Building Maps for "the Phenomenological Walk": Three-Dimensional Digital Cartographic Representation of Archaeological Landscapes using Deformed Perspective.

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Abstract. The use of alternative map projections or cartographic depictions of geospace, by means of transforming or distorting the conventional geometry, is often witnessed in Cartography, when the improvement of geospatial perception is sought, especially in areas with dense information. In this context, the present work is an attempt to create an alternative digital three-dimensional cartographic representation of landscapes generated by means of distorted perspective and local deformations, for the interests of the archaeological community. In one of the most debated and thought-provoking books in archaeological theory, Christopher Tilley's "A phenomenology of landscape: places, paths and monuments" (1994) attention is drawn to the close and interactive relationship between man and environment in landscape studies. This phenomenological methodology was grounded on the concept of the 'phenomenological walk', reflecting on and analysing the sensory experience of walking in a landscape. So it is interesting from a cartographic point of view to construct a meaningful archaeological map that will represent the sense of the three-dimensional landscape from the vantage point of the subject or the kind of mental maps that a subject might have brought to mind along a path. To this end we have carried out a digital procedure that allows one to locally deform the terrain in such a way that in the foreground of a three-dimensional thematic map the subject undertaking "the phenomenological walk" is immersed within its three-dimensional landscape, with optional surrounding 3-D features (such as buildings or man-made constructions), while at the background the landscape is revealed in an almost planar view, approaching the appearance of a slightly distorted two-dimensional map, which resembles the kind of mental maps that a subject could be having on its mind while on a path. An algorithm for an interactive tool that will allow for additional local deformations is also developed.

Keywords: landscape visualization, deformed perspective, archaeological landscape study, phenomenological walk, terrain deformation

1. Introduction

The use of alternative map-projections or cartographic representations of the geographic space by means of transforming or distorting the conventional spatial geometry is often witnessed in Cartography, when the improvement of geospatial perception is sought, especially in areas with dense information. This transformation of the map image or the landscape represented, has a cartographic tradition of centuries and it was originally carried out by conventional mapmaking means and tools; examples of such distorted map views can be found for both two-dimensional and three-dimensional cartographic representations, e.g. deformations of poly-focal, rubber-sheeting or local type of space distortion. The digital tools and means of nowadays offer strong support for the creation of such cartographic products and their production, availability and use is continuously evolving and improving.

In this context, the present work is an attempt to create a digital tool for an alternative three-dimensional cartographic representation of landscapes generated by means of distorted perspective and local deformations. A scientific community highly interested and involved in the exploration of such unusual views of landscapes is the archaeological one and the work presented here is the result of a cooperation stemming from cartographic developments in terrain representation, combined with the interests and approaches to landscape by the archaeologists.

Landscape studies have a long history in archaeology and a series of theoretical premises have been largely embedded by now in archaeological narratives. Of the most basic premises, widely accepted, is the fact that human actions and space do not stand as two independent entities in a co-operative or antagonistic relationship. It is generally agreed that there rather exists a reciprocal and meaningful relationship between culture and environment. In this sense human practices are situated in and informed by the meaning of the landscape, while landscape is fluid and constantly inscribed with people's actions, memories and meanings (Tuan 1977, Basso 1996, Tilley 1994, Bradley 1998).

Initial hermeneutical approaches to landscape conceived it as a palimpsest, a multi-layered text that is inscribed on the landscape by people's actions over the years and can be read-off the same way a book can be read (Hodder 1986). Phenomenologists in the archaeological discipline proposed rather that the understanding of the landscape is relational, different for every agent moving about and experiencing it (Tilley op. cit., Anschuetz *et al.* 2001). In this context and under the influence of one of the most debated and thought-provoking books in archaeological theory, Christopher Tilley's *"A phenomenology of landscape: places, paths and monuments"* (1994), our aim is to create a tree-dimensional representation of the landscape to explore the close and interactive relationship between man and environment. Based on Tilley's phenomenological methodology, grounded on the concept of the 'phenomenological walk', the cartographic views produced here are meant to assist archaeologists to reflect on and analyze the sensory experience of a subject walking in a landscape and the kind of mental maps with social associations that a subject might have brought to mind along certain paths. The main idea is that while viewing the landscape as a whole, one also needs to acquire an immersive feeling of

the surroundings, managing somehow to have a local as well as an overall view and perception of the environment.

