Преглед НЦД 22 (2013), 26–35

Kaja Antlej
IB-PROCADD d.o.o., Slovenia
Roman Uršič
MediaInteractive, Slovenia
Mojca Šavnik
National and University Library, Ljubljana, Slovenia
Bernarda Županek
Museum and Galleries of Ljubljana, Slovenia

INTERACTIVE TELEVISION OF CULTURAL HERITAGE AND MULTIMEDIA E-BOOK OF ROMAN EMONA

Abstract: In the last decade an increased number of digitised and digitally born cultural heritage (CH) content in the form of texts, images, sound recordings, videos and 3D models can be observed. This material is frequently disseminated in an incoherent way on various websites. The paper deals with the potential of interactive television (ITV) for aggregation, integration and presentation of different types of CH content. Based on cloud computing and HTML5, the ITV upgraded with tools for social communication and compatibility with the other content management systems (CMS), is becoming a new type of tool for information exchange. Access is possible via mobile devices like smartphones, tablets, laptops, etc. thus it is not limited to the use of TV sets (four-screen strategy). The ITV of CH (ITVCH) is not just a medium but also a platform for networking of all those interested in heritage content. During the *Virtual Emona* project, archaeological objects and a model of archaeological site were 3D digitised and published (3D-PDF and metadata) in the Digital Library of Slovenia – dlib.si; they were soon accessible also through Europeana. In this paper, the special attention is paid to the further interpretation of Roman Emona (modern-day Ljubljana) on the ITVCH. The e-book on Emona (*i-Emona*) including 3D objects from *Virtual Emona*, is presented. A multimedia e-book can stand alone or it can be one of the integrated content of the ITVCH. It enables setting and publishing of text, video, image galleries, interactive HTML5 animations, 3D objects, questionnaires and external frames – therefore it represents a new generation of presentation tools, intended to content holders with less technical skills to share their content with a wider public. Multimedia e-book is based on four-screen platform as well.

Keywords: HTML5, interactive TV, multimedia e-book, 3D content, Roman Emona, heritage interpretation

1. Introduction

During the last decade, the development of information and communication technology (ICT) and the support of the European initiatives for digitisation of cultural heritage (CH), have resulted in a large number of digitized and digitally born content in the form of texts, images, sound recordings, videos and 3D models. To the general public and professionals this material is frequently disseminated in a scattered and incoherent way on various websites, mostly in form of digital libraries and collections, virtual museums and virtual worlds. Access is possible either remotely or on-site at museums (exhibitions), libraries, archives, schools and research centres. This paper deals with the potential of the interactive television (ITV) to aggregate and integrate all of the above mentioned types of heterogeneous CH content, and its dissemination in the easiest way. At the beginning, a short overview and estimates of the ICT in CH are described. The importance of the interactive TV, smart

education (serious games etc.), digital heritage (virtual museums etc.), followed by the examples of 3D digitised heritage performed by our team are highlighted. Comparable projects of other researchers/institutions are also discussed. Special attention is paid to the further presentation of Roman Emona (modern-day Ljubljana) on the ITV of CH (ITVCH). Recently, the *Virtual Emona* project resulted in 3D archaeological objects and a model of archaeological site in 3D-PDF file format with metadata to be published in the Digital Library of Slovenia – dlib.si, will be soon accessible also through Europeana. To provide wider public with contextualised and thought-provoking, as well as eye-catching 3D digitised artefacts, we decided to publish it in a form of the interactive multimedia e-book as well: it can stand alone or it can be integrated into ITVCH. A working prototype of the e-book *Roman Emona, predecessor of modern-day Ljubljana* (*i-Emona*) is presented in order to show some of the technical possibilities of this innovative tool that can be used for "non-heritage" content, too.

2. ICT in cultural heritage – short overview and predictions

Nowadays we are witnessing extreme changes in the field of ICT not only in analysis of professionals but also in our everyday life. David W. Cearley from Gartner explains that our time can be compared with PC (personal computer) or Internet revolution a few decades ago. One of the recognised changes in this post-PC era, as he calls it, is a shift to mobile computing. He stresses that mobile is not just a niche; it has become a fundamental and primary part of our world. Just look around to see how many people bought a (new) smartphone or a tablet recently. It is estimated that 47% of all adults will own a smartphone by early 2013 [6, 7].

