ARK4 AN INTERACTIVE HERITAGE LIBRARY, PHASE 2 PART 1

By Alexandra Angeletaki,

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Ark4 is a two and a half years project initiated by the NTNU University library in 2014 as a heritage library for young users. The project involves four Institutions that have been working with dissemination of knowledge from the past and use emerging technology to create new dissemination products for institutions of repositories such as libraries, museums and special collections to be included in their outreach program.

Its main aim was to investigate the possibility for such institutions to become active mediators of knowledge from the collections of different institutions using a workshop concept developed through a common software tool, adapted to the needs of the collaborators.

The project received 600000 NOK by the National Library of Norway from the call of exploring new dissemination paths for libraries. The Total budget of the project for two years was 1.607.686 NOK with funding from NTNU UB mostly as salaries. The project was extended to the end of September 2016 because of various delays in the funding transfer and contract formalities. The rest of its budget in salaries were covered by NTNU UB.

INTRODUCTION: Ark4 is a cooperation project between four Institutions of Trondheim and a Digital Research Center from Athens, Greece. The purpose of the project was to create a digital heritage library of games that allowed users to access the content of archives in an interactive mode and support learning. It has opened up a space of dialogue between the common user and the institutions involved.

The NTNU University library of Trondheim, and especially its Gunnerus branch is the oldest Scientific Library in Norway established in 1768 and holds rich special collections of manuscripts Libri Rari, pictures and different archives that have been trusted to its care since the 1760s. It plays an active role in the production of academic knowledge as a University library and through its ongoing digitalization program of its archives and special collections with free online access (see Gunnerus.no). Its public has been NTNU students and researchers, scholars from other parts of Norway and Scandinavia, local history experts, journalists and writers.

In order to reach a wider public, NTNU UB has had several research projects since 2012 that have been communicated and presented through an extended network of researchers, academics, university students and school classes and teachers and has been collecting user data on the use of such resources, through international research collaborations as MUBIL and ARK4.

The main research objective for ARK4 was to study the possible implications of the use of technological platforms, social media and the web as information provider to its users. It`s scope was to collect user data as to how and why such tools can be used by libraries, archives, and become embedded in their outreach activities for teaching and assisting their users in retaining, organizing and evaluating information that is available on line.

ARK4 has established a new collaborative concept of interactive workshops with focus on the use of emerging technology as a new dissemination path between the institutions involved and the users. The project started in 2014 with the development of digital game software used by all collaborating institutions.

During the first year, ARK4 developed 3 workshop applications for multi-touch screens and several workshops (see ARK4 report 1), based on the same software developed by the Department of Information Science, IDI NTNU for the project itself. The prototype has been tested by several groups of users and have been published in several blogs and conference papers. (see workshops and publications section in this report).

In its second phase ARK4 established an interactive library platform of heritage in collaboration with its partner from Greece, Digital Curation Unit, Athena Research Center (DCU) and Europeana research. Our common aim in phase 2 was to explore the possibility of creating an open source game platform, where all of games would become accessible to the common user. The products have been shared with teaching communities, museums, archive institutions, academics, and students and workshops and demonstration stand s have been organized for their dissemination. The project will continue with further presentations and analysis of the data collected in 2017 in order to proceed in publications.

The platform is now available to all as an open gaming platform called ARK4: a digital heritage library, at the following address:

DCU server: http://core.cloud.dcu.gr/ark4-front-no/?lang=no

1.   COLLABORATORS:

Our collaborators in Phase 1

- **NTNU Department of Computer and Information Science** Trondheim, Norway (IDI) with Professor Letizia Jaccheri and Assistant Professor Michail Giannakos.
- **Regional State Archives of Trondheim** Norway with archivist and outreach educator, Gunnar Sørum.
- **Norwegian Deaf Museum** Trondheim, Norway, with outreach educator, Line Nordsveen.
- **Digital Curation Unit Athena RC** (DCU)
- Athens Greece with Dr. Agiatis Bernadou and Dr. Dimitris Gavrilis

Our main collaborator in phase 2 was: Digital Curation Unit Athena RC (DCU)

The DCU team consisted of: Agiatis Bernadou, Dimitris Gavrilis, Eliza Papaki, Nephelie Chatzidiakou, Eleni Afiontzi.

External collaborators

- **Ioannis Eleftheriotis** (IT development) **Gavriela Papastefanou** (botany expert) collaborated to organize the workshop at Athens in cooperation with the Norwegian Embassy of Athens.
- **Alex Andreou** edited the mubil.no site.
- **H2Concept** with Fratzeska Hanioti, Voula Hnioti, Vivi Hanioti were responsible for the layout and set uo of the Greek Games and their presentation at the Greek website Mubil.gr

- **Namtaru Creations** Design and Art Direction, Trondheim, Norway, Irene M. Dominquez
- **Roger Hansen** -Video game development, Trondheim, Norway
- For phase 1 (Read Report 1 delivered to National Library in 2016)

1.2 Adjusted time plan agreed between NTNU UB and DCU

For further info look at Appendix 1, contract between NTNU UB and DCU
Plan for deliverables from Athena Digital Curation Unit IMIS DCU:

Dato	Content	Payments from NTNU UB to ATHENA RS
December 2015	Signing contract between NTNU UB and Athena IMIS DCU	invoice from IMIS DCU 20000 NOK
Mid January 2016	A prototype of a gaming platform that will manage users (registration, login, etc.) and a number of games.	
Mid-February 2016	Two complete games based on material from two respective collections, see content selection by Athena IMIS DCU.	
Mid-March 2016	One user testing with report by Athena	
Presentation at Krakow, Digital Heritage	By Athena RS	Conference participation expenses paid by ARK4 after the trip.
Mid May	Final corrections	
30.8.2015	Final products delivered	invoice from IMIS DCU 40.000 NOK MVA paid to the Norwegian state 15000
30.11.2016	Final corrections	

Project ARK4, phase 1 (1.03.2014 -30.03.2015) is now completed with all the following applications and products produced. The products are realized in three languages Norwegian, English and Greek. They have been tested, by at least, 300 users up to now and feedback has been collected in the form of surveys and questionnaires. Several interviews were also processed and observation notes collected. The project faced a great challenge at the start of the process when the main collaborators of phase 1 from the Deaf Museum, Hanna Mellemsdatter and Maria Press from the States Archives were transferred to new positions and could not contribute any more to the project. The substitution came some months later with Linne Nordsveen og Gunnar Sørum.

The softaware for the following games were developed by Michalis Giannakos (NTNU IDI) and Ioannis Elefthteriotis(phd Student from Corfu University and eternal collaborator).

1. **Flora Danica (Botany, Norwegian):** A game on plants and botany systems with digitalized drawings from a flora encyclopedia published from 1761 until 1883 from the collections of NTNU University library in Trondheim.
2. **Museum on Screen (History, Norwegian):** A game on the history of the school for the hearing impaired established in Trondheim in 1825. The game content comes from the picture archives of the Norwegian Deaf Museum in Trondheim and the assignments, developed by the Deaf Museum with Line Nordsveen as the expert of the subject. (See part 3)
3. **The war and the archives (Local history, Norwegian):** A game supplementing the workshop offered by the states archive of Trondheim on the subject of using archive material in order to acquire information on the second world war. The game has pictures and archive documents from the states Archive of Trondheim and the expert on the subject that developed the content of the game and the assignments is Gunnar Sørum. (See part 3)
4. **Rødøyquizen** (Archaeology, Norwegian): A video production on the history of defense mechanisms in the middle ages at Rødøya in Nordland, Northern Norway we have developed a quiz to be used by the project based on archeological materials found on the island. This was a collaboration with the project "Opp i dagen" and archaeologists, Anne Katrine and Kari Binns. (See part 3).