2. Alternative map projections

Cartography has a long tradition in applying various transformations onto the map image of the geo-space or the landscape represented on maps and this was originally carried out by conventional mapmaking means and tools (see e.g. URL1 for an early version of a focal type of deformation on a map by Braun & Hoggenberg from 1572, or URL2 for the famous Berann's panorama maps). Various examples of distorted map views, such as polyfocal-, rubber- or local deformations etc., can be found for both two-dimensional and three-dimensional cartographic representations (see for instance some indicative work in: Kadmon & Schlomi 1978, Snyder 1987, Fairbairn and Taylor 1994, Boutoura et al 1999, Harrie et al 2002). The digital tools that we have at our disposal nowadays offer increasing possibilities for the creation of such cartographic products; as a consequence their availability and use is continuously evolving and improving and their production becomes relatively easier than in the past (see e.g. Jenny at al 2010, Jenny at al 2011, Boutoura et al 2012, Aza & Koussoulakou 2014). The idea is always to improve the geospatial perception, especially in areas with dense information -the manipulation of space by means of its transformation and display in unconventional manners attempts to serve this purpose. The question usually is how to manage to both focus on details, while at the same time keeping the sense of the overall space and context of the display (what often is referred to as "focus and context" in information visualization, see e.g. URL5). Following the tradition of the basically 2-Dimensional focal maps, an interesting extension of the basic idea is its 3-Dimensional counterpart; here the surface of the terrain and 3-D constructions on it (e.g. buildings, landmarks etc.) are deformed, seeking alternative displays for various purposes. Two prominent cartographic examples within this context were the motive for the present work, namely Jennys' "*TerrainBender*" software for applying deformations on terrain surfaces (URL3) and a superb map of Manhattan by the company Berg (URL4).

What is common in the above is the approach of "focus and context" with respect to geo-space, although in a different manner in each one. This common approach initiated an attempt to try and combine the *TerrainBender* tool with the concept of the Berg map, via the functionality of a GIS package, in order to extend its capabilities with respect to 3-D cartographic representations with varying perspective. More specifically, in the initial step of this attempt the aim was to take advantage of *TerrainBender's* free availability and try to make a horizonless-projection type of map (as is the Manhattan one by Berg), by using the software in the inverse way (i.e. for shaping a concave -instead of a convex- curved terrain surface) and then add 3D geometric objects after importing the output in a popular GIS package for creating the urban scene (Aza 2014). A further elaboration of this combination resulted in a map (Aza et al 2015) which is also presented in the map exhibition of the present Conference. Since this cartographic procedure seemed to work rather effectively (despite the inevitable drawbacks encountered), another possible field of application for the cartographic process established was its utilization in the archaeological

approach described above, with the purpose of creating a landscape representation of an archaeological site that would enhance both local and overall view and perception of the environment, according to the archaeologists' established approach. Within this context, the notion of the so-called phenomenological walk is central in archaeological theory and it is briefly described in the following. The case study that follows concerns the settlement of Mycenae, in Greece, over a period of 400 years during the Late Bronze Age (ca. 1600-1200 B.C.).

3. The "phenomenological walk"

In *"A phenomenology of Landscape: Places, Paths and Monuments"*, Tilley (op. cit.) argued for a phenomenological approach to landscape. He tried to develop ways for a sensory experience of the landscape as a means of connecting the present to the past. Although in 1994 he based his approach on the methodological tools of walking and the visual experiences of landscape, he gradually developed methodologically the concept of the "phenomenological walk" (Tilley & Bennett 2008). The core of the concept is grounded on the notion that one needs to immerse oneself in the landscape, by means of walking and writing down his observations, in order to experience in a multi-sensory fashion the world around him. The bodily experience of the landscape involves sensing loci (natural formations, landmarks, structures and/or monuments) through vision, smells, sounds, touch, feelings, body gestures and posture. Walking, thus, becomes a means of aggregating experiences of different locales along the route, locales that are connected to the walker's feelings, memories, and ideas of them (op. cit.).

