Fantastic Reconstructions or Reconstructions of the Fantastic? Tracking and Presenting Ambiguity, Alternatives, and Documentation in Virtual Worlds

(work-in-progress)

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Abstract

This paper considers the presence of ambiguity, evidence, and alternatives in virtual reconstructions of ancient, historic, and other no-longer-existing environments. Because the foundation of these reconstructions is data coupled to interpretations, virtual intellectual products can be grounded through critique and citations. The real-world basis for a virtual world may include multiple sources of evidence. This paper will demonstrate a methodology for making ambiguity, the quality of the evidence, and alternative reconstructions dynamically transparent to a user. This methodology harnesses the dynamism and perceptual expectations of multimedia-literate users. In our experiments we have mainly used Flash and rollovers to create a static version of a “self-tour” that lets the viewer engage ambiguity and evidence in a virtual world dynamically and interactively so that the level of confidence can be mediated and adjusted as desired.

By creating these tools, reconstructions can be explicitly linked to the real world while maintaining the flexibility, experience, and interactivity of the multimedia environment. Most importantly, the virtual rendition offers researchers the ability to show a complex set of variables dynamically, thereby allowing them to be intuitively and interactively grasped in combination, a process that is not presently possible using standard techniques of static research presentation.

1 Introduction

Transparency between the real and virtual worlds is desirable, and in certain cases it is essential. The interpretive power of 3D reconstructions of ancient places is apparent in our research, as it is in the work of others (Saratto-Combe 2001; Snyder and Paley 2001). Both the process and the product of virtual reconstructions provide visualization, communication, and experimentation opportunities that might be difficult to attain using traditional 2D or even static 3D techniques (Heylighen and Neuckernmans 2001:91; Snyder and Paley 2001:63). The ability of creators of virtual reconstructions to enhance and direct cognitive perceptions of antiquity (or of counterfactuals) entails risk (Forte 1997). The risk is that virtual archaeological reconstructions can have lives of their own; they are seductive; they can seem viable. This situation, especially when there is no explicit linkage to an evidence corpus of the type usually provided in text-based or static 2D reconstructions in the form of footnotes, or when
the virtual product is not properly constrained because of the lack of evidence, or when a virtual reconstruction is created without rigorous reference to the extant evidence sources, is a problem recently considered by Serratto-Combe (2001). Virtual reconstructions might seem viable, especially when there is no explicit linkage to an evidence corpus; and they can offer an experience that could be perceived as authoritative. Even careful scholars can be seduced by the realistic imagery, renderings, and animations. Although an archaeologist might know what the columns of a particular temple looked like (having found remains at the site), have a fairly good idea of the wall construction (from comparative buildings), but be a bit vague as to the roof of the building (some indications in text resources); still the rendering of this temple might look equally resolved, presenting the same degree of certainty for all aspects.

This paper seeks to address one aspect of the challenge of educating and researching using 3D and multimedia tools: how to use virtual reconstructions in order to enhance scholarship and education (whether of archaeologists, architects, graduate students, third-graders, or tourists) rather than distracting from it. Such distractions could range from waste of research time and money to deception (normally unintended) through the presentation of naïve virtual reconstructions as authoritative. It is this last aspect that we address here. Our goal is to take steps to craft a reflexive relationship between the virtual product and the complex nature of the design and rendering decisions employed in a virtual reconstruction.

A variety of existing tools for providing access to the underlying corpus of evidence have already been suggested by researchers in this field, including some that might exist in the future (for example, Snyder and Paley 2001:68). The goals of these evidence presentation interfaces are twofold: (1) to make evidence accessible to the user of the virtual world and (2) additionally to make the experience more immediate, more “real” and more convincing by rendering an ancient place in such a way that the projected or real activities that took place there resonate through to the user of the virtual world (Serrato-Combe 2001). The concern of our experiments is similar but with an important exception.