ARK4 phase 2: (1.04.2015-1.10.2016) got external funding from the National Library of Oslo and ARK4 has been extended to October 2016. The funding was communicated to be given to the project, early in 2015 but reached our University account late October in 2015. We have also faced some internal delays as to the contract signed and the MVA to be paid and had thus to extend the development of the products until October 2016 and the dissemination and last corrections until the end of the year 2016 (see time-plan)

5. **Magic herbs** (Botany English) an open source game developed by an external collaborator Roger Hansen, based on the content of the book of Adam Lonicer from 1569 from our library.
6. **Mykonos and Delos History and archaeology quiz (Archaeology2, Greek)** with content developed by Alexandra Angeletaki, NTNU UB.
7. **Women`s history** (History, Norwegian)a quiz on the women's rights movement in Norway and one of the main characters Mrs. Kvam with visuals from the Gunnerus library developed by Alexandra Angeletaki.
8. **Children's Literature (Literature, English)**a quiz with knowledge question on Children's books and characters developed by DCU. (See DCU report)
9. **Europe and me,** a quiz with general knowledge questions about Europe with content from EUROPEANA, developed by DCU. (See DCU report).

https://www.google.com/culturalinstitute/u/0/asset-viewer/postcard-with-advertisement-for-patisserie/EQGWJnhAmGEX3g?exhibitid=QRtG6eMd. Europeana Food and Drink. Public Domain

10. **Lost Cultures 1 and 2 (Archaeology, English):** A quiz on history and archaeology of sites that have been threatened by catastrophe and war. Developed by Alexandra Angeletaki and the team of DCU(see more at the DCU report)
11. **ART and drop game (Art, English)**: a game on Art history subject with content from Europeana, developed by DCU. (See DCU report)

12. Saint Olav and Trondheim (Archaeology, Norwegian): A quiz with questions about Saint Olav and the Nidaros Cathedral on the history and archaeology of Trondheim with visuals from the archives of Gunnerus library.

13. Choose the right period(Archaeology, Greek): Drag and drop game of Archaeology with objects from archaeological sites as Palmyra, Nineveh and Delos with content developed by Alexandra Angeletaki NTNU.UB.

3. WORKSHOPS AND OUTREACH ACTIVITIES:

The following workshops were organized throughout the whole project period:

• **June 2014**: workshop of Flora Danica in collaboration with NTNU ID, for Steiner school students.

• **November 2014** ARK4 seminar for the collaborators and NTNU at Trondheim.

• **November 2014** A Digital Humanities seminar for NTNU and Museum professionals at Trondheim.

February 2015: Workshop with Flora Danica in collaboration with Gavriella Pappastefanou biologist, Giannis Eleftheriotis, IT developer and Agiati Bernardou and Elisa Papaki from Athena Digital Unit as evaluators. The Workshop was organized in Athens for Norwegian speaking children, in collaboration with the Norwegian Embassy of Athens. (see DCU report)

March 2015: Workshop for the teacher education program of NTNU(PLU) as a combined Museum visit at the Deaf Museum in Trondheim

April 2015: Workshop with "Museum på skjerm" application by Line and Irene for the jubilee of the Deaf school in Trondheim (more about that from Line).

June 2015: RK4 organized a 4 hours workshop for a school class at Mykonos secondary private school, "Sygxroni Paideia". The students have agreed to become the focus group of ARK4 in Greece.

November 2015 and **March 2016** a series of workshops was organized for the same school with a visit to the Archaeological Museum of Mykonos and the Archaeological site of Delos. The students had a four hours introduction and a four-hours, hands- on activity at the museum. They also delivered their presentation to ARK4 to be used at its site and publications. That will be uploaded soon after the Ephorate of Cyclades grants the project permissions for the publication of photos taken by the students.

4. IT DEVELOPMENT

4.1. The gaming platform

DCU with Dimitris Gavrilis and Eleni Afiontzi has developed the software and all the games in the website "ARK4 A digital heritage Library" with content produced by NTNU UB and DCU.

Each game is seen as a widget that can be activated within the platform for a specific user group. A learning scenarios editor has been developed in order to allow teachers to create an educational scenario that will have:

- a description of the game
- a goal
- hints
- scores

Within this scenario editor, the teacher that created the quiz or game has been able to include a number of levels and games per level that will appear as grid. The user will be able to see the goal of the game along with the list of available games and play them. The user wins points when playing the games and can move on to the next level. The score of the user appears in a scoreboard where he can actually see them after he completes the game.

The new aspect added to the games is that the user can check his results and find out which answer was wrong. That was an adjustment at an early stage of the development of the platform that delivered as feedback from colleagues and users to the ARK4 team.

The platform is based on a responsive web based framework and could run on touch devices such as smartphones and tablets.

Three types of games have been produced
1. **A quiz game** will present a number of questions along with a number of possible answers per question. Along with the question description, a number of pictures / videos can be included. Each question could be accompanied by a hint.
2. **A Drag & organize game** with a set of items that can be put in four different categories. Each item is represented by a box and has a picture, a title, a description. The game defines a number of target categories and the user drags the items into the corresponding baskets. The user can get information on each item by clicking on it. He can also get information on what each basket represents by also clicking on it. When the user finishes, he clicks on the "check" button and sees his score.
3. A 3D game for younger kids see part 3.

We chose to deliver the games in an open format so that the IP address will not be part of the information we acquire and we also keep no log files of the activities of the users. **(read more at the DCU report)** DCU established a collaboration with Europeana research so that ARK4 was granted access and the possibility to reuse visuals from their repository for its games.

Mubil.gr

4.2 websites and other contributions

- Ioannis Eleftheriotis signed a contract as an external collaborator and developed two more applications for ARK4 with the content provided from Line Nordsveen from Deaf Museum and Gunnar Sørum from the States Archives.

- Namtaru Creations has produced logos, posters and edited game layouts.
- Chiara Evangelista signed a contract as an external collaborator, and has also worked with videos produced for Rødøyquizen.
- Roger Hansen has also signed a contract as an external collaborator and has delivered his game application in 2015.
- H2 has developed the website Mubil.gr
- Simona Canellou and Chrismar Guzman has also contributed to the project with drawings.
- Alex Andreou has signed a contract as an external collaborator and worked with editing texts and pictures in collaboration with Irene D. Marquez for our new website published now in world press, where Ark4 is presented. See Mubil.no.
- A second site is produced in Greek language to present ARK4, see mubil.gr. in collaboration with H2 concept, based in Mykonos Greece. They worked with the layouts of the site and the games produced in Greece.
- Several blog articles were also published by NTNU UB and DCU(see publications)

5. PRELIMINARY EVALUATION OF COLLECTED DATA

ARK4 phase 2: As the project finishes its second phase, it has managed to create engagement and educational activities in the immediate community in order to engage school students, university students and local enterprises in the investigation of the past in both countries. An interactive web platform designed by ATHENA RC allows each individual to enter through a web platform and interact with the project games according to their own individualized level of pre-understanding and motivation. That is the user's background; nationality and identity seem to influence and vary the outcome of the experience. Thus the visit becomes a complex process of interpretation and our inquiry might add a new dimension to the debate of creating a dialogue between European shared memory institutions and the individual visitor which can then manifest itself in experiencing diversity. Using the interaction between the participants and the objects as an observation field one allows the outcome to be varied and justified by the visitors' personal intention. Focusing on archaeological context, the project ARK4 in its second phase focuses on the following:

- digital technology and games as a tool for community action of heritage protection and knowledge sharing.
- the idea of community-based participatory approaches to heritage and archive dissemination work.
- the role, end-users play as active participants in the design process.
- The outcomes of user-interaction, in the context of a targeted activity, using mobile technology.

The evaluation methodology applied in all workshops during the second phase of the project was indicative of the aims set. Aiming to draw conclusions on the impact of the digital game as learning activity, among other ARK4 employed mixed methods for data collection ranged from questionnaires to observation-notes to focus group interviews. In particular, the participants provided their own feedback by filling questionnaires evaluating the quality of the gaming experience or by answering knowledge tests before and following their interaction with the digital game. This data was further enriched by observation of the actual gaming performance and by moderated group discussions with project members. The analysis of the data that followed focused on three factors: investigating a) the degree of coordination among the users, b) the type of collaboration and c) the positioning of the users' interactions and their meaning.

Knowledge gained from several workshops and the feedback delivered bu the users allowed us to draw some preliminary conclusions:

a. digital technology and games has been an attractive tool for High School students for knowledge sharing.
b. the idea of team work and participatory design seemed engaging.
c. the students participated actively in seeking information and in designing the dissemination product in a context of an informal workshop.
d. users were interacting socially, reflecting and seeking information, in the context of a targeted activity, using mobile technology.

