Digital Applications for Tangible Cultural Heritage

A Proposal

Report On an Academic Curriculum for Digital Approaches to Cultural Heritage

Volume 3

EPOCH

Edited by
Sorin Hermon

Franco Niccolucci
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EXECUTIVE SUMMARY

This report describes work in progress to define a curriculum that would answer modern needs of a knowledge-based society, where Information Society Technologies went well beyond the state of merely digital tools, but, as pointed out by last twenty and more years of research in social and behavioural studies, continuously shape the way we perceive our world, enable the access to an influx of information never precedent before and eventually accelerate the rhythm our society is evolving and forming. As such, EPOCH recognized the imperious need to understand whether the academic curriculum is adapted to cope with these rapid and evolving changes, and eventually propose a curriculum that would best reflect the multi-disciplinary essence of EPOCH, demonstrated in its research activity, as well in the academic curriculum. One of the most recent attempts to establish an inter-disciplinary, inter – university program is the EU Socrates funded EUROMACHS project, a Master's program that aims at offering students training in the field of CH, IT and New Media (http://www.uc.pt/en/fluc/euromachs). Such examples, and others, of existing modules, courses, academic programmes, vocational training and as such offers were summarized in previous EPOCH reports (Niccolucci, 2006, Trainings Offerings and Needs in Europe). These reports, as well as continuous feedback received during the WP4 training activities and dissemination, leaded to the organisation of a final event (see report on Events, 2008) at BTA2007, Paestum, Italy. The event gathered together prominent scholars from UK, Italy, Greece, France, Spain, Israel and Cyprus, which presented the situation in their countries related to the field of IST and CH as reflected in existing curricula. A round-table discussion, with the participation of the public, mainly academics from Italy, young researchers and students, followed, its scope being to receive a feedback as wide as possible, in order to assemble these ideas and present them in a draft proposal for a curriculum in Digital Approaches to Cultural Heritage, presented hereafter.

Abstract

This paper considers the likely educational requirements which will result from the increasing use of technologies within the Cultural Heritage sector. The levels of engagement with technologies for different participants and roles in the sector are considered along with the associated form that their education might take. To achieve this requires some hypothesis about the ways in which the professions may engage in the use of technologies and the degree to which technologies would be adopted and embedded in their practice. By considering the comparison with the changes in the nature of the architectural profession some tentative conclusions about the timescales, nature and requirements for the design of educational systems are reached.

Introduction

In common with virtually every sector of professional life, Cultural Heritage professionals are making increasing use of technologies in their everyday working lives. In fact, in many ways, the sector is a rather late adopter – a very understandable position given the sector's appropriate emphasis on conservation, and a technology sector that has exhibited continual change and short lived deployments of technological innovations coupled with fairly scant regard for long term preservation of data and systems.

It is also clear that there will be a range of technological capabilities required in nologies in their everyday working lives. In fact, in many ways, the sector is a rather late adopter – a very understandable position given the sector's appropriate emphasis on conservation, and a technology sector that has

remain a backlog of Continuing Professional Education (CPD) need in respect of developing the competences of professionals already through initial training and working at some point in an expected 40 year career. In many cases such CPD is a mixture of gaining new insights and regularising informally acquired skills.

These basic-level skills will need to incorporate understanding of both data and process limitations including that:

- tools will have limitations in the range of situations in which they are useful
- the way in which they are used will impact the usefulness of the results
- the form of the results themselves have implications to the range of situations in which they are useful and
- any digital tools have implications in terms of working practices (operations and workflows) in terms of long term preservation, risk management and obsolescence.

The most difficult areas in which to predict training and educational requirements are where the advent of a new technology has a fundamental impact on the nature of the professional activities undertaken. The characteristics of these aspects are also addressed later.

Technology Adoption and the Nature of Change

Figure 1 illustrates the processes over time which characterise the adoption of new technologies in an application domain. This follows a life cycle where basic research results are used to underpin the development of practical tools (with some lag) and the tools are gradually adopted – starting with early adopters and progressing until the use is a standard part of the toolkit of every professional in the field. It is clear that at this point the education of every professional needs to include an understanding of the use of such tools and their limitations, but it is equally clear that this is not a "one-off" step change, but implies an evolution from such training as is required by early adopters to the systematic incorporation in the training of all professionals. This will be a gradual process and it is certain that the transition will be part of a wider raising of general awareness of ICTs and their use coupled with training in a variety of tools and techniques that are at different stages in the adoption life-cycle.

The Majority – Responsible Reflective Professionals

Education in the professions has increasingly recognised the need for "Continuing Professional Development" – the process by which professionals adapt their practice to the current state of research and development in their fields. Since tools are at different stages of maturity it must be true that the highest priority CPD will address tools that appear to be making a transition across the "chasm" identified in Figure 1, between early adopters and early majority use. Of course some tools will never be used by the majority, but may be standard use by a specialist minority. CPD in respect of such technologies would be a high priority part of the CPD requirements for accredited specialists in these fields but perhaps of less importance to others.

Similar distinctions would dictate the time at which it becomes necessary to consider the inclusion of education about specific tools and technologies in the basic education of all professionals at the start of their careers.

Of course this discussion on the timing of change in professional education ignores the difficulty of predicting when a technology has reached the transition point to mainstream use. In addition there will be an additional inertia in designing and deploying changes in educational programs, re-accreditation of programs etc. Given that re-accreditation tends to be on five year cycles in Higher Education these delays should not be underestimated – such change may take 5–10 years to permeate the sector.

There is also an issue in determining who is appropriate to decide that change has now become required and needs to be included in basic education for the sector. The obvious and appropriate place for such