2 Quality of Evidence

We are addressing the theoretical and practical issues of making ambiguity unambiguous. In seeking to make the level of ambiguity apparent, one major focus is how to use competing or non-definitive sources of evidence as a basis for all or part of a virtual reconstruction. This can occur because of layered occupation episodes at a site. In such a situation the question becomes: Which building is being reconstructed among the many possible buildings? The reconstruction of Isthmia offers one solution to this: model all the periods (http://humanities.uchicago.edu/orgs/isthmia/siteimages/render_array.html). Another set of issues occurs frequently in archaeological practice when a building’s plan is no longer complete when it is excavated or when an excavation uncovers only a small portion of the ancient place. This is especially prevalent in Cultural Resource Management where restricted funds, as well as the demands of construction or property ownership, constrain the extent of an excavation. Subway construction has been a significant contributor in this case; the Templo Mayor in the center of Mexico City is such an example (Cuevas 1979), as is the “Big Dig” in downtown Boston (http://www.bigdig.com/thtml/archaeol.htm). In many other cases, parts of the building or the site might have been destroyed by any number of formation processes, such as erosion or aggressive earth moving for local agricultural or other needs. Whatever the cause, the result is the same: constraints on evidence available for a reconstruction.

Each loss of evidence opens up multiple, possible, and realizable alternatives for a virtual reconstruction because a less-complete (and thus less-constrained) data set exists as a restraint on interpretation. Only a fully-standing, perfectly preserved, measurable building would avoid any concern for alternative reconstructions (Anderson and Bilde 2000). Thus, any single presentation of a version of a virtual reconstruction is by its very nature an abridged version of the possible reconstructions. In the case of academic researchers, normally the reconstruction chosen is that which corresponds most perfectly to the evidence and the designers’ understanding of it.
3 Reconstructions of Physical Objects

In the museum world, artifacts are regularly reconstructed for display according to the most current understanding of the former reality. In certain cases, the original form is contested, or there are multiple possible realizations in existence. Normally, the viewer is presented with the work without commentary about other possible poses in which the object might be realized or reconstructed. In some cases, the museum curators have provided information to the visitors, making it clear which parts of the statue are real and which parts have been rebuilt. This was done with the Lansdown Herakles, a large, nude male sculpture. Three of the four limbs of the figure have been subjected to restoration that is not readily apparent to the gallery visitor but is somewhat clarified through discrete labeling and through website content. The reconstruction on display contains significant modern reconstructions, albeit a reconstruction grounded in ancient evidence. Here the web-based image employs false color to show viewers what was reconstructed. In contrast, the statue itself is displayed fully reconstructed, giving an impression of seamless integrity where in fact ancient and modern are mixed. (see http://www.getty.edu/art/collections/objects/oz7638.html and http://www.getty.edu/art/collections/objects/ot55507.html.)

In other instances, museum conservation and restoration practitioners adhere to the so-called 10-inch rule. This approach reconstructs objects so that a viewer can stand at a comfortable distance and get a sense of the object’s original form, while allowing the viewer to see, under close inspection, which elements are reconstructed. This is often done with texture and color differences between the original material and the restored material. In certain respects, this is the conceptual frame on which we are modeling the approaches described here. A viewer can experience the reconstruction fully (as from a comfortable distance), but when desired, can quickly interrogate any portion of the virtual object to isolate and identify the nature of the evidence on which it is based, that is, its connection to the real world, to a body of evidentiary data elements and associated interpretations (as if they were inspecting from a few inches away).

Transparency is sometimes used to display gaps. This leaves open whatever portion of the reconstruction cannot be achieved using ancient, original material. It is immediately apparent what is original (as nothing is filled in), but it does lack the complete picture that a good reconstruction can provide. In other cases, false color fills are used in order to more clearly highlight the reconstructed part. The false color fill might either be a color that contrasts significantly with the original material in order to show the degree of reconstruction clearly, or a color that is more similar to the original material. (see http://www.civilization.ca/archeo/ceramic/savage.html for an example of this)

These techniques are already well established, although the limitations in the real world are notable. Once an object is restored, there is considerable investment required to change the form to accommodate new data or to experiment. Such constraints are less relevant in a digital domain.

