Cretan cultural landscapes: using virtual reality to promote the marine and mountainous environment of Mirabello. The experience of the research project DIATOPO in Crete

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Abstract. This paper aims to present "Cretan cultural landscapes over the time: promoting marine and mountainous environment of Mirabello – DIATOPO" (hereafter DIATOPO) a multidisciplinary research program exploring and documenting the cultural heritage of Elounda and its surrounding landscapes. DIATOPO's primary goal is to develop novel, suitable, and effective methods for the application of different and diverse cultural heritage documentation practices as well as ways of promoting marine and mountainous heritage landscapes and raise awareness for cultural and natural heritage preservation. Focusing on eastern Mirabello gulf, the program gathers all kinds of archaeological and historical resources, produces knowledge and reinforces deeper understanding of the landscape and its multiple past and present uses. Drawing from the content produced through archaeological and historical research, analysis of the environmental conditions of the archaeological sites, documentation and mapping sites through geoinformatics methods and practices (aerial photography, underwater documentation, geophysical mapping, 3D landscape and architectural representations) DIATOPO designed four heritage routes that connect Elounda and its marine antiquities to the byzantine heritage site on the mountain of Oxa. Within its scope, DIATOPO combines all relevant resources in a virtual reality application in an effort to creatively disseminate scientific knowledge concerning the natural and cultural landscape of the region and experiment with state-of-the-art digital means.

Keywords: Cultural heritage documentation, virtual reality application, 3d landscape representation.

1   Research Context

1.1   Goals and objectives

The idea of DIATOPO was developed on the basis of recent scholarship concerning the ways in which cultural heritage documentation can become relevant to the public (Simon 2016) and meaningful for local communities, tourists and the society at larger scale (among others Fernández et al 2012). The context of Mirabello gulf provided a great case study for this research. Elounda, the village located on the southern side of the gulf, is today a world famous tourist destination. Attracting most of the tourism attention, Elounda is considered to be the center of the region of Mirabello, thus overshadowing other sites of interest. Oxa, an outstanding mountainous landscape centred around the Timios Stavros byzantine church is one of them. What is today known as the ancient Olous, the underwater site which is being investigated by a team of marine archaeologists in the bay of modern Elounda and around the so-called island of Kolokytha, along with the peak of Oxa have been our two major focal points. Our multidisciplinary team has been researching these two sites as well as sites of historical interest such as the salt pans of Elounda and aspects of the natural environment.

East Crete, due to eustatic and tectonic processes, appears to have several submerged sites, seven of which are found in the Elounda bay. This phenomenon is expected to gradually increase risk caused by climate change and its negative impact on the natural and built environment according to European Environment Agency 2012 report (EEA 2012). At the same time, the mountainous environment is equally at risk. Peak of Oxa is facing the multi-sided issue of desertification in the same way as other Mediterranean mountains and regions (Dubost 1997). Dealing with these growing challenges that make cultural heritage documentation and public engagement with its management difficult, DIATOPO team works towards devising new methods by applying practices from different disciplinary fields and combining diverse modes to support creativity and transform research material into a digital experience of the mountainous and marine landscape of Mirabello for the public.

Further, taking into account the local community's turn of interest the project will promote sustainable tourism and will compile directions to protect, preserve and present cultural heritage assets hitherto unknown to massive tourism. Thus the main goals of DIATOPO will try to respond to social and environmental needs including the following:

- Document and promote sites of cultural interest in Elounda (Ancient Olous) and Oxa through digital topographic and geometric documentation by applying the most advanced methods of geoinformatics.

- Implement a GIS database to organize the collected amount of information. This database will be of use for the local and government stakeholders as well as for the tourist industry.
- Define hazards and impact on cultural heritage sites.
- Design heritage routes that bring together marine and mountainous landscape. Emphasis was placed on the urban center of the submerged ancient Olous, salt pans of Elounda, the island of Kolokytha and the fortified site on the top to Oxa mountain.
- Design and implement an interactive narrative application combining video, virtual reality, historical information and 3-D models of archaeological sites. This application aims at providing ways to attract interest in geoarchaeological trails and routes that connect land and off-shore archaeological and historical sites of Crete.
- Enhance and empower cultural and environmental education through easily usable and reliable information about the history of the place and the formation of its natural landscape.
- Disseminate new knowledge produced through the combination of the collected amount of information by three groups involved in the research: scientists, local communities and tourists.
- Attract tourists' interest and increase tourism through enhancing high quality tourist products of the region.
- Draw from the experience of designing and implementing the interactive application to compile good practices for the preservation and promotion of heritage sites, the engagement of local communities and tourism.

