

# Kyrenia - hyper storytelling pilot application

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## Abstract

A team of multidisciplinary experts from computer science, visual arts, literature, film directing, psychology, communicology and human computer interaction developed a new interactive digital storytelling method - hyper storytelling. Hyper storytelling offers a solution for narrative paradox in introducing motivation factor into interactive digital story. In this paper we present Kyrenia - the first hyper storytelling application. Its purpose is to introduce the Internet users with the oldest sunken ship from 280 B.C., found in 1975 near Kyrenia, Cyprus.

## CCS Concepts

•Human-centered computing → Hypertext / hypermedia; Virtual reality; Web-based interaction; Interaction design; •Computing methodologies → Virtual reality;

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## 1. Introduction

UNESCO defines cultural heritage as "the legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations" [UNE]. Heritage communication is benefiting from advanced technologies using their tools to convey information to general public. One of the most powerful means of human communication is storytelling. Since the first moments of human existence people tell stories. Once they were told in front of camp fires, while today they are told using digital technologies through Internet.

Digital storytelling is defined as the use of digital media platforms and interactivity for narrative purposes, either for fictional or for non-fiction stories [HM14]. Interactive digital storytelling (IDS) involves the user in tailoring the story. Various IDS methods compete in level of user immersion and aim to teach the viewers about the topic in an engaging and attractive way. The quality of user experience is the main success factor of IDS applications.

We believe that IDS applications should be developed by professionals from different fields to achieve maximum user satisfaction. Therefore, we engaged experts from computer science, visual arts, film directing, psychology, communicology and human computer interaction to develop a new method for interactive digital storytelling: hyper-storytelling. After analyzing a sample interactive digital storytelling application they offered their insights and recommendations in form of guidelines for interactive digital storytelling [RDA\*17]. Kyrenia is a pilot application developed according to these guidelines, with goal to evaluate the hyper storytelling methodology through user experience studies.

Section 2 introduces the main characteristics of hyper story-

telling. In Section 3 we offer a brief overview of related work in IDS field with particular emphasis on cultural heritage presentations. Section 4 describes the implementation of Kyrenia application. Section 5 shows results of user experience evaluation. In Section 6 we present our conclusions and future work directions.

## 2. Hyper storytelling

According to Athena Plus recommendations for cultural institutions, conveying cultural heritage information through digital storytelling is highly encouraged, with particular emphasis on trans-media storytelling [Ath]. IDS applications for cultural heritage presentations usually contain stories, interactive 3D models of cultural heritage (CH) artifacts and/or interactive virtual environments (IVE) with reconstructions of cultural monuments' original appearance. While virtually exploring the IVEs, watching or listening to stories, users learn about the purpose and historical context of selected cultural heritage objects. IDS applications are usually online or accessible for mobile download. Some of them introduce augmented reality elements which combine digital content with landmarks and on site elements.

IDS applications aim to obtain maximum user immersion in cultural heritage virtual presentation. In hyper storytelling we target the implicit immersion created by quality of storytelling, with or without the explicit one, created by virtual reality tools and methods. IDS applications for cultural heritage target also the maximum level of edutainment, conveying information to educate users in historical context of heritage object or site, while making them amused and engaged by the presentation. In our user experience evaluation presented in Section 5, we will use levels of user immersion and

edutainment value of the application to show the perceived quality of our concept.

In virtual environments with interactive storytelling the users can watch stories on demand. This advantage could turn into a drawback if they do not watch all offered content. In literature this is called solving the narrative paradox. It is the conflict between pre-authored narrative structures - especially plot - and the freedom a virtual environment (VE) offers to a user in physical movement and interaction, integral to a feeling of physical presence and immersion [SF15]. The hyper storytelling method introduces a motivation factor for users to view the whole offered content. We can consider it as adding a gamification element to create more engaging user experience.

According to guidelines for IDS presentations of cultural heritage, hyper storytelling IDS application has the following characteristics:

- unique visual styling
- information divided in a set of short stories
- actors engaged to convey the information
- motivation factor to ensure that users see all offered content
- interactive virtual environments to enable users to explore reconstructed cultural heritage object or site
- easy and intuitive navigation

We have applied these guidelines in creation of Kyrenia interactive digital story in order to show advantages and drawbacks of hyper storytelling methodology.