Tilley's kinaesthetic and sensory approach to landscape has been criticized for not taking into consideration that the formation of locales, landmarks, structures, and/or monuments is inscribed with the feelings, ideas, memories and intentions of their creators (Fleming 2006, Barrett & Ko 2009, Ljunge 2013). The qualitative properties of structures or monuments (i.e. the method of construction, the materials chosen, the size, the placing in the landscape) are based on strategically made choices of their makers and, as Tilley (Tilley & Bennett 2008) himself acknowledges, they shape other persons' sensory experience of them (Bradley 1997, 1998). Landscape and locales along the "walk" may, therefore, become or be used as means of conveying significant messages on ways of thinking or conduct, metaphors of social forces as well as means for negotiating social structures.

4. The "phenomenological walk" in the archaeology of the mycenaean landscape

Phenomenological landscape studies are rare in the archaeology of the Aegean Bronze Age. Yet archaeologists need to understand, among other issues, the meanings embedded in the landscape and the driving forces behind the ever-changing spatial organization of Mycenaean settlements and their hinterland.

Our case study is chosen because it represents a continuously changing settlement locus, where the notions of ritual, mortuary and political landscapes are gradually, but strategically, merged into one. Tilley's experiential and kinaesthetic approach to landscape provides an insightful interpretative framework for understanding the formation of this settlement landscape.

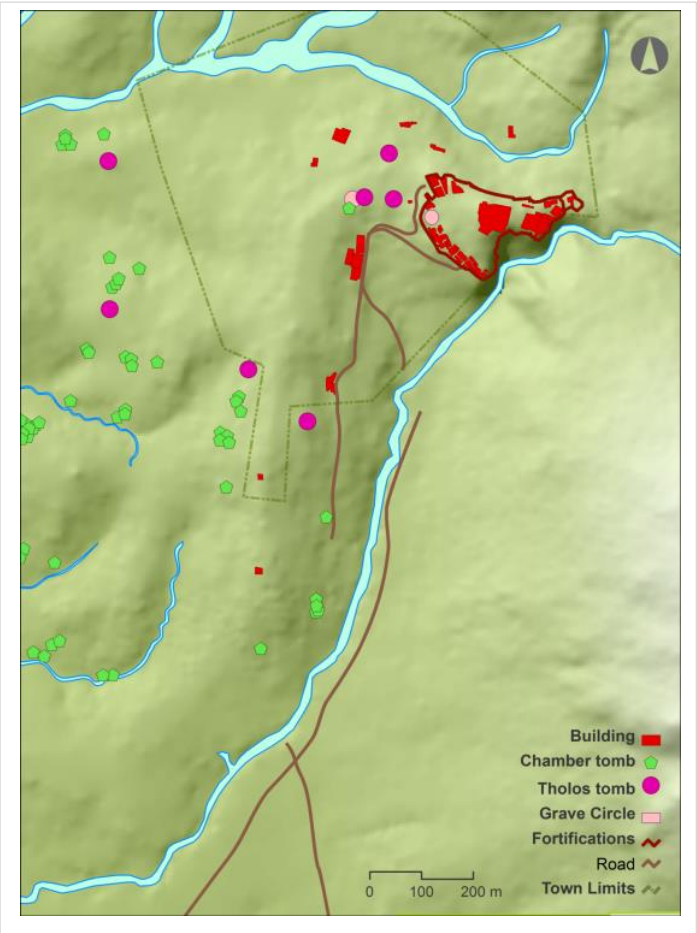

Figure 1. A planar view of the area around the palace and site of ancient Mycenae

