



Generalized ICT

Centre National de la Recherche Scientifique (CNRS)
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Deliverable 7.1





1. Introduction

The WP7 on *Generalized* ICT has seen variegated and broad dialogues among different participants, focused on the primary functionality of information and communication technologies of augmenting human learning, both individually and collectively. To this respect cities and museums, at macro and meso level respectively, can be considered as having this role.

There are many ways of considering urban systems as examples of generalised ICT. Urban systems have a major property of facilitating communication inside cities through personal proximity, and between cities through all kind of material infrastructures and exchanges, as well as personal and virtual contact. It is in that sense that although self-organised, systems of cities were “conceived” - or rather progressively constructed in all societies - for ensuring the reduction of local uncertainty by sharing resources and information.

On another level museums, places of informal education *par excellence*, have great potential in supporting the education activities in schools and fostering lifelong learning. Through online information, museums may become key actors in valuing and sharing tangible and intangible heritage, enabling interactions that enhance the exchange of information, as well as the acquisition and creation of new knowledge. Museums rely on social relationships and on information and communication technologies to create spaces of interaction fostering shared knowledge and meanings. In this context, narratives can play a great role in the design and activation of spaces of interaction among users.

This deliverable will be an account of both these discussions, and therefore it will be divided into two parts. The first one is dedicated to the activities carried on around the analysis of urban systems; the second one is focused on the role ICT can play in supporting multimedia narratives, which enhance tangible and intangible heritage in education and cultural mediation. In particular the Homm-sw and the implications of its uses - discussed along the INSITE project meetings - will be described in details. At the end, an appendix presents Officina Emilia and its specific relation with Crafts Museum in the INSITE project.



2. Urban systems as generalized ICT

We can consider urban systems as generalized ICT because they facilitate communication within cities and among cities through different material and immaterial infrastructures and exchanges. Moreover, systems of cities have been progressively constructed for ensuring the reduction of local uncertainty by sharing resources and information.

During the past decades, a major issue in the analysis and comparison of urban systems has been the availability of sound spatial information. Nowadays, the wide diffusion of electronic devices providing geo-referenced information has resulted in the production of extensive spatial information datasets. This trend has led to entirely new social practices where mass collaboration plays a key role in main components of spatial information frameworks (hardware, software, data, and people). Some authors (Goodchild, 2007) talk about “Volunteered Geographic Information” (VGI), as the harnessing of tools to create, assemble, and disseminate geographic information provided by individuals voluntarily creating their own contents by marking the locations of occurred events or by labelling certain existing features not already been shown on map.

The term “neogeography” is often adopted to describe people activities when using and creating their own maps, geo-tagging pictures, movies, websites, etc. It could be defined as a new bottom up approach to geography prompted by users, therefore introducing changes in the roles of traditional geographers and consumers of geographical contents themselves. The volunteered approach has been adopted by important American organizations, such as US Geological Survey, US Census Bureau, etc. Whilst technologies (e.g. GPS, remote sensing, etc.) can be useful in producing new spatial data, volunteered activities are the only way to update and describe such data. If, on one hand, spatial data have been produced in various ways, on the other hand remote sensing, sensor networks and other electronic devices generate a great flow of relevant spatial information concerning several aspects of human activities or of environmental phenomena monitoring.

Among these, we have chosen to deal with mobile phone data. Exploiting the large amounts of geolocation data are now available, we provided a better understanding of intra-urban mobility which was not easily accessible with traditional survey methods. A new dynamic perspective on a city emerges from these data that can be displayed at a precise temporal resolution and at individual scale of analysis (Fen-Chong, 2013). Differentiated mobility patterns are associated to



population categories and it is now possible to show how they interfere with the urban environment, landmarks and some temporal events.

2.1 - Models for interactions between cities

Another kind of “big data” is provided when theoretical information is constructed through simulation in computers. The series of Simpop models simulate urban evolution from spatialized socio-economic interaction between large number of cities differentiated by their size and economic functions that are sustained by the creation and diffusion of social and technological innovation. The models generate billions of data describing the evolution of cities and their interactions that are used for testing and validating competing hypothesis. Using genetic algorithms and a computation grid thanks to the OpenMOLE simulation platform, we compare simulation output data, available empirical data and established stylized facts. The plausibility of each hypothesis is thus neatly evaluated, consolidating step by step the principles of our urban theories. In that case, ICT are obviously challenging the way of validating the hypotheses of scientists and help comforting them when conveying their models as decision tools for stakeholders. This tool enables now to share views about the evolution of cities in different parts of the world with different stakeholders by accompanying a narrative with visualization of possible urban futures that emerge from global interactions.