### 3. Related work

Importance of interactive digital storytelling for presentation of cultural heritage has been recognized by the European Commission by issuing several calls for proposals in this area. EMOTIVE project [Emo] is already offering valuable contributions through production of prototype tools and applications capable of generating immersive, personalized digital narrative experiences for museum and heritage site visitors. However, in hyper-storytelling we are not focused on personalization of user experience as much as on level of perception of conveyed information and edutainment value of the presented content. We strongly believe that users need to see all available material, otherwise the production costs are not justified.

In our quest for narrative paradox problem solution, we encountered several works arguing in favor of emergent narratives [LA03], [Ay199], [TSF12], as stories that emerge from the interaction between players and the systems that govern gameplay. As our application can not be considered a game and our scenario is already predefined, this solution was not applicable.

In [HJM12] the authors propose a solution to narrative paradox in form of modelling the narrative as multiple threads, woven together to create a braid, thus managing the narrative paradox by separating logical cohesion within threads from thematic cohesion across the whole braid. Again, this solution refers to adaptive documentaries, while our application aims to combine storytelling with interactive virtual reality.

Most of the literature related to narrative paradox solutions,

while discussing alternate reality and role playing games suggests implosive stories, present in alternate reality games (ARGs), which allow to understand the problem of action and narration in interactive fiction and can help design more engaging spaces and environments [Gou09]. The described experiences will be of great value in the future serious game edition of our project.

Among interactive storytelling cultural heritage presentations we studied the "Heart of stone" project [Dvo15], containing interactive documentary which immerses the user in the culture and traditions of the Khakas people, [MWZ\*13] providing intelligent assistance to story construction in museum storytelling, [VKK\*14] explaining how multimodal serious games can create immersion to enhance the visitor's experience, and finally a very valuable CHESS project [CHE] which attempted to integrate interdisciplinary research in personalization and adaptivity, digital storytelling, interaction methodologies and narrative-oriented mobile and mixed reality technologies with a theoretical basis in museology, cognitive and learning sciences. In comparison, hyper-storytelling offers a simpler approach, aiming to attract the users through quality of storytelling and efficient information distribution and enabling them to virtually visit the 3D model of selected cultural heritage object and experience what they have been watching in stories.

### 4. Kyrenia interactive digital story

A ship sank around 288 B.C. near Kyrenia, Cyprus. Its remains were found in 1967 by a Cypriot diver looking for sponges. A major salvage operation has been conducted. Remains of the ship were conserved using special chemical procedures. Studying them, the archaeologists discovered details from ship's past, life on board and other interesting elements of seafaring in Mediterranean during that historic period [Kat12], [Dem13]. Several replicas of the ship were created, one of them exhibited in Thalassa Museum at Cyprus (Figure 1).



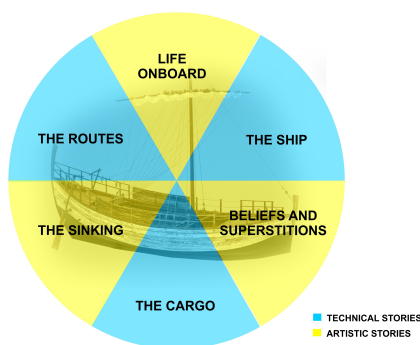
Figure 1: Kyrenia ship replica

Kyrenia interactive digital story aims to introduce Internet users with this ship, as an important cultural heritage object, through a set of short stories. After watching all stories the user is granted an opportunity to virtually embark the ship, browsing the interactive

virtual environment based on its 3D model. This application should serve as a proof of concept for hyper storytelling IDS method we developed. It is created according to guidelines described in Section 2. Two actors are engaged as narrators in the stories. Motivation factor for users to see all stories is the possibility to browse the interactive model of the ship. Here we will describe the workflow of the project through its three main stages: pre-production, production and post production.