The case study involves the development of part of the settlement of Mycenae, in the Greek plain of Argos, over a period of 400 years during the Late Bronze Age (ca. 1600-1200 B.C.). The settlement of Mycenae is characterized by its gradual transformation over this period from a mediocre settlement site into one of the largest palatial sites in the Greek Argolid, participating in regional exchange networks and controlling most of the wealth circulating in its surrounding periphery (Voutsaki 2010). Observing the sequence of monuments and other structures (tombs and residences) built in one restricted area of the settlement to the southwest of its palace-centred acropolis, it has been proposed (Efkleidou 2014, Efkleidou in press) that the landscape was manipulated in such ways as to shape people's sensory experience of it. The monuments and different structures (Grave Circles, monumental tholos tombs, elite residential structures, ritual structures) built along one route were meant to convey specific messages (Efkleidou 2014, Efkleidou in press) regarding the

endowment of their makers and users in economic, cultural and social capital (cf. Bourdieu 1986). Gradually, this route must have developed into a type of "processional route" along which ritual processions would regularly take place.

Walking along this route in the context of a ritual procession recalls Tilley's "phenomenological walk". During this "walk" participants in the procession would consecutively come in contact with a series of monuments commemorating over time the power of the elite. To understand the sensory experience of these monuments is very important for successfully assessing the importance of ritual practices such as processions for the confirmation and projection of the participants' group identity and for manipulation of the settlement's social structure.

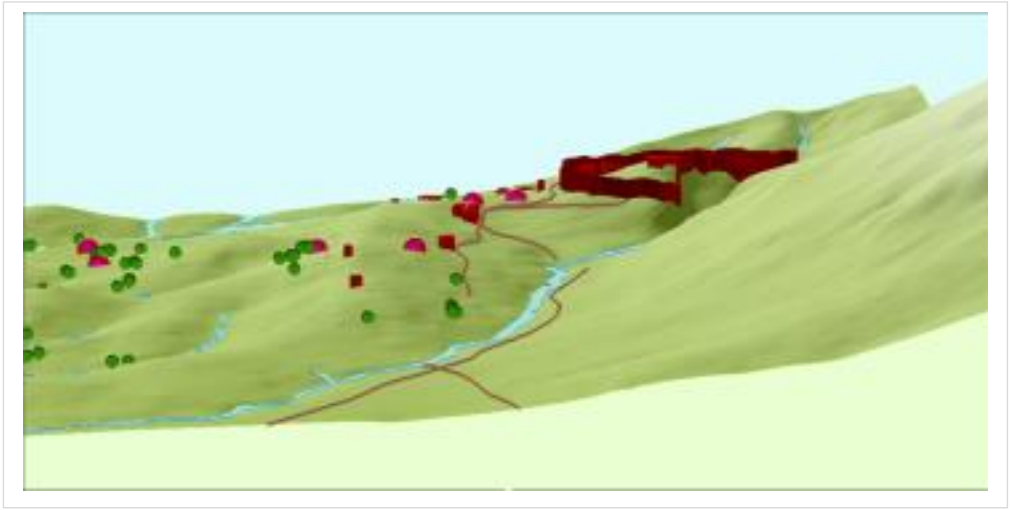

Figure 2. A ground-level perspective of the area of Mycenae viewed from southwest, with the processional route ahead (see text)

3D reconstructions of the landscape at different points along this route from the vantage point of a standing human figure seem insufficient to convey all aspects of the experience of this "walk". Such reconstructions could capture the magnitude of size of the monuments relative to human body size or the impression made by the elaborate materials and decoration of the tombs' façade. Nonetheless, walking in processions creates expectations and mental images to the participants of what lies ahead and of the end point. These mental images could not have been proper maps, but rather mental maps where routes are commonly reduced to lines, along which only landmarks and locales vested with memories, ideas and/or feelings are represented (Tuan 1975). Such mental visions are possible to be represented by a 3D representation of landscape using distorted perspective, whereby the agent appears at the foreground immersed in a 3D reconstruction of the landscape around him and an almost planar view of what lies ahead (the road, the monuments, the landmarks, the end-point) is shown in the background (see e.g. Fig. 3). Such representations could add to the archaeologist's toolkit for better understanding of the experiential aspects of a landscape and for visualizing and reproducing an aspect of a

"phenomenological walk" in the past that would otherwise rely simply on textual narrations.