In parallel we have extracted knowledge from various data bases and constructed models on how exchange networks connect cities and establish the communication between them, supporting the concept of cities as “generalized ICT”. Two different subsets of data have been explored: one concerned how researchers constructed the European space of research during the series of FPs. We demonstrated that research specialty was more important than distance for explaining the connections between cities, but that the spatial expansion at European scale was following classical models of hierarchical diffusion according to city-size as well as the center-periphery enlargement to new member states. The second one regarded instead the construction of the city networks of firms of the food industry. It has been suggested a geographical approach that observes the process of firms’ creation through transnational flows of investment within a world already organized by international linkages. International linkages (between countries) differentiate both integrated economic regions facilitating connections and political or economic borders restraining them. Moreover, it has been developed an agent-based simulation model for exploring the plausible network configuration resulting from the transnational dynamics of firms



as applied on these international networks. Starting from the “basic principles” (Grimm et al., 2010) of an individual firm N located in place A and looking forward investing in other places, we model analytically the probability to create a link from the place A to a foreign place B. It is suggested that this probability is conditional of A (Owner space), conditional of B (Location space), conditional of A-B (Differences-resemblances of A and B and distance(s) from A to B), conditional of the whole firm network, conditional of other networks (resources, trade, collaborations and competitions) and of general conditions (growth or crisis: access to capital). Then we also explored the conditions of the sustainability of the link A-B, according to previous connections between A and B (path dependencies hypothesis), and the attractiveness of B in the international system (preferential attachment hypothesis). Finally, considering the overall objectives and architecture of the model, scales and “basic principles”, we discuss the capabilities of the model to simulate the emergence or adaptive traits or behavior (of individual firms or collective groups of firms) according to international rules.

3. Museums, ICT and narrations

The exploration of the thematic of museums as generalized ICT and of narrations has been pivoted around specific social practices related to the Officina Emilia initiative, supporting young people in acquiring an active knowledge of the social economic and cultural context in which they live.

At the beginning of the INSITE project, Officina Emilia (Italy) and Crafts Museum (India) launched the development and use of a web application, Homm-sw, for digital storytelling (www.homm-museums-software.org). So far, it implements the engine for creating and managing the activity ‘networks-of-stories’, to create a nonlinear and open multimedia narration (Crawford, 2013; Aylett, Petta, Lim, Louchart, Riedl, 2010).

Homm-sw supports multimedia narratives which enhance tangible and intangible heritage in education and cultural mediation, as well as in tourism. Focusing on an active role of students, teachers, experts who become not only users but also producers of new contents, or providers of different interpretations of the contents already available, a basic goal of this web application is to create, and share on the web, transmedia narratives. A series of workshop have been organized to further test of Homm-sw prototype and disseminate this application in different contexts,



especially museums, education services, business communication and communication of social practices.

3.1 - HOMM-sw: a web application to create networks-of-stories

Social inclusion, lifelong learning and the regeneration of competence networks are key processes which foster innovation. Museums may play an important role in these processes, and ICT can strongly support the effectiveness of the interventions required. Among them, digital tools used to tell stories are becoming increasingly popular. Narratives in new dimensions enable the formation of personal and community identities, and the construction of meanings (Czarniawska, 2004; Hazel, 2008).

In the last decade, **digital storytelling** has rapidly spread due to the growth and possibilities offered by new ICT devices, but is still facing some critical challenges: creation of content on tangible and intangible heritage, classification and re-use of existing documents and clips, cooperative and coordinated production of new content. Moreover, for an effective exploratory paths and a more analytical approach to browsing material, contents must be set in the overall perspective of the narrations, to ensure narration is coherent. Finally, validation and dissemination of related outcomes must respect scientific standards.

Homm-sw has tools that: support educators, also in contrasting learning difficulties, in developing inclusive and collaborative educational practices; support curators; facilitate crowd sourcing; create a personal web repository of contents and connections; share contents to be published; create a network of contents and applications, at different levels for different users and specific needs. Moreover, Homm-sw allows visitors to a museum (students, teachers, public) to process (before, during and after the visit) information on tangible and intangible heritage, to use museums' multimedia content in a personalized way, as well as to support the many experiences offered by museums (hands-on activities, living laboratories, demonstration programs).

Homm-sw shows how ICT can help in extending the museum experience. Before the visit, users can have a general look at museum contents and note, in their online personal desktop, what they are interested in. During the visit: users can retrieve their notes and add what is available on the museum's exhibits and augmented reality, hands-on activities and multimedia contents, living



laboratories, demonstration programs. After the visit: users access their online workspace to retrieve and explore their notes, and any other content, as much as they wish.

Homm_sw's designers and developers aim at building greater awareness of the importance of cultural heritage in supporting sustainable social development. Therefore, they encourage an active involvement of users, also as contributors, to increase collective resources shared through the museums websites. Homm-sw is a tool for online information crowd sourcing: it allows the creation and sharing of relevant knowledge on tangible and intangible culture, along dimensions not often available through the scientific and academic literature. Through crowd sourcing and sharing of non-linear narratives, it increases the effectiveness of museums in developing inclusive and collaborative educational practices, contrasting learning approaches and creating connections between people.

