE STUDY AND SILLE EXAMPLE   | 595 |
| <b>Yildiz F., Karabork H., Yakar M., Karasaka L., Yilmaz H.M., Ozgan R.</b><br>PHOTOGRAMMETRIC WORKS ON BOULAKRATES FOUNTAIN IN KNIDOS ANCIENT CITY  | 598 |
| <b>Zolfaghari M., Chegini N.N., Malian A.</b><br>PHOTOGRAMMETRIC DOCUMENTATION AND ANALYSIS OF DARIUS' MONUMENT AT BISOTUN   | 601 |

**WORKING GROUP II**

**DOCUMENTATION AND INFORMATION MANAGEMENT**

- Agosto E., Demarchi D., Digangi G., Ponza G.** 605  
AN OPEN SOURCE SYSTEM FOR P.I.C.A. A PROJECT FOR DIFFUSION AND VALORIZATION OF CULTURAL HERITAGE 607
- Agosto E., Macera M., Rinaudo F.** 612  
A GIS FOR THE MONITORING OF THE HYDRAULIC SYSTEM OF THE ROYAL RACCONIGI PARK
- Agosto E., Osello A., Peretti L., Rinaudo F.** 617  
S.MARCO'S CHURCH IN VERCELLI: THE SHAPE MODEL FOR THE REUTILIZE. LIDAR PROJECT IN A SIMPLE ARCHITECTURAL SPACE SURVEY
- Akcay O., Yilmazturk F.** 622  
AN APPROACH FOR REPRESENTATION OF HISTORICAL OBJECTS BY MEANS OF 2D WEB-BASED GIS
- Al Bayari O.** 625  
NEW SURVEY TECHNOLOGIES FOR PRODUCTION OF GIS MODEL OF THE ANCIENT ROMAN JERASH CITY IN JORDAN
- Alby E., Grussenmeyer P., Perrin J.P.** 631  
ANALOGY BETWEEN ARCHITECTURAL DESIGN PROCESS AND THE DOCUMENTATION OF ARCHITECTURAL WORKS
- Almagro A.** 637  
SURVEY, RESEARCH AND VIRTUAL REALITY IN THE MONUMENTS OF SEVILLE INCLUDED IN THE WORLD HERITAGE LIST
- Ardissone P., Rinaudo F.** 643  
A GIS FOR THE MANAGEMENT OF HISTORICAL AND ARCHAEOLOGICAL DATA
- Baiocchi V., Lelo K.** 649  
GEOREFERENCING THE HISTORICAL MAPS OF ROME BETWEEN THE SEVENTEENTH AND EIGHTEENTH CENTURIES
- Balletti C., Guerra F., Adami A.** 654  
3D MULTIREOLUTION REPRESENTATIONS IN ARCHAEOLOGICAL SITES
- Baratin L., Bonnici H., Curti S., Lodi M.** 659  
THE DIFFERENT METHODS TO DOCUMENT AND INTERPRET THE ARCHAEOLOGICAL SITES CONTAINING CART-RUTS
- Baratin L., Checcucci G., Curti S., Lodi M., Romeo M.** 664  
3-D VISUALIZATION AND ANIMATION OF ARCHITECTONIC ELEMENTS FOR PREHISTORIC MEGALITHIC TEMPLES OF THE ISLAND OF GOZO: THE TEMPLE OF GGANTIJA
- Barnobi L., Colaiacovo L., Andreozzi L.** 669  
THREE-DIMENSIONAL DIGITAL MODELS FOR ARCHITECTURE'S DOCUMENTATION: BADIA DI S. AGATA IN CATANIA

|   |     |
|---|-----|
| <b>Barrile V., Cotroneo F., Tringali S.</b><br>APPLICATION OF MAPPING PLAN WITH A NON-DETERMINISTIC ALGORITHM FOR GIS QUERYING  | 675 |
| <b>Bonora V., Tucci G., Vaccaro V.</b><br>3D DATA FUSION AND MULTI-RESOLUTION APPROACH FOR A NEW SURVEY AIMED TO A COMPLETE MODEL OF RUCELLAI'S CHAPEL BY LEON BATTISTA ALBERTI IN FLORENCE   | 679 |
| <b>Boriani M., Cazzani A., Giambruno M.</b><br>THE NAVIGLIO OF MARTESANA: A GIS TO MANAGE A PROTECTED AREA  | 685 |
| <b>Brizzi M., D'Andrea A., Sepio D., De Silva M., Court S.</b><br>PLANNING A CONSERVATION PROJECT: THE INFORMATION SYSTEM OF THE <i>INSULA ORIENTALIS I</i> AT HERCULANEUM  | 691 |
| <b>Brukamp K.</b><br>APPLYING NURBS MODELING TO RECONSTRUCTION OF A GOTHIC-FLEMISH FACADE   | 697 |
| <b>Brumana R., Achille C.</b><br>INTERNATIONAL DESIGN COMPETITION FOR THE REFURBISHMENT AND ENHANCEMENT OF THE VILLA REALE IN MONZA. THEMATIC MAP: FROM CLOUDS POINT TO SURFACE ANALYSIS. CASES STUDY: SALONE D'ONORE, SCALONE AND SALA DEL TRONO   | 701 |
| <b>Brumana R., Achille C., Oreni D., Prandi F.</b><br>FROM THE GUIDE OF GEOREFERENCING CULTURAL HERITAGE FOR THE MAP OF RISK (REGIONE LOMBARDIA) TO THE GEOREFERENCING AND TROUBLESHOOTING IN HISTORICAL SITES  | 707 |
| <b>Brumana R., Prandi F.</b><br>STRUCTURING 3D NUMERIC CARTOGRAPHY IN GML3  | 713 |
| <b>Bueschenfeld A.</b><br>REAL-TIME RENDERING IN A PC-CLUSTER ENVIRONMENT PROVIDED BY OPENSF  | 718 |
| <b>Cardenal J., Mata E., Ramos M., Delgado J., Hernandez M.A., Perez J.L., Castro P., Torres M.</b><br>LOW COST DIGITAL PHOTOGRAMMETRIC TECHNIQUES FOR 3D MODELIZATION IN RESTORATION WORKS. A CASE STUDY: St. DOMINGO DE SILOS' CHURCH (XIV <sup>th</sup> CENTURY, ALCALA LA REAL, SPAIN). | 722 |
| <b>Çelenk E., Özalp T., Arikan F., Aydin E.</b><br>ESTABLISHING A DIGITAL PLATFORM FOR CULTURE OF TURKEY  | 728 |
| <b>Costa B., Fiori F., Garau E., Rovina D.</b><br>GIS FOR ARCHAEOLOGICAL DATA MANAGEMENT: THE CASE OF SANTA FILITICA, SORSO (SS), SARDINIA  | 733 |
| <b>Cuno A., Esperança C., Roma Cavalcanti P.</b><br>3D NASCA'S ZOOMORPHIC GEOGLYPHS RECONSTRUCTION  | 736 |
| <b>da Silva R.M., Veronez M.R., Thum A.B., do Carmo C.F.</b><br>ANALYSIS FROM VIABILITY FOR INDUSTRIAL DISTRICT IMPLANTATION INSIDE THE ENVIRONMENTAL PROTECTION AREA USING GIS   | 742 |