In addition to media tablets and mobile applications at the Gartner *Top 10 Strategic Technology Trends for 2012*, contextual and social experience, the Internet of things, big data, in-memory computing and cloud computing can also be found [9]. Researches on human-computer interaction (HCI) which leads to a more popularized mobile computing are also prevalent [29]. When developing new tools and processes for heritage communication it is important to have these buzzwords in mind.

To identify emerging technologies for their potential impact on education and heritage interpretation the *Horizon Report* by *The New Media Consortium (NMC)* is worth reading. Besides emerging technologies that are likely to enter mainstream over the period - like mobile centric applications and media tablets (as Gartner predicted too) – the *2011 Museum Edition Report* exposes that visitors (users) require "*more active role in shaping what museums do*" and "*expect to consume information whenever and wherever they want.*" From technological view, their research indicates that "*Electronic Publishing has fostered both new opportunities and new challenges for museums. New digital formats such as HTML5 are enabling museums to disseminate dynamic, multimedia content across a wide variety of devices, alleviating the time and resources it takes to create multiple formats"* [25]. Cloud computing and HTML5 with its new functions for interactive documents already resulted in increasing number of video and 3D content (real-time and pre-rendered). In the last *Cisco Visual Networking Index* predicted that by 2016 the 70% of world's mobile data traffic would be video [11]. Pre-rendered 3D content (animation, etc.) could also be included into video category. For non-mobile data traffic numbers are similar. Since HTML5 (now also WebGL) doesn't require installation of special viewers for opening and interacting with real-time 3D content, easier access to multimedia content will undoubtedly affect their popularization, especially between less technically versed users. In cloud computing software and data are stored on servers at remote location accessible by the Internet instead on end-users computer. This concept enables better performance (faster running programs, more data can be stored, etc.) and service of applications. All of the content can be automatically updated, since it is dynamically loaded from the server. Offline versions are also available for non-connected devices. In CH sector results can already be seen in increased number of

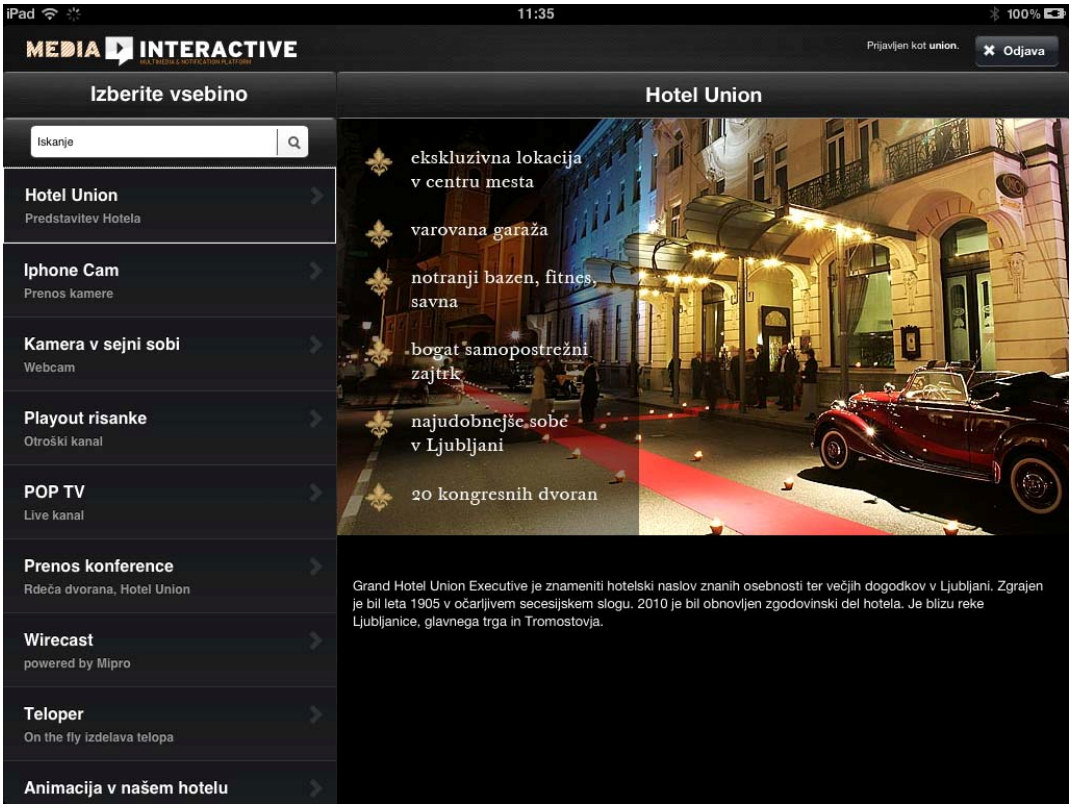
interactive 3D and video content published on the Internet. Some examples are: virtual museums and exhibitions (The ARQVA Virtual Museum, Etruscanning Project, Zoran Djindjic Virtual Museum, Digital Irish Lighthouse Experience, Empire Exhibition Scotland 1938), virtual worlds (Heritage Key, ST.ART), augmented reality applications (Streetmuseum Londinium, Berlin Wall 3D for Layar), serious games (Quest History, ThIATRO, Medieval Dublin: From Vikings to Tudors), etc.