For any activity, the elementary digital documents are 'clips' of three types: videos, texts, images. The engine for networks-of-stories allows one to build a personal sequence to explore and play the clips of the story, according to the sequence triggered by the personal curiosity and interest of the user. The personal path is recorded and then retrieved by the user. Clips may also be viewed according to their main subjects. Metadata, texts and images of each clip can be printed.

The application is now in use with administration permissions to upload multimedia contents and their metadata. Public access is available both for the registered users (who can thus create their personal workspace) and for guest users (who approach the applications just for occasional use).

Homm-sw has been used to create two networks-of-stories (so far available in English and Italian) available for online access. One network-of-stories runs along eight main themes and consists of 43 clips, including 33 video (about 2-4 minutes, for a total of 100 minutes), 6 photo albums (with almost 300 photos), and 4 clips with only text and images. Other networks-of-stories are under review.

Further applications where development is in progress are: back office tools to facilitate uploading of contents and to design networks-of-stories through 'objects'; managing of multilingual contents; serious games, timelines, maps, self-assessment; tools for coordination of group work and submission of group work for publication in the museum online content repository. Together with sharing through social media and a multichannel version, all these



functionalities will be developed and submitted as a complementary storytelling tool in some applications in progress in EU projects on digital heritage, such as Athena-plus, by adopting the standards of online virtual exhibition (Crawford, 2013).

3.2 - Why do we need digital technologies in Museums?

3.2.1 - Context of the experience and motivation of the project

Currently, the promoters are Crafts Museum (New Delhi, India) and Officina Emilia (University of Modena and Reggio Emilia, Italy). Crafts Museum, set up in 1956, has embarked on a major restructuring programme to upgrade facilities and also to ‘open up’ in every sense, its extensive collection of artifacts, so as to better appreciate and value the wealth of traditional skills. The monthly Crafts Demonstration Programme where 40-50 artisans are invited from across the country, offers a unique opportunity for research and documentation of craft traditions. Officina Emilia (OE) offers hands-on workshops on science, technology, history and society so students (as well as their teachers and families) can better understand the social context in which they live. It is a “meeting place” of schools and businesses, where processes of production and innovation and social transformation are examined in a global context.

Although quite different in terms of their collections, the two museums share certain interests and concerns. First, the craft sector in India and the mechanical industries in Italy are both repositories of abundant skills and knowledge that need to be tapped for future growth. Second, the regeneration of competence networks in these sectors is crucial to sustain employment and livelihoods. Third, exposure to skills and practices in these sectors is an important instrument for education and innovation.

Both organizations aim for a new identity for museums as agents of social and economic change. By offering support to education and training systems, Crafts Museum and Officina Emilia hope aim to reach a much wider range of citizens, complementing the knowledge gained in more formal centres of secondary and tertiary education with the unique inputs and approach that museums can provide.

3.2.2 - Goals of Homm_sw

Through Homm-sw, museums may offer interactive applications (“Activities”) to visitors, build tools to assemble Activities, and organize a community around the museum. By proposing Homm-sw to museums and education institutions, we intend: (a) to use ICT to support



interactive workshops in museums; (b) to improve the use of the museum on the part of academic and education institutions, of training centers and in programs of adult education; (c) to promote social inclusion, strengthening the identity of museums as places of learning and to support relationships between individuals, groups and institutions; (d) to create, and share on the web, transmedia narratives co-created by students, teachers, and experts; (e) to encourage the sharing of Homm-sw in networks of museums and research centers interested in its development and use.

3.3 - Methodologies

3.3.1 - ICT for users

Homm-sw uses ICT in five ways: (a) to enhance a large amount of multimedia materials already available for museums' visitors (onsite, in the museums, and on the web); (b) to suggest mental maps that connect information through a semantic navigation and an open nonlinear narrative; (c) to enhance the personal memories of themes and experiences acquired by interacting with the museums' heritage; (d) to support a collaborative environment for communities of practice involved in the processes of teaching - learning and processes of social inclusion and cohesion, i.e. the museums' operators, teachers, literacy centres for migrants, local educators, social workers and operators in social rehabilitation, facilitators in communities of elders; (e) to create a storage of multimedia content produced through the activities and interactions in communities of practice; (f) to produce and disseminate original materials for educational use, in any educational institution, on the salient features of the area (the cultural, historical, institutional, social, economic, technological and environmental).

3.3.2 - Software architecture

To meet these aims, the software architecture adopted in the development of Homm-sw is based on four pillars: (1) a web system for creating and managing community of users, authors, administrators of the sw platform and of contents; (2) ICT information points in the museum that integrate multimedia activities with the hands-on activities; (3) a website with a personal workspace that allows you to 'continue the visit after the visit'; (4) a working group for the production and content management, and a set of collaboration tools used to expand the storage of content.