|   |     |
|---|-----|
| <b>Deveau M., Letellier G., Papanoditis N.</b><br>AUTOMATING THE EXTRACTION OF REVOLUTION OBJECTS FROM SINGLE LASER SCANS OF ARCHITECTURAL SCENES   | 746 |
| <b>Di Francesco C., Bortolotto S., Locatelli E., Palo M. C., Sangiorgio C., Simonelli R.</b><br>CREATION OF A INFORMATION SYSTEM RELATING TO THE ARCHIVES OF "ARCHITECTURAL SITES"                                    | 750 |
| <b>Di Gangi G., Lebole C.M., Demarchi D., Nejrotti L.</b><br>P.I.C.A - PORTALE INFORMATICO CULTURALE DELLE ALPI OCCIDENTALI: A MULTIDISCIPLINARY AND INTEGRATED PROJECT FOR CULTURAL HERITAGE                         | 755 |
| <b>Dorninger P., Briese C.</b><br>ADVANCED GEOMETRIC MODELING OF HISTORICAL ROOMS   | 759 |
| <b>Drap P., Durand A., Provin R., Long L.</b><br>INTEGRATION OF MULTI-SOURCE SPATIAL INFORMATION AND XML INFORMATION SYSTEM IN UNDERWATER ARCHAEOLOGY   | 765 |
| <b>Drap P., Durand A., Seinturier J., Vannini G., Nucciotti M.</b><br>FULL XML DOCUMENTATION FROM PHOTOGRAMMETRIC SURVEY TO 3D VISUALIZATION. THE CASE STUDY OF SHAWBAK CASTLE IN JORDAN                              | 771 |
| <b>Du Z., Li D., Zhu Y., Zhu Q.</b><br>3D GIS-BASED DIGITAL RECONSTRUCTION AND DYNAMIC VISUALIZATION OF TIMBER-FRAME BUILDING CLUSTER   | 777 |
| <b>Duran Z., Akçay O., Toz G., Gulersoy N.Z.</b><br>LANDSCAPE MODELLING AND VISUALIZATION IN SUBURBAN AREAS: A CASE STUDY   | 783 |
| <b>Durduran S., Erdi A.</b><br>APPLICATIONS OF GEOGRAPHICAL INFORMATION SYSTEM (GIS) IN THE ANCIENT TOWN KELENDERIS IN TURKEY   | 787 |
| <b>El-Hakim S.F., Beraldin J.A., Gonzo L., Whiting E., Jemtrud M., Valzano V.</b><br>A HIERARCHICAL 3D RECONSTRUCTION APPROACH FOR DOCUMENTING COMPLEX HERITAGE SITES   | 790 |
| <b>Even P., Gobron S.</b><br>INTERACTIVE THREE-DIMENSIONAL RECONSTRUCTION AND WEATHERING SIMULATIONS ON BUILDINGS   | 796 |
| <b>Fernández-Martin J.J., SanJosé J.I., Gonzalo M., Martínez J., Finat J.</b><br>MULTISCALE THREE-DIMENSIONAL SURVEYING FOR CONSERVATION TASKS: A PILOT CASE FOR THE FUSION OF RANGE-SCANNING ON ARCHAEOLOGICAL SITES | 802 |
| <b>Gabellone F., Giannotta M.T.</b><br>REALTIME 3D MULTIMEDIA SYSTEM FOR THE DISTANCE VISITING OF CULTURAL HERITAGE. A CASE STUDY ON THE CHAMBER TOMBS IN VIA CRISPI, TARANTO   | 808 |
| <b>Gabellone F., Monte A.</b><br>A VIRTUAL THEMATIC MUSEUM OF THE <i>TERRA D'OTRANTO</i> LIGHTHOUSES BASED ON A LOW COST METHODOLOGY  | 813 |