2   Working together across disciplines

2.1   Transdisciplinarity and novel approaches in heritage studies

As a digital heritage project, DIATOPO aims at bringing together diverse understandings of the natural and cultural landscape of Mirabello. Archaeological, historical, anthropological and environmental data concerning sites of interest within our research field were listed in a registry containing visual and textual forms of information providing proper documentation. In this part of the documentation process, team members arranged all sorts of bibliographical references from previous research in Mirabello and combined them with newly produced knowledge through archaeological and anthropological fieldwork.

In parallel, geoinformatic technologies were put into use to map terrestrial and submerged sites of historical and archaeological significance. These methods were not only aimed at documenting sites and spatializing knowledge produced through

archaeological and historical research but also at adding into efforts of preserving the landscape and promoting its cultural assets. As it has been pointed out by many scholars, geoinformatic methods and practices provide efficient ways of documenting cultural heritage and thus protecting and promoting it (among others Sarris 2015, Barrett 2018, Karle & Carman 2020).

Geoinformatic documentation technologies have been extensively applied in mapping terrestrial archaeological sites. In marine archaeology, interpretation of geophysical recordings has been used especially for spotting deep-water shipwrecks (Sakellariou et al. 2007). A major effort of DIATOPO was put into implementing and assessing non-destructive geophysical methods to explore and document shallow submerged archaeological finds in the gulf of Mirabello. To do so, and in order to improve practices of capturing underwater sites, the team of geophysicists brought in the experience of different case studies in the eastern Mediterranean into a comparative account recently published by Nikos Papadopoulos (2021).

The end product of DIATOPO is a web interactive virtual reality application for the transformation and dissemination of the scientific knowledge acquired through our landscape survey in Mirabello, which comprises a major challenge of the project. It demands to convert analog information into digital multimedia, combine diverse research material, find associations between manifold types of knowledge, and make it relevant to different sorts of publics. For this, DIATOPO members have been involved in reviewing and considering digital research infrastructures, disciplinary boundaries, and methodological frontiers.

2.2   A technology-enhanced landscape experience

DIATOPO web application is designed and implemented to provide remote access to the landscapes of the gulf of Mirabello. It is expected to increase interest towards the natural and cultural landscape surrounding Elounda, influence leisure activities (Han, Tom, & Jung, 2019) or even inspire innovative guided tours or other physical experiences offered by tourism professionals. The digitized environment of Mirabello is to facilitate discovery of the place beyond its most known tourist attractions but also beyond what is physically accessible. The overall effort is in line with the emerging sustainable tourism and economy. Experience and knowledge produced throughout the research serves to inform the development of an application where users can "walk" through heritage trails, "meet" scholars and researchers, listen to locals and view various sites that aren't easily accessible.

Cultural and heritage trails and routes as a means to attract local attention and tourism interest in less known sites and their intangible aspects have been widely used in

empirical studies aimed at proposing new experiential activities and increasing our understanding of the multiple dimensions of landscapes (see for example Boyd 2017, Timothy & Boyd 2015). DIATOPO's heritage trails are informed by several development models that have been put forward by scholars and heritage practitioners in Greece and abroad (among other Greek case studies Kanellopoulou 2020). Yet, heritage trails are most often designed to connect sites of interest in physical space. Moving into the abstract and digital space while trying to exploit possibilities and resources offered by cutting-edge interactive technologies is one of the main challenges of DIATOPO.

Our goal, concerning this part of the project, is to design and efficiently implement an interactive experience of the landscape of Mirabello that will go beyond mere reproduction of accurate images and detailed maps. In our effort to expand visitor's experience of heritage sites, we are working on the production of rich content and multimedia material that will enhance views and perceptions of the landscape. The virtual reality application that we are working on is based on a simulation of the world around us which is possible through the use of advanced technological equipment. That also has been tested and assessed in various applications which make use of virtual and augmented reality in several heritage sites around the world (see for example Kenderdine 2019 as well as other publications, projects and exhibitions by Sarah Kenderdine). To move a step beyond that, DIATOPO application is trying to bring in narrative aspects of the landscape. Narrative engagement is expected to be triggered by site-specific video and audio material intertwined with three-dimensional representations of heritage sites that remain inaccessible to the public such as the swallow water ancient remains in Elounda bay.

3   Preliminary remarks

Although the overall research was intended to meet the needs of the so-called digital heritage tourist (Navarrete 2019), its outcome couldn't be more timely, as the demand for digital experiences and digitized activities is considerably increasing due to the Covid-19 pandemic. Pressing conditions of the current pandemic along with parameters that affect cultural heritage such as mass tourism, climate change and loss of interest have been advancing needs for documentation and dissemination as well.

DIATOPO research has been developing for the past two years on two major pillars. The one being the practice and assessment of cultural heritage documentation through technological means and geoinformatic technologies and the other to design and implement a virtual reality application combining digital objects and multimedia material in a three-dimensional environment. Both parts of the research have been faced with challenges and have provided fertile ground for advancements as well as

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considerations regarding the ways in which digital heritage production can be integrated in multidisciplinary research.

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