The software architecture is built around the needs of the end users of the activities of the museum. Before the visit to the museum, the enrollment of individuals and the group to which they belong (e.g. as school classes accompanied by teachers) will set the conditions to create a personal workspace and a group's workspace. A self-assessment test prior can be implemented (customizable by the teacher, in the case of classes of students), related to the aspects that are specifically explored in the activities of the museum. During the visit, the users will be identified by a proximity card. The time for interaction with ICT tools will be limited, during the visit, since the museum is a unique place to make the real visit and the hands-on activities. The personal workspace will be enriched by various information and may be extended through many channels (tablets, mobile phones with custom applications). After visiting the museum, each user will be able to navigate freely through the Homm-sw application indefinitely. The personal web space may be adapted to the specific needs (for example, the level of knowledge effective) and to user's preferences.

The following Figg. 1-7 outline the main features of the software architecture: multimedia clip repository, activity authoring and use of clip repository; activity engines and custom activities; personal space and activity instances, user interaction state, generalization; user lifecycle by using Homm_sw; user identification and user role.

The most original parts of the architecture of Homm-sw are: the tools for the work groups of students (coordinated by teachers and tutors) and for the groups that will be created for the sharing of digital resources; the tools to validate the work of each group and for the publication of the output produced by their work (new clips, additional metadata, new links between clips).

These outputs, produced by the original elaboration of information emerged from the interaction with the heritage of the museum, its artifacts and through the hands-on activities offered by the museum, may be shared through the web in the wider community.

3.3.3 - Software functionalities so far designed

To date, three types of software tools have been designed.

The first relates to the user in the context of the visit. A selection of digitized information, such as text, photos, video and voice comments made during the visit can be stored. All this information can be retrieved and used in subsequent activities to be shared by classmates and by others selected from the groups of registered users. The teachers accompanying the class can re-



elaborate the texts, build narratives, browse storytelling of their students, share activities and collaboration with peers, and more others.

A second type of functionality concerns potentials of personalization of information for the individual user. The elementary unit in the network-of-stories is the clip (a video, a photo album, a text). Each clip is a narrative with a nucleus around which develops a beginning and an end. Through the connections between clips, individual narratives form a network-of-stories. The connections between the clips are a trace for an open narrative, non-unique. Each object (media clip) is included in a network of content and applications at different levels (for specific users and different needs). In the network-of-stories, some of the objects will be connected according to the narrative logic proposed by the author who created the navigation between those contents. Links or other items can be added by users. Other networks-of-stories are possible: following the links between clips proposed by the author, the explorer ("user"/"navigator", as we call it) can change the order in which to read, listen to, view the clips; but also new links can be defined by the explorers, depending on their perspectives/ interests/ skills in exploring and analyzing the individual clips (verbal and textual content, images, sequences, music and sound). This constitutes an important tool for teachers that can build original tracks of multimedia documents in support of the proposed activities to their students, taking into account the needs of their specific educational programming, as well as skills in starting and learning goals that characterize each class. It is then possible to produce, with little effort, different documents and stories, customized to suit the needs of students who have special educational needs.