|  |     |
|--|-----|
| <b>Grammatikopoulos L., Kalisperakis I., Karras G., Petsa E.</b><br>DATA FUSION FROM MULTIPLE SOURCES FOR THE PRODUCTION OF ORTHOGRAPHIC AND PERSPECTIVE<br>VIEWS WITH AUTOMATIC VISIBILITY CHECKING | 819 |
| <b>Guarisco G.</b><br>SIT FOR THE CONSERVATION OF ITALIAN HISTORICAL CENTRE  | 825 |
| <b>Guarnieri A., Vettore A., Pontin M.</b><br>A VOLUMETRIC APPROACH FOR 3D SURFACE RECONSTRUCTION  | 831 |
| <b>Guney C., Thys-Senocak L., Ulugtekin N., Tomlin D., Celik R.N.</b><br>AN E(X)TENSIBLE AND MODULAR HISTORICAL DOCUMENTATION MODEL: THE "GeoHistoryPortal"  | 837 |
| <b>Hamamcioglu-Turan M.</b><br>REPRESENTATION OF HISTORICAL STRATIFICATION IN A CHURCH CONVERTED INTO A MOSQUE   | 843 |
| <b>Henze F., Lehmann H., Fischer-Genz B.</b><br>DEVELOPMENT OF AN INTERNET-BASED INFORMATION SYSTEM FOR ARCHAEOLOGICAL RESEARCH<br>AND STUDIES ON URBAN HISTORY IN BAALBEK/LEBANON                   | 849 |
| <b>Ientile R., Astori B., Chiabrando F., Naretto M.</b><br>GEOGRAPHIC INFORMATION SYSTEM FOR MONITORING AND CONSERVATION OF THE CULTURAL<br>LANDSCAPE  | 855 |
| <b>Ioannides M., Georgopoulos A., Scherer M.</b><br>STANDARDS IN CULTURAL HERITAGE: THE MISSING GRAMMAR FOR THE DIGITAL DOCUMENTATION OF<br>THE PAST   | 861 |
| <b>Jobst M., Lubansky O.</b><br>ACCESS AND USAGE OF ARCHAEOLOGICAL-ARCHITECTURAL ON-SITE FINDINGS WITH CARTOGRAPHIC<br>PRESENTATION METHODS  | 871 |
| <b>Kadobayashi R.</b><br>VIEWPOINT-BASED SEARCH AND BROWSE OF DIGITAL ARCHIVE CONTENT  | 876 |
| <b>Karel W.</b><br>SOPHISTICATED USE OF VIRTUAL SHAPES OF ARCHITECTURE + VISUALIZATION OF QUALITY  | 882 |
| <b>LeBlanc F.</b><br>RecorDIM TASK GROUP 1 – PRINCIPLES & GUIDELINES FOR RECORDING, DOCUMENTATION AND<br>INFORMATION MANAGEMENT OF THE BUILT CULTURAL HERITAGE                                       | 888 |
| <b>Lelo K., Travaglini C.M.</b><br>THE GIS-BASED HISTORICAL ATLAS OF ROME  | 891 |
| <b>Lerma J.L., Biosca J.M.</b><br>SEGMENTATION AND FILTERING OF LASER SCANNER DATA FOR CULTURAL HERITAGE   | 896 |
| <b>Lerma J.L., García A., Pérez C.</b><br>3D RECONSTRUCTION AND MODELLING OF ARCHITECTURAL DOMES   | 902 |

|   |     |
|---|-----|
| <b>Li D., Hong T., Zhu Y., Yang J.</b><br>3D RECONSTRUCTION AND SIMULATING ASSEMBLY OF ANCIENT CHINESE TIMBER-STRUCTURE BUILDING  | 906 |
| <b>Malian A., Zolfaghari M.</b><br>DOCUMENTATION OF THE ANCIENT VILLAGE OF KHORANAGH FOR REHABILITATION PURPOSE: A PRELIMINARY REPORT   | 912 |
| <b>Merlo S., Shell C.A.</b><br>DEVELOPING A MULTIDIMENSIONAL GIS FRAMEWORK FOR ARCHAEOLOGICAL EXCAVATIONS   | 918 |
| <b>Meyer É., Grussenmeyer P., Perrin J.P.</b><br>EVOLUTION OF SURVEYING PRACTICES IN ARCHAEOLOGY: A TECHNICAL OVERVIEW TO INTRODUCE NEW MANAGEMENT POSSIBILITIES FOR CULTURAL HERITAGE DATA       | 923 |
| <b>Nickerson S., Swan R.</b><br>ASCIX : A SIMPLE CATALOGUER FOR HERITAGE DATA   | 929 |
| <b>Peipe J., Przybilla H.J.</b><br>MODELING THE GOLDEN MADONNA  | 934 |
| <b>Pomaska G.</b><br>XML BASED DATA DESCRIPTION FOR THE PHOTOGRAMMETRIC DOCUMENTATION OF HISTORIC BUILDINGS   | 937 |
| <b>Ressl C., Kraus K., Höppl W.</b><br>DOCUMENTATION AND DEVELOPMENT OF THE COLUMNS OF THE CHURCH OF ST. CHARLES IN VIENNA  | 941 |
| <b>Scianna A., Ammoscato A., Corsale R., Villa B.</b><br>THE LAST DEVELOPMENT OF ARCHEONAV: AN OGC COMPLIANT NAVIGATOR FOR ARCHAEOLOGICAL SITES RUNNING ON A POCKETPC                             | 946 |
| <b>Sormann M., Zach C., Zebedin L., Karner K.</b><br>HIGH QUALITY 3D RECONSTRUCTION OF COMPLEX CULTURAL OBJECTS   | 952 |
| <b>Spallone R.</b><br>PRESERVING THE ARCHITECTURAL HERITAGE BY INCREASING THE KNOWLEDGE OF THE COMMUNITY: THE CASE OF THE ANCIENT CHURCH OF SAN PIETRO DI CONSAVIA IN ASTI                        | 958 |
| <b>Spanò A., Bonfanti C.</b><br>LARGE SCALE SPATIAL DATABASE SUPPORTING ARCHAEOLOGICAL RESEARCH   | 963 |
| <b>Tapinaki S., Georgopoulos A., Sellis T.</b><br>DESIGN OF A DATABASE SYSTEM FOR GEOMETRIC DOCUMENTATION   | 969 |
| <b>Tsioukas V., Tsirliganis N., Pavlidis G., Arnaoutoglou F., Chamzas Ch., Mpakourou E., Mexia A.</b><br>PHOTOGRAMMETRIC MODELING OF BYZANTINE CHURCHES   | 974 |
| <b>Valzano V., Bandiera A., Beraldin J.A., Picard M., El-Hakim S.F., Godin G., Paquet E., Rioux M.</b><br>FUSION OF 3D INFORMATION FOR EFFICIENT MODELING OF CULTURAL HERITAGE SITES WITH OBJECTS | 978 |

