PREHISTORIC ARCHAEOLOGY IN A DYNAMIC SPATIAL VISUALIZATION ENVIRONMENT

Bernadette Flynn [1]

Abstract

My paper addresses how the past can be understood as experiential by exploring the interaction between the mobile body and the structures of the built environment. My central argument is that in order for digital cultural heritage to include the social context it needs to consider bodies and patterns of movement in relation to physical architecture. In this paper a model is proposed for articulating embodied subjectivity and the intangible aspects of social history as part of a virtual cultural heritage experience.

1. Introduction

If we take as a starting point the argument that tourists visit prehistoric sites for a sense of the past then a question to be asked is what part virtual heritage can play in evoking meaningful engagement with a past. One aspect of the solution is the creation of quality geometric simulations of material objects and the built environment. But what of a past that is not longer accessible or is part of intangible heritage[2]? A proposed solution is the inclusion of lived mobile bodies in the creation of a user experience.

In addressing the adoption of a spatial visualization environment for creating a dynamic engagement between user and architecture, the architecture of the Megalithic temple Mnajdra in South East Malta is used as a case study. Mnajdra offers a useful example for analysis being amongst the oldest freestanding Megalithic structures in the world where complex feats of building and astronomy were accomplished within a great round context. The paper firstly outlines how temple spatial structure has been considered from the archaeological record. The paper then explores how an understanding of the architecture framed from the perspective of archaeological spatial knowledge systems can provide a strong sense of the lived past. Finally a phenomenologically informed approach is proposed in the design of a interactive visitor experience where the past is accessed through kinaesthetically engaging the body and digital reconfiguration of perceptual registrations of real world situations.

---

[1] Bernadette Flynn, The Griffith Film School, Griffith University, Brisbane, Australia

[2] Intangible cultural heritage is described by UNESCO as living cultural heritage, which includes social practices, rituals and oral traditions.

2 The architectural space of the temple

This section identifies the physical space of the Mnajdra temple site by describing the shape or basic morphology and the orientation of the temples. It is argued here that if we are to include the social aspect of temple culture they need to be understood as environments that were lived in, explored and occupied by prehistoric peoples and as such examined from the perspective of human participation and patterns of movement indicated by temple design. Such an approach drawing on archaeological spatial knowledge systems enables us to reinterpret the social practices embedded in architectural form.

2.1 Temple morphology

Dating from roughly 3,6000BC to 2,5000BC Mnajdra is a UNESCO world heritage Megalithic site in South East Malta. The architecture of Mnajdra is characterized by three distinct temples on an almost circular forecourt with semi circular or apse like rooms [8][3]. A number of separate zones delineate the temples' layout such as side niches with altars; oracle room and pitted threshold markers. The site presents an early example of superb design and engineering craft with multiple tiers of overhanging stones creating a semi-corbelled domed arch. Archaeologists generally agree that the roof of Mnajdra was at least partially if not fully covered creating a strong contrast between the intense exterior Mediterranean light and the darker interior space. (See also Chalmers and Debattista tests on the structural validity of roofing models using computer graphics and structural engineering [3])

The shape of the Mnajdra temple embodies the functional and aesthetic expression of circularity and receptivity. As Mimi Lobell has argued the Maltese temple culture, can usefully be considered as the spatial archetype of the great round [7]. She suggests that while the particular spatial arrangement of the Maltese temples is unique to the Maltese islands there are underlying structural similarities with other sites such as Khirokitea on Cyprus, Boyne valley culture in Ireland, and Catal Huyuk in Anatolia. For Mimi Lobell and other feminist archaeologists such as Marija Gimbutas, the great round spatial archetype is equated with matrilinear families and relatively egalitarian social structures and indeed there is no evidence of slavery or war in relation to the Maltese temple period [5, 7].