Figure 1 - Multimedia clip repository

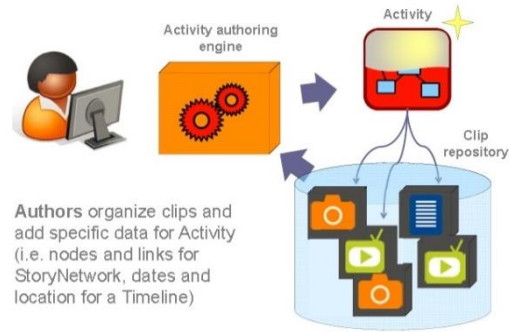


Figure 2 - Activity authoring and use of clip repository

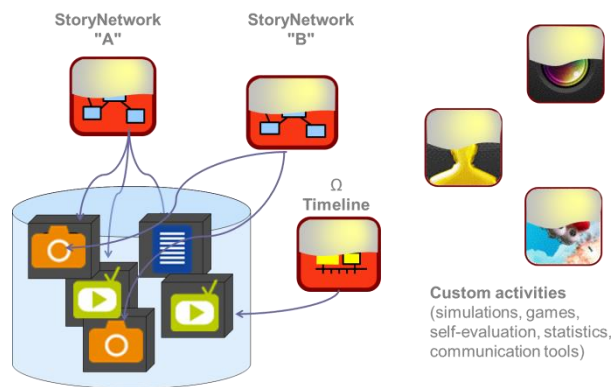


Figure 3 - Activity engines and custom activities

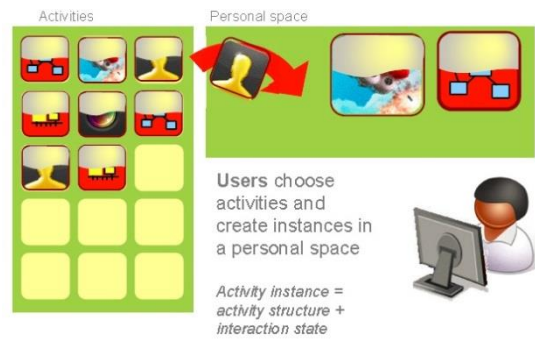


Figure 4 - Personal space and activity instances

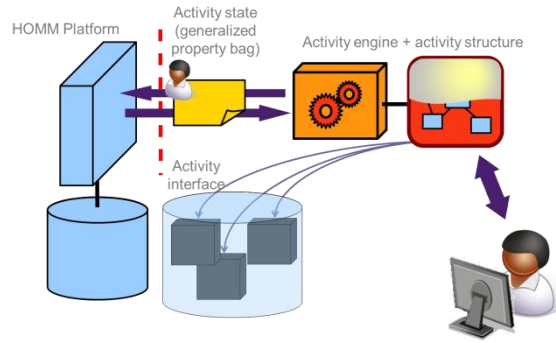


Figure 5 - User interaction state_generalization

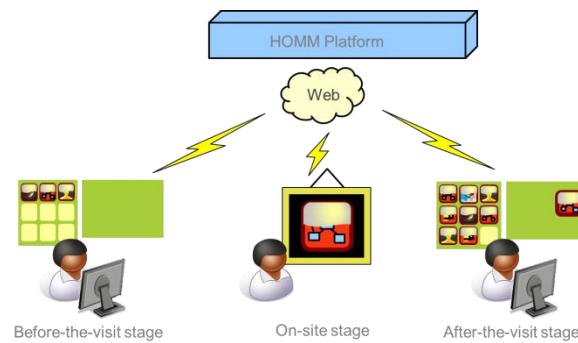


Figure 6 - User lifecycle by using Homm_sw

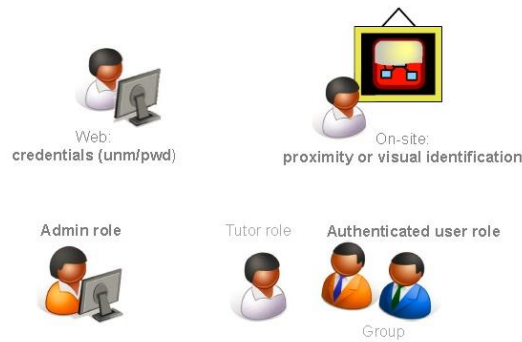


Figure 7 - User identification and user roles

A third type of functionality is the validation of the contents created by users. This feature will allow the users to create a customized network-of-stories, to be shared with a selected group of users (e.g. a team of students in the class working on a specific subject). The contents implemented on the web with Homm-sw are then validated by the administrator of the activity undertaken who can authorize online sharing of the authored contents, or highlight restriction to the individual communities or individuals.



In schools, this application creates platforms to share information and specific contents between colleagues in the same level of class, or who teach disciplines in the same area or the same discipline. Given the strong acceleration of scholarly publishing in the creation of online tools, let us imagine a production of tools more effective and efficient (also monitored by relationships with the universities) which can exploit the potential of creating documents by professionals in the field of education, and by teachers. Homm-sw is an excellent example of a platform that allows you to build pathways of multidisciplinary contents, scientifically validated and monitored by professionals working in museums, in order to support learning processes linked to an active knowledge of the local context.

The opening of the tool we have designed is high and allows one immediately to "manipulate" contents so far poorly disseminated, poorly known, printed in a few copies, too specialized or even outdated, but still appropriate in their educational usage. The manipulation of texts, the use of agile images and videos, the ability to create free connections and to implement the filing of documents are exactly what a new generation of educational staff and teachers expect to find in a toolbox to support them in the common work at school and in museums.

3.4 - Digital storytelling: functionalities so far implemented

At present, there are two browsing environments of the networks of stories. The first one, play-mode, helps in building a personal sequence to exploring videos, albums of photos, and reading the texts of the story according the sequence spurred by the personal curiosity and interest of the user [Fig. 8]. In the second one, browse-and-print-mode, the clips are ordered according the main thematic area and type. In this consultation, text and images of individual clips can be easily printed, video can be played and album browsed [Fig. 9]. The webpage of each clip can be shared through social media.