|  |      |
|--|------|
| <b>Volpiano M., Zich U.</b><br>SCIENTIFIC MONITORING AND DOCUMENTATION OF THE VENARIA REALE RESTORATION SITES  | 982  |
| <b>Xia S., Zhu Y.</b><br>3D SIMULATION AND RECONSTRUCTION OF LARGE-SCALE ANCIENT ARCHITECTURE WITH TECHNIQUES OF PHOTOGRAMMETRY AND COMPUTER SCIENCE   | 986  |
| <b>WORKING GROUP III</b><br><b>TRAINING, TECHNOLOGY INTERCHANGE AND COMMUNICATION.</b>   | 991  |
| <b>Agosto E., Coppo S., Osello A., Rinaudo F.</b><br>SURVEY AND REPRESENTATION METHODOLOGIES IN TEACHING EXPERIENCE  | 993  |
| <b>Almagro Vidal A., Almagro A.</b><br>TRAINING ON DOCUMENTATION IN ARCHITECTURAL HERITAGE: THE EXPERIENCE OF ARIS AND CLADIC COURSES  | 998  |
| <b>Arsenault D.</b><br>RecorDIMM TASK GROUP 22 - FROM REAL TO VIRTUAL... THE POTENTIAL FOR BETTER RECORDING A UNIQUE ROCK-ART SITE IN THE CANADIAN ARCTIC  | 1003 |
| <b>Bahar H., Çay T., Koçak Ö., Işcan F.</b><br>A PLAN FOR ARCHAEOLOGICAL EXCAVATION OF LYSTRA (ZOLDURA HÖYÜK)  | 1007 |
| <b>Bottaro C., Traverso A., Ancona M.</b><br>VISITING ARCHAEOLOGICAL SITES WITH OUR MOBILE PHONES: THE AGAMEMNON PROJECT   | 1013 |
| <b>Bucolo O., Costa E., Miron D., Tucci G.</b><br>PHOTOGRAMMETRIC DATA BASE WEB SHARE FOR KNOWLEDGE AND SAFEGUARD OF THE CULTURAL HERITAGE   | 1018 |
| <b>Castoldi V.</b><br>CONTEMPORARY ART IN MILAN SQUARES. KNOWLEDGE AND PRESERVATION  | 1021 |
| <b>Ciocsan O., Ciocsan S., Rogneanu F., Bogdea D., Iasinschi V.</b><br>PROJECT OF THE RESTORATION OF DRETEA CHURCH, XVIIth C   | 1027 |
| <b>Ciocsan O., Ciocsan S., Rogneanu F., Iasinschi V., Tigae C.</b><br>THE DRAWING UP OF A DATABASE, THE STUDYING AND THE TURNING INTO GOOD ACCOUNT OF THE WOODEN CHURCHES FROM THE GORJ AND VALCEA COUNTIES, ROMANIA | 1031 |
| <b>Cristiano M.</b><br>RECOVERY OF A BUILDING WITH RECEPTIVE TOURIST PURPOSES IN THE ANCIENT CENTER OF ZUNGOLI. THE ACTUATION PROCESS OF THE INTERVENTION PROGRAM FROM THE CITY TO THE BUILDING                      | 1035 |
| <b>De Filippi F., Balbo R.</b><br>VERNACULAR ARCHITECTURE. IDENTIFICATION, PRESERVATION AND UPGRADING PRINCIPLES   | 1039 |

|   |      |
|---|------|
| <b>Dequal S., Lingua A.</b><br>A NEW SUPPORT FOR TEACHING AND RESEARCH IN PHOTOGRAMMETRY: THE STEREOSCOPIC CLASSROOM  | 1042 |
| <b>Elwazani S.</b><br>HERITAGE DOCUMENTATION EDUCATION: AN INTERNATIONAL COLLABORATIVE ACCOUNT  | 1048 |
| <b>Fiorio Pla' E., Greborio S., Formento D., Garretti L.</b><br>EXPLOITING THE CULTURAL HERITAGE OF THE PIEMONTE REGION   | 1053 |
| <b>Gillani G.</b><br>THE CULTURAL HERITAGE PROTECTION AND MUSEALIZATION WITHOUT EXCAVATION: ACQUISITION OF NEW RESOURCES FOR ARCHAEOLOGICAL SITES                                     | 1056 |
| <b>Gruber P., Herbig U.</b><br>RESEARCH OF ENVIRONMENTAL ADAPTATION OF TRADITIONAL BUILDING CONSTRUCTIONS AND TECHNIQUES IN NIAS  | 1062 |
| <b>Lingua A., Todisco V., Moglia G.</b><br>COMPARISON OF SURVEY AND REPRESENTATION TECHNIQUES FOR ARCHITECTURAL OBJECTS   | 1068 |
| <b>Lönnqvist M., Lönnqvist K., Whiting M.S., Törmä M., Nunez M., Okkonen J.</b><br>TRACING NEW DIMENSIONS IN THE ROMAN MILITARY ORGANIZATION OF THE EASTERN LIMES                     | 1074 |
| <b>Lo Turco M., Vitali M.</b><br>THE COURTYARDS OF THE <i>SEMINARIO ARCIVESCOVILE</i> AND THE UNIVERSITY OF TURIN: INTEGRATED SURVEY TECHNIQUES AND REPRESENTATION METHODS            | 1080 |
| <b>Lunnon S., Blake B.</b><br>RecorDIM TASK GROUP 3 – MEASURED AND DRAWN THE UNDERSTANDING AND APPLICATION OF METRIC SURVEY TO HISTORIC BUILDINGS                                     | 1085 |
| <b>Manto M., Marconi M., Celestini G.</b><br>FOUNTAINS, DATED 1800; PALAZZO MONTALVO, DATED 1565  | 1087 |
| <b>Marotta A.</b><br>DECORATION AS A SYSTEM. SURVEY AND CRITICAL INTERPRETATION   | 1090 |
| <b>Minez B., Erdoğan N., Dökmeci V.</b><br>REVITALIZATION OF KÜTAHYA'S CBD IN TURKEY  | 1096 |
| <b>Monti C., Brumana R., Achille C.</b><br>AN INTERDISCIPLINARY RESEARCH AND SITE AS A UNIVERSITY TEACHING LABORATORY: THE 'CONTINUOUS WORKS' OF THE BASILICA OF SAN LORENZO IN MILAN | 1100 |
| <b>Paşaoğulları Şahin N., Vehbi B.O., Faslı M.</b><br>PHYSICAL ANALYSIS TECHNIQUES FOR IDENTIFICATION OF CULTURAL HERITAGE IN THE BUILT ENVIRONMENT                                   | 1106 |