6.PUBLICATIONS

Phase 1

1. Workshop for Steiner school classes in September 2014 with Flora Danica by Michail Giannakos, Ioannis Eleftheriotis, Bjørn Sæther Irene M. Dominquez and Alexandra Angeletaki" in collaboration with Ringve historical garden and Steiner school teachers.
2. ICM conference paper, 2015 How Space and Tool Availability Affect User Experience and Creativity in Interactive Surfaces?". Michail Giannakos, Ioannis Elefteriotis.NTNU. IDI Corfu University
3. Digital Humanities workshop, Trondheim November 2014, NTNU IDI Athena RC and ARK4 seminar
4. ARK4 workshop with NTNU collaborators and AThena RC collaborators in Trondheim November 2014.
5. Researchers-night, Trondheim September 2014. Alexandra Angeletaki and Michail Giannakos.
6. Deaf Museum Jubillee, Line Norsveen from Døvemuseet and Irene M. Dominquez from Namtaru creations.
7. Digit woman meeting 8th of March 2015 in Trondheim, Alexandra Angeletaki and Irene M. Dominquez " Where did the cable go?"
8. Stavanger History-days conference, Line Norsveen from Døvemuseet

Phase 2

9. Europeana meeting in London, Alexandra Angeletaki,NTNU UB
10. EAA conference: Glasgow, Alexandra Angeletaki, NTNU UB, Eliza Papaki Athena RC
11. Workshop for Norwegian-speaking children in Athens Greece in collaboration with the Norwegian Embassy of Athens. Agiatis Benrdou, Eliza Papaki, Alexandra Angeletaki.
12. Workshop for school children in Mykonos, by Alexandra Angeletaki.
13. Workshop for PLU students at the Deaf Museumby Line Nordsveen and Alexandra Angeletaki.
14. The creative Museum, EU project, by Alexandra Angeletaki and Line Nordsveen.Case study MiST - ARK4 - (4) (002).docx
15. Futurescapes symposium on Digital media and Humanities, demo and Lightning talk http://typecraft.org/tc2wiki/Futurescapes by Alexandra Angeletaki.
16. 6-10th of April Athens Science Festival by Athena RC, http://www.athens-science-festival.gr/en/ by Agiatis Bernadou, Eliza Papaki, Nepellie Chatzidiakou

17. 12-16 July DH 2016 at Krakow poster presentation, poster slam by By Agiatis Bernadou, http://dh2016.adho.org/ARK4DH2016.docx

18. Hands-on demonstration in Researchers night Trondheim 23rd September 2016 bu Ingunn Østgaard and A. Angeletaki.

19. Hands-on demonstration in Researchers night Athens, September 30, 2016 by By Agiatis Bernadou, eliza Papaki, nephelie Chatzidiakou.

ARK4 in websites and social media:

- ARK4 NTNU blog in english: https://www.ntnu.no/blogger/ub-ark4/
- Google plus ARK4 collection in Norwegian: https://plus.google.com/109343604423739790695/posts/Cif4ydGWaYZ
- Main website : http://mubil.no/ark-4/
- Ark4 in Greek: mubil.gr
- NTNU Archaeology blog, Aleka https://www.ntnu.no/blogger/ub-arkeologi/
- The archives and manuscripts of Gunnerus library: http://gunarchives.blogspot.no/
- Facebook site for Mubil and ARK4: https://www.facebook.com/MUBIL2012/?ref=hl
- Twitter account: https://twitter.com/AAleka
- Europeana research blog, Europeana research blog publications: Click and learn! Re-using Europeana content to support learning activities , Reuse of Europeana content for fun! Lost Cultures within Europeana

Report for ARK4, 2015, contribution by the Digital Curation Unit, Phase 1

Authors: Agiatis Benardou and Eliza Papaki, Scientific

Associates at DCU

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Introduction

The research project ARK4 on an interactive heritage library seeks to create a virtual dialogue between the public and institutions which hold information. By exploring innovative technology, it aims to disseminate knowledge from the past to a wider, younger audience. How? By applying user-centric methods and collecting fresh narratives, which it will then share with libraries, schools, archives and community organisations, both locally and nationally.

Pilot phase: The pilot platform combines high definition digital representations of material and a game to be explored by high school students performed in a workshop format that supports learning. Based on the pilot game on Flora Danica (a scientific encyclopaedia on Scandinavian fauna), evaluation workshops have been held in Norway and Greece during this testing phase of the project. This task aims in evaluating how users' understanding of a subject advances through playing, as well as their engagement and satisfaction with the activity. The overall aim of these workshops is to inform the future development of this concept and platform, helping it towards its ultimate goal of becoming a standard teaching tool.

In this context, ARK4's international partner, the Digital Curation Unit "Athena" R.C., held a workshop on February 7 2015 in Athens, Greece, adopting the standards of the first prototype launched in June 2014 in Norway. This first prototype workshop on plants constituted of 12 students from the Steiner school in Trondheim in collaboration with Ringve Botanical garden, Vitenskapmuseet in Trondheim and Bjørn Sæther.

A second evaluation task in Greece would contribute in exploring and consolidating user experiences in a different audience, with the added specificity of bilingualism or even trilingualism, through comparing, confirming or contradicting the results and reactions gathered during the first prototype. This report documents this second evaluation workshop in Athens, Greece, the mixed methodology protocol employed and its findings.

2. Methodology

Following the standards of the first prototype workshop held in Norway and in accordance to the project's aim for a second evaluation workshop of the digital platform and game in a different audience, a one-day event was organized and held by the Digital Curation Unit "Athena" R.C. on February 7 2015.

The target audience of this evaluation workshop, similar to the target audience of the digital platform, was set to be school children of the ages 10 to 17. While tracing such an audience seems to be quite flexible, a significant component had to be faced. The digital game on Flora Danica in this initial phase of the project was designed and developed in the Norwegian language. Therefore, in order to face this restriction, it was decided to test this game on bilingual - or even trilingual - school children in Greece, having knowledge of the Norwegian, Greek and/or English language. To this purpose, the workshop was organized in collaboration with the Norwegian Embassy in Athens.

Five school children of the ages 10 to 16 participated in this workshop as an extracurricular activity, Andreas age 10, Maria age 12, Alexia age 16, Nora age 13 and her sister Andrea age 12. This group of four girls and a boy, presented an interesting linguistic mixture that had to be dealt with as some of them had no knowledge of the Greek language while others had only basic knowledge of English. In this way all the accompanying to the workshop material (questionnaires and vocabulary) was provided in both languages (Greek and English) while the language of the discussions following the game was selected based on students' capabilities.

The user-centric methods employed for evaluating the digital game and its learning impact were multiple and followed a predefined procedure in an effort to reach methodological completeness and efficiency:

- Observation
  - Questionnaire on the topic of plants
  - Presentation on Flora Danica and Botanny by the botanist, Gabriella Papastefanou
  - Interaction with the digital game on Flora Danica - technical expertise provided by the IT expert, Ioannis Lefteriotis
  - Repetition of the questionnaire on the topic of plants
  - User evaluation: Questionnaire on the overall experience from the digital game
- Focus Group interviews
  - First Focus Group in the Norwegian language - interview moderator project leader, Alexandra Angeletaki
  - Second Focus Group in the Greek language - interview moderators DCU colleagues, Agiatis Benardou and Eliza Papaki

3. Observation - Findings

The first part of the workshop constituted an exploratory phase which followed a series of steps for introducing and observing children's interactions to the digital game on Flora Danica. The workshop began with participants answering individually a questionnaire of seven multiple choice questions on the topic of plants. In particular, they had to identify the plant species by selecting from the list of answers provided according to their own understanding and knowledge.