3. Interactive television

Research [43] indicates that ITV (based on the over-the-top – OTT technologies; OTT TV or Internet TV allows users to interact with a content that is available over the internet and not delivered by traditional TV operators) with added tools for social communication and compatibility with other content management systems (CMS) is becoming a new type of tool for information exchange. In many cases (organization websites) the ITV is slowly replacing standard websites that were until now mostly based on texts and images. It is usually quoted that ITV provides a better comfort at watching TV and an interactivity and personalization of the Internet. Therefore, beside general public it is becoming also attractive for elderly, children and other more vulnerable groups with difficulties to interact with ordinary websites. Access to content on the ITV is possible via mobile devices like smartphones, tablets, laptops, etc. and is not limited to the use of TV sets. This concept became known as four-screen strategy. ITV has already been used in health care (telemedicine), hospitality (hotels, events), live sports (multiple camera angles), entertainment (reality shows, interactive polling), social communication (social TV), etc. See also: Artoteka Project [13], The10th Slovenian Forum on Craft and Small Business [10], Conventa TV [12], etc. iTV is not just a flash in the pan – this is evident from ICT leaders strategies: Apple launched the Apple TV and its competitor Google their own Google TV. Due to their impact on the market, the internet TV BBC iPlayer and recently launched platform Zeebox can be mentioned as well [45]. All of them are regularly integrating further interactivity into their services.

3.1 Interactive television of cultural heritage - ITVCH

ITV of cultural heritage (ITVCH) is not only a medium for providing information on heritage – it is primarily a forum for sharing knowledge (like the concept of modern museum) and a platform for networking all those interested in heritage content (Picture 1). On one hand, ITVCH is intended for teaching/learning, gaining new knowledge, and on the other it provides quality leisure and animation of (potential) users visiting museums and monuments *in situ*. In addition to ordinary digitised content, ITVCH enables aggregating all CH material like traditional CH TV channels, augmented reality (AR) components and video presentations (live studio) of CH institutions. Through social networking, users/visitors can publish their own content. Therefore, the ideas behind the ITVCH that we propose are (1) interconnection of all digital and digitised heritage content, regardless of their heterogeneity, (2) dissemination of the content to the users in the easiest way regardless of which type of the media they use and regardless of their location, (3) subsequently to establish communication between all users and providers of the content, which in turn enables the spread of knowledge.



Picture 1: Interactive television.

4. Multimedia e-book

As we already mentioned, the ITV integrates different types of content. Interactive multimedia e-book can also be a part of ITV content; however it can exist as an independent app, too.

Origin of interactive multimedia e-books (and e-textbooks) arises from several concepts, such as distant learning and smart education. Smart classrooms and similar applications have been in use for some time [34]. Research of the Internet based education is focused especially on new paradigm of acquisition and sharing of knowledge instead of copying traditional teaching/learning methods. Therefore, experience, interactivity and multimedia are now appropriate key words.

In January 2012, Apple launched iBook Author. The application for digital publishing is designed for less technically skilled users wishing to share their content. Similar idea to develop tool for assemble and present combination of various multimedia content in a form of an e-book was proposed by the Immersive Education Initiative (iED) [22, 26]. One of the ten focus areas described in *iED Talking Points* was "*Design and develop Web3D Books*" [22]. The iED is mainly focused on 3D immersive worlds, serious games and virtual reality applications; however the e-book they have suggested, also comprises text, imagery and audio to gain full learning/teaching experience.

