

Digital Photography and Architectural Modeling as Elements of Conservation

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1 Digital Photography: Advantages of Digital Photography

As digital photography is coming more and more into common use, it is important to consider carefully its applications in archaeology in general and archaeological conservation in particular. The great advantages of digital photography, for those who have not experienced it firsthand, are speed of availability, unlimited exposures and the immediate organization of photographs.

With film photography, the delay from click to seeing the image is at the shortest a few hours, requiring a camera and either a dedicated darkroom or fast access to a shop that can develop film. These conditions are very expensive or impossible to find in some environments. Realistically, however, it is often a few days before photographs are developed, and several rolls are developed together so that one is presented with large numbers of photographs all at once. There is also a second step in developing: first the developing of the roll and the printing of all the photographs in a small format, then the photographer, conservator or archaeologist choose ones that are particularly good and have them printed in a larger format. Sometimes a week passes from the time the photograph is taken to when the conservator has a useful print in hand.¹ Digital photography, on the other hand, requires a digital camera and a computer with adequate storage space, and can furnish the images in a matter of minutes.

¹ These time estimates reflect what one was able to produce with a fully equipped darkroom and several photographers in Mozan in the years prior to the availability of digital cameras.

Again, film photography is limited by number of exposures: one has to ration the number of exposures taken so that the film lasts, or be close to a source of film that is kept in optimal conditions. – Digital photography, on the other hand, is limited only by the number of images that fit in one's computer, and with a computer equipped with a recordable CD drive the storage capacity is almost without limit. As opposed to film photography, where supplies one needs are proportional to how many exposures one takes, digital photography requires the same equipment for one or one thousand photographs (the only barrier being the storage capacity of the computer).

Film photographers must wait until the photographs are through the developing stage before archiving them, and then when copies are made each copy needs to be labeled. – On the other hand, once the images are in the computer, the photographers who work digitally have the possibility to label immediately the photographs they have just taken. Since digital photographs are files, they can be labeled as soon as they are downloaded, and each copy preserves the description and catalogue numbers of the original.

As soon as the conservators have access² to these image files, they can enlarge, crop and print photographs that are useful to them without going back to the photographer with a request to print again specific negatives in a larger format (as was described above) saving time for both photographer and conservator as well as producing the required prints in a matter of minutes instead of hours or days.

Disadvantages to Digital Photography

There are, nevertheless, disadvantages to digital photography: resolution and color precision. Digital cameras come in varying resolutions: the worst resolutions are good only to be displayed on the Web, while the best still are not as good as a slide (although it is sometimes difficult to tell the difference when printed). Of course, besides the resolution of the image itself, there is also the question of the printer. Professional printers produce images that are virtually identical to prints made from negatives, whereas an inkjet printer produces inferior copies.

² If several computers are used (not linked through a Local Area Network), the distribution system can be as simple as a CD that is passed around, allowing for instant file transfer from one computer to the other.

The second drawback is that of color precision. While there are many applications and devices that aim to achieve a precise color match between the object photographed and the image that is in the end printed, the process is much more laborious than with film.

Digital Photography as Conservation Tool

Digital photography allows conservators at Mozan to use images as a tool for conservation, not merely as a method of documentation. This tool is especially important in two cases: before the removal of objects from the field in order to conserve them in the laboratory, and to control the condition of objects in the laboratory or museum from year to year.

I will refer here to two examples of the first case. The photographers of the expedition (Giuseppe Gallacci and the author) took photographs of two pot smashes *in situ* so that the conservators would have a visual reference as to the pieces found and their position. The first, a jar decorated with scorpions and snakes (A13.3), was found in one hundred and four pieces: the digital photographs helped identify the position of the individual pieces within the whole (see above, Chapters 6 and 7 and Illustr. 6:9-10; 7:9). The second was a burial (A16a15) which utilized a jar (A16.68) as a coffin (Illustr. 10:1 and 3). The digital photographs (Illustr. 10:2 and 4) helped in the placing of the pieces, but also in the identification of areas of the pot that were missing already in antiquity, and therefore without sherds when found.