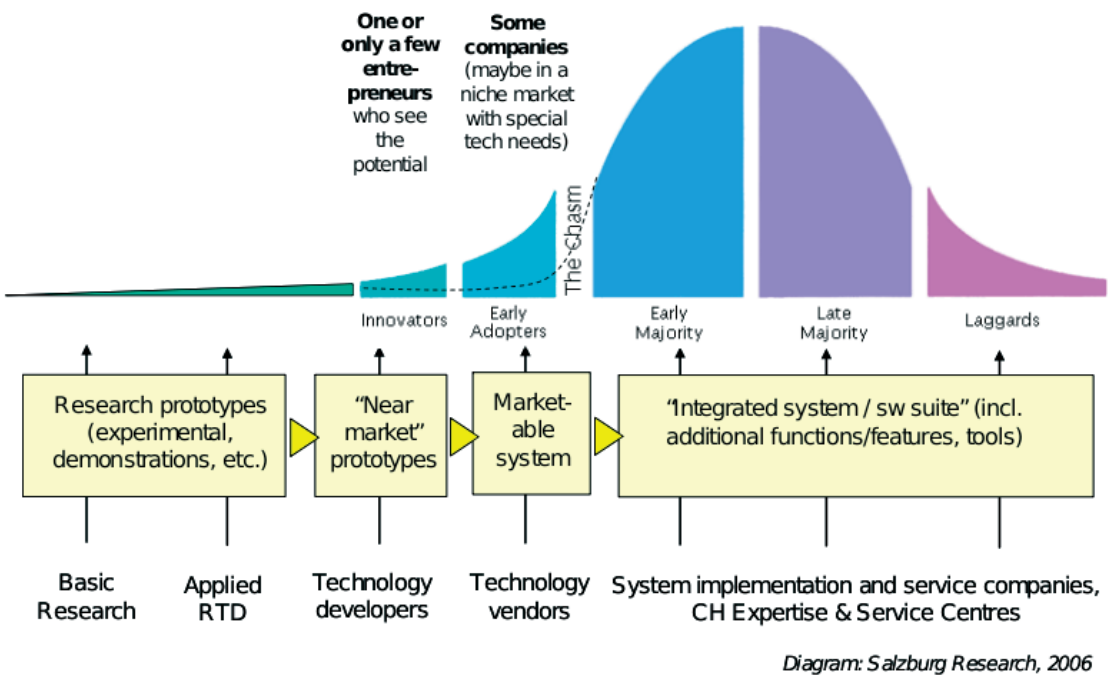

Figure 1: Adoption of Technology (From EPOCH Research Agenda -1st edition)

decisions is in the professional societies that accredit the competence of professionals in their fields. This will favour a conservatism, which is almost certainly appropriate given technologists' tendency to introduce new tools as early as possible, which may be too early for the Heritage sectors. However it also places obligations on senior practitioners to be ahead of their fields by definition and, whilst this is a general obligation, the unrelenting pace of change in technological opportunity makes this sphere of scholarship especially challenging.

In practice developments appropriate to a generalist practitioner tend to have arisen within a specialist environment and then gradually broadened their field of application. The senior professionals who have ultimate responsibility for changes in the profession will be drawing advice and guidance from those in specialist fields that contribute to the overall picture.

The implication is that within the professions there will be a continuing need for early adoption and experimentation with potentially significant new technologies. To engage successfully in these activities some cultural heritage professionals will require technological understanding at significantly more depth than is the norm. We note in passing that there is also a complementary obligation on the technologists who would engage in development of new tools targeted at the Cultural Heritage sector to equip themselves more fully to understand that sector. There are thus at least three distinct levels of engagement that can be expected of professionals working in the field. These levels can be characterised as "sufficient" to:

- Participate in the profession (in a requirement of all professionals in X)
- Engage with ICT professionals in the development of new tools
- Develop new tools for others to use.

In each of these areas a matching CPD provision will also be required for those already in the professions.

Current supply situation

Whilst not based on a thorough survey even a quick review of the current situation in the UK implies some significant gaps, when it comes to addressing the likely impact of technology on professions related to Cultural Heritage. The levels described above do not appear to be addressed explicitly or systematically and the provision that has evolved seems to be distinctly lacking in many respects.

In the UK all Undergraduate admissions are undertaken through a central service – the Universities' Central Admissions Service (UCAS). A search of the UCAS database of courses on offer revealed over 100 BA/BSc programmes which addressed different areas of cultural heritage (including, for example, archaeology, museology, librarianship and conservation) in their course titles. None of these made reference to technology within the program title. At one level this is not surprising and would be appropriate if all programs could be expected to have an appropriate level of ICT education within the program, but from the perspective of marketing it is significant in that UK universities are competitive and frequently suggest distinctive "flavours" or strengths through course titles. That none have done this suggests that it would not be considered a "market advantage" to provide anything beyond minimum expectation.

From these courses a representative selection of the online descriptions from each area were examined to review the level of ICT coverage included. While the survey was anything but systematic and thorough, the early indications were that the ICT components were low level and generic, with databases and websites as the dominant ICT areas named and syllabuses that implied fairly low levels of coverage. There were some mentions of GIS systems, but in this sample, no mention of digitisation, digital libraries, or knowledge management for example.

At the postgraduate level there is no equivalent of UCAS and hence to search fo all programs that might be relevant would be labour intensive and beyond the scope of the current paper. However reviewing a sample of institutions with significant presence in the undergraduate level, the ICT coverage at Masters level appeared similar – no Masters programs were found that implied advanced ICT understanding for uses in the Cultural Heritage professions, although again the review was not conducted in great depth. Similarly an examination of specialist Masters programs on offer to students in Computing Science through a sample of Universities that seemed most active in fields relating to Cultural Heritage revealed no programs targeting ICT professionals wishing to engage in the Cultural Heritage sector.

The supply side of the educational provision therefore does appear to be limited, but is there enough evidence of the need for future professionals to have more on offer?

ICTs in Cultural Heritage

The EPOCH Network of Excellence in FP6 has been addressing the use of ICTs across the range of processing for data about physical cultural heritage in monuments, sites and museums. This holistic view has been described as a number of interconnecting processes, described as pipeline at times, but more appropriately perhaps as a set of processes which draw in information at particular stage of refinement and produce new information in a refined form. The results of any process maybe suitable as input to further processing as well as forming results in their own right. EPOCH has considered the following processing types in this framework:

- Data Collection – primary and metadata
- Data organisation – collection formation
- Search and research
- Reconstruction and hypotheses
- Communication to the public
- Derivative works

Each area may draw on a different balance of underpinning technologies to develop appropriate applications. These include technologies for:

- GIS systems
- Mobile technologies for field work
- Data bases/digital resource management
- Search and research (location/ identification of resources and testing hypotheses)
- Communication (presentations, story-telling, multimedia)

There are other more generic office functions that would concern organisations working in Cultural Heritage (payroll, ticketing, sales etc) which have been largely omitted as beyond the remit of technologies specific to the sector

and this remains appropriate in considering the educational challenges for those in the sector. Part of the purpose of this analysis and this event is to begin a more systematic examination of what would be the educational requirements in respect of these potential uses for future professionals in the field. These requirements relate to normal, current professional activities and reflect currently available technologies. The education is required to support their inevitable uptake, and ensure that it is appropriate, as well as enabling future developments or be firmly based on requirement of the sector.

Designing Tools for the future

The advent of a critical mass of more ICT-aware Cultural Heritage professionals brings us to a final and very important benefit of enhancing the ICT education for this group – enhanced influence and participation in design and development of future tools.

ICT research has too often been open to accusation of being a "solution in search of a problem". This not only gives the ICT research a bad name but inhibits more targeted and appropriate developments from achieving the take-up and deployment that they would merit, and wastes significant talent and resources in "blind alleys". Whilst a certain amount of free enquiry and blue skies research is undoubtedly appropriate, this argument is all too often confused with lack of understanding of the sector purportedly being addressed.

In recent years the concept of "Use-inspired Basic Research" has attracted increasing interest and attention. The concept was elegantly expressed in Stokes book [Stokes, 1997] as covering situations where fundamental research is required to generate basic understanding of processes which limit progress in particular target application domains. Stokes describes Pasteur's work on micro-biology as epitomising this approach since the basic research was always known to be targeting the food industry.