This first questionnaire was followed by an introduction presented by the botanist, Gabriella Papastefanou, on Botany and plant species. The aim was for students to be introduced to the relevant terminology and to acquire a basic understanding of this topic in order to reach the goal of identifying the plant species later on during their interaction with the digital game. Regarding language, the presentation was given in Greek as this was the common language for all participants while the terms were also presented in the Norwegian language, translated and explained in Greek soon afterwards. Lasting approximately thirty minutes, this brief presentation attempted to familiarize the audience to the content and questions of the game that followed.
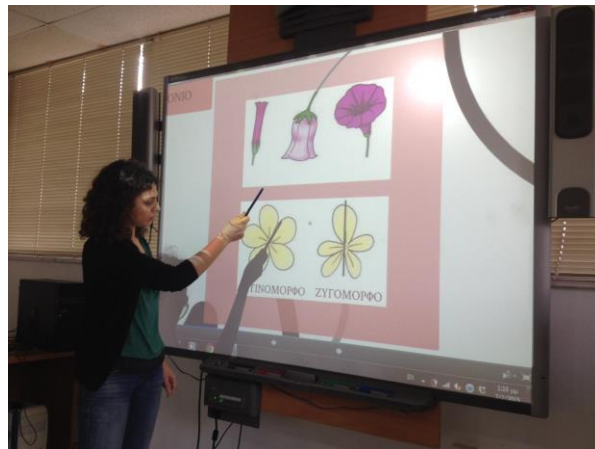
The game was offered on a touch-screen by the IT expert Ioannis Lefteriotis who supervised the whole game interaction of the participants. After an initial testing, during which the process of answering questions was explained, by applying one-finger touch in order to select the first alternative or a two-finger simultaneous touch so as to select the second alternative, participants formed groups. In groups of two or three, the students were playing against each other while having audio feedback about their right or wrong selections. They competed based on their total score along with their personal time that was displayed in the bottom of the screen.

All participants were quite enthusiastic during their interaction with the game while they understood and followed the rules of the game easily. Playing a knowledge-test on a touch screen was not a problem for them as they were quite familiar with this kind of technology; therefore, it could be said that the technological aspect/nature of the game contributed rather than prevented the enjoyment of the game activity.

Following the end of the game, each participant was given two questionnaires: a knowledge test on the topic of plants and a brief questionnaire on the quality of the gaming experience. The knowledge test included the same questions with the first questionnaire given in order to test the learning efficacy before and following the presentation and the game itself. It seems that while in the first questionnaire, participants picked their answers randomly by selecting, crossing and then re-selecting new answers, in the second questionnaire they picked their answers more decisively. This observation strengthens and confirms the assumption for learning efficacy of the digital game. The measure of its learning impact is also reinforced in the answers provided by the participants in the user evaluation questionnaire. This questionnaire, including 6 multiple choice and 2 open-ended questions, aimed to value the overall learning experience, the satisfaction and usefulness of the game activity. Interestingly, all participants rated highly all these aspects while they gave useful feedback on its future development. In the question "Do you have any suggestions in order to improve the activity", one of the participants suggested:

"You can order the questions by level, and choose questions for people according to their age or previous knowledge" and *"If someone gets a question wrong, you can give him/her an easier question right after"*.

Finally, in the question "Here you can write whatever you want for the activity" a participant wrote:

"I certainly knew very little about botanology before this activity, and I always thought it wasn't such an interesting branch of science. Actually, it's really fun!".

4. Focus Group - Findings

The final part of the workshop included a wider group discussion with all the participants regarding:

- the usefulness of the introductory presentation
- the learning efficacy of the game
- its strengths and weaknesses
- and its future use by a wider community of users.

Due to linguistic reasons/restrictions, two smaller focus groups were formed, the first conducted in the Norwegian language, having two participants and as interview moderator the project leader Alexandra Angeletaki while the second was conducted in the Greek language, having three participants and as interview moderators the DCU colleagues Agiatis Benardou and Eliza Papaki. This discussion, which was recorded by the moderators, lasted approximately ten minutes during which not all participants contributed in the same measure. Some were leading the discussion while others were shy enough to express their opinion, even in such a small group of participants. However, all five users valued positively their experience with the digital game and expressed their wish for wider adoption of such digital knowledge platforms in schools. According to their opinion, all of their classmates would be happy to have such an opportunity for gaming engagement as part of their educational curricula.

5. Conclusion

The developed application of the Flora Danica game is used as a case study to investigate a) the degree of coordination among the users, b) the type of collaboration (whether the users do really collaborate or they are just working in parallel doing different jobs and c) the positioning of the users' interactions and their meaning. Evaluating this application in a Greek-Norwegian audience was quite encouraging considering their positive reaction to such a technological experiment in the area of gaming learning. According to the results gathered in this evaluation workshop, users tend to conveniently adopt the new technology, exploring and learning through their gaming experience a new topic. Especially, the interaction observed in groups of two or three draws from the user behavior in gaming activities in which participants compete for reaching the best score rather than playing independently.

Final Report for ARK4, 2016, contribution by the Digital Curation Unit

Authors: Eleni Afiontzi, Agiatis Benardou, Nephelie Chatzidiakou, Dimitris Gavrilis,

Eliza Papaki, Scientific Associates at DCU

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1. Introduction

This report presents work conducted during the final phase of the project (2015-2016) and also builds on previous reports produced in the course of ARK4. Based on a series of digital games developed, disseminated and tested in evaluation workshops, such as the Flora Danica Game, the final phase of the project aimed in reusing already existing digital content in the area of Cultural Heritage for creating knowledge testing games[1]. It was thus decided that the digital library of Europeana could serve as the content source for this task due to its rich and diverse content in the area of Cultural Heritage and clear copyright statements. This collaboration between ARK4 and Europeana was an initiative of ARK4's international partner, the Digital Curation Unit "Athena" R.C. In this context, the Digital Curation Unit created four knowledge testing games with diverse topics, aimed at various target audiences reusing Europeana content for educational purposes in gaming activities.

Final phase: It could be argued that the final phase of the project had a dual aim. On the one hand, the production of new knowledge testing games reusing digital content from Europeana and on the other hand, the presentation of all games developed in the context of the project in a single platform. Moreover, it was considered vital to disseminate and test these games to the corresponding audience, documenting reactions, comments and suggestions.

According to the description of work the games to be produced should be of two types:

- Quiz

A quiz game in multiple-choice form that presents a number of questions along with a number of possible answers per question.

- Drag & Organize

A drag and drop game that allows users to drag items and match them to their corresponding basket. Each item is represented by a box and has a picture, a title, a description and a set of links for getting further information. The user can get information on each item by clicking on it.

Based on this description, content-wise, four knowledge testing games were produced in this final phase of the project by the Digital Curation Unit:

(1) Quiz on Children's Literature
(2) Lost Cultures 2: Quiz on Palmyra, Syria
(3) "Europe and Me": Quiz on the cultural heritage of Europe (in Greek)
(4) "Art & Drop": Drag & organize game on Art History

** Please note that as ARK4 has been a multifaceted initiative in which a number of international partners were involved, in this present report the section on the technical

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[1] Report for ARK4 2015, contribution by the Digital Curation Unit.

implementation refers to the development of the gaming platform used not just for the quizzes created by the Digital Curation Unit but also for the NTNU. Likewise, the section on user feedback takes into account feedback from the Lost Cultures 1 quiz developed by NTNU.

2. Content curation and technical implementation

In the course of the ARK4 project, two types of games were developed. Initially, as already mentioned, the idea of a quiz map was introduced, where the user is able to play different quizzes with multiple choice questions within a single map. Each map consists of an image with a clear depiction of the quizzes. Quiz content can be described in three different languages (Greek, English and Norwegian). The researcher can insert the quizzes using the back end application and connect each of them to a specific point in the map. All quizzes consist of a title, a description, a few images or videos and of course the questions with the possible answers. The users can choose the language they feel comfortable with, from the entering page in the front end of the application, which leads to different quizzes. After the completion of each quiz, the user is presented with a score and can see the correct answers. Finally, a short evaluation is in place, to report some demographic data and also feedback on the whole process.

In addition to the quizzes, two drag and drop games were developed. They mainly consist of categories and items, with the restriction that each item can be matched only to one of those categories. Like before, the researcher can insert the categories, the items and information on them (title, description, images) in the back end, while the user can play the game in the interface. Depending on the language chosen, the corresponding game is made available. Each time the game starts, the user has five tries to categorize the items correctly. If those so called "lives" end, the game can start from scratch.

All games were developed using Javascript, PHP and MySQL. Bootstrap framework was used in the interface development, for a more responsive application.

In terms of content (language, audience, content)

In terms of content, as already mentioned before, all games reuse digital content deriving entirely from Europeana. Children's Literature is the first of the knowledge testing games produced in the context of the project, in English. Launched on March 3, on the occasion of the World Book Day, this quiz aims to travel an adult audience back to their childhood and test what they have been reading and remember from then through fifteen multiple choice questions with beautiful visual records.