4 Reconstructions of Architectural Objects

One two-dimensional solution to revealing the relationship between extant remains (evidence of a material nature) and the reconstruction is well-known: books using transparent overlays. For example, in *Israel Past and Present* (Macmillan Travel, 1999), the temple of Solomon has been reconstructed on the Temple Mount in Jerusalem. This is an (at-present) unrealizable reconstruction because the area is contested, and the Haram es-Sharif, or Temple Mount area, is occupied by mosques and other buildings. Similar popular books exist for ancient Rome, Pompeii, and Greece.

Transparent overlays have been attempted at the site level, in full size. This excellent, unique example is situated in Ename, East Flanders, Belgium (figure 1). The resources to accomplish this are more substantial, but the relationship between remains and reconstruction is intuitively apparent. Still, the reasoning behind the entire reconstruction, though it can be read or voiced, is not made transparent to the viewer, although this could be accomplished within the framework the creators have established.
Figure 1. TimeScope 1 system on-site kiosk houses the system that projects its reconstruction onto the visible foundations of the Saint Salvator church. (image from http://www.ename974.org/Eng/pagina/archeo_concept.html; copyright Provincial Archaeological Museum Ename and the Institute of Archaeological Heritage; used with permission)

There are also already several easily accomplished, two-dimensional, computer-based reconstruction techniques available. These include mouseovers, false color (figure 2), mixed opacity values (figure 3), hybrid systems (in this case false color and different opacity values, see figure 4), and rendering types (wireframe, shading, rendered, see figure 5). All these methods offer the viewer a reconstruction based on some body of evidence that grounds it in reality, but none of these methods necessarily addresses the issues of ambiguity or the evidence base on which the displayed view of the ruins and its reconstruction is predicated.

Figure 2. A false color version that shows the level of confidence in various sections of the model. Green hues implies greater confidence, while red hues implies lesser confidence. Darker hues imply greater confidence than lighter hues.
Today, most archaeologists still do not have the time or the tools to attempt a reconstruction of their site. In terms of archaeological reasoning, it is common for an excavator to create a mental picture of the whole on the basis of the fragments found. For instance, the excavator might locate a section of a large wall and a gate and make a logical, conceptual leap to the original built form and begin to refer to the finds as a fortified city. When the excavator finds an oven-base and wall foundations of small rooms organized around wall foundations of a central large room, she might consider it to be a domestic dwelling. The evidence for these inferences is normally presented in a written format (often heavily footnoted) accompanied by static, two-dimensional illustrations in scholarly journals. However, this material is not normally present in publicly accessible formats such as in museums, on TV programs, or on tourist sites. This transformation into the public sphere can reduce an often well-documented body of evidence, conjecture, and reasoned arguments to a single image. In many cases, the Internet (with its ability to combine both graphics and text) has offered the opportunity to offer both reconstructions and text-based detail as an extension of traditional publications. Unfortunately, as the information becomes more popularized through television specials, Web sites, or even games, it might also lack the richness and description of evidence that the original material had.
Important exceptions exist, but in these cases the resources needed to create the result were substantial and far outstrip most normal research budgets. For instance, again using the Temple Mount as an example, the Urban Simulation Team at UCLA teamed up with the Israel Antiquities Authority to create a real-time navigable version of the reconstructed buildings (figure 6). These reconstructions include clickable boxes that allow a user to see static images of remains that actually exist (in comparison to the created model) with some text commentary. Although currently the actual live version of the reconstruction can only be viewed by using an extremely powerful graphics server, the inclusion of the images of the material evidence heightens the believability of the reconstruction.

Figure 6. Reconstruction of doorway to temple mount, with pop-up window showing photo of ancient remains and static text commentary.  
(copyright Urban Simulation Team at UCLA and the Israel Antiquities Authority; thanks to Bill Jepson and Lisa Snyder for permission to use the image.)