Stokes highlights the way in which "use-inspired" is often confused with "close to market". In the context of this paper the importance of realising that these are different takes us back to figure 1. The research that prepares for future tools may well have a lead time of 10-20 years even if the benefits of success can be foreseen now. In the most fundamental cases these might be part of developing completely new ways of working. To highlight the issues let us consider some developments that have taken place in architectural practice since research in the applications of technology to architectural design became commonplace.

Lessons from Architecture

Early experiments in the applications of computing to architectural practice addressed the challenge of assisting in then current manual processes, in particular draughting of architectural plans using what is now known as Computer Aided Design. Isolated aspects of the design process were tackled for example using increasing sophistication in structural analysis, thermal and acoustic modelling, and increasingly moving from 2D to 3D with enhanced visualisation of proposed built form, for both client and planners. Realism in these visualisations require increasing cognisance of the behaviour light and led to some significant advances in computing science – notably the advent of radiosity algorithms for computing light distribution in closed spaces. It was also probably concern to support architectural design which was most cited as the reason for developing sketch interfaces a field which continues to attract interest.

These individual aspects were gradually developed and integrating, requiring development of standards or agreements on data formats, which included shape and other data to feed other applications such as the production of cost estimates and bills of quantities. The development costs were normally justified in terms of being able to work more cheaply, but in practice being able to be more responsive to clients was probably a bigger advantage.

In parallel to these incremental advances there were a number of more radical lines

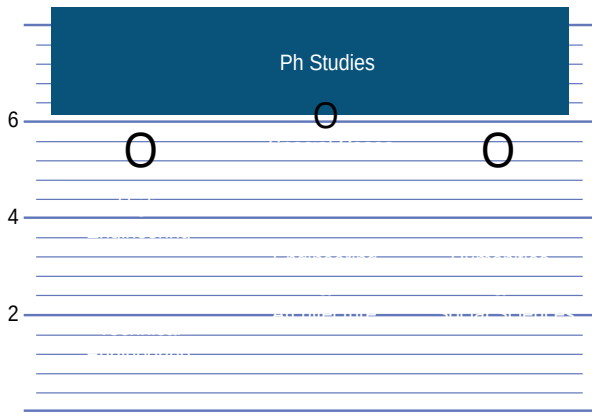

Imagen 5: Estructura del Sistema Educativo Español de Educación Superior

Dentro de la enseñanza superior en España solo se reconoce la universidad como institución que puede impartir cursos oficiales. Podríamos considerar, en líneas generales, tres grandes bloques de enseñanza universitaria en España, atendiendo a la duración de los estudios. Así nos encontramos con estudios de 4-5 años en especialidades de Humanidades y Ciencias Sociales, de 5 años en títulos de Ingenierías, de 6 años en Arquitectura y alguna Ingeniería; de 3 años en los títulos de Ingenierías Técnicas, y otros títulos de 2 años de Segundo ciclo de estudios de enseñanza superior.

Respecto a todos ellos hay que señalar que, según la Disposición Adicional Primera "Implantación de las nuevas enseñanzas" del Real decreto aprobado el pasado octubre:

"2. En el curso académico 2010-2011 no podrán ofertarse plazas de nuevo ingreso en primer curso para las actuales titulaciones de Licenciado, Diplomado, Arquitecto, Ingeniero, Arquitecto Técnico e Ingeniero Técnico"

Así pues, a partir del 2010 sólo se ofrecerá el primer curso de estudios universitarios con el formato del Acuerdo de Bolonia. El Real decreto (RD) de Octubre de 2007, señala que las universidades españolas impartirán enseñanzas de Grado, Master y Doctorado conducentes a la obtención de los correspondientes títulos oficiales (Artículo 3.1).

Y en el Artículo 3.3, indica que las enseñanzas universitarias oficiales se concretarán en planes de estudios que serán elaborados por las universidades, con sujeción a las normas y condiciones que les sean de aplicación en cada caso. Dichos planes de estudios habrán de ser verificados por el Consejo de Universidades y autorizados en su implantación por la correspondiente Comunidad Autónoma. Es interesante el Artículo 3.4 que expresa cómo las universidades podrán, mediante convenio con otras universidades nacionales o extranjeras, organizar enseñanzas conjuntas conducentes a la obtención de un único título oficial de Graduado, Master Universitario o Doctor.

Según este RD, las enseñanzas de Grado tienen como finalidad la obtención por parte del estudiante de una formación general, en una o varias disciplinas, orientada a la preparación para el ejercicio de actividades de carácter profesional (Artículo 9.1). Las enseñanzas de Master, por otro lado, tienen como finalidad la adquisición por el estudiante de una formación avanzada, de carácter especializado o multidisciplinar, orientada a la especialización académica o profesional, o bien a promover la iniciación en tareas investigadoras (Artículo 10.1).

El Capítulo IV se dedica a las enseñanzas universitarias oficiales de Master, estableciendo en el Artículo 15, las Directrices para el diseño de títulos de Máster Universitario. En concreto (artículo 15.2) se especifica que los planes de estudios conducentes a la obtención de estos títulos tendrán entre 60 y 120 créditos, y que contendrán toda la formación teórica y práctica