3.4.1 - Clips in the "play-mode"

Clips in the story-net. Each thumbnail on the screen represents a clip: a story. The lines are links to netting them. It is a mind map you can navigate as you like. What we get on the screen it is not the entire storynet, but a local map, showing only the stories with connection of degree-2 to a particular focus, in the center. By dragging any other clip to the center, you will change the focus and explore other clips. In fact, all the clips can be moved around and the links act like springs to keep boxes connected while you perform some manipulation. Anytime you put a clip



in the center, in the viewfinder, that story enters your playlist, displayed on the right of your screen, and your choice is recorded and an orange triangle appears in the right corner of the thumbnail. You can always reset the view and start a new browsing. For every line connecting two clips, a caption appears by pulling each of the clips connected with the one in the viewfinder.

The playlist. On the right of your screen there is the playlist and the panel to visualize your story. The software memorizes your path in the story net transforming your selection in a sequence of clips to be viewed. You can change the order in your playlist, by dragging clips in a different position: to play them immediately or to come back to what you visited before. Clips are not only videos, but also photo albums and text documents, as highlighted by the icon on the left of the title. Media type will be presented in different players to allow specific control (for instance you can download the documents). A button allows you to play the story in full screen. By clicking on the icon (video/text/album) at the left of each title, you can enter the "browse-and-print-mode" of information on each clip.

3.4.2 - Clips in the "browse-and-print-mode"

A graph offers an overview of the clips according the links proposed by the authors of the narrative. Clips are also listed according the section (e.g. the thematic areas) they belong and the type (video, album, text). Clips in the list can be browsed by accessing to detailed information on the content of each clip. The graph you find in the page of each clip highlights the specific connections of the clip considered. You can view the clips connected, by browsing the graph or by clicking them in the table of links for each clip.

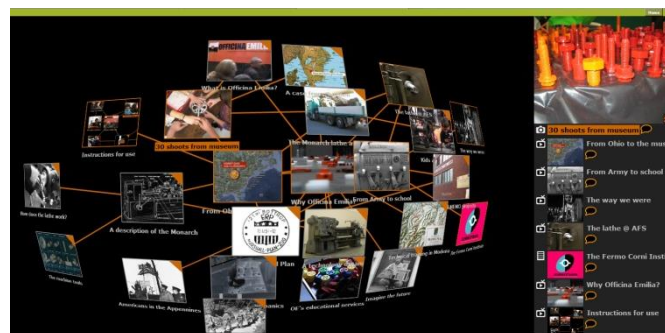


Figure 8 - Screenshot of the play-mode



149 The TITLE of the clip
CAPTION
 The clip shows an excerpt from the book by Carlo...
TRANSCRIPT OF THE DIALOGUES IN-VIDEO clips
 Title: From the documentary by Carlo...
SOURCES of the clip
LEGENDA OF SUBJECTS and types of clips
 Hyperlink to the list of clips by subject and type

Figure 9 - Screenshot of a clip view in the "browse-and- print-mode" mode

3.4.3 - Where can we go from here?

So far we have produced a modular activity. This is just the starting point of a more complex project. The software could be developed for many different contexts, languages and so on.

3.4.4 - Target

Students, teachers, tutors, educators territorial, social workers visiting a museum (and visitors to the museum in general).

OE and CM wish to explore the use of Homm-sw and its full development through a network of museum experiences that promote learning through workshops on technology, culture, art and society, such as the network European Virtual Museum Transnational Network (V-MUST, <http://v-must.net>) and the Asia-Europe Museum Network (ASEMUS, <http://asemus.museum>), and the network created by the Inclusive Museum Community (<http://onmuseums.com/about-the-community>), the networks of eco-museums (<http://www.ecomusei.net>) and the international network of museums of industrial heritage (TICCICH, www.ticcih.org).

3.4.5 - The strengths

Beyond ones common to other ICT tools in use in museums, Homm-sw has two key innovative functions. First, recording and retrieval of users' activities: during the visit in a museum, the visitor accessing her account may browse and take notes in her personal workspace and then



retrieve and explore them, and many more, as much as she likes after the visit. Second, information offered by a set of related clips are easily seen in the conceptual map proposed by the authors. Crowd sourcing and sharing of non-linear narratives may enhance the effectiveness of museums in developing inclusive and collaborative educational practices, contrasting learning difficulties and creating connections between people. ICT can enhance learning, both informal learning, which is typical of traditional museums, and non-formal learning (increasingly important in museums through hands-on activities aimed at creating practical skills and know-how). Homm-sw can improve the usability of museums to enrich the knowledge acquired in formal education and support dissemination of learning processes associated with the knowledge of the local context and its relations with the rest of the world.

Through the creation of knowledge and of opportunities for interaction, Homm-sw may help to enhance historical, cultural, social heritage of a territory, strengthening the museums as agents that promote social inclusion, community cohesion and sustainable development.

3.4.6 - Results of the evaluation and training needs revealed

The functionality of the prototype Homm-sw was evaluated by two groups of users: this has allowed us to refine the back office tools and features to highlight what further developments could be useful both in the administration that during the consultation phase of the content.