A second function of digital photography as a tool in conservation is as a means to monitor and control the changing conditions of an object over time. Digital photographs can be printed on-site and the photograph immediately compared to the actual state of the object. Should small changes be detected, it is then possible to crop and enlarge a small portion of the digital image and re-print in order to have a very detailed comparison. In a calibrated photographic setting, photographs from which measurements can be taken are possible.

This aspect of digital photography in Mozan can be illustrated with reference to a case when an andiron was found in the excavations, and brought back to the lab as a complete block, without removing the dirt that was inside and immediately around the object (already discussed above in Chapter 7, see Illustr. 7:1-3). It was then excavated in the lab and conserved over 2 seasons: digital photography was essential in maintaining a running record of the many stages through which the process passed (Illustr. 10:5a and b; 10:6). The record

was not only for documentation purposes, but also to allow a constant check on the impact that the procedures chosen were having on the artifact.

In fact, digital photography provides not only new tools to the conservator, but also new methods in documentation. The digital image can be annotated in a program that allows for two elements to be present as distinct layers on the same page: the reality of the object as a find, and the understanding of the object as an analysis (which we call “templates,” see an example in Illustr. 10:5). This is accomplished by marrying a digital photograph with text and line art in the computer. The result is a single page that contains the object as artifact as well as what is understood about the condition of the object.

2 *Computer Aided Modeling: Material and Form*

Why speak of modeling³ at a conference on conservation? I would like to suggest that conservation has two main goals: first, to preserve the *material* of an object, emphasizing the preservation of the substance with which an object is formed, and second to preserve the *form* of an object, emphasizing the preservation of the idea.

Computer Aided Modeling of ‘architectural objects’ can be understood as addressing the second goal of conservation: it preserves the form as distinct from the material in which it is otherwise embedded. It is obviously impossible to bring a royal palace into a museum. Even if scholars interested in royal palaces travel around the Near East, they cannot have the physical buildings present in front of them at one and the same time. A computer model of a building allows individuals to appreciate the form of a building, or many buildings at once, by recreating this form in an environment where matter does not exist, resolving the problem of portability. This is why I feel that model-making is in some measure a sort of conservation: it brings the form of a building to an audience which would otherwise not have the chance to observe it. If one is interested in building materials then the model is useless, but to investigate room function, accessibility or similar questions the model is a very satisfactory tool.

³ See F. Buccellati, “3-D Rendering and Animation at Tell Mozan/Urkes,” in G. Buccellati and M. Kelly-Buccellati (eds.), *Urkes and the Hurrians A volume in Honor of Lloyd Cotsen*. Urkes/Mozan Studies, 3. Bibliotheca Mesopotamic 26. Malibu 1999, 51-62. An earlier version of the 3-D rendering of the Royal palace is presented in Fig. 1.

I would like to illustrate this with some vistas of Urkesh in virtual reality (Illustr. 10:7a and b). Note that the pictures of the virtual model are in fact two dimensional, but the underlying model itself is in three dimensions. This means that one can take virtual pictures from whatever angle – as is true of a physical model as well. A virtual model, however, allows for changes to be made, changes that reflect progress made in the field.

Interactive feedback in the field

Since the beginning of our work with Digital Computer Modeling in Tell Mozan we aimed for a goal which we always considered of primary importance: the modeling had to be fully operative in the field, and not just a later development which would be superimposed, as it were, on data brought back from the field. The rationale for this was twofold.

In the first place, this tool is at its most useful when it can be employed as a heuristic mechanism, not just as an aesthetic embellishment. The virtue of the latter is obvious: a three-dimensional rendering is more appealing than a floor plan, and the perception of spaces and circulation much more intuitive. For this reason, such applications of digital modeling are especially useful for an outsider, who can relate to a modeled rendering with much greater empathy. But there are unexpected benefits for the archaeologists as well: through modeling, they can perceive space and volume relationships much more effectively than through the isolated fragments with which they are otherwise familiar. Hence it is that modeling serves a distinct conceptual purpose, which supplements in a major way the traditional tools of drawn floor plans and section profiles. This, of course, is at its optimum when the modeling is done directly in the field. Then, the archaeologists can alter their own perceptions and, more importantly, their strategy: for, in the measure in which they reach a better understanding of the architectural space, they can modify their ongoing intervention in the excavation. One must remember, in fact, that the process of recovery is fluid, and that architectural volumes are, as it were, dynamic during the process of excavation.