5 Multi-Media Opportunities

Multimedia solutions allow a variety of graphic and non-graphic information to be linked. This ability to flexibly associate different kinds of data allows information about the reconstruction to be linked so that details about existing ruins, structural feasibility, textual sources, ancient and modern pictures, comparative examples (appropriate cultural norms), and alternatives offered by other researchers (or even by the public as is the case in Chatal Höyük where all voices are given space) can all be called up and considered by the viewer. Once the viewer has asked for additional information, there is a wide variety of possible techniques that could be used to convey information: sound, text, scanned photographs, links to other reconstructions, etc. Despite the already considerable multimedia tools available off the shelf, we have so far been unable to identify any instance in which the reasoning or the
balance or assessment of the value of multiple evidence sources is articulated visually so that the
viewer can seamlessly make a transition from the viewing of the reconstruction to the rationale for the
reconstruction.

6 Interactive Links: Virtual Reconstruction to Real-world Evidence

Some useful suggestions have already been made about ways to make accessible to the
reconstruction’s consumer the evidence on which the virtual reconstruction is based (Snyder and Paley
2001: 68). Also, steps have been taken to make apparent the process by which the reconstructions are
digitally realized (Samuel and Paley 2000). This is a step in the direction of transparency. Transparency
is desirable and entails the presentation of a real-world basis for a virtual reconstruction. To address this
theoretical issue, we have encouraged students, through the use of Web page explanations, to annotate
their reconstructions with data from excavation reports and interpretations of other scholars. Students
were required to keep “design notebooks,” which corresponded to the development of their computer
models. In these journals the students recorded their questions and uncertainties about their
reconstruction. They also recorded evidence and answers to their questions when answers were
identified (for example: “What did the column look like? On page 100, Petrie states that he found a
partial column base in his excavation of this side of room 8...”).

Providing the information statically has the disadvantage that the viewer is required to remove his gaze
(mental presence) from the virtual world in order to assess its relationship to the real world. This
strategy fails to realize the possibilities of the virtual world and of the multimedia tools. We have made
an attempt to eliminate the divide between the virtual world and its evidentiary basis by allowing the
viewer to stay in the reconstruction while also assessing its relationship to the real world evidence and
conclusions on which it is based. We have made two in-progress prototypes that offer dynamic,
interactive solutions. These are not ideal solutions, but they are a means of addressing this theoretical
concern for transparency between the real and virtual worlds. The prototypes also can stimulate further
discussion of the issues and prompt researchers to create other, better solutions. The intent of these
“consoles”, as we call them, is to allow multiple evidence streams to be perceived both independently
and in interrelation without leaving the virtual reconstruction, but in fact dependent on selecting areas
within the virtual world.

The interactive console makes the reasoning process more transparent because it visually shows a
multiple-variable array of data categories that comprise the evidentiary foundation. The console also
presents the level of confidence the designers place in that evidence, and simultaneously shows the
summary result. A further step, and an equally important one, is to make clear the interlocking nature of
the evidence and the way in which various components of the evidence corpus have been privileged in
the creation of the presented version of the virtual world or reconstruction.

Console 1

In the context of web-based interactive 3D reconstructions, certain areas within an image can be made
“live” so that when the mouse moves over them the data appropriate to that area are invoked and cause
an interactive, multimedia console to appear. The console shown in figure 7 was made in Dreamweaver
using simple menu-driven commands that produce a series of disjointed mouseovers that link to pages
containing further details about the reconstruction and the evidence on which it is based. The console
shows the creator’s confidence level in the material being viewed. This confidence (or lack of
confidence) can be made apparent to the viewer by using real images of the archaeological site, varied
opacity levels, false color, and rendering-type depictions of a reconstruction; these links are above the
image of the temple portico. Links to other possible reconstructions are also offered so that the viewer is
able to cycle through other options as possible alternative reconstructions. In this example, there are
multiple possible column types that might be appropriate in this reconstructed Egyptian temple portico.
Figure 7. The console that can be used to cycle through various reconstructed views. The console uses bar graphs to graphically present the evidentiary basis for the various choices.

