

Digital Hindcasting

Critical Analysis through Virtual Reconstruction

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Manah is an abandoned oasis settlement in Oman. During what is termed the “Golden period” in the region’s cultural development the settlement became one of the most important cultural centres of the interior. For a long period Manah stood as the seat of learning in sciences and arts. A current project is underway to establish, as far as possible, how the settlement evolved; how tribal, cultural, religious and social factors impinged on Manah as it grew over the years. The work described here is directed at applying computational methods to augment the analysis and critical review of that evolution. We are aiming to explain the evolutionary process using computer mediated techniques, working backwards from the current state, to the inception of the settlement; hence the term Digital Hindcasting.
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Introduction

Critical review and theoretical analysis of architecture can be undertaken via a range of methods that Attoe (1978) classifies as Normative, Interpretive and Descriptive. Digital representation now offers us new ways of augmenting these critical styles in ways that have yet to be fully exploited, and possible means of exploitation are illustrated in this paper. In short, the work described here shows how digital techniques can be used to enrich architectural investigation and analysis. In the case reported here the focus of that investigation is historic and relies in part on virtual reconstruction. The overarching aim is to gain a better and deeper understanding of a significant, but now abandoned, Arab settlement.

The start point is similar to the kind of digital-unbuilt work reported by Novitski (1999). Here, a number of interesting precedents are reported. One of particular note in the context of our work is the reconstruction of Ceren; a Central American village,

destroyed by volcanic activity around fourteen hundred years ago (fig 1).

Reconstructing works of architecture has, as an idea, found application in examples such as new proposals for a site, or for the recreation of destroyed or unbuilt architectural projects such as those described by Maver and Petric (1999), and Voigt et al. (1999). As a way of allowing us to visualise what does not exist, examine spatial qualities and engage in contextual criticism [a form of descriptive criticism according to Attoe (1978)] this has been very valuable. Mitchell (1999), describes the process involved as “filling in missing information and resolving base data. This is an intellectual enterprise closely analogous to that of a textual scholar attempting to recreate a definitive version of some ancient text from the multiple, imperfect, incomplete copies that have come down to us”.

In this paper what we do is to illustrate how digital recreation can be used as the core tool in an examination of building, settlement and use patterns.



The context of our study

Our study is based around a particular example: that of an abandoned oasis settlement in central Oman, Bilad Manah. Manah oasis with its principal settlement Bilad Manah (bilad = town) lies 20kms Southeast of Nizwa, East of the main highway linking Muscat to the southern city of Salalah. Isolated by some of the major wadi-s (seasonal rivers) of the region that run off the Jabal al-Akhdar (Green Mountains) towards the desert, the oasis was an island of astonishing verdure watered by falaj-s. The falaj-s are complex systems of water harnessing and distribution, often of pre-Islamic Persian origin (c. 1000 BC), employing underground galleries and surface channels. A falaj channel near Bilad Manah is said to have been dug by Malik bin Fahm, the legendary forefather of all Arab-Omanis, giving Manah a central place in the myth regarding the Yemeni origin of the Omani people. In the early 16th century Manah was an important contributor to the Ibadhi renaissance resulting in the accumulation of wealth, which also made it a sanctuary for artisans. Over the next hundred years this “Manah school” produced some exquisitely decorated mihrab-s (prayer niches) which now dominate the mosques of Manah and many important towns of the interior (fig 2).

Bilad Manah has remained deserted for approximately twenty-five years, partly due to practical but also political reasons; over the last ten years the deterioration of the settlement fabric has been extremely alarming. A similar fate has befallen the



Figure 1 (left). Recreation of ‘Structure 1’ in the Ceren project.