For the CH institutions e-books are applicable as a prominent interpretation and communication tool. Owing to four-screen technology, content can be accessed from a user's device or via devices installed on exhibitions. Not just TV sets and PC terminals, tablet computers housed in a protective enclosure as interactive kiosks are integrated in various museum exhibitions worldwide [37] as well. Some institutions offer smartphones as multimedia guides (instead of old-fashioned audio guides) and visitors can use them to enrich their exhibition visit. Increase in numbers of smartphone and tablet users is especially significant for *in situ* interpretation of monuments and sites since no

museum/heritage staff is needed to lend interpretation devices to the visitors. In this case, user can download (via QR code, etc.) an e-book on his/her device by her/himself.

5. E-book of Roman Emona

To contextualise the 3D digitised artefacts from the *Virtual Emona* project, we decided to integrate its content into a multimedia e-book, which Mediainteractive company is developing at the time. Simultaneously, Emonian content represents the first "testing content" of this e-book.

An e-book is a tool that enables setting and publishing of text, video, image galleries, dynamic 3D objects, questionnaires, external frames (linked maps, virtual museums and worlds, etc.). Additional contents, either on the same topic or related to different scopes (medicine, primary school curriculum, etc.) can be assembled or published, too. Apple iBook Author represents a new generation of presentation tools, developed for content holders to share their content with a wider public. In the field of cultural heritage, users of this tool are museum educators, heritage interpreters, teachers, etc. As a pilot project, a prototype of e-book on Roman Emona (as a product with content) has been made. Mediainteractive plans to develop a tool (software) with basic templates similar to other CMS (webpage and blog editors, e-mail etc.) for assembling an e-book to enable less technically skilled people to insert, assemble and publish their own content. Basic HTML skills will still be required. Multimedia e-book as well follow four-screen concept and can be accessed on-line (remotely via the Internet) or off-line (stored as an app on a device or on a DVD etc.). E-book can be part of ITV (or ITVCH) or a standalone application.

5.1 3D collection of Emonian objects published in the Digital Library of Slovenia – dlib.si

In autumn 2009, the National and University Library of Slovenia (NUK) became the national aggregator of cultural e-content for Europeana. In an effort to examine the usability of 3D content, a pilot project named *Virtual Emona* initiated by NUK was launched. Between 2009 and 2010, during the run of project, our group 3D digitised 13 (the14th object was digitised previously by TECOS) objects found at archaeological site of the NUK II, and its model in the scale of 1: 50. Archaeological objects are kept by the Museum and Galleries of Ljubljana (MGML), scale model was kept by NUK until May 2012, from May 2012 is kept by the Museum and Galleries of Ljubljana. The 3D digitisation was provided by company IB-PROCADD [1, 2].

During the Roman period, there were private houses and public baths in the area of the new Library building, called NUK II. It will be built above the archaeological site. Archaeological presentation *in situ* is also planned. Until then, a virtual presentation of several objects found is publicly available as a 3D collection in the Digital Library of Slovenia – dlib.si. Objects in 3D-PDF file format with metadata are published on the dlib.si, and will soon be accessible through Europeana. Already during the *Virtual Emona* project we planned to create a virtual exhibition of Emona, which could provide a wider context for 3D digitised objects, making them more understandable for a wider public [1]. It was the reason that the idea of an e-book on Emona arose.

More than 3,000 unique searches by the key words "virtual" and "Emona" were made in a six-month period (September 2010 – March 2011) [19]. Objects of *Virtual Emona* have been the top 10 searches since their publishing. The very good response of end users led us to go further with our idea, following the newest technological development and end users' needs. The goal was that *i-Emona* would reach all types of end users – from primary school pupils to elderly population, since an e-book can be seen and read on a PC, mobile devices and on TV.

5.2 The i-Emona - the e-book of the Roman Emona, predecessor of modern-day Ljubljana

A working prototype of the *i-Emona*, the e-book of the *Roman Emona, predecessor of modern-day Ljubljana* comprises different chapters that can be assessed linearly (horizontal and/or vertical) or non-linearly (hyperlinked). On touch-screen devices pages are turned by sliding. On other devices browsing is possible with keyboard, mouse, remote control, etc. To attract potential users, the *i-Emona* starts with coloured front cover (Picture 2) similar to traditional books. The next page contains *Table of Contents* which can also be accessed from anywhere in the book by double clicking anywhere, and then *Table of Contents* is sliding up from the bottom. All titles are linked to a chapter. Text of each chapter can be vertically longer than just one screen. The content is divided into different pages (Picture 3) that link Emona with Roman Empire, describing the place and epoch of its existence. In order to provide the historical context, the interactive timeline explains different eras to the user (Picture 4). Basic characteristics of a planned Roman town, such as walls with towers, moats, roads, *insulae* (building blocks) and *forum* (main square) are described through an interactive map and short text.