The second reason why our project has opted to have an archaeologist, such as myself, learn the techniques of modeling rather than relying on outside experts has been the desire to have our sensitivity condition the technique, rather than the other way around. And this, too, benefits immensely from being done in the field. Direct acquaintance with the physical situation gives greater confidence in arriving at a final presentation of the three-dimensional reality.

In a very real sense, modeling is not a new construction, like one produced by an architect who proposes his or her own view to a client. Rather, our modeling is the embodiment of the archaeologist's vision without intermediaries. Producing such modeling in the field allows for a continuous discussion among the various participants in the excavation, with a give and take that benefits both the strategy in the field and the modeling on the computer.

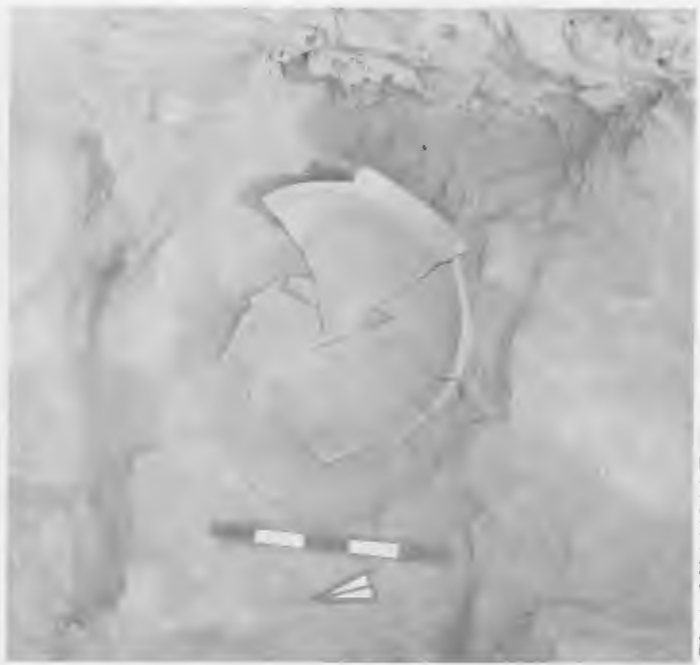
All of this relates to the issue of conservation and restoration in the light of what was said earlier with regard to form and material. Digital modeling projects the perception of a building as both the archaeologist and the conservator see it. If this *form* is satisfactory to the sensitivity of both, then one can proceed with greater confidence with the intervention on the actual material in the field. The immediate feedback in the field makes for a well integrated approach that would have been hardly imaginable only a few years ago.

Photo V14d4210 F. Buccellati



Illustr. 10:1 Jar A16.68
(Burial A16a15) before removal

Photo V14d4214 F. Buccellati



Illustr. 10:3 Jar A16.68
after partial removal

Photo V14d7586 F. Buccellati



Illustr. 10:2 Jar A16.68 during restoration
(S. Bonetti and Stef Mustafa)
with digital photo of full jar (V14d4210)
shown above as Illustr. 10:1

Photo V14d7585 F. Buccellati



Illustr. 10:4 Jar A16.68 during restoration
with digital photo of partial jar
(V14d4214, upside down)
shown above as Illustr. 10:3