In order to acknowledge the Mnajdra temple site as an expression of a lived social structure it is important to place it in the context of the surrounding landscape. Out of all the remaining Maltese temples the temple complex of Mnajdra is perhaps one of the most visually appealing with the Mediterranean on one side and a distant view to

---

[3] It should be noted that dates for the three sections of Mnajdra temple complex differ slightly in archaeology reports.

the rocky islet of Filfla. A short two-kilometre walk up the slope from Mnajdra is the Megalithic temple of Hagar Qim adjacent to the Misqa water tanks (perhaps cut to supply the needs of the temple) and the natural landscape abundant with heath plants and migratory birds. In prehistoric times an approach to Mnajdra would have necessitated a sea journey and a scramble up the rocky slopes or an extended inland journey. Even today, the moment of first encounter with Mnajdra in its landscape setting is both visually dramatic and a visceral experience. This organization of the temple in the landscape setting is evidently a deliberate choice linked to astrological events and associated prehistoric signification. There is a certain dialogue being played out where the environment shapes the temple site in the same way that the temple site shapes the environment. Equally the environment and the temple site shape the various modes of human participation. In this way there is a constant exchange between groups, individuals, the environment and architectural space.

2.3 Interpretations of the temple.

Movement cannot be explored without reference to interpretations of what took place in these Megalithic structures. Evans concurs with other archeologists in concluding that the primary use of the Maltese temples was for sacred or ritual activities rather than domestic use. [4]. As David Trump suggests processions, singing, dancing, and sermonizing are only a few of the activities that might have taken place in them [10]. From the ethnographic record we know that the arrangement of space is frequently based on ideas about how the wider world is ordered. As a number of researchers point out monumental architecture often embodies a series of cosmological ideas about social relations and patterns of participation in ritual or ceremonial activities [6, 9, 11]. Following this the spatial arrangement of the architectural features of Mnajdra is interpreted as a part of a social system for sacred exchange and activity in which the people of Malta and perhaps further a-field would partake. Mnajdra itself has been considered as a site for curing aliments or the offering of talismans in relation to healing especially in light of the use of ex-votos, fire and aural effects as indicative of ritual or worship [2, 10].

As an inverse of the underground hypogea such as the Hal Saflieni hypogeum Maltese temple architecture created mediating places in a layered world: structurally above ground but experientially below ground. Allowing humans to re-create access to a timeless ancestral place they suggest a connection with the underworld, chthonic cult of death and rebirth. The temples are abundant with familiar prehistoric symbols associated with renewal and emergence such as the liberal use of ochre sprinkled over bodies, painted on walls and figurines and the use of painted spirals and as low relief sculptures. Another symbol linking the physical space of the temple landscape to mythological and ritual space is the snake motif. Two distinct snake images have survived: one a relief from the Ggantija temple and the other a snake-like pattern on the threshold of the Mnajdra South temple.

3 Operational strategies for SOM – Spaces of Mnajdra

This section of the paper identifies the operational strategies in the translation of the Mnajdra cultural heritage site into an interactive visualization experience. A large-scale immersive environment AVIE (Advanced visualization and interaction environment) based at iCINEMA in Sydney Australia is chosen as the site for display for the audio-visual project SOM (Spaces of Mnajdra)[4]. Following on from experimental work undertaken in new media interaction environments AVIE provides an environment in which audio-visual experiences are created by a combination of multiple projectors and multiple sound sources [5]. A circular screen four meters high and ten meters in diameters is designed for showing the multi-node 360degree photographic panoramic image sequences.
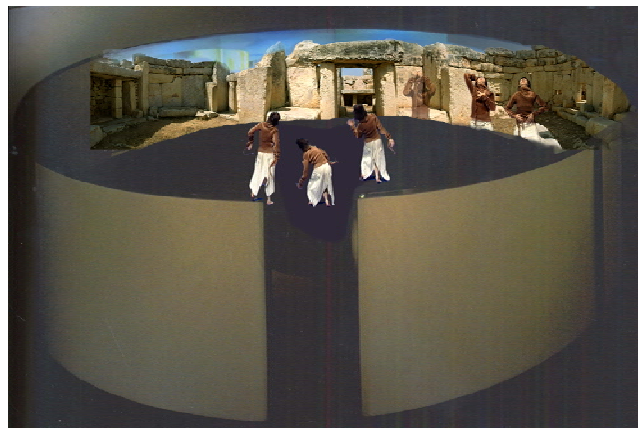