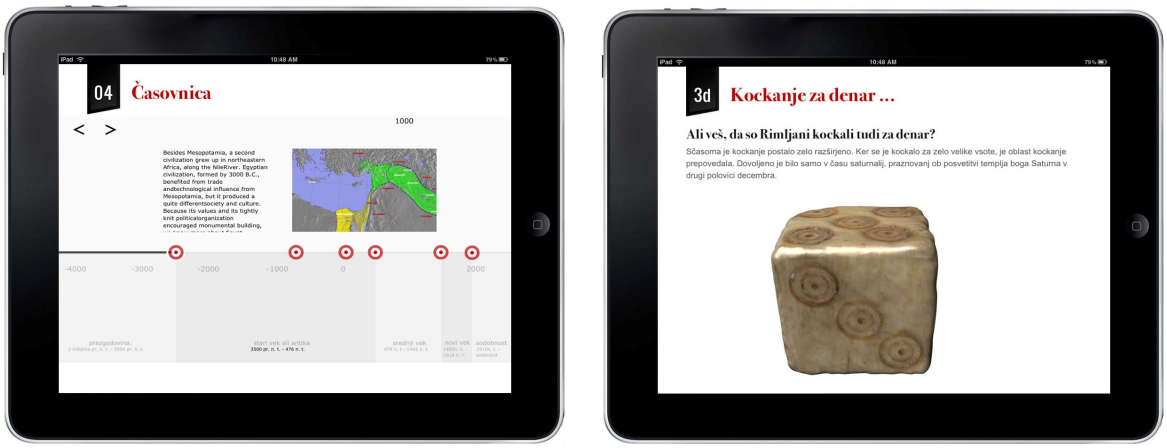
Picture 2 and 3: The e-book of the Roman Emona, predecessor of the modern Ljubljana.

Then, archaeological site NUK II is brought into focus. Some archaeological objects that were 3D digitised during the *Virtual Emona* project are explained: both in a context of NUK II site (i.e. what archaeologists found there) and in a context of Roman town Emona (i.e. how Emonians used those objects in their everyday life, etc.). Artefacts are interpreted using photos, 3D models and short descriptions. At the end of education material, user can test hers/his knowledge on an e-book topic through an interactive questionnaire. It is possible that submitted answers are available to museum educators or teachers similar to Moodle platform [31]. Questions can be adapted to particular user groups. Here is an example of a question connected with 3D model of an artefact: "*What is the sum of opposing sides on a Roman dice found at the archaeological site NUK II?*" To find a correct answer, user has to manipulate the interactive model of the dice and do some basic math (Picture 5). An answer could also be gained from multiple images or video that show dice from all sides, but interaction with 3D model makes the experience richer for the user, thus supposedly improving the learning process.

The e-book is capable of live streaming video and audio to a device, so it's possible to follow conference live talks and discussions, guided exhibition tours, etc. remotely in a real-time directly in

the content. For video capturing, no special camera is required – the performance can be done by smartphone camera. Adaptive streaming enables to follow video content on multiple screens (four-screen). Social communication tools (Twitter, Facebook, etc.) integrated into e-book enable user to send questions to the speaker during the session. It is also possible to upload video and audio content into the e-book. *I-Emona* now contains some short videos from most interesting Emonian sites shared by test users. At the same time, other e-book users can comment uploaded videos. It is important to emphasise that our concept of multimedia e-book provides user with a learning tool that is designed for constant changing and upgrading. Thus, e-book is "never the same" as traditional non-dynamic e-books.

The I-Emona has been prepared according to *the Baselines for the Preparation of Electronic Textbooks,* The National Education Institute of the Republic of Slovenia in 2011 [27].



Picture 4: An interactive timeline. **Picture 5:** An interactive 3D model of Roman dice.