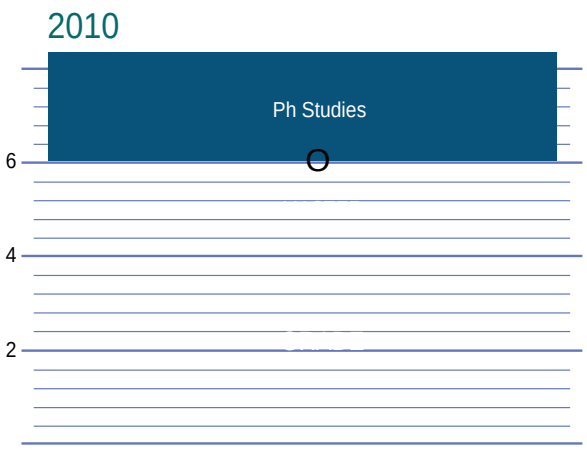

Imagen 6: Nuevo Sistema Educativo de Educación Superior aprobado el 26 –10- 2007

PROGRAM	UNIVERSITY	PRIVATE	CENTER	LOCATION	ADDRESS	NO PLACES
Diploma de Postgrado en Cooperación y Gestión Cultural Internacional	de BARCELONA	N	Facultad de Ciencias Económicas y Empresariales	Avda. Diagonal 690	08034 BARCELONA	
Máster Universitario en Cultura Histórica y Comunicación	de BARCELONA	N	Facultad de Geografía e Historia	Baldiri Reixac s/n	08028 BARCELONA	
Experto en Gestión Virtual del Patrimonio	de BARCELONA	N	Instituto de Formación Continua. IL3	Ciutat de Granada 131. Ed IL3. Distrito 22	08018 BARCELONA	
Máster Universitario en Gestión Cultural	CARLOS III DE MADRID	N	Centro de Ampliación de Estudios. Postgrados	Edif. Luis Vives. Campus Getafe. c/ Madrid, 126	28903 GETAFE (MADRID)	40
Magister en Gestión del Patrimonio Cultural	COMPLUTENSE DE MADRID	N	Centro de Estudios de Gestión, Análisis y Evaluación	Edificio B. Mas Ferré. Campus de Somosaguas	28223 MADRID	25
Máster Universitario en Gestión Cultural	de GRANADA	N	Departamento Historia del Arte	Campus de la Cartuja	18071 GRANADA	41
Máster en Gestión de Instituciones Culturales	Internacional de Catalunya	S	Facultad de Humanidades	Campus Iradier Inmaculada 22	08017 BARCELONA	
Curso de Especialización en Gestión del Patrimonio Cultural Local	JAUME I	N	Centre d'Estudis de Postgrau i Formació Continuada	Campus del Riu Sec	12071 CASTELLÓN DE LA PLANA	
Experto Universitario en Guía Intérprete del Patrimonio Natural y Cultural de Canarias	de LAS PALMAS DE GRAN CANARIA	N	Unidad de Gestión de Investigación; Subdirección de Tercer Ciclo y Postgrado	C/ Murga, 21	35003 LAS PALMAS DE GRAN CANARIA (LAS PALMAS)	30
Postgrado en Gestión Cultural	de LLEIDA	N	Departamento de Geografía y Sociología	Plaça Víctor Siurana, 1	25003 LLEIDA	
Especialista Universitario en Gestión del Patrimonio Etnológico, Turismo y Desarrollo	MIGUEL HERNÀNDEZ D'ELX	N	Centro de Formación de Postgrado y Formación Continua	Edif. Torrevaillo. Avd. Ferrocarril, s/n	03202 ELCHE (ALICANTE)	30
Máster en Interculturalidad en el País Vasco	Mondragon Unibertsitatea	S	Facultad de Humanidades y Ciencias de la Educación	Barrio Dorleta, s/n	20540 ESCORIATZA (GUIPÚZCOA)	
Experto en Interculturalidad en el País Vasco	Mondragon Unibertsitatea	S	Facultad de Humanidades y Ciencias de la Educación	Barrio Dorleta, s/n	20540 ESCORIATZA (GUIPÚZCOA)	

PROGRAM	UNIVERSITY	PRIVATE	CENTER	LOCATION	ADDRESS	NO PLACES
Postgrado en Gestión Cultural	Oberta de Catalunya	S	Punto de Información Postgrado	Avda. Drassanes, 3-5	08001 BARCELONA	
Máster en Conservación, Gestión y Difusión del Patrimonio	Oberta de Catalunya	S	Punto de Información Postgrado	Avda. Drassanes, 3-5	08001 BARCELONA	
Especialista Universitario en Gestión Cultural	de OVIEDO	N	Vicerrectorado de Convergencia Europea, Postgrado y Títulos Propios. Unidad de Títulos Propios	C/.Plaza de Riego s/n. Ed. Historico, 2ª planta	33003 OVIEDO (ASTURIAS)	40
Curso de Especialización en Conservación y Restauración del Patrimonio Arquitectónico y Urbano: Teoría, Historia y Documentación	POLITÉCNICA DE MADRID	N	Escuela Técnica Superior de Arquitectura	Avda. Juan de Herrera s/n	28040 MADRID	
Diploma de Postgrado en Dirección y Gestión de Instituciones, Empresas y Plataformas Culturales	POMPEU FABRA	N	Instituto de Educación Contínua	Balmes 132	08008 BARCELONA	
Postgrado en Comunicación de la Tradición y la Oferta Cultural	Ramón Llull	S	Facultad de Ciencias de la Comunicación Blanquerna	Valldonzella 23	08001 BARCELONA	
Postgrado en Gestión y Didáctica del Patrimonio Cultural	Universitat Ramón Llull	S	Facultad de Filosofia de Catalunya	Diputación 231	08007 BARCELONA	
Especialista Universitario en Gestión Cultural	ROVIRA I VIRGILI	N	Departamento de Antropología Social y Filosofía	Plaza Imperial Tarraco 1	43005 TARRAGONA	
Máster en Evaluación y Gestión del Patrimonio Histórico	de SALAMANCA	N	Centro de Estudios Propios y Postgrados	Patio de Escuelas, 3	37008 SALAMANCA	45
Máster Europeo en Conservación y Gestión de Bienes Culturales	de SALAMANCA	N	Centro de Estudios Propios y Postgrados	Patio de Escuelas, 3	37008 SALAMANCA	20
Máster en Renovación Urbana e Rehabilitación	de SANTIAGO DE COMPOSTELA	N	Facultad de Geografía e Historia	Plaza de la Universidad 1	15782 SANTIAGO DE COMPOSTELA (A CORUÑA)	

PROGRAM	UNIVERSITY	PRIVATE	CENTER	LOCATION	ADDRESS	NO PLACES
Tercer Master Universitario Europeo en Arte, Cultura, Conservación y Gestión de Bienes Culturales	de SEVILLA	N	Vicerrectorado de Postgrado y Doctorado	Pabellón de México. Avda de la Palmera s/n	41013 SEVILLA	30
Experto Universitario en Gestión y Economía de la Cultura	de SEVILLA	N	Vicerrectorado de Postgrado y Doctorado	Pabellón de México. Avda de la Palmera s/n	41013 SEVILLA	40
Master Univeristario en Gestión Cultural	de SEVILLA	N	Vicerrectorado de Postgrado y Doctorado	Pabellón de México. Avda de la Palmera s/n	41013 SEVILLA	40
Máster Universitario en Mediación y Gestión de Patrimonio en Europa	U.N.E.D	N	Fundación General	C/ Francisco de Rojas,2 2º dcha.	28010 MADRID	
Diploma en Manifestaciones Culturales, Museos y Exposiciones Científicas, Marketing y Comunicación	de VALÈNCIA	N	Departamento de Historia de la Ciencia y la Documentación	Avda. Blasco Ibañez 15	46010 VALENCIA	
Máster Universitario en Administración de Indusstrias Culturales	de VALLADOLID	N	Escuela Universitaria de Estudios Empresariales	Prado de la Magdalena s/n	47005 VALLADOLID	40
Máster en Gestión de Políticas y Proyectos Culturales	de ZARAGOZA	N	Facultad de Filosofía y Letras	Pedro Cerbuna 12	50009 ZARAGOZA	35

Planes de studio y analisis preliminares

En el análisis de los planes de estudio, nos detenemos en la relación entre las nuevas tecnologías y los sistemas de gestión, representación y documentación del Patrimonio Cultural, y en los contenidos de los programas de enseñanza. Los Masteres que se ofertan están compuestos de Módulos, con un número asignado de créditos (ECTS o créditos de la legislación española) y distribuidos en asignaturas. Si agrupasemos las asignaturas en cuatro categorías: asignaturas específicas de Patrimonio, asignaturas que analizan temas relacionados con Humanidades, asignaturas de enseñanza de tecnologías, asignaturas que complementan la formación con contenidos de orden territorial local; podríamos obtener las gráficas que se incluyen a continuación.