Fig 1: User in a representation of the SOM (Spaces of Mnajdra) interaction visualization environment

Key to the design of SOM is the user participation in the direction of the experience. People within the visualization environment will be tracked by a series of infrared cameras and real time software able to generate models of their movements and body pose. As such SOM demonstrates the principles of spatial navigation for creating social presence and an embodied relationship to architectural space. Three main operational strategies can be identified:
- Spatial visualization for the exploration of temple space
- Tracking of user movement trajectories and pre-planned outcomes/feedback mechanisms
- Recognition of body gestures in relation to user navigation including the interplay between users and on screen avatars

3.1 Spatial visualization

---

[4] iCINEMA is a research centre investigating interactive cinema based at University of New South Wales in Sydney, Australia. www.icinema.edu.au

[5] AVIE uses a series of eight projectors in four stereoscopic pairs, each pair supplying ninety degrees of the whole image. The stereoscopic effects will be created through the use of opposed polarizing filters. Eight high-performance computers handle the high levels of data, each generating an on-the-fly image sequence for one projector.

SOM (Spaces of Mnajdra) aims to evoke a heightened engagement with physical space by focusing on the spatial arrangement of the temples. The predominance of the great round characteristics at Mnajdra enables a trajectory from one concave room to another – with connection between the temples via a large open area or forecourt. The circular panoramas in the visualization environment surround and encircle the viewer replicating the temple's of circularity, intimacy and enclosure. As such the display environment avoids the linearity and rectangularity of traditional film or computer based screen space. The physical replication of the great round architecture of Mnajdra brings the users' attention to detail the interplay between open and restricted space through the use of screens and curtains and the event of moving upwards, towards and into the inner areas. Recorded as a series of multi-node panoramas the sheer scale of the projection evokes a strong sense of place – of habitus. Such detailing of the spatial arrangement of the visualization environment is not only designed to display a spectacle of visual space but to encourage active spatial wayfinding or exploration.

The temples were added to over time so that in the case of Mnajdra the building spans roughly nine hundred years with the internal partitioning became more elaborate over time. Maltese archaeologist Anthony Bonanno has used archaeological spatial knowledge systems such as space syntax and access analysis. He has argued that over time certain areas in the temples became more restricted and that forms of exclusion were practised. In other words many of the smaller internal spaces were in some way 'controlled, guarded, interrupted, reserved or privileged' [1]. This is evidenced by the system of shutting or bolting the entrance of the temple and chambers suggesting that movement was at times controlled and restricted. In addition sight lines exclude the visitor from seeing the whole of the space at one time and emphasise or frame a dynamic relationship between interior and exterior spaces.
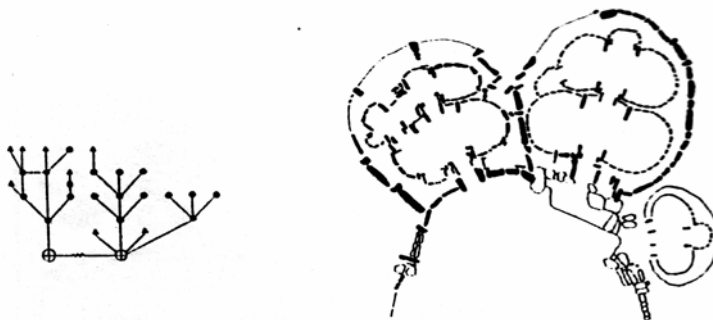