6. Conclusions and further work

For the time being, the working prototype multimedia e-book of the *Roman Emona, predecessor of modern Ljubljana* has been developed and presented in this paper. Further work on this project is directed into technology development on one hand, and content development on the other. Thus, CMS tool for assembling and publishing content into e-book is under development. Some templates to help users (content providers) arranging texts, pictures, videos and other multimedia will also be provided. Due to cloud computing and HTML 5 inserting and publishing of the content including 3D models and other dynamic material will be possible directly in the Internet browser (Firefox, Chrome, etc.).

It is also planned to expand the content on Roman Emona with suitable material aiming to provide in-depth learning tool for those interested in this ancient city. The *I-Emona* can be used by museum and sites visitors, students, tourists and others. We would also like to make this e-book connected (via small QR – quick response codes) with the most exciting locations of remains of Emona in modern Ljubljana. Users that have *i-Emona* on their devices, will be able to enjoy a self-paced tour around Ljubljana and to visit Emona's heritage in situ. To enable this, the content of the e-book will be georeferenced. 2D or 3D AR content could also be provided, accessed by a user's mobile device. In short, there is many possibilities regarding both technology and content improvements.

The aim of our paper is to point out some of the technical possibilities of this tool and to stimulate content providers, especially CH institutions with the aim to integrate new ICT solutions into their work, to improve communication with users and to offer new experiences for them. We can agree with the Horizon Report that "*Greater understanding is needed of the relationships, differences, and synergies between technologies intended to be used within the museum and public-facing technology such as websites, social media, and mobile apps*" [25]. However, CH and educational institutions should be aware that their public expects from them to use ICT in the similar way they (users) use it for communicating with other media, friends, family, etc.

Acknowledgements

The e-book of the Roman Emona was technically made by: Roman Uršič (Mediainteractive), Mirko Orehek (Mediainteractive), Boris Dolenc (Invida d.o.o.), Kristjan Celec (IB-PROCADD d.o.o.) etc. Content was provided by Museum and Galleries of Ljubljana, National and University Library of Slovenia, IB-PROCADD d.o.o. etc. and edited by Kaja Antlej, dr. Bernarda Županek and Mojca Šavnik. This paper was made under the supervision of Edvard Sternad, IB-PROCADD d.o.o., prof. dr. Slavko Dolinšek, IRI UL – Institute for Innovation and Development of University of Ljubljana, doc. dr. Mateja Kos, National Museum of Slovenia, during the Researching program of Young Researcher Kaja Antlej, IB-PROCADD d.o.o. Operation part financed by the European Union, European Social Fund.

References

[1] Kaja Antlej, Miran Erič, Mojca Šavnik, Bernarda Županek, Janja Slabe, Borut Battestin, Combining 3D technologies in the field of cultural heritage: three case studies, in: *VAST Conference 2011, International Symposium on Virtual Reality, Archaeology and Cultural Heritage, Short and Project Paper Proceedings* (ed. Matteo Dellepiane at al.) (Prato, Italy, October 18th – 21st 10 2011), Eurographics Association, Goslar 2011, pp. 1–4, available: http://diglib.eg.org/EG/DL/PE/VAST/VAST11S [Accessed: 21. 03. 2012].

[2] Kaja Antlej, Mojca Šavnik, Bernarda Županek, Kristjan Celec, "Virtual Emona" on Dlib.si Using 3D Technologies, in: *Review of the National Center for Digitization, Faculty of Mathematics, Belgrade*, 18/2011, pp. 19–27, available: http://elib.mi.sanu.ac.rs/pages/browse_issue.php?db=ncd&rbr=18 [Accessed: 21. 03. 2012].

[3] Apple TV, available: http://www.apple.com/appletv/ [Accessed: 18. 04. 2012].

[4] ARQVA visita virtual por el museo, available: http://en.museoarqua.mcu.es/web/visita/index.html [Accessed: 20. 04. 2012].

[5] BBC iPlayer, available: http://www.bbc.co.uk/iplayer/tv [Accessed: 18. 04. 2012].

[6] Steven Beasley, Annie Conway, *Digital media in everyday life, a snapshot of devices, behaviors and attitudes, Part 1: Mobile device ownership*, Museum of Science + Industry, Chicago 2011.

[7] Steven Beasley, Annie Conway, *Digital media in everyday life, a snapshot of devices, behaviors and attitudes, Part 2: Usage by audiance and platform*, Museum of Science + Industry, Chicago 2011.

