

Hack the Map 3D Video Game: Escaping your destiny through Rigas' Charta

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Abstract: Celebrating the two hundred years from the Greek Revolution of 1821 and the War of Independence, Onassis Library, in collaboration with the Cartographic Heritage Archives of General State Archives of Greece and the Department of Geography of Harokopio University, implemented a series of digital workshops on 3D video game design in order to motivate teenagers to interact with one of the most emblematic maps of the eighteenth century and a major artefact of the Greek cartographic heritage: Rigas Velestinlis' Charta (map) of Greece (1796–1797). In 2020, four (4) school teams consisting of sixty-five (65) students 13-17 years old, brought to life the map that inspired the Greek Revolution of 1821, transforming it into a 3D video game for PC or Android devices. By using innovative mixtures of history, geography, cartography, visual arts, and information technology, they managed to build a third-person puzzle game with one hero (Rigas) who had to run through the Charta region to escape imprisonment by solving twelve (12) riddles, collecting all the scattered sheets of the revolutionary map and unifying its parts. This educational activity broke out of the traditional classroom routine, enhanced the engagement, collaboration, and communication of the youngsters, fostering their creativity and their connection with the cartographic cultural heritage. Learning through game-making stimulated literacy development and improved the digital skills of the participants. The success of this innovative educational experience led to the development of an Augmented Reality (AR) application entitled "Rigas' Charta," available at Google Play for Android devices and to the implementation of the game-developing course to an online National Student Competition entitled "Hack the Map: Rigas' Charta" for the school year of 2020–2021.

Keywords: 3D Video Game, Historical Cartography, Rigas' Charta, Digital CartoHeritage, Escape Rooms, Game Based Learning (GBL)

1. Introduction

The Onassis Library is a cultural space which holds a great number of historical objects, documents, archives, and artworks, that became accessible to the public in 2016. Since then, the library has been organizing educational and cultural programs inspired by its special collections, promoting its cultural wealth by investing in research, education, and new technology techniques. In 2020, commemorating the 200th anniversary of the outbreak of Greece's War of Independence from the Ottoman Empire (1821), the Onassis Library in collaboration with renowned institutions implemented the digital workshops entitled "Hack the Map: Rigas' Charta." This innovative program motivated sixty-five (65) students 13-17 years old to reuse and reinterpret the Charta, through new technology tools and digital applications.

Rigas' Charta is a 12-sheet map (each ~50×70 cm), printed in Vienna in 1796–1797, which is widely considered the most prominent example of Greek cartography in the pre-revolutionary period (18th c.) (Figure 1). The creator of the map, Rigas Velestinlis (1758-1798), a scholar, secretary in Ottoman administrative hierarchy, wealthy merchant, and prominent personality of Modern Greek Enlightenment, is known for his radical activism. His progressive views about the role of education in creating citizens devoted to the idea of personal, national, and social freedom and his liberal ideas in the spirit of French Revolution about the creation of a free, democratic pan-Balkan Republic, influenced the Greek War of Independence (1821-1830), as well as similar movements between the neighboring people in the Balkans (Daskalakis, 1937).



Figure 1: Rigas' Charta of Greece, 2x2 meters, 12 map-sheets, Vienna, 1796–1797, source: Onassis Library, photo: Yiannis Soulis

By combining the scientific fields of history, geography, literature, computer graphics, and visual arts, “Hack the Map” digital program aimed at rediscovering a primary source of great cultural value, a so-called ‘multimedia’ of the eighteenth century, inviting school teams to study it, to decipher the meanings of its iconographic elements, and to bring to life the mythical stories and historical events that are engraved on it. This interdisciplinary educational initiative developed an innovative educational model for teaching, by applying OBL (Object-Based Learning), GBL (Game-Based Learning), and PBL (Project-Based Learning) approaches. Through four (4) training sessions (12 hours), the participants managed to upgrade their digital skills and enhance their scientific knowledge. They became technology creators, they came across historical documents, old editions, and archives, familiarized themselves with Hellenic cultural and cartographic heritage, and explored interactive ways of reusing rare material, modifying and promoting it, in order to attract and engage a younger audience. The result was the creation of a 3D video game based on Rigas Velestinlis’ life and works, entitled: “Escaping your destiny through Rigas’ Charta”. The title of the Game was inspired by the importance of this historical document regarding Rigas Velestinlis’ fate, as he was arrested trying to transfer the copies of this map from Vienna to Trieste and this cartographic element was characterized as the main incriminating evidence, that led to his martyrdom (Legrand, 1892, Livieratos, 2008). An interesting detail in his biography, is that when he was arrested, he had also in his luggage a German history card game (Legrand, 1892). Being open to new pedagogical methods and an advocate of lifelong learning, Rigas, definitely could be considered as a pioneer in GBL and OBL.