|  |      |
|--|------|
| <b>Romeo E.</b><br>SURVEY AND GRAPHICAL REPRESENTATION IN THE ITALIAN PROTECTION POLITICS BETWEEN THE NINETEENTH AND THE TWENTIETH CENTURIES   | 1110 |
| <b>Sansone C.</b><br>CONSTRUCTIVE TECHNIQUES OF THE HISTORICAL CENTRE OF ZUNGOLI. FROM THE ANALYSIS OF THE ANCIENT PATRIMONY TO THE RECOVERY METHODS   | 1116 |
| <b>Scalisi F.</b><br>TECHNOLOGICAL FEATURES IN GREEK FORTIFICATIONS IN SICILY  | 1121 |
| <b>Schuhr W., Kanngieser E.</b><br>INTERNATIONAL STEREOVIEWS TO SAVE THE WORLD'S CULTURAL HERITAGE   | 1126 |
| <b>Sechidis L., Sylaiou S., Patias P.</b><br>STEREOSCOPIC VISUALIZATION AND DATABASE INFORMATION RETRIEVAL   | 1132 |
| <b>Sylaiou S., Liarokapis F., Sechidis L., Patias P., Georgoula O.</b><br>VIRTUAL MUSEUMS: FIRST RESULTS OF A SURVEY ON METHODS AND TOOLS  | 1138 |
| <b>Vitrano R.M.</b><br>HISTORICAL, SCIENTIFIC AND EXPERIMENTAL RESEARCHES AIMED AT FINDING NEW TECHNIQUES AND INSTRUMENTS TO RECOVER, PRESERVE AND MANAGE THE XX <sup>th</sup> CENTURY CULTURAL HERITAGE FOR FUTURE GENERATIONS  | 1144 |
| <b>Yüksek İ., Erdoğan N.</b><br>THE WINDOWS OF HISTORICAL BUILDINGS IN KIRKLARELİ/TURKEY: CHARACTERISTICS AND PRESENT CONDITIONS   | 1150 |
| <b>Zámolyi F.G., Zámolyi A.</b><br>DOCUMENTING TRADITIONAL ARCHITECTURE AND SETTLEMENT STRUCTURE IN EASTERN INDONESIA – A BASE FOR DETERMINING INDIGENOUS LIVELIHOOD SYSTEM SUSTAINABILITY AND DURABILITY OF TRADITIONAL HOUSING STRUCTURE IN THE CASE OF NATURAL CATASTROPHES - | 1153 |
| <b>THE CIPA KEYWORDS LIST</b>  | 1159 |
| <b>KEYWORD INDEX</b>   | 1161 |
| <b>AUTHOR INDEX</b>  | 1163 |

## PRESERVING THE ARCHITECTURAL HERITAGE BY INCREASING THE KNOWLEDGE OF THE COMMUNITY: THE CASE OF THE ANCIENT CHURCH OF SAN PIETRO DI CONSAVIA IN ASTI.

R. Spallone<sup>a</sup>

<sup>a</sup>DINSE, Politecnico di Torino, Viale Mattioli 39, 10125 Torino, ITALY - [roberta.spallone@polito.it](mailto:roberta.spallone@polito.it)

**KEY WORDS:** 3D, CAD, Model, Representation, Survey

### ABSTRACT

“The first level of safeguard is, obviously, knowledge; to know means [...] to document. [...] In architecture this problem was conceptually overcome by survey, a composite operation [...]” (Cundari, Carnevali, 2000)

The safeguard of the Cultural Heritage, as stated in the above mentioned document, involves social and educational aspects. As researchers of survey and representation methods, I think that we can propose methodologies that can actively contribute to widen the knowledge and the understanding of the Cultural Heritage and support its sharing, in the conviction that the safeguard and fruition should go together.

The experience that I want to present consists of the case of a historical building that has reached its present condition as a result of a series of factors of aggregation, reshaping, demolition which happened over the life of the building. It is the ancient church of San Pietro di Consavia in Asti, called the “rotunda”, a building of Medieval origin, which was subject to a particular modification and transformation.

For the reconstruction of this process of transformation, 3D modelling techniques were applied, to generate digital geometric models of the changes that the monument underwent over time. The visualisation within the 3D model of the internal and external changes and transformations, permits the user to experience visualisation in 3D virtual space, for the various periods during the evolution of the monument.

The model has been prepared on the basis of historical, bibliographical and archival analyses integrated with the pre-existent archaeological survey as well as direct and photographic surveys.

The results of this work are visible on permanent displays in the building, which is now a museum open to the public, and on the Asti City web site.

### 1. INTEGRATED METHODOLOGIES OF RESEARCH FOR THE SAFEGUARD OF ARCHITECTURAL HERITAGE: FROM DATA GATHERING AND RESEARCH TO ITS DIFFUSION WITHIN THE COMMUNITY.

The monumental compound of “San Pietro di Consavia” nowadays appears to the visitor as a composition of pure volumes forming a U-shaped court open along the eastern side and featuring identical materials (bricks, tiles and sandstone) and an apparently homogeneous style.

The original religious function of the buildings is evident from their external shape: a sixteen-sided body with an octagonal cupola and an evidently truncated tower and connected with a quadrangular hall are the core of the religious function of the compound, while the two-storied sleeves with portico arranged in an L shape to form a cloister had a residential function.

The compound is now open to the public. The buildings around the cloister house the local Archaeological Museum, established in the 1930s by Niccola Gabiani, while temporary and permanent exhibitions are held in the two buildings formerly dedicated to worship.

The seemingly simple aspect of the building compound belies a

complex history of evolution and transformation that affected, since the beginning, first the number of buildings, and then their geometry and functions.

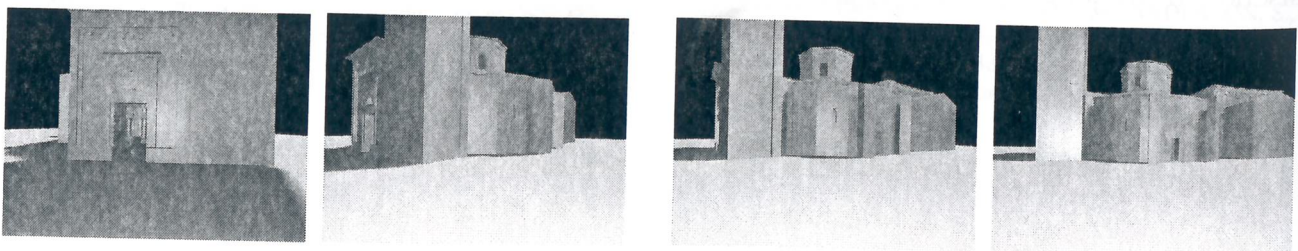
The present aspect is largely the result of the last, substantial and questionable restoration carried out by Gabiani himself. He wanted to isolate the two buildings dedicated to worship “through the elimination of ‘later additions’ [...] and the ‘restoration’ of the portico of the southern court and the arrangement of the open spaces as a *parterre*” (Longhi, 2000).