To deepen and broaden the knowledge acquired in museum visits need appropriate content, various media, from a comparative perspective, and a collaborative spirit in which individual contributions can be valued.

ICT can facilitate the connections between the visit to the museum and the different learning contexts. In this perspective, it is important, in the case of activities with schools, which prepare the visit with teachers, to choose the appropriate activities for the group of pupils or students and teachers by providing practical tools to monitor the process, which includes the learning-visit in the museum. It is important to consider that this learning process does not necessarily develop, before and after the visit, in a linear and a priori defined way. The visit to the museum and hands-on activities, that take place there, must foster care, creativity, interaction and critical knowledge, but always require mediation, reinforcement and monitoring the ongoing processes and ex-post evaluation. The quality of the narrative produced in the application of network-of-stories requires a design that needs multidisciplinary skills.



In addition, collaboration between museums and universities, might ensure the necessary specific skills useful for multimedia production, not available in schools, but more and more accessible to young people, and rarely aggregated around publishing projects.

3.4.7 - Why it can be considered an innovative tool?

We believe that there are some important aspects not yet explored in the use of ICT in museums. In particular, we propose to connect Homm-sw with activities normally kept separate: individual paths of users' interaction before, during and after the visit to the museum, evaluation of the effectiveness of individual activities and hands-on programs, sharing of resources. In a network perspective, we focus on the modularity and replicability in the use of ICT on different scales. There is also the need to encourage the involvement of communities in hands-on laboratory in museum and outside the museum.

The use of ICT to accompany hands-on activities in the museum opens a space for innovation in lifelong learning practices. This would make it possible to provide appropriate solutions to the needs of a large group of people ("from the cradle to adulthood"), while maintaining a high accuracy and scientific rigor.

Moreover, the creation of tools for dissemination and collaboration between communities may support and develop the possibility that school teachers take advantage of educational materials related to the local area and contribute in strengthening awareness about the connections between the local and the global level. The slow replacement of traditional teaching materials with online and multimedia teaching materials is an irreversible process, though not without uncertainties and dangers of non-effective use of resources, an area that we consider with great attention.

Finally, storytelling is widely recognized as an effective natural means of communication and transmission of knowledge. An outstanding promoter is the British Museum with the challenging goal of telling the history of the world through the stories of 100 objects¹. Narratives on the web may enhance many unexplored dimensions. An area that we think we can contribute to enriching with Homm_sw, as recently supported by the comparative analysis on ICT platforms currently available for content sharing in museums (Brouillard, Dierickx, Loucopoulos, 2013). In

¹ BBC - A History of the World - List of Objects. Available at:
<http://www.bbc.co.uk/ahistoryoftheworld/explorertlflash/>



particular, Homm-sw addresses the issue of connections of contents in a conceptual map and the classification of contents, hardly solved by current sw applications (adopting hierarchical navigation²) or sub groups of themes³.

4. Narrations and practices of social change

In our perspective, narrations as well as ICT may support augmenting human learning, individually and collectively. Building and sharing knowledge in context is the other pillar of OE's activities and we have opened up a dialogue on practices and languages able to convey information, to support dialogue and interactions within and across communities. This was essential in using Homm-sw in creating network of stories, where a dialogue has been active with artists, scientists, software developers, videomakers, and experts in graphics and experts in mechanics. In exploring narrations and community building for making citizenship we have focused on narrations in different contexts and involving different forms of artistic dimensions – from theatre to performing arts, to games – comparing artistic practices in “marginal areas” on “marginal domains”.

Narrations, as a means to create and share knowledge within and across communities, enters in different stages of the practices of social change we have examined: at the beginning, when a problem is identified as such within a community; during the project, when the problem is addressed by some set of activities; after the end of project, as the representation of the outcome of the actions undertaken becomes a reference of what happened.

When we consider narrations and artists involvement in projects of social change, from the experiences discussed in the meetings held in WP7, some critical issues emerge that deserve attention. First of all, engaging people: this is often the main task assigned to artistic dimension. What makes artists crucial is their creativity and imagination, dimensions often related to

² MACE : Browse by Classification : LOM Category 9 Classification. Available at: <http://portal.mace-project.eu/BrowseByClassification#/?locale=en&page=1&query=classification,,root,LOM%20Category%209%20Classification>.