2. Game Description

After an introduction to the history of cartography, focusing on the age of Enlightenment in eighteenth-century Europe, and analyzing the personality and works of Rigas Velestinlis, the students studied educational material provided by the Onassis Library and the Cartographic Heritage Archives, in order to find an appropriate title and an engaging story for their 3D video game. With the guidance of two lead professors and the support of the corresponding program educators, they managed to develop an original scenario which is described below:

“Vienna 2020. The hero of the game finds in the attic of an old, abandoned printing house, inside a locked chest, a Greek newspaper of 1797 along with the torn pieces of a map. As he reads the newspaper, his eyes focus on the following lines: ‘...the twelve-sheet Map of Greece created by Mr. Rigas has been published and is sold in Vienna and other cities of his choosing, for the price of three groschen per issue.’ At this moment, something magical happens. Our hero travels back to the eighteenth century and is transformed to Rigas Velesinlis. He lands on a vast area of a map of Greece, trapped. As he is trying to figure a way out, he realizes his purpose in life: The creation of Charta and the educational, spiritual, and national awakening of Greeks, strengthening the desire for freedom, democracy, and equal rights.

You must help Rigas escape! Run through the map amongst ancient monuments, historical battles, and mythological heroes, find the secret symbols and solve the riddles to piece together the 12 sheets of the Charta. Live the adventure, face your destiny, and join the pieces of the puzzle in order to win. Learn the heroic life story of Rigas through an exciting time travel.”



Figure 2: Screenshots from the 3D video game “Hack the Map: Escaping your destiny through Rigas’ Charta”, photos: Kostas Diamantis

3. Pedagogical Goals

The main objective of the 3D video game was to highlight Rigas’ Charta and to motivate the new generation to reveal its secret symbolisms with the help of new digital technologies. This kind of rare and valuable material is usually stored in closed libraries, in strictly guarded areas, on locked shelves and cabinets, for reasons of security, maintenance, conservation. Access is therefore difficult for the average user. Furthermore, there are only few references to Rigas’ Charta in school textbooks. Thus, the fact that the design and the development of the game was implemented by students was a very challenging parameter for the entire educational program.

The pedagogical goals to be achieved by the school teams were set on two levels: firstly, as creators and secondly, as users.

The creators of the 3D video game were expected to:

- Learn about the heroic life and the revolutionary personality of Rigas Velesinlis
- Enrich their knowledge about the Age of Enlightenment, the ideas, influences and effects
- Learn about the history of map creation in the past
- Study the iconographic details of the Charta
- Realize how the symbolic language of the map, old or new, can be used to transmit various kinds of information, form ideas and opinions, discard stereotypes and prompt to action

- Combine distinct scientific fields, talents, skills, and technologies in order to synthesize a cooperative digital project
- Conduct historical research and get in touch with primary sources, old maps, and archival material
- Get acquainted with innovative digital tools and techniques
- Collaborate, cooperate, and communicate with their classmates and their professors, set targets and timely complete them
- Visualize ideas by using their knowledge and imagination, in accordance with new digital technologies and contemporary communication practices.

The users of the 3D video game were trained on:

- Learning about Rigas Velestinlis' purpose in life
- Learning about the twelve (12) sheet map he created in 1796–1797 in Vienna
- Identifying twelve (12) symbols on the Charta
- Solving twelve (12) riddles and revealing the secret messages Rigas wanted to transfer to the Greeks
- Helping Rigas to escape his destiny and unite the pieces of his map, spreading the seeds of freedom and justice for all the enslaved people
- Having fun while acquiring new knowledge.

It has been observed that there are a lot of benefits of using museum collections in learning, with a particular focus on using object-based learning (OBL) to support student learning of 'threshold concepts' and coping with 'troublesome knowledge'. Working with historical objects in education, enhances and makes the learning process more effective. OBL offers an interactive experience for students, challenging them to critically address a variety of topics, interacting with each other and focusing on the subject (Hannan et al., 2013). It has been established that 'object-handling has a long-lasting effect and relationship with memory, more so than text-based learning often has' (Romanek, D. & Lynch, B., 2008, p.284). Biggs explains that 'the more teaching and learning activities tie down the topic to be learned to multiple sensory modes, the better the learning' (Biggs, 2003, p.80). The above learning approach mediates and enhances learning, facilitating the substantive and in-depth understanding of a cognitive area (Freeman et al., 2014) leading to a long-lasting effect and relationship with memory, more so than text based handling often has. (Romanek, D. & Lynch, B., 2008, p. 284).