This event was investigated and reconstructed through a combination of historical, architectural and archaeological studies that through the specific methodologies of each discipline have clarified several obscure aspects.

The opening of the compound to a public of wide-ranging age and education (including school children) made it necessary to research and develop suitable educational communication and presentation systems. These systems were to facilitate the understanding of the main evolution phases that led to the present configuration and simulate dynamic virtual visits of the building through different ages (figure 1).

These studies were first published as a book (Bordone, Crosetto, Tosco, 2000). They were later used for the preparation of the exhibition “San Pietro in Consavia: a priory of the Order of

Figure 1. Frames of the virtual visit in the XV century



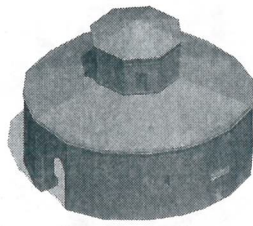


Figure 2. The first phase of construction (1110-1130)

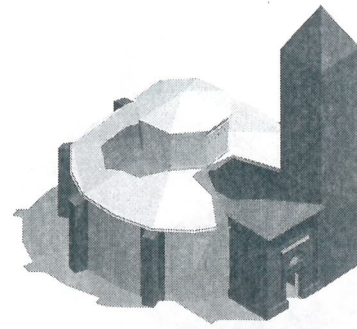


Figure 3. The second phase of construction (end of the XII century - XIII century)

Malta on the *Via Francigena*” (end 2002), to make the monumental compound known to the general public and to promote the comprehension of the buildings. On the same occasion, a presentation was prepared for the web site of the city of Asti. For both events, the author of this paper prepared the 3D digital processing.

## 2. 3D DIGITAL MODELLING AS A METHOD FOR CHECKING THE HISTORICAL RECONSTRUCTION.

The reconstruction of the historical evolution of a building allows viewing through its present aspect the different looks it had in the past, and recognizing their traces.

Francesca Cataliotti wonders about the purpose of such studies, and suggests possible answers. “Why reconstruct? Perhaps is it possible to restore the identity, the sense of *unicum*, by adding up fragments and appearances?”

We reconstruct because of a sort of intellectual pleasure which the architect cannot do without, because of the necessity to satisfy that romantic taste of reviving, if only on the drawing board, the original shape of the ancient monument, in order to understand what has disappeared, in part or whole,... or, perhaps, is it the architecture itself that asks to be represented in order to be understood and enjoyed at a distance, in time and space?

The reconstructive representation is, first of all, a way to understand the object and could become an important tool of historic and iconographic research, because it allows reviving a building, whether it is partly or totally lost, or hiding in the body of a stratified building”. (Cataliotti, 2001)

3D digital modelling offers in this respect a powerful method of checking hypotheses. Notes Gabriele Rossi: “in a 3D digital model, the complexity of the representation gives way to an illustrative schematization which has, in any case, better spatial control of the object and far exceeds the traditional static axonometric and perspective forms of representation.

The model thus becomes an essential tool to check and control the validity of reconstructive hypotheses”. (Rossi, 2000)

## 3. 3D AND KINETIC DIGITAL MODELLING AS A TOOL FOR UNDERSTANDING AND FOR EDUCATION AND COMMUNICATION.

3D digital modelling, a technique of representation by now widely consolidated in the various design phases, is presently stirring a renewed interest for the survey of existing structures.

This is, on the one hand, due to the natural connection with the most innovative methodologies of instrumental survey. On the other, it is a consequence of the wide-ranging potential applications in the fields of critical thematic analyses and of spatial and temporal simulation: “*digital mock-ups* [...] allow a richer and more controlled interaction between user and model [...] *digital mock-ups* are able to cover, within a unique representation system, the entire range of possible modelling”. (Maldonado, 1992).

The quick evolution of digital technologies, hardware and software, makes it ever easier to build 3D models of considerable geometrical complexity.

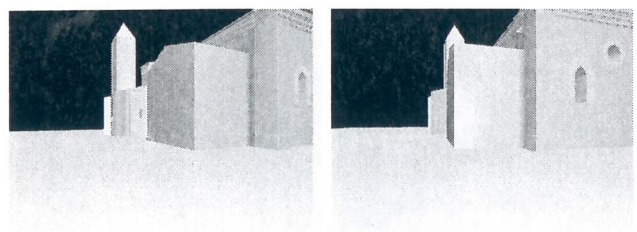
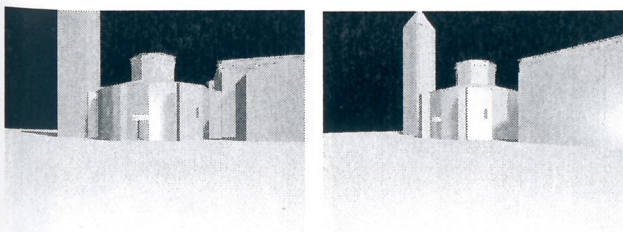
A critical selection of data, first of all in respect of the relationship between scale and contents of the representation, is absolutely essential to avoid, in the modelling phase, very complex procedures adding insignificant detail which uselessly increases the size of the digital file. In this respect it should be considered that the most suitable support for the visualization of the model in its space-time dimensions usually is the monitor of a personal computer.

While 2D digital drawings now usually implement a level of detail that is greater than the level achieved, for the same scale of reduction, in a traditional drawing, it is most appropriate to simplify 3D digital modelling by implementing primitive solids, by analogy with material plastic modelling.

3D digital modelling complements drawing as an information and communication tool, while adding, as a specific prerogative, the possibility to enter the fourth dimension.