Fig 2: Diagrammatic patterns of access at Mnajdra - drawings by Nicholas Vella from Bonanno [1]**. Drawing on space syntax and access analysis allows the environment to be mapped as a set of access grids related to proximity triggers. In the access grids space is divided into: carrier spaces (temple forecourt) enclosed space (side chambers), niches, access lines, privileged access, and split-level areas.**

3.2 Movement trajectories and pre-planned outcomes/feedback mechanisms

Interaction strategies for SOM include the augmentation of the real with the virtual by moving the space of representation outside the purely visual to engage the body of the visitor. AVIE provides a multi-purpose sensory environment for tracking of viewer movement and gesture, offering a large range of motion capture and interaction design functions. In SOM a visitor can inhabit a simulation of Mnajdra by kinaesthetically engaging the body through conscious movement and gesture.

In SOM movement is conceived in terms of how the building conditions the movement of people within it and in turn how the movement of people opens up certain pathways through the space. The movement between chambers requires particular body postures and strategies of movement. Raised levels from the outer to the inner chambers and from one apse to another accentuate these physical demands. Each level of the temple is slightly higher than the one before demanding an acknowledgment of the threshold zone and requiring a bodily shift of focus or adjustment towards a higher level. As Bonnano has pointed out these might be associated with a division between public and private spaces or certain privileged rights of access [1]. Through real time motion tracking and some gesture recognition a single user's body movements and gestures activate images on the screen. Other visitors may enter the space as audience but do not affect the display of images and sound. In tracking a single visitor and their encounter with architecture movement is considered in three ways:

- Movement towards or away from a threshold
- The moment of arrival and entry into an apse of the temple
- Movement into a secluded or privileged area of access (access only at certain times and in relation to certain ceremonial times or cosmographic events).

Central to the project is the importance of the journey or pilgrimage. SOM recognises movement away from and towards a space by changing screen imagery and allowing greater or lesser access to the restricted spaces of the temple environment. Navigation to the directional edges of the room enables transfer to each of the semicircular areas: courtyard; south outer; south inner; middle outer; middle inner and east temple. Material artefacts found at Mnajdra in various parts of temple including ribbed figurine; serrated edge shallow bowl, and ex-votos symbolising body parts. These are accessed through the users' navigation in the visualization environment and appear as visual overlays onto the temple panoramas.

The user's trajectory or pilgrimage is punctuated by moments of transition - arrival at the threshold – and entry into a chamber of the temple complex. Liminality is a key expression within the Mnajdra temple architecture with prescribed ways of moving indicated by the interplay between open and closed spaces, terrain markers and boundary indicators. The transitions between one space and the next calls for the enactment of specific and repeated user movements. From an ethnoarchaeological reading these movements and gestures are positioned in relation to rites of passage or stages of responsibility within the community. Completion of a stage or a challenge

is associated with the user assuming a role within the digital temple culture and obtaining certain spatial access rights. In this way the temple is understood not as an empty space to be traversed but liminal encounters with experiential space alive with symbol, ritual and ceremony. It in the user is embedded in a social framework of cosmological meanings defined by the temple architecture. From this travel through a symbolically loaded space becomes a cosmological venture further potentialized through the ritualized or constrained patterns of participation.

SOM also enables communication in gesture recognition between machine agents and human participants. The machine agents or avatars are provided with a modest ability to sense and interpret the actions of real participants enabling the introduction of avatar based feedback mechanisms. Simple gestures of users will action a response from the temple avatars allowing free passage to another chamber of the temple. The avatars will be camera-generated actors with prehistoric costume and hair ornamentation drawn from the textures, clothing and decorations on surviving figurines.