En este sentido, en un Master de Patrimonio ofrecido por un Departamento de Arqueología o Historia se invita a participar a una persona o grupo de investigación que trabaja en tecnologías, y se brinda la oportunidad de ofrecer una asignatura o varias, enseñando o mostrando aplicaciones de esa tecnología concreta. Si se tiene interés en otra tecnología se invita a otro especialista, de esa misma universidad o de otra. A la inversa, si el Master es ofrecido por un Departamento de Ingeniería o Arquitectura,

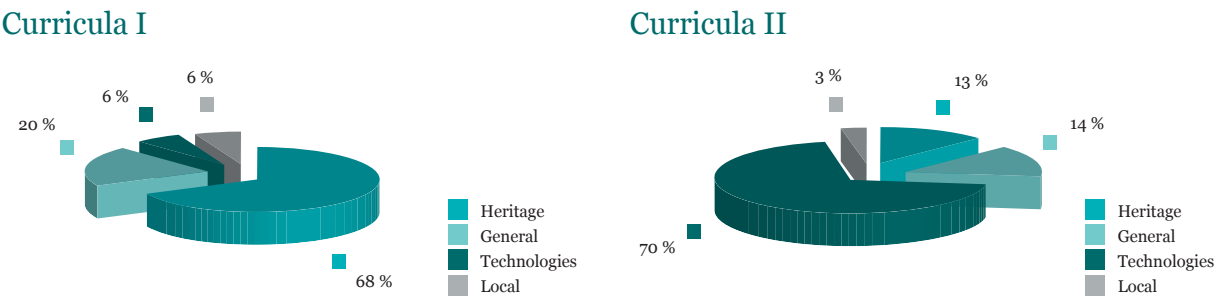

Imagen 8: Currículo comparado de Masteres en Patrimonio Cultural

a modo de profesor secundario y para complemento docente, se invitará a alguien experto en Patrimonio Cultural desde las Humanidades, que contextualice el concepto de Patrimonio.

Esto muestra un primer hecho en la relación entre nuevas tecnologías y Patrimonio Cultural: dependiendo de la Universidad y el Departamento concreto que oferta el Master, el currículo basa su troncalidad y su estructura en materias de Humanidades y Ciencias Sociales, o en la formación técnica experimental, es decir en formación en las tecnologías. En general, en relación con las nuevas tecnologías de documentación, nos encontramos con tipologías muy distintas de Master en Patrimonio, que ofrecen formaciones que no son ni suplementarias ni complementarias, sino que se desconocen entre sí.

La multidisciplinariedad se entiende como una suma de enfoques parciales desconectados, tanto en tecnologías, problemática y necesidades, como en objetivos de formación. Hemos estado aplicando las tecnologías en diferentes escenarios, incorporándolas en diferentes trabajos. Queremos destacar la colaboración especial llevada a cabo con el Grupo de Investigación de Segeda, dirigido por el Dr. Francisco Burillo. El liderazgo de este arqueólogo así como sus es-

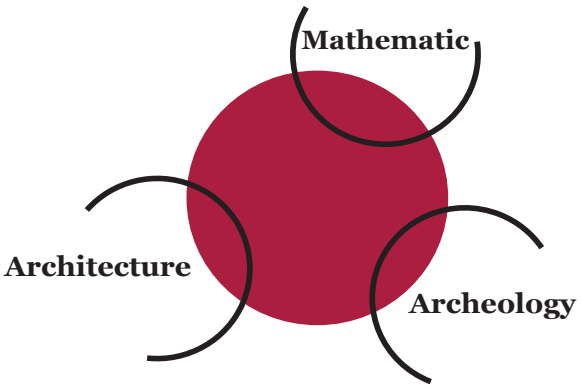

Imagen 9: Diferentes puntos de vista para diferentes especialidades en Patrimonio Cultural

fuerzos para crear un equipo interdisciplinar han hecho posible un enorme intercambio de conocimiento con la finalidad de crear nuevos procesos de documentación y de tratamiento de la información arqueológica.

Segeda fue un enclave importante en las batallas entre los romanos y los iberos en las luchas por dominar la Peninsula Iberica. La estrategia de los romanos para ganar la guerra hizo necesario un cambio en el calendario, de manera que el año comenzase a primeros de enero y no en marzo como venía sucediendo. Esta decisión, tomada en el momento adecuado, cambio la hoja de ruta de la conquista y la historia. Un momento, una oportunidad y una gran decisión que cambio el momento político y nuestro destino, celebrando el comienzo del año el

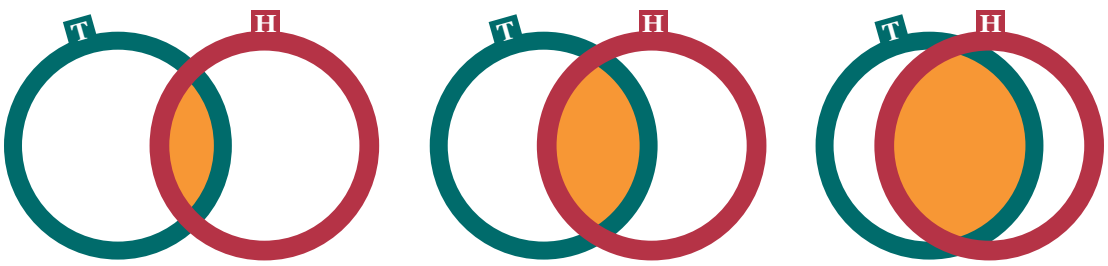

Imagen 10: Interrelación entre Nuevas Tecnologías y materias de Humanidades

1 de enero, entonces y ahora. Una estrategia adoptada por los responsables desde un enfoque interdisciplinar ha de decidir el currículo a partir de una definición clara de necesidades y de objetivos, analizando y decidiendo el grado de interconexión entre ambas disciplinas (Heritage/Technologies). Sea cual sea el currículo que se decida a nivel internacional, nacional o local, a de responder a unos objetivos específicos y generales, que han de ser establecidos contando con los puntos de vista y planteamientos de representantes de las ciencias e instituciones implicadas en la gestión patrimonial.

Conclusiones

This document presents the approach adopted by the Universidad Politécnica of Madrid (UPM) Research Group on Cultural Heritage Management d New Technologies throughout 15 years of experience collaborating in archaeological and Heritage projects. The UPM Research Group foresees the future of Heritage Management incorporating new disciplines. However the process should follow a responsible plan and not the occasional use of resources at isolated sites. Field directors and Heritage Management professionals should seat together to state the goals, structures and team that should collaborate in any documentation project.

From our first visit to an archaeological site we have been implementing degree projects in the curricula of the *Escuela Técnica Superior de Ingenieros en Topografía, Cartografía y Geodesia,* by obtaining cartography at 1/100, 1/200, 1/500 and 1/1.000 scales, achieving thematic mapping from existing information and images from the remote sensing, as well as 3D modelling of sites using traditional equipment, GPS and photogrammetry. After briefly explaining this work and how mapping sciences has begun to be used in any archaeological research project, we present our experience and results, showing the need of a dialogue between new technologies and archaeological research. Chance opens new opportunities but conscience and analysis will help us to find the sense of the search. The Spanish situation allows a great flexibility in the exposition of the formation in Cultural Heritage, as well as starting up national and international programs. In any case he is a little while optimal for a curricular analysis and the design of objectives.