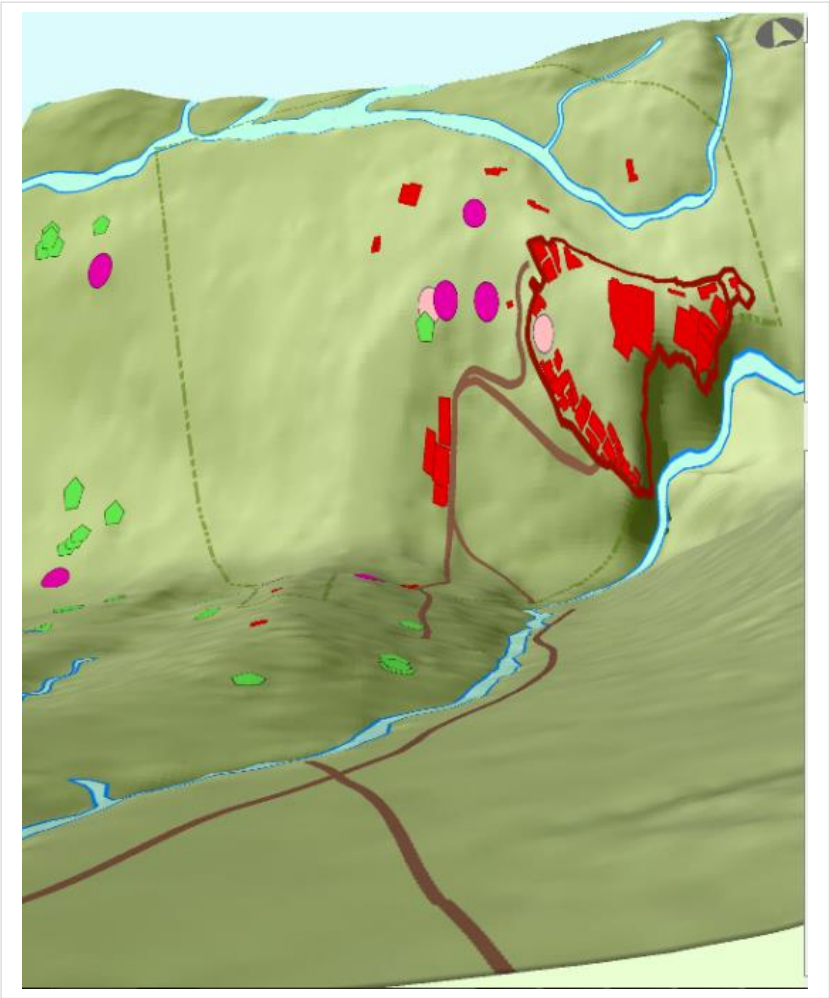

Figure 3. A ground-level view of the same route with deformed perspective; surrounding features are draped on the terrain as a 2-D image

5. The case study: a concave 3D view with varying perspective

In the context described in the previous, the aim is to create a concave 3D view for the area around Mycenae where the viewer immerses within its three-dimensional landscape, with various surrounding 3-D features (such as buildings, landmarks, man-made constructions), while at the background the landscape is revealed in an almost planar view, approaching the appearance of a slightly distorted two-dimensional map, which resembles the kind of mental maps that a subject could be having on its mind while on a path.

The cartographic procedure followed here therefore allows one to locally deform the terrain in such a way that in the foreground of a three-dimensional thematic map the subject undertaking "the phenomenological walk" is immersed within its three-dimensional landscape in the way described above. In practice this is achieved in a number of steps, namely:

- Creation of the Digital Terrain Model for the area
- DTM manipulation with the use of the abovementioned free software *TerrainBender* and creation of a bent surface with a concave shape.
- Import of the resulting file in the GIS software package (ESRI's *ArcGIS*)
- Addition and processing of other 2-D and 3-D information (natural terrain features, buildings, landmarks, symbols etc.) in *ArcGIS*.