According to hyper storytelling applications creation workflow [RDA\*17], Kyrenia application implementation has started with scenario development, visual styling definition and production planning. After obtaining the background historical information from archaeologists, we engaged a movie director and screenwriter to work on the structure of the application (Figure 2) and scenarios for digital stories. It was decided that the application will consist of 6 digital stories and an IVE of the ship.

Stories are divided in two groups: technical and artistic. Technical stories introduce the viewers with the technical characteristics of the ship, the cargo transported by the ship and the routes where it might have sailed. Artistic stories are about the following topics: sailors' beliefs and superstitions, life on board the ship and assumptions how it sunk. Artistic stories are designed as a combination of footage recorded in natural locations and animations of illustrator's drawings (Figures 3a and 3c), while technical stories are a combination of the actor recorded on the green screen and blueprints of the ship and its particular parts, seafaring routes and objects found in the shipwreck (Figure 3b).



**Figure 2:** *The structure of Kyrenia application*

After the users have seen all stories, the virtual environment opens and they are placed inside the 3D model of the ship. They can explore it and sail it around the virtual seascape.

The main design elements of the project are illustrations based on motives from Greek vases. They are used for animations in artistic stories and as background image for the web site (Figures 3a and 3d). After the illustrator has set up the visual style of the project, the rest of production consisted of composing original music, location and green screen footage recording, UI/UX design and backgrounds animation.

Interactive virtual environment of the reconstructed ship was created in Unity 3D (Figure 3e). The 3ds max model of the ship was

imported into Unity 3D and added the realistic skybox with lighting, water and terrain. For the user we have designed two types of interaction with the ship: drive the ship in virtual environment from the third person perspective, or walk on the ship and examine the model in detail from the first person perspective. The virtual environment was exported to Unity WebGL Player and incorporated into Kyrenia web site.

In post production we put together all elements prepared in production stage. They were also combined into an intro video to be played at the beginning of the user visit. The intro has a role to kindle users' interest in the content, informing them that they can embark the virtual model of the ship only if they see all six stories. They can follow their progress through a counter of watched stories at the bottom of the home screen (Figure 3d).

Kyrenia interactive digital storytelling application [Kyr] was created by 20 people from different professional backgrounds. We believe this is the only way to create a successful IDS product and obtain maximum user satisfaction.

## 5. User experience evaluation

In order to evaluate the Kyrenia pilot application we have conducted an user experience survey. Motivation for this evaluation approach was acquiring users' feedback in an efficient manner with respect to evaluation time and costs and avoiding strongly controlled environment of user under observation. Approaches to evaluation of IDS differ regarding to the primary goal: finding flaws and helping developers to improve the interaction [LFH10] or acquiring standardized data for systematic testing of research hypotheses [VRVK10]. At this pilot phase our primary goal was usability testing aimed to improve the pilot application and identify the most evident flaws. In the same time, we wanted to assess our evaluation approach, as the first step in developing more generalized instrument for measuring characteristics such as edutainment and immersion.

We have decided for self-selection of users, with emphasis on their reliability, and openness to convey negative opinions and disclose the information on time dedicated to interaction. In order to ensure that the responses represent diverse cross-section of respondents and to establish validity of survey responses we included questions for relevant demographic data: age, education and computer skills ([LFH10], [LP01]).

The evaluation involved 41 participant. Since presentations of digital heritage are intended for a broad audience, we have invited users representing different groups including school children, students, and professionals. We have selected and balanced different user types regarding their professional background (art, engineering, history, natural and social sciences) and computer proficiency (basic, intermediate, and professional). Users were invited by email to view the digital stories and embark the virtual model of Kyrenia, and after that to fill in the web-based survey summarizing their perceived experience.

Our prior experience in evaluation of multimedia cultural heritage applications showed that users were very frustrated when answering long questionnaires, especially when they have noticed



**Figure 3:** Kyrenia hyper-storytelling application screen shots: a. Illustrations for digital stories, b. Actor superimposed upon the animated background, c. Captain's wife telling a story, d. Kyrenia project's home page, e. Interactive virtual environment of the ship

several questions addressing the same issue but in a different way. This proved to be very demotivating and affecting the reliability of their answers.