The aforementioned effect is amplified and becomes a novel experience when it is mixed with Game-Based Learning (GBL), in which computer game mechanics (such as a point system, reward system, leaderboards, competitive play, achievements etc.) are adopted in a virtual learning environment constructed by educators. Such methodology motivates further, encourages problem-solving, and strengthens understanding (Gee, 2005). GBL is not meant as a replacement to the traditional teaching methodology but rather as an attractive alternative in order to motivate a younger audience, already familiar with technology, to learn and interact with otherwise difficult to understand topics (Papadakis & Kalogiannakis, 2019). Research indicates that there is a direct association to a student's in-game performance to their decision-making skills that contribute to a positive response to the learning process (Squire, 2006).

Moreover, during this educational program we implemented a Project-Based Learning (PBL) instructional approach, giving students the opportunity to develop skills needed in a modern environment and improve their knowledge through projects that encounter real-world challenges and problems. By applying this non-traditional teaching model, the participants worked on concepts and ideas collectively, divided in small groups for discussions and brainstorming, in order to result to the best solution to each issue or dilemma. This active mode of teaching extended learning beyond the classroom, connecting intellectual inquiry to lived and felt experience. In addition, it provided innovative personality development, transforming the participants from passive consumers of technology to active contributors and linking education with entrepreneurship.

4. Methodology

The methodology of the game creation consisted of the following six (6) stages.

4.1 Stage 1: Research and collection of material

In this stage, the educators prepared rich educational content regarding the Age of Enlightenment, Rigas' life and works and the creation of his Charta. Thematic videos, demonstrative scenarios, bibliography, worksheets and other educational resources were delivered to the school professors, in order to encourage, inspire and

support students to the search and in-depth study of the main topic. All the relative material was uploaded to an open access educational platform, Classroom, aiming at providing students and professors with complete and more direct services.

4.2 Stage 2: Theoretical seminars inside a historical library

In the context of the educational program “Hack the Map” the school teams had to visit the Onassis Library and participate in a series of lectures (3 hours) on History of Cartography, History of the Neohellenic Enlightenment and Rigas’ revolutionary activity during that period. Furthermore, the participants had the opportunity to observe and be inspired by an original copy of Rigas’ Charta, which is the main exhibit of the library. Finally, they could ask questions and receive answers by a specialized team of educators (historians, documentarists, cartographers, geographers, researchers, visual artists) who were also involved in the event.

4.3 Stage 3: Scenario building

After the theoretical briefing the school teams had two weeks to decide on a title and prepare a short script for their 3D Video Game, making the best use of the educational material available. The main concept should engage and motivate the user to enjoy their own digital creation.

4.4 Stage 4: Selection of twelve (12) stories

Rigas intentionally incorporated in his map symbols derived from the rich classical and European cartographic and literary tradition (Livieratos, 2008, Pazarli, 2014). This rich thematic material was the basis to create the 12 questions of the game (Figure 3). Following this, an initial selection of twelve (12) stories took place, prioritized with emphasis on their educational value, e.g., the Female figure on the forehead symbolizes the basic principles of a new State (justice, equality, independence, reason, quality education, toleration, fraternity), the Ancient Greek theater is connected to the liberating power of Art, the Naval battle of Salamis or the depiction of the battle between Hercules and the Amazon is a metaphor of the ongoing battle between the Greek democratic spirit and Asian despotism, etc. (Figure 3). The selected stories were accompanied by twelve (12) riddles which the players were asked to solve, in order to collect the twelve (12) sheets of the map and complete the puzzles of the Charta. This way, students were intrigued to re-approach Rigas’ life and learn how these stories and myths relate to the ideals of Revolution and Freedom.