DIGITAL ARCHAEOLOGY CURRICULA: SOME ASPECTS OF THE STATE OF PRACTICE IN FRANCE AND TOURS UNIVERSITY EXPERIENCES

4

E. Lorans
Laboratoire Archéologie et Territoires

This paper is divided into two mains sections. The first one provides information regarding the development of interdisciplinary curricula in archaeology and architectural studies in France; it is not a systematic survey but it insists on some of the main actions in favour of such development. The second one presents the archaeological curriculum offered by Tours University, insisting on digital tools and on the strong links between teaching and research within the "Laboratoire Archéologie et Territoires".

1. Some aspects of French state of practice in digital humanities applied to archaeology and architectural heritage

1.1. A limited teaching in first degrees and master degrees

Regarding the situation in France, the main point to underline is the fact that very few universities offer curricula which associate humanities and digital tools in first degrees or even in master degrees, although many degrees deal with archaeology, art history and, more recently, cultural heritage. This appears from a preliminary survey of many curricula offered in these fields which have been listed by the National Institute of Art History (INHA; http://www.inha.fr/rubrique.php3?id_rubrique=237).

All together, this kind of teaching is offered in places where there is a close connection between teaching and research developed by teams belonging to the National Centre of Scientific Research (CNRS). Apart from the example of Tours (*cf. infra*), one can point out the team MAP (for "**M**odèles et simulations pour l'**A**rchitecture, l'urbanisme et le **P**aysage", i.e. Models and simulations for architecture, urbanism and landscapes; (http://www.map.archi.fr/). This research team is mainly based in Marseille within the local school of Architecture but it also includes members based in other towns, like Nancy.

This research team plays an important part in developing teaching on architectural models through various types of actions, mainly a post-graduate degree, entitled "Digital world and Architectural Heritage", on one hand and summer schools on the other.

1. 2. The leading action of the National Centre of Scientific Research: the creation of three complementary networks in humanities and Social Sciences

Beyond these few examples of specific training, one should insist on the leading action of the National Centre of Scientific Research (CNRS) which clearly appears through the creation and the development of three complementary networks: ISA, MoDys and M²ISA (slide 6). The first two ones, ISA and MoDys, are based on collaboration between archaeologists and geographers and play an important part in the formation of doctoral students and archaeologists of various functions. Both of them are run from Tours University were their web sites are developed and maintained.

– ISA, «Information Spatiale et Archéologie» (http://isa.univ-tours.fr)

The purpose of the network ISA is to gather up geographers and archaeologists who are used to geomatic in order to enable:

1. the definition of new research topics concerning the past societies;
2. the transfer of geographical concepts into the field of archaeology;
3. the use and distribution of geomatic in the various professional environments of archaeology.

In order to reach this purpose, the network offers several sorts of actions:

1. collecting information regarding geomatic applied to archaeology;
2. organizing conferences and seminars every year;
3. developing cooperation between research teams to apply to national or European projects regarding the development of new methodologies.

This network therefore offers both a research and a training environment for archaeologists, including doctoral students. In June 2007, the first international summer school was organized by ISA in Tours, devoted to Time, space and the dynamics of change in archaeology (http://isa.univ-tours.fr/index.php). Finally, this network also offers regular teaching for professionals, organizing short sessions mainly devoted to the use of the software ArcGis and of GPS.

– The second network, MoDys, "Modélisation et Dynamiques Spatiales", is an interdisciplinary network created by the CNRS in order to develop the use of spatial models within humanities and social sciences and to encourage interdisciplinary work (http://modys.univ-tours.fr). Many different bodies involved in various aspects of archaeology but also in other sciences belong to this network.

MoDys organizes every year a seminar for doctoral and post-doctoral students; the first one took place in 2006 and included mainly archaeologists and geographers but the next one, organized in December 2007, was more largely open to other disciplines. The proceedings of both sessions are available on the web site (http://isa.univ-tours.fr//modys/rencontre.php?liste).

– The third and last network to mention, CRN M²ISA (« Centre de Ressources Numériques Méthodologies pour la Modélisation de l'Information Spatiale Appliquée aux Sciences de l'Homme et de la Société ») provides digital data for spatial analysis within humanities and social sciences (http://isa.univ-tours.fr).
The unit "Archéologie et Territoires" plays an important part in the first two networks because of the early development of research in that field in Tours, which makes possible to offer students a coherent curriculum associating digital tools with archaeological training.

2. Teaching and research in archeomatic at Tours University

2.1. Overview of the curriculum

Since 1998, Tours University offers a complete curriculum in archaeology, from the first degree up to doctoral thesis. This curriculum is strongly connected with the main aspects of our research programmes which put the emphasis on the relationships between past societies and space (http://univ-tours.fr/lat). Therefore, students are trained to the use of DBMS and GIS from the third year onwards, when they specialise in archaeology after reading mainly history or art history in the first two years with optional classes in archaeology and field training. Within the first degree, students are provided with 24 hours of practical teaching on DBMS and on GIS, using respectively the softwares 4th Dimension and Mapinfo.

The Master degree is two years long and offers a choice for the second year: either students choose a research master, which may allow them to do a thesis afterwards, or they choose a professional master which is meant to be their last degree and to give them the possibility of getting a job at the end of

Almost all departments offer post-graduate courses on the main disciplinary areas they belong to, whereas there are certain examples where interdisciplinary curricula have been developed. All departments of Information Technology and Computer Sciences as well as all departments of Humanities organize courses on the main fields of their disciplines. Some IT departments, in collaboration with other universities or other departments organize programmes addressing mainly the use of informatics in education. For example, the University of Piraeus, Technology Education and Digital Systems, offers post-graduate programmes on e-learning and digital communication and networks. Alternatively, there are departments, which focus on the use of ICT for education in terms of their specific disciplinary interests. For instance, the Department of Philosophy, Pedagogy and Psychology of the University of Athens offers a postgraduate programme on Contemporary Technologies in Education, the Biology Department of the same university offers a course on "New Technologies in Teaching Biological Curricula", whereas the Department of French Language and Literature in collaboration with the Departments of German and Italian Languages and Literatures and the Department of Electric Engineering offer an inter-departmental course on "Applications of Technology in Language and Communication".

Interestingly, though, there are very few post-graduate programmes combining ICT technologies with cultural heritage issues in particular. We managed to identify seven programmes that offer partly (meaning specific subjects) or fully Intelligent Heritage courses. Apart from the three of the University of the Aegean that we have already mentioned in detail, we also identified the following four.