Figure 8 also shows how a viewer can easily select one column (lotiform column in this example) after another to see the data for that particular reconstruction. More importantly, an image pops up to show visually and interactively (in response to the mouse movements of the viewer) what level of confidence the designers had in the object under investigation (lotiform column) compared with the best case (bundled papyriform column). The bar graphs show the confidence level for each of the three evidentiary categories on which the aggregate measure was calculated: archaeological, documentary, and comparative (note that others have used varying categories (Wright 2000)). A user who wants to query any of the individual categories, or the aggregate indicator, clicks on the meter, and an explanation will pop-up describing the evidence source or clarifying how the aggregate confidence value was calculated.
Figure 8. Pop-up windows appear when any of the evidence bar graphs is clicked, in order to allow access to a discursive narrative about the evidence. (composite image)

Console 2

A second prototype is focused more on user interactivity in producing architecture reconstructions (of a single element) and then providing a “confidence meter” supported by textual evidence indicating the likelihood of that reconstruction (figures 9 and 10). Flash was used to achieve this end.
Figure 9. An area of the virtual reconstruction can be used to link to a pop-up window that gives information about the level of confidence in this element of the reconstruction (prototype mockup).
In the example shown (figures 11 and 12), the user selects among the choices of capital, shaft, and base of a column. The system was designed to prevent “nonsense” selections from being made (for example, a Hathor capital with a tapered bundled shaft on a double circle base). Essentially, a morphologic table of columns is provided with the base, capital, and shaft as the parameters. The column is shown in context, and the confidence meters would activate through mouseovers a mainly textual description for the evidence used in making the reconstruction. In addition, a pop-up window would show a QuickTime VR of the column or other building element being discussed.
7 General Characteristics

When a user wants additional information about an area, she need not leave the reconstruction and enter a text data environment. Instead, the user is given dynamic access to additional information visually, allowing a nested view of the console’s critique and the object under critique. In the case of Snyder and Paley, whose interesting work is bringing the Palace of Ashurnasirpal into ever-sharper focus, the evidence underlying the reconstruction is presently available to user interrogation as external links to the reconstruction (for instance, multiple drawings and alternate ground plans can be viewed). In addition, the creators of the site not only state a confidence level for their reconstruction, but also provide evidence supporting their version of the reconstruction. The console described in this paper differs from that because of the interactivity and the image-based delivery of information about the evidentiary basis for the reconstruction.

These are two steps in the direction of transparency between the real world foundations and the virtual reconstruction. A key benefit of the graphic presentation of the various evidence types is that it offers the possibility of representing the reasoning process used by the designers of a virtual reconstruction. To do this without the intervention of an avatar (which would have both benefits and drawbacks), we created a visual representation of how the evidence available to the designers was evaluated and applied in the particular component part (or the total reconstruction) being queried by the user of the virtual world.

8 Future improvements

Our suggestions provide a framework in which reasoning, level of confidence in the evidence, and the nature of the evidence that ties a virtual construction to the real world (past or present) is presently offered in two-dimensional interactivity. It could expand to a 3D holographic environment (Snyder Paley 2001:68). In the future, it might be feasible (and more affordable) to have an ersatz or avatar scholar available to give tours of a virtual space or reconstruction in the way that home tours or Discovery channel site tours are conducted on television today. This interactive interface would be able to articulate the evidentiary basis for a component of the reconstruction and the level of confidence, making the relationship between the real and virtual portions more transparent. In some more distant future, it should be possible to invoke a completely immersive holographic experience so that using voice commands, a viewer could manipulate and interrogate the reconstruction.

Another future direction for this research might be the development of a meta system that would help scholars create their own versions of this kind of interactive dynamic console. In some ways this might be like an IBIS (issue based information system), but instead of design issues the tool would query evidence and arguments.

It is unclear whether scholars will find these content creation and explanatory exercises useful enough in their research to warrant the effort. The norm and culture of the field of archaeology has historically

**Figure 12.** A QTVR can be embedded in the console so that a viewer can look at the chosen element from all sides and in three dimensions.
been to accept the high ethical standards and the authority of the author as a guarantee of appropriate, acceptable analysis. Usually an author uses a set of illustrated, textual reports or technical articles in which to display authoritative knowledge of the site through text-based, heavily footnoted articles. Specialist knowledge is displayed and specialist knowledge is also required to effectively challenge or probe the material presented.