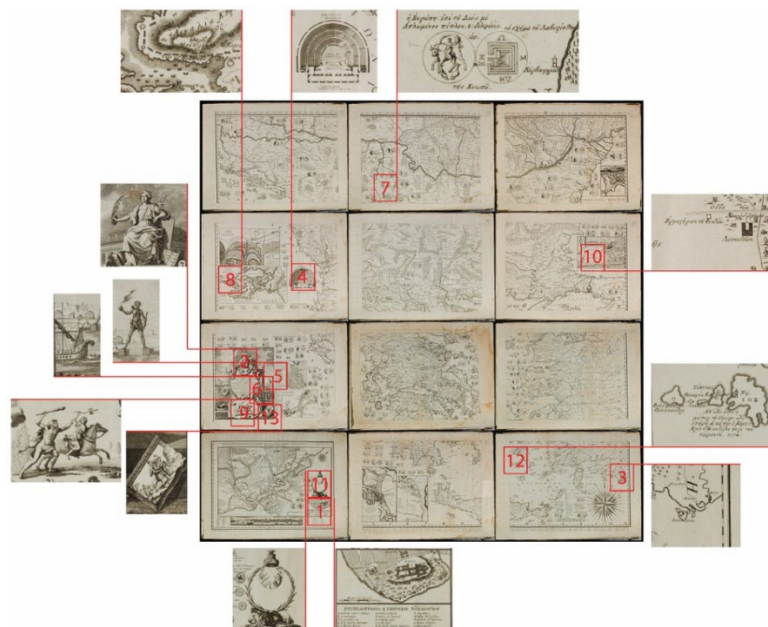


Figure 3: The twelve points of interest and the relevant details, upon which the questions of the game were based: 1. Constantinople 2. Female figure on the forehead 3. A sunken city 4. Ancient Greek theater 5. Colossus of Rhodes 6. Ancient trireme 7. 162 ancient and medieval coins 8. Naval battle of Salamis 9. Hercules and Amazon 10. Ancient Olympia and the Olympic games 11. Sleeping lion 12. Ios island and the tomb of Homer, photo: Maria Pazarli

4.5 Stage 5: Selection of technological equipment, tools, programs

For the creation of the game application, the following equipment was selected:

1. Hardware
 - A laptop for every student; each laptop had a wired connection with access to a shared folder
 - Free internet connection
 - A projector connected to a laptop for the instructor
2. Software
 - Autodesk 3ds Max 2016 educational edition: a software used to create 3D models, complete with textures and animation and is one of the most used tools in the games and VFX industries
 - Unity 3D 2017.3.1f1: an advanced computer game engine that combines all the multimedia elements into a final app or game for various platforms, such as web, mobile, PC etc.
 - Gimp: a free software with a wide array of tools used to edit 2D still pictures and create images and textures
 - Openshot: a free video editing software that can combine and animate 2D elements and effects, producing a video file
 - Chrome: an advanced web browser used for accessing material and testing
 - Audacity: a free software used for audio mixing and editing

4.6 Stage 6: 3D Video Game Implementation - synthesis

The 3D video Game implementation was implemented during three (3) workshops (3 hours/each) which took place in the school computer laboratories and in the premises of Onassis Stegi. There, the students learned the basic principles of game design, level design and gameplay design. In parallel, they were trained in 2D and 3D graphics creation, basic coding via simple scripts, and animation techniques.

More specifically, an introduction was made to the 3D modeling software 3ds Max, following the creation of a simple 3D object for each student, representative of each of the twelve questions of the game. After locating and recognizing the various symbolic depictions and the hidden myths and stories they represent, the students were asked to choose an element to demonstrate how to convert this into a 3D object and build the basis of each of the twelve (12) questions. The next steps would be to import the objects into the Unity game development platform, demonstrate the engine's interface and mechanics, as well as to learn some basic world-building functions and in-engine modeling, animating, scripting assets and effects, such as particles. Animations that would play on a loop were created for most stories with random offsets in order to enrich variation whilst keeping the project optimized for mobile devices as well. Scenes from the Charta were used in some instances and were brought to life by animating the separate elements in 2D or by animating a 3D skeleton; such an example is the scene with Heracles and the Amazon (Figure 4). For certain stories, 3D models optimized for mobile usage were created and exported with custom animations into the Unity 3D game engine. The final material and texture setup took place inside of Unity, with mobile-optimized materials as well for maximum device compatibility. Animations were either created entirely inside of Unity 3D and were initiated via code (some simple geometry objects, such as the coins), or they were imported from the 3D modeling software. A background music track was applied throughout the application and various sound effects per riddle were created and triggered via scripting, as well as narrations for certain events, using the Audacity software. Some additional effects, such as particle effects, were created in order to depict flames or dust for example. Finally, some graphic elements were designed using the Gimp software for the presentation of the app whilst maintaining a unified aesthetic look.