Figure 2 (right): Contemporary condition of Manah – the round tower of the south wall with ruins in the foreground

other constituent towns of the oasis, leading towards not only a gradual erasure of her town configuration and architecture, but also of a major section of Omani cultural history. Modern planned settlements and administrative facilities have been established beyond the eastern edge of the oasis. In this context of cultural prominence, desertion and dilapidation, the present study assumes added importance; the speculative modelling of the likely impact of historical events on settlement evolution, especially those related to tribal movement, could be considered the first step in the preservation of this unique settlement.

Although popular stories hint at the establishment of a settlement by the Fars (Persians) around 531-579 AD, it is certain that the combined Halfayn-Kalbu wadi system was settled as early as the 2500-2000 BC. A developed oasis settlement would likely to have existed in the 6th century BC. This older form of oasis settlement, primarily an agricultural and commercial centre, straddled the developing trade routes on the desert periphery and had a symbiotic relationship with industrial (mainly copper producing) settlements. The settlements and the oasis depended on the perennial surface flow in the wadi-s supplemented by natural springs (‘ayn) and wells. From these early days of

Figure 3: Reconstructed plan of Bilad Manah with main circulation routes in black.

habitation in the desert foreland, the springs were held in sacred esteem and became the focus of the settlement (fig 3).

The orientation of the early rectangular walled settlement, as well as the principal north-south street, followed the natural gradient and culminated at the spring. Introduction of Islam (7th century) saw the pre-Islamic sacred center turned into a mosque (Masjid al-'Ayn) and the addition of two more (al-Shara and al-'Ali) on the main street. The decorated mihrab-s followed in the early 16th century. Towards the end of the Ya'ariba period (mid-18th century), the walled settlement of Manah underwent a significant extension.

There were no less than twenty tribal groups residing within the settlement around the time of its desertion. Different tribal groups may have gained importance at various times as a result of important socio-political changes taking place within the region. Although the majority belonged to the Hinawi political moiety, there were elements of the Ghafiri faction present within the settlement. The spatial and social exclusion or segregation of the three bayasira groups, the Sawaqi, Araini and Haddadi, into distinct housing clusters, was particularly interesting. Attached to various Arab clans in a client status, these groups were commonly thought not to possess a true Arab origin (asl).

Application of Computational techniques

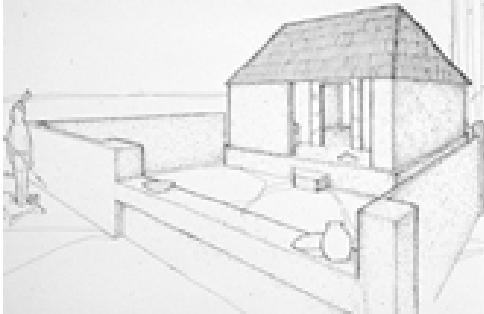
Our illustrative study looks at the potential benefits that 3D modelling and subsequent computer-based analyses can bring to historical research over and above straightforward virtual reconstruction. The focus for this study is issues such as tribal ownership patterns. With the complex relationship between property, status and family established, the current work analyses tribal use and building patterns. The work is ongoing and it is intended that the end result will be in the form of an interactive VR model where analysis can be made of both the 'abstract' and 'real'; a visualisation of not just the built forms but the nature



and patterns of growth and use. Once systems have been identified for one area of Manah, it is intended to extend the methodology to other areas within the settlement.

One aspect that is worthy of comment is that if we are to represent, using the techniques offered through computer visualisation, architectural objects which no longer exist, the appropriate nature of that representation requires consideration. In the Ceren reconstruction referred to above, the researchers have chosen to represent most of the buildings modelled using almost photorealistic images. But in one case a building is represented in monochrome with only edges identified (fig 4).

AlSayyad et.al. (1996) note, in relation to their work on the reconstruction and analysis of Cairo, the importance of taming the desire for 'complete reliability'



and geometric accuracy and photorealism that this entails. They suggest that “to be successful for historical reconstructions, the models must be treated as abstractions”. Monochrome and sketch-like renderings (such as those in Figure 4), are, therefore, appropriate for many aspects of such work. Such representations, suggest, correctly, that the image is based on partial information and that it is open to some differences of interpretation.