The second game (Lost Cultures 2), focuses on the ancient site of Palmyra. Since its destruction, the ancient city of Palmyra in Syria has been a popular topic among archaeologists and the public and has been reconstructed in various ways, from crowdsourcing projects to 3D virtual modeling initiatives. In this context, this quiz addresses the topic of Palmyra and Syria in fifteen multiple choice questions with the corresponding visual content from Europeana. This game also addresses adult users and was created in English.

The third quiz entitled "Europe and Me" was created in Greek and targets younger users, mainly between 6 and 15 years old. Its content focuses on the European geography, people and traditions. Eleven multiple choice questions with different weighting factors were created. The visual content of the quiz derives entirely from the Europeana collections. This quiz was launched and presented in the Athens Science Festival, as is described below, in an attempt to expose young Greek users to high quality visual material from across Europe.

The last game entitled "Art and Drop" is a drag and drop type of game on the History of Art. Addressing young but also adult users, this game was created in English and presents several European paintings to be matched with their corresponding art movement. It will be launched in the Researcher's' Night 2016 in Athens.

3. Events and dissemination activities

As described before, the dissemination process and testing of the games was a vital part of the project. Therefore, the same process of publicity was also followed in this final phase for the new games produced. The first two quizzes produced, Children's Literature Quiz and Lost Cultures 2 Quiz, were mainly disseminated online through social media (Twitter, Facebook), with great success. However, both of these quizzes alongside the new quiz entitled "Europe and Me" were also presented in the Athens Science Festival.

Hosted in Athens in April 2016, this Festival is already established as one of the biggest celebrations of science and technology in Greece, despite the fact that is rather a new initiative. Organized annually in the spring, the Athens Science Festival attracts tens of thousands of visitors, among them students, researchers and teachers. As most of the visitors of the Festival are young people, the Digital Curation Unit participated and presented the "Europe and Me" quiz in the Greek language. However, the rest of the quizzes were also presented and played by older visitors of the Festival (parents, teachers, researchers). Altogether, we managed to gather 137 responses to the quizzes; the majority of the respondents was not older than 17 years old.

According to the evaluation questions that accompanied the quizzes, all users liked the game and most of them expressed positively on their educational value.

4. User feedback

In order to evaluate the ARK4 quizzes and gather information on the level of satisfaction as well as on the profile of the participants, a series of evaluation questions was available at the end of most of the quizzes. The evaluation questions were answered by users of the following quizzes: (1) Europe and Me, (2) Lost Cultures 1, (3) Lost Cultures 2, and (4) Children's Literature. The first quiz mentioned above is in Greek while the last three are in English.

The list of questions was purposively short in order to gather as many responses as possible. The participants, mostly children and young adults, were asked to answer whether they liked the quiz, whether they learnt something new, which aspects of the quiz they liked most, in which ways the quiz could be ameliorated and they were also asked to state their age and gender.

Overall, 145 responses were gathered from all quizzes.
According to the results, the users of the quizzes were extremely satisfied, as 96% of them

responded that they liked the quiz they had tried, 4% responded that they "sort of" liked it and none stated not to like the quiz (see Figure 1).

Most of the participants felt they learned something new (62%) or something relatively new (23%) while 15% of the participants did not feel that they have learned anything new (see

Did you like the quiz?
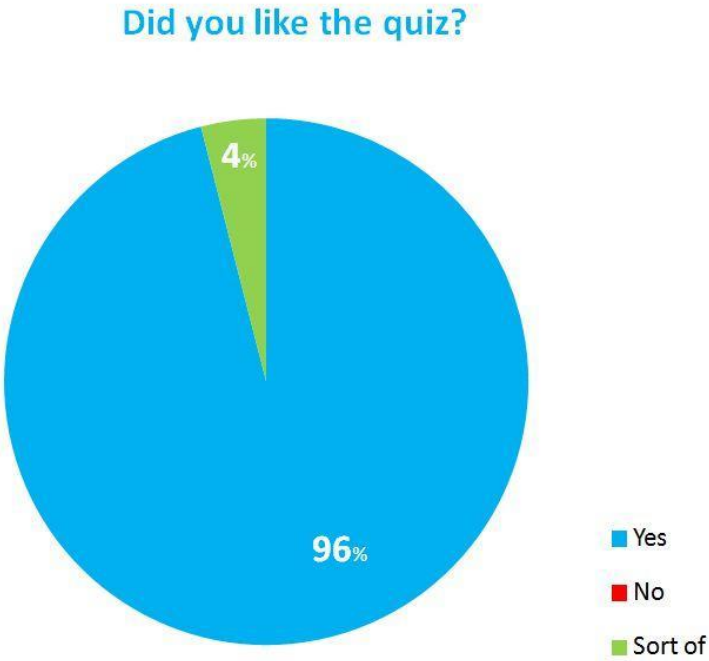
Figure 2).

Did you learn something new?
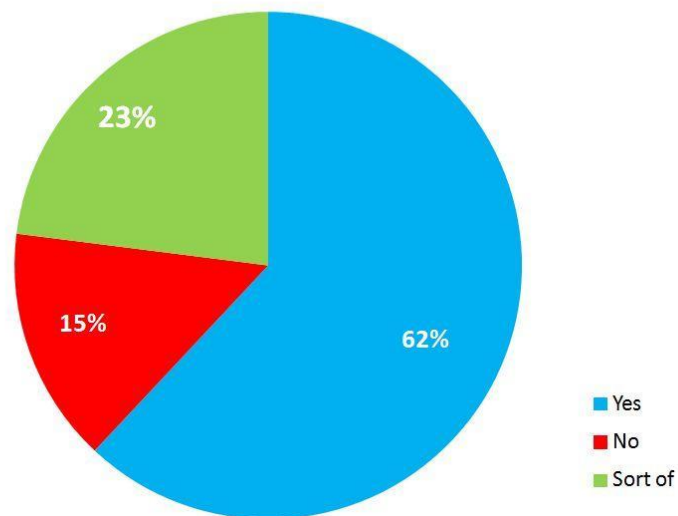
In a subsequent question the participants were asked to state which aspects of the quiz they mostly liked (see Figure 3). Most participants stated that they liked all aspects of the quizzes, that is the questions, the layout, the theme and the visuals. Relative frequencies on the responses indicate that the participants principally liked the questions (27%) and subsequently the layout (18%), the theme (14%) and the visuals (13%). Very few participants (0,6%) stated that they did not like any of the aforementioned aspects of the quizzes.

What did you like most?

Category	Percentage
All of the above	27%
The questions	27%
The layout	18%
The theme	14%
The visuals	13%
None of the above	0,60%
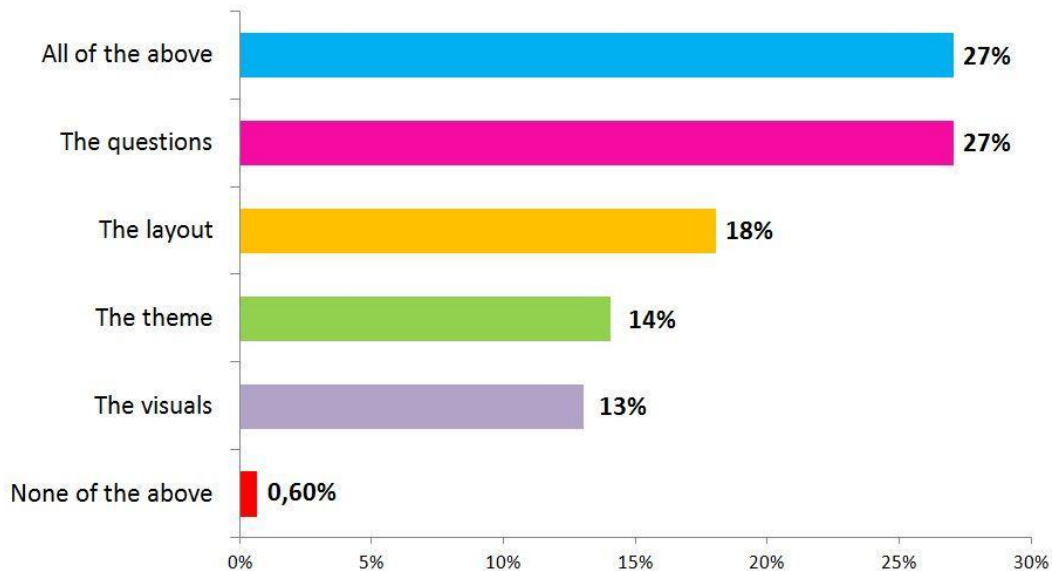
The participants were also asked to present suggestions about how the quiz could be improved. A small number of them reported back, and their suggestions include that we provide more questions, perhaps shorter or more lively and also more difficult questions. It was also proposed that the questions should be of gradually increasing difficulty or that several quiz "levels" are introduced. The use of moving images and sound/ music was also proposed. Finally, participants also suggested that we make more quizzes and use various topics.