Figure 4: Heracles and the Amazon, source: Hack the Map video game, photo: Kostas Diamantis

All the above were combined into a single project so as to have access to all twelve questions in a game primarily built for Windows 10 devices but also compatible with Android devices. All questions and answers derived from the provided educational material and by examining and exploring the original Charta. Through this innovative educational activity, the students managed to build a 3D ‘escape room’ with various trigger points in a digital environment, experiencing the game developing production process from start to finish while producing a short serious game inspired by Rigas’ life. (Figure 5)



Figure 5: Rigas in front of some puzzle questions, source: Hack the Map video game, photo: Kostas Diamantis

Regarding the game mechanics and the visuals, a unified artistic look was chosen to successfully combine material from various sources while keeping a common aesthetic and achieve better device compatibility. A third-person camera was chosen to both empathize with the main character but to also facilitate the riddle-solving mechanisms. Furthermore, the design of the game itself aimed to reward and not punish the player; to that end an incorrect answer would not have a negative impact on the user. A capture video of the 3D Video Game was uploaded on the [Classroom](#) educational platform.

5. Assessment

In order to evaluate the pedagogical value of the educational program and the 3D Video Game, a combination of anonymous questionnaires, direct feedback, reflection, and observation was performed both at the end of each session and after the completion of the series of four workshops. Positive commentary was received by all participating parties (students, professors, educators), with emphasis on the structure, originality, quality, educative value it offered being an interdisciplinary initiative.

According to the anonymous questionnaires, the assessment results were the following:

1. The implementation of the educational program was considered excellent as there was direct communication and facilitation from the organizers and took place inside venues where all the required technical equipment and resources were available to each participant.
2. The structure exceeded the expectations created by the program announcement as beside the scheduled training sessions, the educators provided online documentation and support, in order to help and assist school teams further develop their digital projects.
3. The content was characterized as inspiring and innovative as it combined various cognitive fields with advanced technological tools. Most of the participants answered that they got in touch with new ideas and new information and learned new digital practices and techniques through this experiential educational activity.
4. The lecturers and instructors were assessed as adequately prepared on the topics they presented, effective in transferring knowledge and open to dialogue, fostering an ambience of collaboration and participation. The presentations were considered very inspirational and the provided source material very detailed and challenging in a manner that reinforced creativity, imagination, and ingenuity.
5. The participants enjoyed most the cooperation between people with various interests, the new knowledge, and digital skills they acquired, the fact that they became creators and not consumers of technology and the different perception they gained regarding the lessons of history and geography. On the other hand, they liked least the considerable amount of time they needed to spend on this demanding project, the high degree of difficulty faced and the great effort they had to make in order to succeed their goal.
6. The 3D Video Game created was tested by the educators and the classmates of the school teams and the feedback was very positive. The quality of the game was satisfactory and the user experience very pleasant. It was easy to play, and its educational purpose was simple and clear. The questions selected for the puzzle game motivated the user to seek and learn, strengthening participation and engagement. Visualization helped in understanding difficult or abstract concepts, especially for visual learners. The basic principles of constructive learning, experiential learning (ExL), and discovery learning were combined and delivered through a rewarding system, which greatly encouraged the educational process.
7. In general, the participants were very contented and proud with the digital project they managed to complete, and they were willing to participate again in relative educational events. Also, they noted that they would be very pleased if such kind of activities were incorporated in the main high school program of studies in Greece.

6. Conclusions

“Hack the Map: Rigas’ Charta” was an interdisciplinary educational program combining the fields of museum education, history, geography, and cartography with advanced technological tools. The implementation of digital projects, inspired by a cartographic document of the eighteenth century, was a collaborative activity, that developed student’s personal qualities, enhanced participation, encouraged original thinking, and promoted positive behavior, trust, and contribution amongst them. This contemporary learning approach created an attractive classroom atmosphere and set the basis for the establishment of a new educational model that would give students the required skills in order to compete effectively in the twenty first century and face the challenges of the future.

Although the program was rather difficult and attracted students with different interests, experiences, perspectives, talents, and needs, it managed to unite them under a collective effort due to the project’s demanding nature, triggering Project-Based Learning (PBL). The use of different learning materials and resources provided by the Onassis Library and the Cartographic Heritage Archives, allowed students with various principal learning styles to understand information while boosting their imagination. Moreover, the conception and creation of the digital works gave the students satisfaction, self-esteem, and the freedom to discover their capabilities and individual potentials, promoting dialogue and interaction. Due to the novelty of the concept, this educational program contributed to the cultivation of many different abilities of the participants, including ‘soft skills’ such as understanding, empathy, and communication. Also, learning was fostered by multidimensional interactions between students and their professors, improving their relationship and encouraging the exchanging of ideas.