[8] Berlin Wall 3D for Layar, available: http://www.layar.com/blog/2010/04/16/the-berlin-wall-is-back/ [Accessed: 20. 04. 2012].

[9] David W. Cearley, Carl Claunch, *Top 10 Strategic Technology Trends for 2012*, Gartner, February 16th 2012, available: http://www.gartner.com/technology/research/top-10-technology-trends/ [Accessed: 23. 03. 2012].

[10] The Chamber of Craft and Small Business of Slovenia, 10. Forum obrti in podjetništva, available: http://www.ozs.si/Iframepage.aspx [10. 5. 2012].

[11] *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2011–2016*, White Paper, February 14th 2012, available: http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf. [Accessed: 23. 03. 2012].
[12] Conventa 2012, South East European Exhibition for Meetings, Events and Incentives, available: http://www.conventa.tv [10. 5. 2012].
[13] Tanja Čajavec, Primož Skočir, Franc Dolenc, Gregor Vidmar, Project ARTOTEKA – The Modern Way of Digitization, Inventorization and Popularization of Contemporary Visual and Intermedia Art, in: *The Sixth SEEDI Conference Digitization of Cultural and Scientific Heritage, Book of Abstracts* (Zagreb, Croatia, May 18th – 20th 2011).
[14] Digital Irish Lighthouse Experience, available: http://irishlighthouseexperience.com/ [Accessed: 20. 04. 2012].
[15] Elios Lab, Serious Games, available: http://www.elios.dibe.unige.it/index.php/areas?task=show&view=researcharea&id=2 [Accessed: 21. 03. 2012].
[16] Tom Elliott, Web development predictions for 2012, *Tom Elliott, web Developer etc*, December 27th 2011, available: http://www.tom-elliott.net/future-of-web/web-development-predictions-2012/ [Accessed: 21. 03. 2012].
[17] Empire Exhibition Scotland 1938, available: http://www.empireexhibition1938.co.uk/ [Accessed: 20. 04. 2012].
[18] Etruscanning Project, available: http://regolinigalassi.wordpress.com/2011/07/06/hello-world/ [Accessed: 20. 04. 2012].
[19] ESTATISTIKA: v1.0, Orodje za spremljanje statistike, available: http://statistika.dlib.si/Default.aspx. [Accesed: 23. 4. 2012].
[20] Josef Froschauer, Max Arends, Doron Goldfarb, Dieter Merkl, Towards an Online Multiplayer Serious Game Providing a Joyful Experience in Learning Art History, in: *Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES 2011)*, Athens, Greece, pp. 160–163, available: http://vsem.ec.tuwien.ac.at/wp-content/publications/vsgames2011.pdf [Accessed: 20. 04. 2012].
[21] Google TV, available: http://www.google.com/tv/ [Accessed: 18. 04. 2012].
[22] Grid Institute, Talking Points: Immersive Education Initiative, 2008, available: http://immersiveeducation.org/TalkingPoints.pdf [Accessed: 10. 04. 2012].
[23] Heritage Key, available: http://heritage-key.com/ [Accessed: 20. 04. 2012].
[24] iBooks Author, available: http://www.apple.com/ibooks-author/ [Accessed: 21. 03. 2012].
[25] Larry Johnson, Samantha Adams, Holly Witchey, *The NMC Horizon Report: 2011 Museum Edition,* The New Media Consortium, Austin, Texas, 2011, available: http://www.nmc.org/publications/horizon-report-2011-museum-edition [Accessed: 23. 03. 2012].
[26] Carlos Delgado Kloos, Jose Jesus García Rueda, María Blanca Ibáñez Espiga (editors), *1st European Immersive Education Summit, Conference Proceedings* (Madrid, Spain, November 28th – 29th 2011).
[27] Nives Kreuh, Liljana Kač, Gregor Mohorčič, *Izhodišča za izdelavo e-učbenikov*, Zavod Republike Slovenije za šolstvo, Ljubljana, 2011.
[28] Lift your (museum) game, available: http://museumgames.pbworks.com/w/page/38863237/FrontPage [Accessed: 21. 03. 2012].
[29] Angela McIntyre, iPad and Beyond: What the Future of Computing Holds, *Gartner*, September 30th 2011, available: http://www.gartner.com/resources/219000/219035/ipad_and_beyond_what_the_fut_219035.pdf [Accessed: 23. 03. 2012].
[30] Mediainteractive, available: http://www.mediainteractive.tv/ [Accessed: 23. 03. 2012].
Medieval Dublin: From Vikings to Tudors, available: http://www.medievaldublin.ie/ [Accessed: 20. 04. 2012].
[31] Moodle, available: http://moodle.org/ [Accessed: 19. 04. 2012].
[32] Michela Mortara at al., Serious Games for Cultural Heritage: the GaLA Activities, in: *VAST Conference 2011, International Symposium on Virtual Reality, Archaeology and Cultural Heritage, Short and Project Paper Proceedings* (ed. Matteo Dellepiane at al.) (Prato, Italy, October 18th – 21st 10 2011), Eurographics Association, Goslar 2011, pp. 69–72, available: http://diglib.eg.org/EG/DL/PE/VAST/VAST11S [Accessed: 21. 03. 2012].