Regarding the age of the participants, for the most part they are children and young adults. 26% of the participants are up to 12 years old, 45% are 12 to 17 years old, 5% are 18-24 years old, 12% are 25-34 years old, 8% are 35-44 years old, while the remaining 6% either are older or stated that they did not wish to answer this question (see Figure 4).

Age of the participants
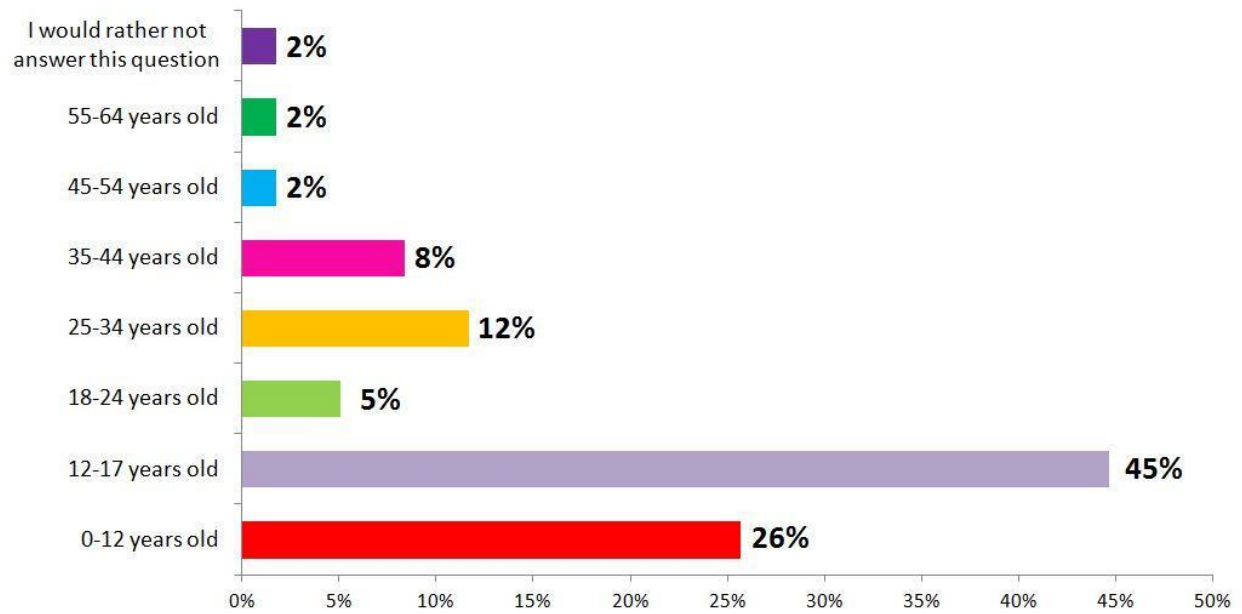
Figure 4 Age of the participants. N=121

Finally, most of the participants (96%) were female and 44% were male (see Figure 5).

Gender of the participants
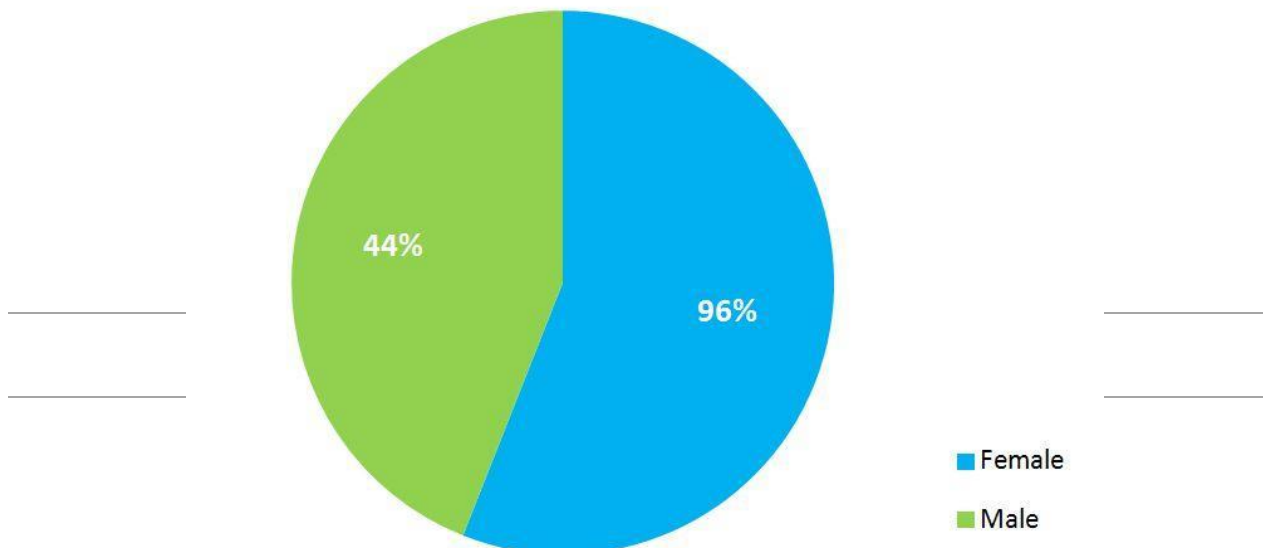
5. Lessons learned and Future plans

The final phase of the project ARK4 aimed in designing and developing a gaming platform that would incorporate a number of games in three different languages (English, Norwegian, Greek) developed in the course of the project. Research concentrated on practices that involve the user or visitor of the platform as a user of an interactive digital experience focusing mainly on measuring entertainment factors. As the dissemination practices employed for the new games changed from workshops to social media sharing and presentation in science festivals, new user-centered methods were enforced to collect new data to be shared by the community. Namely, brief questionnaires were added at the end of the games so that users could evaluate their overall experience and suggest any further improvements, as presented before. All participants were quite enthusiastic during their interaction with the games while they understood and followed the rules of the game easily. Playing knowledge-testing games on touch screens (tablet) and on laptops was not a problem for any target audience, either young or adult, who is quite familiar with this kind of technology. Therefore, it could be said that the technological aspect of the games contributed rather than prevented the enjoyment of the game activity. Observing the user-game interaction during the Athens Science Festival, it is suggested that users tend to conveniently adopt the new technology, exploring and learning through their gaming experience a new topic. Even if the quizzes were mainly a one-player game, it was observed that in most cases people shaped groups to play collaboratively. In these cases, users jointly contributed to successfully complete the games.

The success of media as guidebooks and learning systems is apparent from the growing interest in the use of interactive devises as learning tools in informal learning contexts. Informal knowledge acquisition activities are getting more and more popular and interest on media technologies have opened up a vast range of possibilities. The Digital Curation Unit, through this project, has experimented in testing user satisfaction and learning efficacy of digital games with diverse topics, diverse target audiences and with diverse linguistic content. Among the future plans for ARK4 is the presentation and testing of the new game "Art&Drop", but also of the rest of the quizzes produced, in the Researcher's Night 2016 in Athens and in Trondheim. ARK4 results and games have also been published in the Europeana Research blog (http://research.europeana.eu/blogposts) and this space could still host any further developments and promotion for public engagement with the gaming platform.

3.1.HERBS OF MAGIC BY ROGER HANSEN

Premiss

Prosjektet er tenkt for å bli et lite 3d spill for barn og unge som spilles i web browser.

Man kan velge å spille gutt eller jente, for så å løpe rundt i skogen å lete etter mistede sider fra en plantebok (Flora Danica?). I skogen kjemper de mot fiktive monster slik barn ofte leker. For hver side fra boken som blir funnet, vil barna få inspirasjon, og nye monstere dukker opp i skogen. Dette gjør spillet gradvis vanskeligere til alle sidene er funnet.

Story

Det handler om to barn (søskenbarn) som er på besøk til felles bestemor. som bor i skogen.

Bestemor sier at hun drar en tur til byen for å handle. Barna må holde seg rundt huset.