Photo V12d0908 O. Khalsa



Photo V12d1435 O. Khalsa

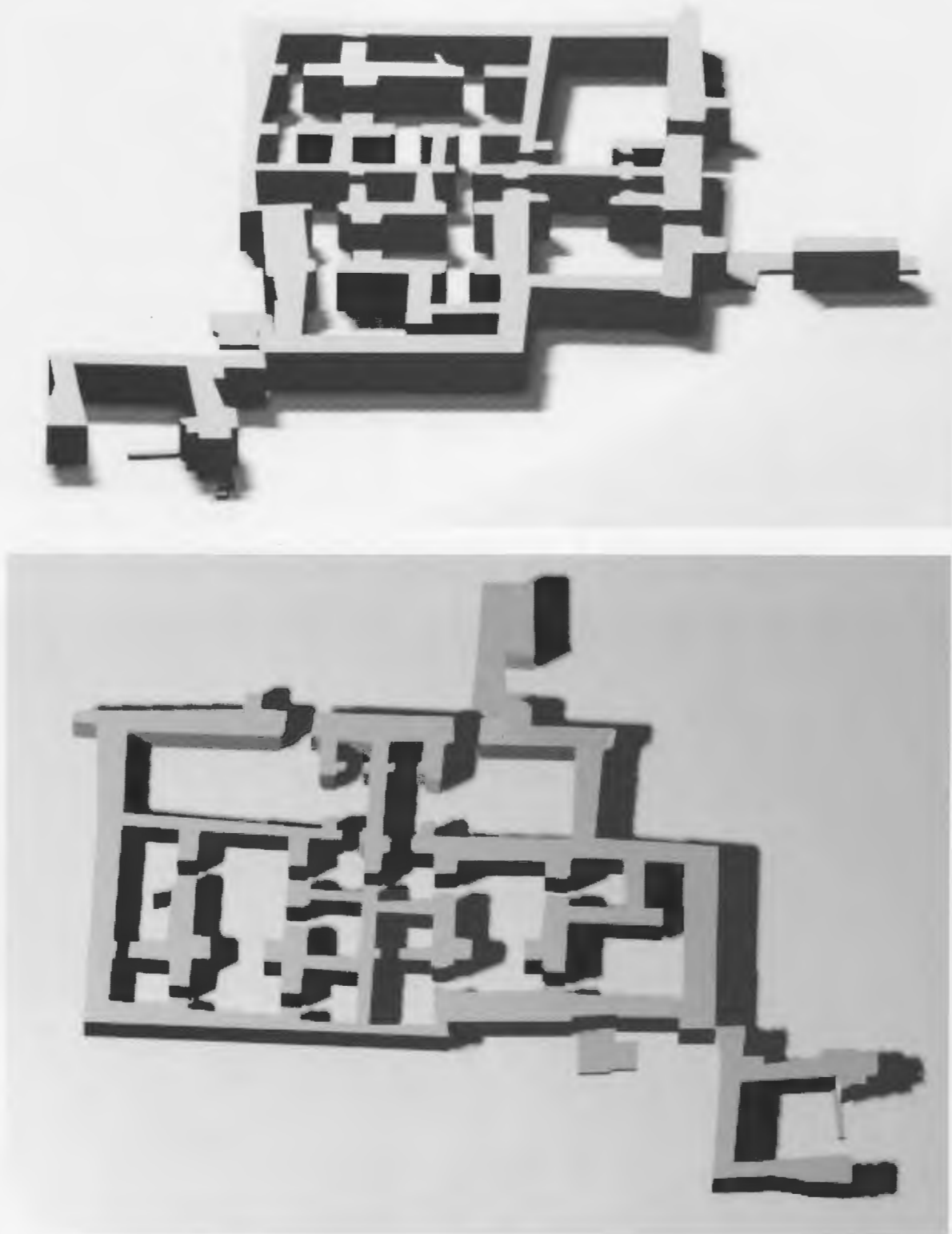
Illustr. 10:5 Example of template (andiron A11.34)

Arrows on the left indicate areas that were already cracked before dirt removal. The fissures became more apparent after the dirt was partially removed. They were consolidated during treatment. Arrows on the right indicate a corner of the arm of the andiron that was missing already when first excavated. Templates such as these are produced in the field and are immediately available for inspection.

- a Photo taken on July 7, 1999 before the start of the in-house excavation
- b Photo taken on July 11, 1999 at completion of the in-house excavation



Illustr. 10:6 Work in the conservation laboratory on the andiron A11.34 comparing earlier stages of the process with the help of digital photography



Illustr. 10:7 Two examples of digital modeling of the Royal Palace

- a Looking east, at a low angle with two sources of light
- b Looking north, at a higher angle, with one source of light

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