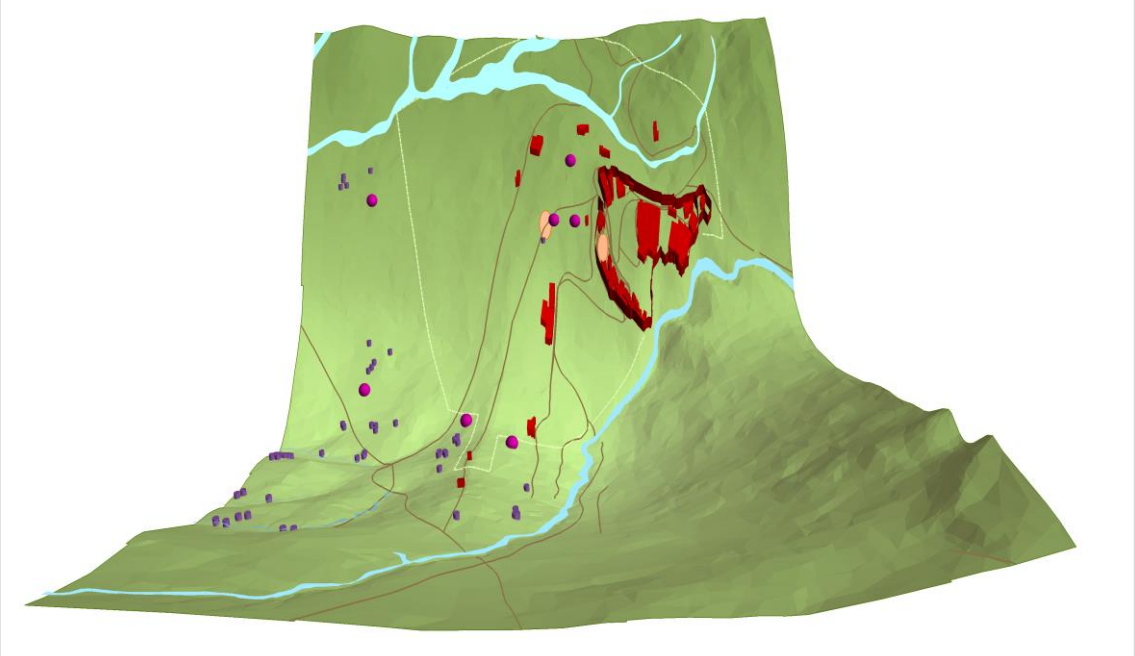

Figure 4. A ground-level test-view of the same route with deformed perspective; surrounding features are placed as 3-D objects

In general the process of data exchange and manipulation across the two software packages that were used seems to run smoothly. The result (Fig. 4) gives a more "intense" three-dimensional sense of the landscape, although with less view manipulation capabilities and limited rendering capacity at this current testing stage. Therefore additional elaboration is necessary.

6. Preliminary conclusions and planned development

The combination of the free software package *TerrainBender* with a GIS package such as *ArcGIS* gives interesting possibilities for enhancing the deformed 3-D terrain views that can be created. However some limitations of the existing tools and their combined use with respect to the theme's peculiarities and requirements have still to be overcome; for the purposes of the present work this means more functionality for the manipulation of the terrain display by the user. Consequently, an algorithm for an interactive tool that will allow for additional local deformations of the terrain is at the moment of priority for the project and is currently being developed.

The work presented here constitutes only a preliminary test of the possibilities of unconventional terrain displays as approached by the archaeological community; on this basis there seems to be a potential for cartographic production and generation of terrain displays for mapping landscape concepts. The continued cooperation with the archaeologists and the exploration of possibilities for cartographic visualizations of archaeological information seems to offer a promising potential for the development of further digital mapping tools and cartographic representations.

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