The first attempt for collaboration between the two fields was made by the University of Crete in 1998. The Department of History & Archaeology and the Department of Computer Science of the University together with the Institute of Mediterranean Studies and the Institute of Information Science both of the Foundation of Research and Technology offered a joint postgraduate program entitled "Advanced Methods and Information Systems in Archaeology: Research and Management of the Material Remains of Aegean Cultures", leading to a M.Sc. in "Systems of Cultural Information and Management of Cultural Resources". The course acquired an excellent reputation by both archaeologists and computer scientists, but was only taught during 1998-99 and 2002-03 and is not available anymore.

The Panteion University in Athens, offers a MA degree on Cultural Policy, Management and Communication. As part of this degree there is one subject entitled "Cultural Communication and New Technologies". Similarly, the inter-university, inter-departmental postgraduate course on Museum Studies of the University of Athens (Depts of History/Archaeology and Geology of the University of Athens and the Dept. of Conservation of Works of Art of the Technological Educational Institute of Athens), offers "Computers, New Technologies and Museums" as part of its curriculum.

Finally, the University of West Macedonia, in Florina, offers a postgraduate course within the Department of Pre-School Education, entitled "Cultural Studies (Language, literature, artistic expression) and New Technologies". Although this could be included in the previously mentioned courses on new technologies and education, the notion of "cultural studies" which seems to be the unifying force for the course gives it a wider perspective.

Taking into account the fact that all the above have been developed during the last 9 years, and the fact that new departments have been recently created to offer courses at an undergraduate level, as we mentioned above, it seems that the Greek academic interests move rapidly towards the combination of new media and traditional disciplines and that the courses on Intelligent Heritage will soon be multiplied.

University	Department	Course	Title	Subjects in Curriculum
Panteion	Department of Communication and Mass Media	MA	Cultural Policy, Management and Communication	Offers course in "Cultural Communication and New Technologies"
of the Aegean	Department of Cultural Technology & Communication	MSc	Cultural Informatics	It offers two divisions: Museology and Design and Production of Digital Cultural Products
	Dpt. Of Cultural Technology & Communication and University of Westminster, Harrow School of Computers	MSc	Multimedia Systems for Cultural Heritage	Course is approved and will start in August 2008
of the Aegean, of Patras & of Athens	Dpt. Of Cultural Technology & Communication & Department of Architecture & Depart. Of History and Archaeology, respectively	MA	Cultural Administration: Archaeology, Architecture and the City	1/3 of the curriculum includes ICT; in combination with history, archaeology and architecture
of Athens	Dept. of Archaeology, Dept. of Geology and Dept. of Conservation of Works of Art, TEI ATHENS	MA	Museology	Offer a course on "Computers, New Technologies and Museums"
of Crete	Department of History & Archaeology and the Department of Computer Science The Institute of Mediterranean Studies and the Institute of Information Science of the Foundation of Research and Technology	MSc	Advanced Methods and Information Systems in Archaeology: Research and Management of the Material Remains of Aegean Cultures	Started in 1998 Programme leading to a "Systems of Cultural Information and Management of Cultural Resources"
of West Macedonia	Dept. of pre-school education at Florina	MA	Cultural Studies (Language, literature, artistic expression) and New Technologies	Although not humanities in the strict sense of the word, it does indeed offer educational programs in this broader area.

Problems and Concerns

As can be expected, the introduction of new curricula in Greece has not without problems and special concerns, as was the case elsewhere in Europe. We can divide them in two broad categories: those deriving because of deeply founded preconceptions and those deriving from practical and financial reasons.

Finding the right balance between theory and practice, humanities and computer studies has not been easy. The more interdisciplinary and diverse the students' group is, the more difficult it becomes to create an academic platform upon which to built research and new knowledge. In the case of our postgraduate courses, students coming from humanities backgrounds, for instance archaeology or cultural anthropology, usually feel less confident to study their more technical subjects and expect a slower pace in the acquisition of new technical knowledge than the students who come from an informatics background (despite the fact that all students with a humanities background have to pass a competitive examination in computers, among other entry requirement, for getting into the postgraduate programme in the first place). On the contrary, as expected, the latter group of ICT-able students does not feel comfortable at all with issues of theory, such as content analysis, communication models, educational approaches and so on. It

is up to the experience of the teaching faculty to find the right pace for the group, to bring it in balance, to encourage them to gain from each other's experience, to persuade the group members not to be afraid of the new knowledge and to motive them all towards a common goal.

In addition, alternative teaching methods often receive suspicion and negative attitude. For instance, e-learning teaching methods are often met with resistance and suspicion because of personal insecurities in terms of the use of new media.

On the other hand, the financial implications of running undergraduate and postgraduate programmes which combine new technologies with cultural heritage studies have to be seriously taken into account. The cost for equipment, their upgrade, software licenses and so on, increases the cost of running such a programme and creates difficulties especially to the poorly financed humanities departments. The lack of experienced staff specialized on the interdisciplinary area of cultural informatics, which also relates to the priorities for hiring of previous years and generations, adds to the above problems. Similarly, informatics departments tend to be less concerned about content that they should be, or they concentrate on technological development more than on the use of it. Sometimes, it is just the lack of a common language that will allow humanities and ICT people to communicate and share their concerns. This adds to the existing reluctance and perpetuates the distance.

Suggestions: how can an inter-disciplinary programme be constructed

Combining particular aspects of different disciplines to develop entirely new ways to approach humanities and information technology research problems is daunting in many ways. Nevertheless, experience over the last seven years has persuaded us that it is an effort worth undertaking. We believe that it is important to try to strike the right balance between technology and culture and also between theory and practice and aim into creating a real synthesis.

An academic programme (whether at undergraduate or postgraduate level) aiming to combine humanities and new media should aim at very clearly defined aims, right from the beginning. It should aim to provide an academic and professional experience in both the sciences and technologies that underpin information and communication studies as well as cultural studies, including archaeology, history, cultural anthropology, art, museology, tourism and so on. Furthermore, it should aim to produce graduates possessing awareness, knowledge and practical skills in the field it aims to cover and enabling them to follow a programme of study that will offer them relevant specialization and career options. We believe that in this direction it is more important to focus on methodologies and ways of thinking and approaching a problem, rather than on teaching the use of specific ICT tools. In the same direction, it is important to incorporate real case studies and encourage their critical analysis in the programme of studies. In addition, an interdisciplinary programme should aim to develop the students' professional attitude, interpersonal and entrepreneurial skills, required by the contemporary job market, which is why we believe that offering opportunities for work experience and practical training are important in the design of similar curricula. Finally, it should produce experts with critical and evaluative perspectives related to both the technologies and the humanities, while developing their capacity for independent and self-reflective learning, ensuring their future contribution to research and development. We have seen all too often new technological tools being used to convey old messages in traditional approaches and we think that it is important for academic programmes in this developing field to encourage new ways of thinking and novel approaches.

Inter-departmental, inter-university and international co-operations are important in order to achieve a high standard of education in the contemporary world. We believe that

the academic programmes developed at the University of the Aegean lead the way towards new perspectives in Heritage Interpretation with the use of new media and we are looking forward for new developments and new perspectives in this field.