The evaluation was based on rating the set of statements on the 5-point Likert scale ranging from Strongly Disagree to Strongly Agree. The statements were mixed, both positive and negative, and responses were translated into unified scale ranging from Strongly Negative to Strongly Positive. The survey included open questions for user comments. The survey contained following sections: (1) introductory part with user demographics data; (2) questions assessing level of completeness of user specific path through the Kyrenia IDS; (3) main part with Likert scale questions addressing digital stories (20 questions) and Kyrenia virtual model (15 questions); (4) questions related to general user satisfaction features as visibility and user control.

Distribution of responses for digital stories and Kyrenia model is presented in Figure 4, in accordance with [HR14] to facilitate identification of weak and strong points of the pilot. Prevailing Strong Positive and Positive answers are easy to notice, and this positive response of users is similar when rating both edutainment and immersion. The higher percentage of negative answers for the virtual model was expected for the pilot version of the application as the ship model was not entirely completed, but the fact that the users got to visit the model tells us they watched all 6 stories, so the introduced motivation factor has contributed in solving the narrative paradox.

At the end it is worthy to cite the statements with the highest

positive rating: "Sailors' life was very hard and dangerous.", and "I would like to see more stories about the ancient Mediterranean." illustrating empathy and curiosity raised by interacting with the Kyrenia application.

## 6. Conclusion

Kyrenia hyper storytelling application, apart from communicating heritage information about one of the oldest sunken ships, aims to serve as a proof of our new IDS concept. In comparison with related work and our previous IDS projects, we emphasize as the main contribution of this method introduction of the motivation factor as our solution of the narrative paradox problem. Even having a choice of watching stories on demand, users still decide to watch all of them in order to be able to embark the interactive model of the ship. This way all presented content is perceived.

The conducted user experience evaluation shows that we achieved a high level of edutainment, as users state that they learned about the ship in an attractive and amusing way. They have also acknowledged some drawbacks, mainly related with the interactive virtual environment of the ship, but that part of the application needs some more work anyway.

We conclude that interactive digital storytelling could become a major tool for heritage communication, as it follows the logic of Internet and new media, offering chunks of information and appreciating users' lack of time and patience. We forecast that most of media communication will move in this direction in the future.

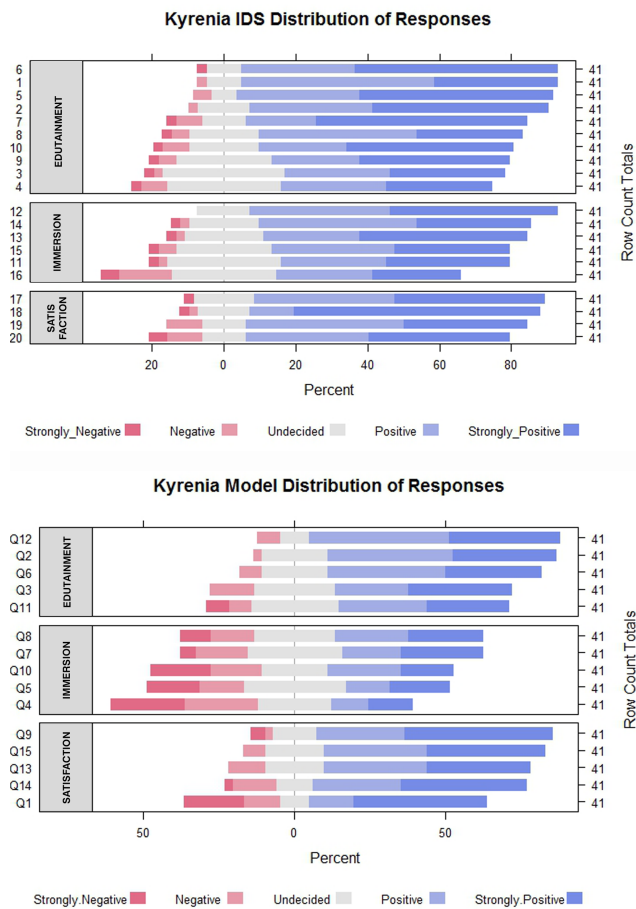


Figure 4: Distribution of evaluation responses

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