Barna bestemmer seg for å leke "monsterbekjempere", fordi gutten allerede har et tresverd. Jenta har ingen "våpen" men gutten sier hun kan være heks, og da trenger hun en trollbok. De låner en gammel utslitt bok om planter fra bestemor.

Når de kommer ut av huset for å se i den, kommer det et vindkast og blåser mange løse sider fra boken utover i skogen. I full panikk må en av barna hente sidene tilbake før bestemor kommer hjem. Den andre må stå igjen å passe huset.

Fra her spiller vi selv.

Når alle sidene er samlet inn og boken er satt tilbake, vil selvfølgelig bestemor komme hjem. Det første hun går i gang med er å rydde ut avfall, og i esken med avfall ser vi selvfølgelig den gamle boken ligge øverst i haugen. Ha ha! The end.

Forklaring

Spillet starter med en valgfri historie intro vist som slideshow i bilder og tekst. Når spilleren kan styre en av karakterene vil dette foregå i tredjeperson 3d sett skrått ovenfra. Med repititive tastetrykk sloss man mot monster for å komme seg frem til den manglende boksiden. I starten er det enkelt men etterhvert blir det vanskeligere. Det kan bli 7.10 forskjellige monstre/boksider. Avslutningen på spillets historie vil også vises i slideshow med bilder og tekst. Stemingen er lys og trivelig med mye farger i noe tegneserie-aktig stil.

Spillerne får Diplom etter hvor mange monster de har tatt. De er 5 forskjellige diplomer, og her handler det om at det ikke er noen vinnere, og hvert diplom er en refleksjon på ferdigheter brukt for å finne boksidene.

Størrelse og budsjett

Det er uvisst hvor lang spilletid dette spillet vil gi, men 15 -30 minutter er nok for web.

Det vil i hovedsak ha 10-20 bildeillustrasjoner, 3 menneskekarakterer, 7-10 forskjellige monstre, lydeffekter og en god del naturelementer for 3d verdenen.

Dette er estimert på ca 6 måneders utviklingstid og en kostnad på 60 000kr.

3.2 ARK4 – Rapport fra Norsk Døvemuseum

Norsk Døvemuseum v/formidlingsleder Line Nordsveen har deltatt i prosjektet ARK4. Vi har bidratt med innhold til et digitalt spill om døves historie i Norge. Spillets innhold består av informasjon og foto fra våre samlinger. NTNU Universitetsbiblioteket v/Alexandra Angeletaki har vært leder for prosjektet, og Institutt for datateknikk og informasjonsvitenskap har stått for det digitale rammeverket.

© Irene Dominguez Marquez
www.namtarucreations.com

Forventningene var store til prosjektet, og det har vært spennende å samarbeide på tvers av fagretninger. I begynnelsen var det noe uklart hva innholdet skulle være og hvilken form spillet skulle ha. Etter at vi fikk teste prototypen som var ferdig sommeren 2014 (Flora Danica) ble prosjektets mål mer håndfast for oss, og prosjektet kom virkelig i gang for Døvemuseets del.

I prosjektsøknaden gikk Norsk Døvemuseum opprinnelig inn med 20 timers arbeidsinnsats. I realiteten har det blitt brukt en god del mer tid på prosjektet enn først antatt. Både arbeidet med å lage gode nok spørsmål, samle bakgrunnsinformasjon samt finne gode illustrasjoner/foto fra eget arkiv har vært tidkrevende. Det er ikke urimelig å si at i alt 14 dager har blitt brukt på prosjektet. Dette har vært nødvendig for å sikre god nok kvalitet på innholdet. Vi har også

måttet samkjøre med IDI og rette opp en del feil som dukket opp etter hvert som spillet ble ferdig, noe som også har tatt mer tid for begge parter.

Det er fortsatt detaljer som gjenstår før spillet vil fungere virkelig godt i f.eks. skolesammenheng. Dette handler både om innhold, tekstmengde og de tekniske løsningene, noe som vil være mulig å rette opp. Fremdeles fremstår nok Flora Danica som spillet med de mest spennende løsningene, der man får utnyttet berøringsskjermen og teknologien til fulle. Døvemuseets spill fungerer imidlertid som et fint tilskudd til vår formidling.

Døvemuseet v/Line Nordsveen har også presentert ARK4-prosjektet på en konferanse: Norske historiedager i Stavanger, juni 2015.

Line Nordsveen,
30. juni 2015

3.5 ARK4 Rapport av Gunnar Sørum fra Statsarkivet, Trondheim

Statsarkivet i Trondheim har høsten 2014 medvirket i prosjektet Ark4. Vår del av samarbeidet har vært å bidra med innholdet til en quiz basert på virksomheten som vi driver opp mot ungdomsskoleelever. Quizen har fått navnet "Kildene og krigen" og gjennomføres på en touchskjerm. Der måler man antall rette svar, samt tidsbruk. Selve programmeringen og den tekniske delen av arbeidet har andre bidratt med.

Over en del år har vi hatt besøk av mellom 6-800 skoleelever årlig, som har fått lære om arkiv, kildekritikk og generell historie fra andre verdenskrig. Vi har benyttet "Kildene og krigen" på den måten at elevene har tatt quizen mot slutten av besøket hos oss, både for å gi dem en motivasjon til å finne ut av ting de ikke har fått med seg, og for at vi skal kunne undersøke om de har fått med seg det innholdet som vi har forsøkt å formidle.

Statsarkivet lovet å stille med ett ukeverk i dette prosjektet. Vi endte opp med å benytte to dagsverk mer, dvs 7 dagsverk.

3.6 Orientering om kreditering ifbm. Opp i dagen-prosjektet av Anne –Katrine Meland

Generelt om organiseringa av prosjektet:

Prosjektet drives av næringsforeninga på Rødøya, *Rødøy Stå På*, som består av 8 medlemsbedrifter. Prosjektleder for Opp i dagen er Anne-Katrine Meland. Prosjektet startet i november 2012, og vil fullføres i november 2015.

Generelt om kreditering:

Alle illustrasjoner, foto, kart o.l. som benyttes i materiell er brukt med tillatelse fra rettighetshaver, og fotograf/illustratør/kilde oppgis ved bruk. I boka finnes også litteraturlister i slutten av kapitlene.

I tabellen nedenfor sees en oversikt over de forskjellige produktene som er skapt i prosjektperioden, hvem som har bidratt i det konkrete produktet og hvem som krediteres for det.

Produkt	Medvirkende	Kreditering/bruk av logoer
Bok (hardperm, 86 s.)	Forfattere: Anne-Katrine Meland Kolbjørn Lorentzen Kari Støren Binns Richard Binns Jurgen Wegter	Opp i dagen Forfatterne Utgitt av: Rødøy Stå På Økonomiske bidragsytere til utgivelsen: Helgeland sparebank Nordland fylkeskommune Polarsirkelen friluftsråd Klokkergården Nova Sea Lovundlaks Samlerhuset Kystinkubatoren
Kulturminneskilt (6 stk., norske + engelske tekster)	Polarsirkelen friluftsråd har finansiert grafisk oppsett + produksjon. De to øvrige har bidratt med sponsing til prosjektet i sin helhet.	Opp i dagen Polarsirkelen friluftsråd Nordland fylkeskommune Helgeland sparebank
Foldere om kulturminneløypa	Polarsirkelen friluftsråd har finansiert grafisk oppsett + produksjon. De to øvrige har bidratt med sponsing til prosjektet i sin helhet.	Opp i dagen Polarsirkelen friluftsråd Nordland fylkeskommune Helgeland sparebank
Program for åpningsarrangementet	Rødøy Stå På - arrangør	Opp i dagen Sponsorer for åpningsarrangementet: Samlerhuset Klokkergården Helgeland sparebank

Den arkeologiske sandkassen (arkeologi for barn)	Bamsehuset	Opp i dagen i samarbeid med Bamsehuset
Film om leidangen	NTNU Universitetsbiblioteket ARK 4 (produksjon av film) Opp i dagen (innhold)	NTNU Universitetsbiblioteket ARK 4 Opp i dagen (I slutten av filmen finnes en mer detaljert beskrivelse av hvem som har medvirket)
Rødøy-quiz	NTNU Universitetsbiblioteket ARK 4 (utvikling av dataspill) Opp i dagen (innhold)	NTNU Universitetsbiblioteket ARK 4 Nasjonalbiblioteket Opp i dagen
Kulturminne-app (Stedr)	SINTEF i samarbeid med NTNU-studenter (utvikling av app) Opp i dagen (innhold)	SINTEF NTNU-studenter innenfor programmering Opp i dagen
Rødøysmykket	Smykker støpt i kopi av støpeform fra vikingtida fra Rødøya.	Opp i dagen
Nettside		Opp i dagen Under utarbeiding

COLLABORATIVE RESEARCH PROJECT AGREEMENT

BETWEEN NTNU UB AND ATHENA DIGITAL UNIT

NOVEMBER 2016 TRONDHEIM-ATHENS

Statement of work: ARK4 An interactive heritage library, phase 2

ARK4 is initiated by the NTNU University library in 2014. This two years project intends to create an interactive library web platform of games with content from heritage culture and archives. (see content document).
Our main partner in phase two, is Athena Digital Unit (ADU) based in Athens Greece.
The contractor ADU is specialized in application development and research design and has been involved in this research project since 2014. ADU has been a research partner from the first phase of ARK4 and has delivered already two quizzes and a workshop testing in 2015.