With the plan of Manah assembled and the 3D survey information added to that plan data the 3D models could be created. Five stages of development are identified in the growth of Manah so models showing each of the five key stages have been created. Figure 5 shows a block model of the buildings comprising the settlement in the second phase of development of the settlement (fig 5).

As the settlement grew the buildings filled up the enclosure within the walled boundaries of the settlement. Eventually, in the final stage (Figure 6) the settlement has overspilled into a western extension. These staged models provide a useful and informative adjunct to the 2D plans. They show the stages and patterns of growth suggested by the initial research on the settlement. The problems are then to find ways of checking that the postulated patterns of growth can be substantiated and then to account for these patterns and the individual buildings that were created within those patterns (fig 6).

In developing the ideas that have evolved into various generations and variants of the idea of Space

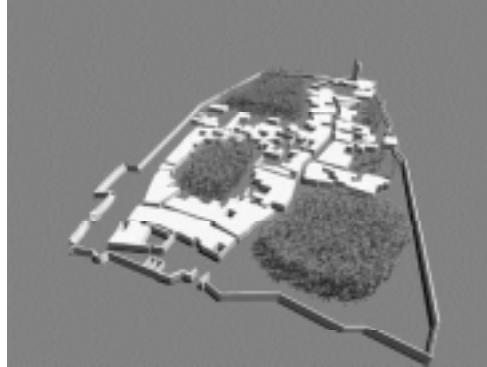


Figure 4 (left): Recreated building represented in monochrome with edges defined

Figure 5 (right): Manah – second stage of development

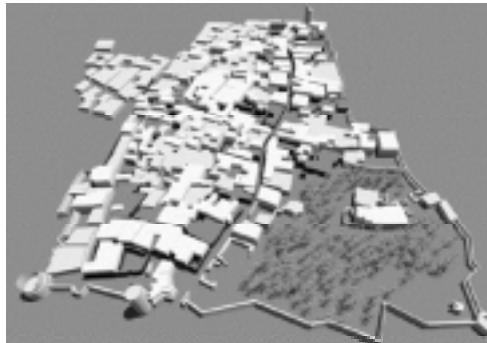


Figure 6 (right): Final stage in the growth of Manah showing western extension top left.

Syntax Hillier (Hillier and Hanson, 1985) has described societies as spatial systems. There were a range of powerful cultural and religious forces that shaped Manah into the community that it became. Our work is being developed in such a way that we can examine the spatial systems that acted in the evolution of the settlement.

Conclusions

We believe that the computer-based studies of Manah have had, and will continue to have, a positive contribution to make to the understanding of settlement and its evolution. We can summarise some of the key findings from the analysis of the settlement of Manah gained so far as follows:

- (i) The age of the domestic buildings can be linked, generally, to the degree of internal subdivision. Heavily subdivided spaces suggest older

properties. This is probably due to buildings growing incrementally over time as family groups expanded but wished to stay together.

- (ii) Later properties tend to have a more regular subdivision of space.
- (iii) There is a disjunction towards the middle of the westerly of the two main north-south routes through Manah that suggests a reworking and replanning of the settlement.
- (iv) The VR modelling of key dwellings has been useful in enhancing the understanding of how the dwellings and the spaces within them operated when occupied.
- (v) The work is ongoing and techniques of spatial analysis and subsequent animation are being developed to aid current investigations.

One issue that is worth noting here is the fact that with contemporary modelling and rendering tools we have a range of rendering styles available to us. In virtual reconstruction and the subsequent analysis of reconstructed settlements and buildings we are often postulating as to what might have been. In many cases the logic that follows from this is that the rendered image should suggest that what is being presented is tentative and open to some interpretation. Monochrome and non-photorealistic (such as Figure 3) representations are therefore most appropriate and should be preferred in many cases where historic analysis based on incomplete information is being presented.

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