³ Fondazione Fitzcarraldo - LabforCulture.org, CASE STUDIES. Available at: <http://casestudies.labforculture.org/flash/main.php>.



processes of social change, that could facilitate the sharing of something outside the routine. But creativity and imagination of artists are generally relegated to a specific stage, the one in which to boost people's engagement, as it were a one shot event. Second, there is an evaluation issue: which is the impact of narration in the representation of the conditions that are addressed by the project? Artists are not generally involved at this stage and they are supposed to receive or mediate a pre-existing knowledge, shared by those commissioning their intervention. Third, we must reflect on a power issue: which is the relative power of the agents involved in the different stages of the project that has been implemented with the contribution of artists? Relative power, permissions and commitments of artists, of community's members, of funders or commissioners of the project are crucial components of the project. Forth, there is a multi- disciplinary or cross-disciplinary issue linking artists and social scientists. The latter increasingly rely on narrations to tackle the complexity of social phenomena, due to the multi-dimensional, multi-level issues they have to address in social sciences. Narrators (such as novelists or video-makers) largely consider that tools of social analysis they need are those embedded in their art of narrating. They get an immediate reward when they draw people's attention through "good stories". Lastly, feedbacks from projects to policy makers are in the form of narrations (nowadays they may be videos): by presenting the final outcome they may call for changes at many levels (from changes in institutional settings to changes in relative power to enlarge the appropriate opportunities for communities' members). And very often artists are kept apart from this stage, too.



APPENDIX

Officina Emilia

The Officina Emilia initiative, supported by the University of Modena and Reggio Emilia since in 2000, builds on research into comparative analysis of education systems and into industrial districts and local development policies. Officina Emilia's action-research aims at addressing the problems of re-generation of technical skills, whose shortage is critical in areas with a strong presence of engineering and manufacturing companies, as in the industrial districts of North-East Italy. So far, "Officina Emilia" has produced educational hand-on laboratories that have fostered significant changes into contents and methods of teaching and learning, by linking science, technology, engineering and mathematics in a more effective way (Mengoli & Russo 2000, 2009). At the same time, Officina Emilia's laboratories allow students to develop soft skills, such as time management, proper allocation of resources, efficient team working, problem solving, communication, use of feedbacks from processes. Because of these characteristics, the Officina Emilia's laboratories share many elements with several initiatives carried out over time in Italy and in Europe. Its special contribution is on three related domains: (1) to connect technologies with the knowledge of the workplaces and the enterprise activities; (2) to promote knowledge and understanding of the industrial structure of the territories; (3) to involve all young people, not only students enrolled in technical and vocational training pathways. Moreover, Officina Emilia addresses teachers' involvement as a crucial issue for innovation processes in education.

Lastly, Officina Emilia embraces the need to support bottom up changes in education through multi-agent and multi-level actions: this is why an open public hybrid space has been designed to allow students, educators, production and technology experts, policy makers to open their mindset and improve their understanding of the issue and practices of regeneration of competence networks. Public hybrid spaces are increasingly recognized as *loci* fostering innovation processes, since they provide a venue in which new ideas and insights can emerge by allowing interactions and interpretative ambiguity. As Lester and Piore (2004) have stressed, these are often the missing dimensions in innovation processes, which are nurtured not only by analysis and problem solving, but also by generative relationships which are based on heterogeneity, aligned and mutual directedness of the relevant agents, and appropriate permissions to support agents' opportunities of action (Lane, 2011). A special teaching-learning environment – the



Museum-workshop (Museolaboratorio) – opened in 2009. It evokes the industrial workplaces but it is suitable for not-experts, such as students, for initial and in-service teacher training, for the networking activities at regional, national and international level⁴.

OE has produced a coordinated package of education activities to be implemented by schools within the regional curriculum. The action-research explored (a) how to disseminate the tested education activities in the pre-university education system at regional level, and (b) the more appropriate ICT tools to support hands-on activities complemented with multimedia contents. In relation to this issue, it is worth mentioning the use of MOVIO⁵, an open source web application to implement the on line version of the multimedia contents and procedure of the labs; and the development, and use of Homm-sw to create, and share on the web, transmedia narratives co-created by students, teachers, and experts.

By focusing on hands-on practices that could enhance technical culture and handicraft knowledge to support social sustainable growth, OE started a collaboration with the Crafts Museum (CM) in New Delhi, who was embarking in 2011 in a radical restructuring with a focus very close to the one of Officina Emilia: It was during this collaboration that the two partners started the development of ICT tools to support hands-on and multimedia laboratories in museum.

Narrations and ICT became the focus of this common exploration also through a series of contacts with EU projects such as, V-must and Athena+ (to whom both CM and OE become associated partners). These EU projects provided opportunities for disseminations (through their international conferences and workshops hosting presentations on homm-sw) and testing in museums contexts the web application during the various stages of its development (a collaboration with the Budapest's Museum of Fine Arts was also initiated and recently formalized with a cooperation agreement to joint develop of further functionalities of homm-sw).

⁴ Since 2009 until 2012, laboratories have involved approximately 5,000 students from pre-school to upper secondary education. Nearly 170 teachers have been involved in in-service training to promote changes into their everyday work, 12 schools signed a permanent collaboration agreement on innovative education to be developed with the support of the university, and 3 schools introduced Officina Emilia labs in their official curriculum.

⁵ <http://www.movio.beniculturali.it/>



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