In addition, this educational activity contributed to the students' positive association with the Onassis Library and its exhibits, and to the formation of a high-quality visitor experience. Through the Object-Based Learning (OBL) approach, students had the opportunity to observe and interact with rare cultural objects, artworks, books, and archives, learn about their protection and conservation and use tools and methods drawn from different disciplines. The adoption of an open access policy for a space full of rare cultural materials amplified the creative expression of the participants and produced interesting associative connections between the theoretical lessons and the material culture, aiding the cognitive process and enriching the learning outcome.

The 3D video game "Hack the Map: Escaping your destiny through Rigas' Charta" strengthened the emotional involvement of users with a historical document and cultivated a positive attitude and enthusiasm towards the learning process, enriching the content of history and geography lessons and creating awareness on cartographic cultural heritage using innovative technical tools in education. The need to devise new teaching methods that appeal to demanding students, in combination with the usage of digital games, led to the adoption of gamification as a learning methodology, focusing on disguising an existing learning process so that users perceive it as a game (Landers, Auer, Collmus & Armstrong, 2018). The gamification approach was successfully implemented in the Rigas' Charta 3D video game, encouraging creative thinking, allowing discovery learning, giving the user a feeling of surprise and excitement, and promoting diversity in education by creating opportunities for students to develop new and different learning styles. The importance of this approach focuses not only on the reward mechanics (Kapp, 2012), but also on the interesting combination of physical and virtual worlds, the immersive mixed reality experiences, the satisfaction of the unexpected, and the joy of discovering hidden symbols and meanings. Finally, the educational program "Hack the Map" intended to bring to light a significant historical document, to animate it, and to motivate the next generation to reuse and reinterpret hidden treasures of the Greek cultural tradition through new technology applications and visual art creations.

The success of this innovative educational experience led to the development of an augmented reality (AR) application entitled "[Rigas' Charta](#)", available at Google Play for Android devices (Figure 4). The application was the 1st Runner Up in the Best Use for Fun Category of the [2021 Digital Humanities Awards](#). Thanks to the positive outcome of the "Hack the Map" program, for the running school year (2020–2021), a National Student Competition was also organized, addressed to all Secondary Schools of Greece with remarkable [results](#) in the category of 3D Video Game.

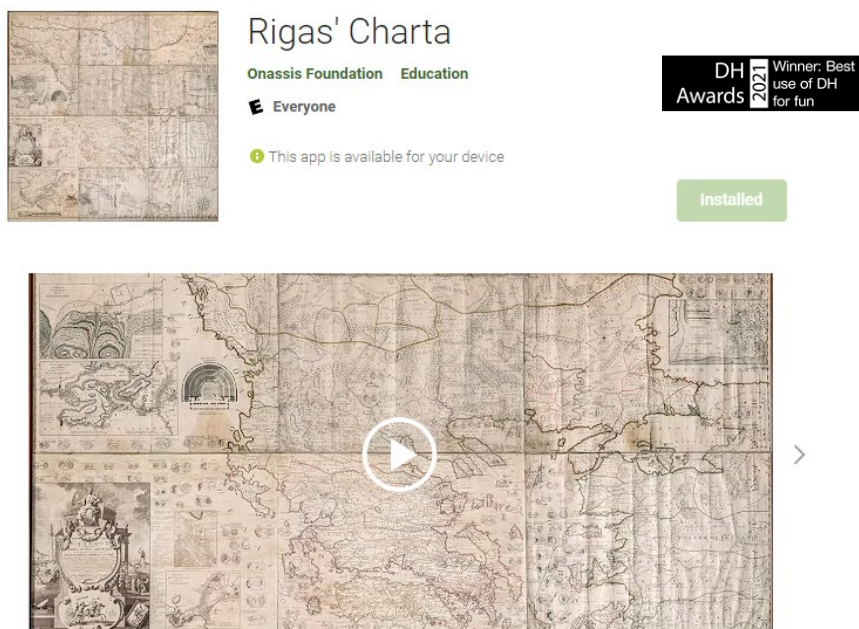


Figure 6: Rigas' Charta, AR application, source: Google Play, photo: Kostas Diamantis

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