A PROPOSAL FOR A CURRICULUM IN DIGITAL APPROACHES TO CULTURAL HERITAGE

6

S. Hermon
Vast-Lab, PIN,
University of Florence, Italy

Keywords: individual knowledge, multi – disciplinary approach, inter – departmental center, selective knowledge, communities of practice, digital knowledge technologies, transfer of learning, educational psychology, learning by engagement.

The draft curriculum presented below is based on ideas taken from educational psychology approaches related to the use of new media and new (IST) tools, and in particular the application of IST as digital cognitive tools, having in mind two main objectives: engaging IST for the creation of knowledge by learners and the use of IST for the creation of social spaces of learning, merging concepts deriving from the constructivist learning theories with the emergence of new technologies and their (potential) impact on society in general and on the learning processes in particular. As such, the curriculum proposed should reflect a balance between the learning of existing IST tools, the creation of new ones, adapted for CH, finding new answers to old questions, the definition of new research questions while implementing IST tools and, in very general terms, using IST in a modern knowledge – based society as a learning instrument of Cultural Heritage.

Following is a proposed syllabus, at BA, MA and PhD levels of courses in CDH. The modules are grouped by the main arguments that complete the research pipeline in humanities and social sciences. This curriculum finally aims at defining a new discipline – Digital Approaches to Cultural Heritage Studies.

Figure 1 summarizes the distribution of modules across semesters and academic degrees; figure 2 offers a potential distribution of attendees across various departments, while figure 3 presents in details the inclusion of different modules into various degree programs.

1. *Introduction, theory, methodology and history of research*
   - a. History of research
     - i. history of computing
     - ii. logics and mathematics
     - iii. how computers work
     - iv. digital humanities – state-of-the-art and successful stories
   - b. Knowledge representation
     - i. classification systems and methods
     - ii. types of knowledge and epistemology
     - iii. philosophy of language and communication
     - iv. logic and aesthetics

c. Research methods
    i. project design and performance characteristics of digital tools
    ii. text analysis
    iii. data capture, storage and processing
    iv. electronic publication

d. New trends in Digital Humanities
    i. fuzzy logic, chaos theory and expert systems
    ii. agent based modeling and empirical modeling
    iii. artificial intelligence
    iv. natural language processing
    v. time, temporal relations and predictive modeling

e. Impact of ICT
    i. shift from work to text and back
    ii. form and expression
    iii. social and economic impact
    iv. information sharing and information overflow

2. *Data Acquisition*

a. Text analysis
    i. Digitization and OCR
    ii. Mark-up (JITM, COCOA)
    iii. DTD

b. Online data harvesting
    i. Internet search and evaluate
    ii. Query building
    iii. Knowledge recovery
    iv. Resource selection strategies
    v. Data mining (NORA, D2K, T2K)

c. Remote sensing and image processing
    i. Image acquisition (3D scanner and photogrammetry)
    ii. Video mosaicing
    iii. Satellite and aerial photos
    iv. Remote sensing
    v. Nomadic technologies (total station, PDA, etc.)
    vi. CAD systems

3. *Knowledge Management*

a. Text managing
    i. Encoding and XML
    ii. Tagging
    iii. Knowledge compilation
    iv. Automatic planning

b. Standards
    i. Building ontology
    ii. Thesauri definition
    iii. CIDOC and other standards
    iv. Data and metadata
    v. Mapping data formats
    vi. Indexing

WHO SHOULD ATTEND							
Module No.	Anthropology Archaeology	Geography	History and Art History	Knowledge Management	Literature	Museology	New Media, Communication and Design
1a	x	x	x	x	x	x	x
1b	x	x	x	x	x	x	x
1c	x	x	x	x	x	x	x
1d	x	x	x		x		
1e	x		x		x		x
2a			x		x		
2b	x	x	x	x	x	x	x
2c	x	x					
3a			x	x	x	x	
3b	x	x	x	x	x	x	x
3c	x	x	x	x	x	x	x
4a	x		x		x		
4b		x	x				
4c	x	x	x				
5a				x			x
5b	x	x	x			x	x
5c				x	x	x	x
5d				x		x	x
6e				x		x	x

Figure 2. Possible attendees by departments

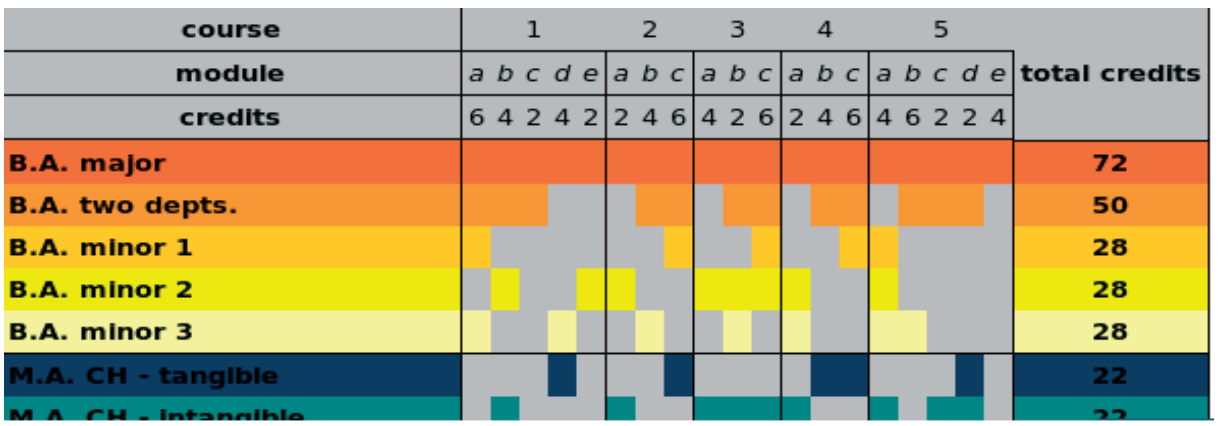

Figure 3. Distribution of courses by academic programs

LIST OF AUTHORS

David Arnold
University of Brighton
Email: D.Arnold@bton.ac.uk

Alexandra Bounia
Assist. Professor, Department of Cultural Technology and Communication,
University of the Aegean
Email: abounia@ct.aegean.gr

Maria Economou
Assist. Professor, Department of Cultural Technology and Communication,
University of the Aegean
Email: m.economou@aegean.gr

Juan Gregorio
Universidad Politécnica de Madrid, ETSI de Caminos,
Canales y Puertos, Ciudad Universitaria, 28003 Madrid
Email: rejasaj@inta.es

Sorin Hermon
Vast-Lab, PIN, University of Florence, Italy,
Email: sorin.hermon@pin.unifi.it

Elisabeth Lorans
Laboratoire Archéologie et Territoires
(UMR 6173 CITERES, Université de Tours-CNRS)
Email: elisabeth.lorans@wanadoo.fr

Mercedes Farjas Rejas
Universidad Politécnica de Madrid, ETSI en Topografía,
Geodesia y Cartografía, Ctra. de Valencia km 7, 28031 Madrid
Email: m.farjas@upm.es