This important aspect is underlined by Claudio Moriconi, who observes that “with the digital support the drawing simulates the hypothetical reality, overcomes static limitations and allows interacting with any kind of sign.

By creating virtual images, digital graphics is probably the most suitable tool to interpret the complexity of reality [...]”.





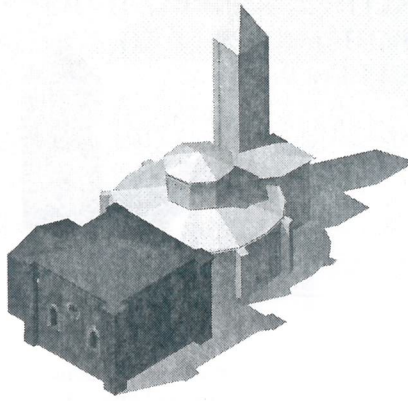


Figure 4. The third phase of construction (XV century)

(Moriconi, 2001)

The creation of a 3D digital model offers, as a result, infinite possibilities of observation: from the objective visualization of a cylindrical projection, to the subjective visualization of a conical projection. In this respect Mario Docci and Riccardo Migliari state that: “modelling is not only a creative strategy, but also a cognitive one. Digital models allow 3D simulations... Computerized models are conceived as 3D systems, real *maquettes* that live in a virtual space perfectly corresponding to a real space, so much so that they encompass all four dimensions. They are visible through a screen, a window (which reminds the window of Alberti’s *perspectiva artificialis*). This window visualizes the models in a 2D space that can be perceptive (in a central projection) or measurable (in a parallel projection), with the capability to vary the point of view so as to simulate the mobility and the transformability in time and appearance”. (Docci, Migliari, 2000)

The meanings of the introduction of the time dimension, and the relationship of the latter with the history of the representation techniques, are sharply investigated by Giorgio Garzino: “the possible kinetic representations are closely related, even in the intent of their author, to the views shown in ancient architectural drawings. In fact, from the standpoint of the history of representation they take a place of extraordinary interest. The all-encompassing representation intent of synthetic images, which centres the same extents on the human viewer, is inherently in contrast with the graphic technicality and the supposed rigor of objectivity. Additionally, the introduction of the time factor to a certain extent introduces a dynamic element in the representation and in the knowledge of its subject. While the representation that followed the ‘paper path’ refers to a precise moment in history, the representation that unfolds as a succession of images on the screen emerges as a becoming, a process”. (Garzino, 1996)

The monumental compound, and in particular the core buildings with a religious function, was a test case both of the potential of 3D digital modeling for the historical reconstruction of the monument and of the perceptive quality of the virtual visit in space and time. The communication clearness and immediacy could be verified in both respects.

Thanks to digital modelling, the 3D visualization of the

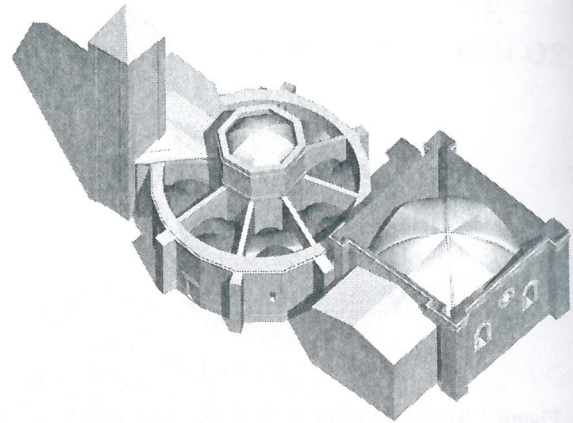


Figure 5. The fourth phase of construction (XVI century)

morphological transformations of the urban fabric as well as of buildings or complexes in various historical periods makes it possible to share this information and diffuse it in a readily understandable form to a wide-ranging spectrum of public.

“The digital techniques of representation make it possible to create a picture of the situation before and after the intervention, and to rebuild, if necessary, the stratification too.

The era of graphic papers that only the specialists can decipher is over. Now the very users of a building or of an urban complex can appreciate spaces [...] before during and after its irreversible transformation”. (Moriconi, 2000)

#### 4. THE FIGURATIVE RECONSTRUCTION OF THE EVOLUTIONARY STAGES OF THE CHURCH OF SAN PIETRO OF CONSAVIA IN ASTI.

The complex history of the evolution of the core buildings formerly dedicated to worship was the subject of a volumetric representation, of the interior as well as the exterior, divided for simplicity in six main phases, illustrating the studies mentioned above.

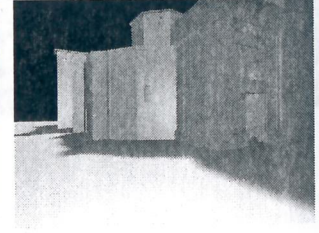
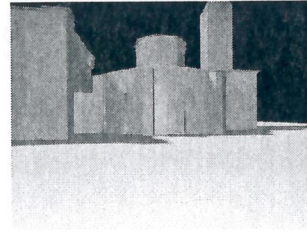
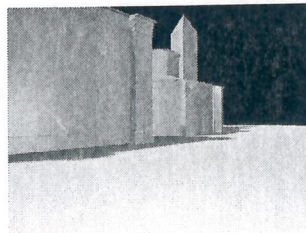
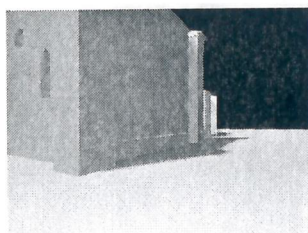
The first phase (figure 2) addresses the construction, from 1110 to 1130, of the most ancient kernel, the Romanesque church of Santo Sepolcro, a rotunda. The church includes an “ambulatory with eight columns inscribed within a circular perimetrical wall inside and a polygonal one outside” (Tosco, 2000). Both the ambulatory and the cupola have no vault.

The second phase (figure 3) is characterised by the changes carried out between the end of the XII century and the XIII century by the Knights of San Giovanni, consisting of the addition of the central vault, the buttresses, the hall and the tower.

During the third phase (figure 4), in the XV century, the Valperga hall was built, a square structure probably serving funerary functions, covered by a cross vault.

The fourth phase (figure 5) is characterised by the building of the barrel vaults, with lunettes, of the ambulatory, in the XVI century.