3.3 Digital reconfiguration of perceptual registrations of real world situation

A closely related issue to user movement is the way the temple spaces are experienced through the senses. Working with a performer and trained body system analyst the physical environment of Mnajdra will be explored through the skeletal-muscular system and the fluid systems of the body. These will be translated into key gesture patterns incorporated into the gesture recognition system in AVIE. This help locate the body in space and tells the user where each part of their body is in direct relation to temple space. SOM explores the sensations arising from encounters between body and architecture such as the step over a portal threshold or the crouch required to enter a side chambers. The activation of the proprioceptive centres is translated into user interaction within SOM. Perceptual registrations of the real world temple environment are used to design contextual restraints and affordances, which recognise certain types of user gestures. An example of this might be raising an arm in a gesture of offering at a portal doorway. This movement of the musculature also evokes a corresponding perceptual shift experienced in the body.

Sonic elements will also feature significantly in SOM. The acoustic properties of the Hal Saflieni hypogeum have been documented and one can well imagine that the enclosed structure of Mnajdra in prehistoric times would have offered similar dynamic sonic resonance. Audio soundscapes played across the twelve stereo pair of speakers of AIVE would evoke temple atmosphere, time of year and avatar movement. These can be activated in relation to spatial proximity between architecture and user.

4. Conclusion

This paper has identified a model for engaging with the embodied subjectivity of cultural tourists. This takes a departure from traditional models for designing virtual heritage that have been dominated by the plan view and its representation in 3D. My main argument in the paper is that the inclusion of the visitor's body within a simulation can aid in creating a more affective engagement - or a visceral encounter - with the past. This is not to discount the material evidence of archaeological enquiry but to approach it from a phenomenological or body-centred experiential perspective. These ideas are discussed here as a way of theorizing how bodily encounter might be reformulated as a situation of user navigation and agency. Three key element have been proposed for creating a dynamic visualization experience: firstly, a heightened encounter with physical space; secondly, a kinaesthetic engagement of the body in space, and thirdly, digital reconfigurations of perceptual registrations of a real world situation.

References

[1]   BONANNO, A., The rise and fall of Megalithism in Malta, in K. W.BEINHAUER, ed., The Megalithic Phenomenon Recent research and Ethnoarchaeological Approaches, Mannheim, 1999.

[2]   ---, Rituals of life and rituals of death, in D. CILIA, ed., Malta before History: The world's oldest free-standing stone architecture, Miranda Publishers, Malta, 2004.

[3]   CHALMERS, A. and DEBATTISTA, A.K., Investigating the Structural Validity of Virtual Reconstructions of Prehistoric Maltese temples, in N. R. M MADGE, R. SCOPIGNO, ed., The 6th International Symposium on Virtual Reality, Archaeology and Cultural Heritage, 2005.

[4]   EVANS, J.D., What went on in a Maltese Megalithic ' 'temple'?, in A. PACE, ed., Maltese Prehistoric Art 5000–2500BC, Patrimonju Publishing Ltd, Malta, 1996.

[5]   GIMBUTAS, M., The Goddesses and Gods of Old Europe, University of California Press, Berkley, 1982.

[6]   GRIMA, R., An iconography of insularity: a cosmological interpretation of some images and spaces in the late Neolithic Temples of Malta, in Papers from the Institute of Archaeology (2001),

[7]   LOBELL, M., Ancient Religions in the context of cultural types, in A. BONANNO, ed., Archaeology and fertility cult in the ancient Mediterranean, B.R. Gruner Publishing Co. Amsterdam, University of Malta, 1985.

[8]   PACE, A., Mnajdra, in D. CILIA, ed., Malta before History, The world's oldest free-standing stone architecture, Miranda Publishers, Malta, 2004.

[9]   TILLEY, C., The Materiality of Stone Explorations in Landscape Phenomenology: 1, Berg, Oxford, 2004.

[10]   TRUMP, D.H., Malta Prehistory and Temples, Midsea Books Ltd, Malta, 2002.

[11]   TURNBULL, D., Performance and Narrative, Bodies and Movement in the Construction of Places and Objects, Spaces and Knowledges, in Theory, Culture and Society, 19 (5/6) (2002),