[33] Charles Moad, Rob Stein, What's On TAP? – Strategies for keeping pace with rapid changes in mobile technology, *Museums and the Web 2012* (April 11th – 14th 2012, San Diego, CA, USA), available: http://www.museumsandtheweb.com/mw2012/papers/what_s_on_tap_strategies_for_keeping_pace_with [Accessed: 10. 04. 2012].
[34] Davar Pishva, G. G. D. Nishantha, Smart Classrooms for Distance Education and their Adoption to Multiple Classroom Architecture, Journal of Networks, Vol. 3, No. 5, May 2008, pp. 54–64, available: http://ojs.academypublisher.com/index.php/jnw/issue/view/91 [Accessed: 10. 04. 2012].
[35] Quest History, available: http://questhistory.com/ [Accessed: 20. 04. 2012].
[36] Ute Ritterfeld, Michael Cody, Peter Vorderer (editors), *Serious Games, Mechanisms and Effects*, Routledge, 2009.
[37] Miriam Roberts, Hot-Button Issues: Using Technology to Address Topicality, Uncertainty, and Controversy in Science Exhibits, *Museums and the Web 2012* (April 11th – 14th 2012, San Diego, CA, USA), available: http://www.museumsandtheweb.com/mw2012/papers/hot_button_issues_using_technology_to_address_ [Accessed: 21. 03. 2012].
[38] Simon Sherrin, Elycia Wallis, Creating a Mobile App Ecosystem—The Genera Project for iOS, *Museums and the Web 2012* (April 11th – 14th 2012, San Diego, CA, USA), available: http://www.museumsandtheweb.com/mw2012/papers/creating_a_mobile_app_ecosystem_the_genera_pro [Accessed: 29. 03. 2012].
[39] ST.ART, available: http://startproject.eu/ [Accessed: 20. 04. 2012].
[40] Streetmuseum Londinium, available: http://www.museumoflondon.org.uk/Resources/app/Streetmuseum-Londinium/index.html [Accessed: 20. 04. 2012].
[41] Cherry Thian, Augmented Reality – What Reality Can We Learn From It? *Museums and the Web 2012* (April 11th – 14th 2012, San Diego, CA, USA), available: http://www.museumsandtheweb.com/mw2012/papers/augmented_reality_what_reality_can_we_learn_fr [Accessed: 29. 03. 2012].
[42] ThIATRO, Unity Web Player – level, available: http://www.oinobareion.at/files/level1.html [Accessed: 20. 04. 2012].
[43] Francesco Venturini, *Bringing TV to Life, Issue II, The race to dominate the future of TV*, Accenture, 2011, available: http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_Communications_Media-Entertainment_OTTV_Future_of_TV.pdf [Accessed: 17. 04. 2012].
[44] Aaron Weiche, Marketing & Technology Predictions For 2012, *Spyder Trap Online Marketing Blog*, January 17th 2012, available: http://www.spydertrap.com/blog/2012/01/marketing-technology-predictions-for-2012/ [Accessed: 21. 03. 2012].
[45] Zeebox, available: http://zeebox.com/ [Accessed: 18. 04. 2012].
[46] Zoran Djindjic Virtual Museum, available: http://www.zorandjindjic.org/en/virtual-tours [Accessed: 20. 04. 2012].

kaja@ib-procadd.si
roman.ursic@mediainteractive.tv
mojca.savnik@nuk.uni-lj.si
bernarda.zupanek@mgml.si