In many cases, academic inquiry and the assessment of the evidentiary basis of a virtual world might not be the primary goal of the reconstruction. In such cases, and in order that a viewer can experience the virtual world or reconstruction directly, the console can be “turned off.” This prevents the benefits of the console (its ability to appear instantly) from becoming a liability; the pop-up console will not spoil the wonder of the reconstruction and the experience of this virtual world.

9 Interactivity of Explanation

Users’ expectations of and fluency in multimedia and interactivity is viewed as part of the challenge and as part of the solution. Our experiments evolve from recognition that “seeing is believing” and “the medium is the message.” Because any virtual reconstruction of a past world is grounded and limited by its presentation format (whether a multimedia or 3D presentation, or a static drawing), we attempt to communicate the critique of what the viewer is experiencing and seeing through interactivity, in multimedia, in a 3D methodology. Users of a virtual reconstruction perceive visual data, and so we choose to present the critique of this evidence and the linked design decisions in visual terms.

Our goal here has been twofold: to present the results of these first logistical experiments, and to raise several issues germane to the presentation of ambiguities inherent in all virtual worlds that are reconstructions of a past reality. All serious researchers consider the problems of interpretation when they make any leap from evidence to reconstruction. Some researchers actively engage the issue of multiple possible or feasible interpretations of the data. There are excellent examples of work in which the ambiguity inherent in a fragmentary archaeological record have been acknowledged and even explicitly presented [Eiteljorg 2002; Snyder and Paley 2001]. This is not entirely an academic exercise. In this world of CD and DVD supplemental materials, interpretive commentary and interactive analytic tools might be welcomed by the public and educators in the same manner as film buffs revel in a director's audio track, behind the scenes material, or out-takes.

Few creative solutions currently link evidence to an interactive reconstruction; yet there are strong reasons to explicitly address the multi-variant nature of the ambiguities inherent in alternate reconstructions. The level of objectivity or evidence can vary widely, not only on a gross scale but also from element to element in a virtual world. It is not only that a particular plan might be substantially different, but that individual pieces within a particular microcosm of the virtual world could vary independently. Our experiments focus on the dynamic possibilities of virtual worlds and attempt to engage the viewer dynamically in the presentation of levels of evidence, alternatives, and objectivity. One goal is to show everything, all at once, to make the experience of the ambiguity of the virtual world as transparent and seamless as the experience of the presented environment in a dynamic and interactive solution. We are not there yet.

10 Summary

These attempts to make concrete experiments with the presentation of ambiguity were catalysts for us to consider critically what the rationales are that underpin the creation of a virtual world. Fundamentally, a concern for ambiguity recognizes that there can be multiple sources of evidence, multiple bases for reconstructions. When archaeological reconstructions are at issue, there is the further layer of analysis because interpretation is a creative authoring act that takes place in the present. Ideally, this reconstruction or presentation of the past occurs in some bounded relationship to a body of evidence in the past. But the bounds of this relationship are potentially fluid and elastic. The perspective of the
interpreter is fundamentally and explicitly engaged in the identification, the evaluation, and the selection of the evidence being used as criteria for elements and versions to gain entrance, or to be excluded from a virtual world. In short, the difficulty is how one can dynamically and fixedly represent the intention and the expertise or competence of the author of the virtual world.

Even once the nature of the foundational evidence has been identified and evaluated, there remains the issue of confidence assessment in the assigner of the evidence confidence assessments. In this respect, the virtual world is always unable to escape the limitations of its real world origins, and it is grounded in the same need for critique and reflexivity as has any investigation of our environment, past or present. If the means of making ambiguity transparent is left unconsidered, then the money and time lavished on such reconstructions is not well spent and might be better directed toward programming a video game, which would at least have commercial potential.

Sources Cited


Wright, G.R.H. Ancient Building Technology, Volume 1, Historical Background, pg. 89, ed. Brill, Ledien, Boston, Koln, copyright 2000. It is interesting in the classification of Greek buildings (noticed after this paper was substantially written) that his sources for evidence are listed as archaeological evidence, art evidence by way of ancient representations, epigraphic evidence (contracts), and literary evidence.