The fifth phase (figure 6) includes the elaborate transformation of the Valperga hall into a parish church having a longitudinal



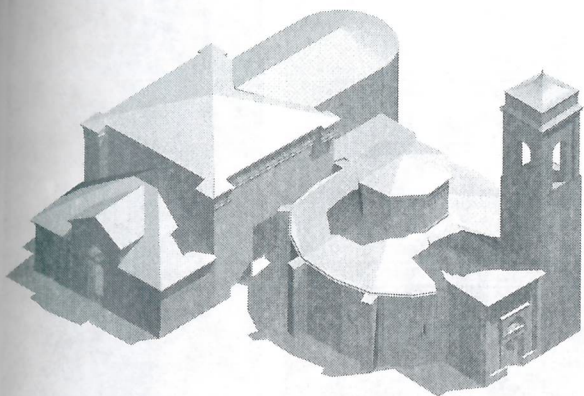


Figure 6. The fifth phase of construction (XIX century)

plan, during the nineteenth century. The Valperga hall became the hall of the new church placed between the entrance body and the presbytery. The tower was reshaped and the rotunda was transformed in baptistery. Mario Tamagno documented this change in his survey (Tamagno, 1897). "Actually the survey was still carried out in accordance with the 19th century custom of adjusting reality to an ideal model, and searching for "original" conditions, with an eye to a possible stylistic restoration". (Longhi, 2000).

The sixth phase (figure 7) is characterised by the complex restoration, dating back to the early 1930s, carried out by Niccola Gabiani.

An official of the municipal Arts Department, he wanted to free the church and the baptistery from the additions made to the original constructions. He thus operated as a restorer with the 'naivety' of a neophyte that finally joins the select circle of restorers of d'Andrade's school" (Longhi, 2000), returning the building to us in its present conditions.

##### 5. 3D DIGITAL MODELLING FOR THE REPRESENTATION OF MORPHOLOGICAL TRANSFORMATIONS: METHODOLOGIES AND PROCEDURAL ASPECTS.

The reconstruction of the evolution of the buildings required the geometric modelling of the interior and exterior. This was based on the recent archaeological and planimetric survey by Elisabetta Genta (Crosetto, 2000), and on the survey of the fronts prepared by the author and by Marco Vitali, integrated with data drawn from historical-archival and bibliographical sources and additional measurements directly taken in a survey of the interior.

3D digital modelling required a critical selection of the data with the goal of simplifying the representation of the geometrical shape, internal and external, of the buildings. This included everything, from the vertical load-bearing structures to the vaults and roofing, the openings and the decorative apparatus.

For the reconstruction of the demolished parts, based on the hypotheses of Tosco and Longhi, volumes were used which

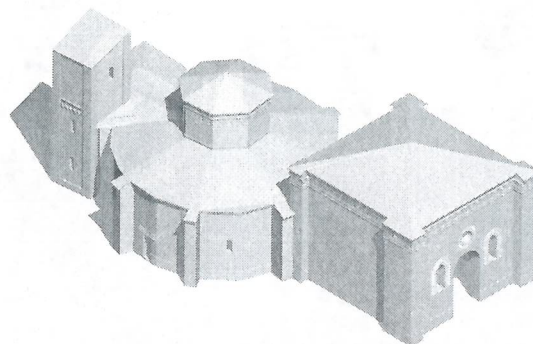


Figure 7. The sixth phase of construction (after 1930)

only represent the outer shapes. When historical-iconographical documentation is available, on the contrary, as was the case for Mario Tamagno's survey which was supported by a series of historical photographs, it was possible to implement the same level of definition that characterizes the modelling of current structures.

The MicroStationV8 CAD software package was used for the preparation of the 3D digital model. To highlight each of the new construction phases with respect to the previous ones, the identification of the changes that the monument underwent through the ages.

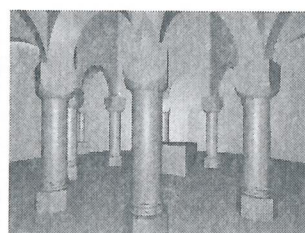
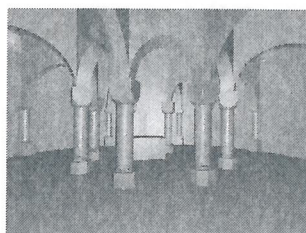
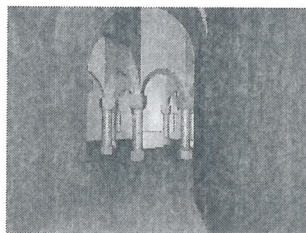
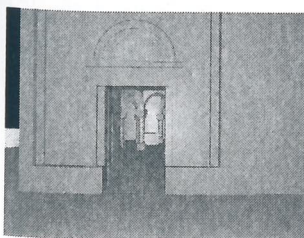
The model was used to produce a set of axonometric views of the exterior, for presentation and educational purposes. The views highlight the extent of the interventions by following an ideal path around the compound. Axonometric cutaway views where the roofing is not shown display the underlying vaults, which were built in several subsequent phases after the original construction.

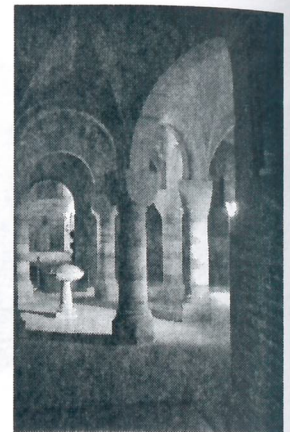
The images produced were included in the city of Asti web site pages dedicated to the church. They are also visible through the information system supporting the permanent exhibition located inside the "rotunda".

The model also demonstrated its value in conducting virtual visits at various times in history.

Via the "Fly-through" procedure supported by the MicroStationV8 software package, an ideal path was built outside and inside the monument. A large set of virtual cameras was uniformly scattered along the path, so that a very large number of frames is available.

The editing of the individual frame, which MicroStationV8 can do automatically, was instead performed through the Premiere software package, which ensures a better control of the fluency of the sequence and allows saving the file in compressed formats compatible with standard applications (i.e. Windows Media Player) normally installed even on entry-level personal computers.





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