NTNU UB desires to have the contractor perform the design of the gaming platforms and applications and run a user testing and evaluation report in a frame of a research collaboration agreed in 2016.

Budget: The project is a response to the call of the National Library of Oslo on projects that stimulate and is financed mainly by NTNU UB and Athena with an external funding from the National Library of Oslo (see budget).

Aim: Our common aim in phase 2 is to explore the possibility of creating an open source game platform, for university students where all of the developed applications will be presented and become accessible freely to the common user. The products will be shared by workshop settings organized in Greece by ADU and Norway by NTNU UB and the partners of ARK4 as well as collaborating universities, museums and archives and contribute to life-long learning activities. The pilot will be tested in spring 2016 by our collaborators at the Athena RS in Athens. The results collected will be published and presented in national and international conferences.

Delivered work: ADU will deliver the applications agreed in the frame of ARK4 phase 2,
- **an instruction manual as to the changes of content needed.**

- **Technical documentation on server use and client use is also delivered by the end of the collaborating period.**
- **Application data is agreed and signed here as follows.**

Our partner form Athena Digital Unit in Athens Greece will be working from January 2016 until September 2016 with the development of the following:

1.Gaming platform

This project will design and develop a gaming platform that will manage users (registration, login, etc.) and a number of games. Each game will be seen as a widget that can be activated within the platform for a specific user group. A learning scenarios editor will also be developed in order to allow teachers to create an educational scenario that will have:

- a description of the game
- a goal
- hints
- scores

The learning scenarios editor will also be able to export a simple IEEE LOM + SCORM xml file so that learning scenarios can be easily published to external learning environments (e.g. moodle, eclass, its learning etc.).

Within this scenario editor, the teacher will be able to include a number of levels and games per level that will appear as grid. The user will be able to see the goal of the game along with the list of available games and play them. The user wins points when playing the games and can move on to the next level. The score of the user could appear in a scoreboard where for example, all students of a class / group can compete.

The platform will be based on a responsive web based framework and could run on touch devices such as smartphones and tablets.

1.2 A number of games will be developed. These games can be parametric so that they can allow teachers to easily create multiple instances of them and include them in the platform. Each game will include two interfaces: (a) an editor that will allow teachers to create instances of the game, (b) a front end that the users will use in order to play the game. Furthermore, each game will have at least two ways of ending: (a) success, (b) failure. When the user plays the game, depending on the outcome, he receives or looses points (or none).

- **<u>Quiz</u>**

A quiz game will present a number of questions along with a number of possible answers per question. Along with the question description, a number of pictures / videos can be included. Each question could be accompanied by a hint.

- **Drag & organize**

A drag and drop game will allow teachers to create a set of items and put them on a basket. Each item is represented by a box and has a picture, a title, a description, a set of links for getting further information. The teacher also defines a number of target baskets (each one representing a group) and the user drags the items into the corresponding baskets. The user can get information on each item by clicking on it. He can also get information on what each basket represents by also clicking on it. When the user finishes, he clicks on the "check" button and sees his score.

3. Functional Requirements: The functional requirements describe how the software will respond to the environment when deployed. The product will have 2 games from different subjects.

The platform product will have 3 different kinds of users; Students, Teachers and System Administrators.

4. Modifiability
The software will allow administrators to modify certain parameters so that it can evolve and meet user requirements over time. Examples of these parameters are:

- Goal information (what the user needs to achieve in order to win something / move to next level etc.)
- The games that will be active when the user logs in.
- Some parameters of the games. For example if there is a parametric quiz game the administrator could use this to create multiple quiz games.

Appendix 3: General Purchase conditions

1. Security
The security issues that are raised in this case are privacy issues mostly. The platform will need to safeguard users' privacy including personal details, performance in the game etc.
The game platform itself will not record or store IP addresses except for the currently opened sessions. This means that for the duration of a game session, the system will have to know which Ip address corresponds to which user id but this information will be deleted after the user logs off. Secondly, we could disregard any personal information such as the full name , age, and email of the users. We won't keep any log files. However, the web server itself maintains an access log but this cannot be traced back to any particular user so no such issues arise. The server in the one Atehna RC uses.

2. Research design: The research will concentrate on practices that involve the user or visitor of the platform as a user of an interactive digital experience. We will survey on entertainment-factors that apply user-centered methods and collect new data to be shared by the community.

3. Target group: University students and scholars

4. Intellectual property rights: By that we mean any copyright, trademark trade name connected to the particular applications and content signed in this agreement without limitation in method, process, procedure, invention ideas, results produced during this collaboration by the parties is of joint ownership. If a party wishes to use the application that requires the written consent of the other partner. Both partners are allowed to use the application for non commercial purposes including to let other academic institutions use the application for non commercial use upon notification of the other party.

In case of publications and presentations the contractor will always cite the NTNU UB and the National Library of Norway, as sponsor of the research, inform via email or letter about the intended publication and via-versa. The names of authors will be agreed as appropriate by both partners for every publication or dissemination action.

5. Dissemination: ARK4 will summarize its experience with the application groups involved in this project and prepare a number of publications to peer-reviewed conferences and journals. These published results will describe best practices, conclusions, and recommendations for dissemination through innovative technologies and learning activities for libraries archives and Museums. With the maintenance of an active project web site all the technical reports and prints of the research papers, as well as the system documentation, will be provided to the ARK4 community. The overall purpose of the project is to try and identify parameters of success in redefining the role of cultural heritage dissemination programs that include digital management based on the user's interest and his learning behavior.

6. Plan for deliverables from Athena Digital Curation Unit IMIS DCU:

Dato	Content	Payments from NTNU UB to ATHENA RS
December 2015	Signing contract between NTNU UB and Athena IMIS DCU	invoice from IMIS DCU 20000 NOK
Mid January 2016	A prototype of a gaming platform that will manage users (registration, login, etc.) and a number of games.	
Mid-February 2016	Two complete games based on material from two respective collections, see content selection by Athena IMIS DCU.	
Mid-March 2016	One user testing with report by Athena	
Presentation at Krakow, Digital Heritage	By Athena RS	Conference participation expenses paid by ARK4 after the trip.
Mid May	Final corrections	
30.6.2015	Final products delivered	invoice from IMIS DCU 40.000 NOK MVA paid to the Norwegian state 15000
30.9.2016	Final corrections	

KAN TEKNOLOGI OG SPILL GI KUNNSKAP?

PRØV VÅRT SPILL OG FINN DET UT!

ARK4 er et prosjekt som ønsker å undersøke om spill og teknologi kan bidra til å skape interesse for ulike fag blant skolelever.

Vi er et internasjonalt team som jobber tverrfaglig, og har laget en prototype som skal testes. Vi prøver å formidle kunnskapen som gjemmer seg i museer, gamle bøker og arkiv ved å gjøre den tilgjengelig og interessant for skoleelever.

Vi kan tilpasse opplegget til klassens arbeidsplan og kan skreddersy et opplegg for forskjellige fag.

BESTILL ET MØTE MED OSS ELLER KOM PÅ BESØK EN DAG SOM PASSER

MUBIL-laben tilbyr mange opplevelser med interaktive spill og befinner seg på Gunnerusbiblioteket, Kalvskinnet.

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