

The Rome Reborn Project.

How Technology is helping us to study history

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In the Dark Ages before the Internet—and some of us are old enough to remember those gloomy times—we used to love to say, “the more things change, the more they stay the same.” Now we have to emend the old cliché and say, “the more things change, the more they become really different—and better.” A case in point is the study of History and the humanities generally. When I was starting my career as an assistant professor of Classics in 1976, a new scholarly project was almost always conceived and implemented by an individual scholar. Publications rarely had more than a single author. That is the way humanistic research had been conducted for literally millennia, since it began—at least in the western world—in the Alexandrian Museum in the third century BCE.

Why did we conduct our research in this way? The answer has a lot to do with information technology. In the analogue age, books were written out and copied by hand or, starting in the mid-fifteenth century, by the printing press. The great scholar was the one who could read, retain, and synthesize the most information from the books he read. Reading could only be done by one person at a time and the “information pipeline” consisted of tools best utilized by individuals: the pen or pencil, typewriter, printing press, and printed book. Imagine trying to employ such tools to write a coherent text co-authored by ten, one hundred, let alone ten thousand scholars. It may have been theoretically possible but, in practice, it hardly ever happened, at least if we leave aside exceptional cases such as encyclopedias or scientific journals.

How different things have become in just the past twenty years since academics got access to the Internet! These days, a scholar can “read” —that is, search through—hundreds of thousands of online books and scholarly papers in an instant. This is far, far more than any individual scholar could ever have read, let alone remembered, in an entire career before the Internet came along. Today, data can be just as quickly mined from vast databases, such as the US census reports. Collaborative software exists that not only allows dozens of scholars to co-author a research report but these wonderful computer programs often don't even cost anything.

So today, the humanities are well on the way to becoming part of “Big Science.” Like Earth Science, Neuroscience, Genomics, etc., disciplines like English Literature, Art History, and Archaeology are launching projects based on large teams of experts who cover a subject in a holistic way. Of course, History and the other fields in the humanities have a long way to go before they will catch up with the physical and biological sciences, but the way things

are going, it won't be long before the individual, isolated scholar working in the "Alexandrian" mode will himself have become a museum piece.

Just as the production of scholarship in History is changing, so, too, is its dissemination. Go to your local library and count the number of people in the stacks. I bet the number is pretty low. Then go to the area set aside for public computers. I bet it's very crowded. And now think about all the people who are accessing the same information in their homes, dorm rooms, or in coffee houses.

Printed books and journals aren't disappearing—indeed, more than ever are being published. But these days, they are not the principal way we get our news or our research sources. There are vast online repositories of excellent scholarly materials, many of which are free to students and scholars (even if their universities have to pay a site license to make them available). Thousands of scholarly journals have been retrospectively digitized and distributed through JStor. ArtStor is doing the same thing for the old 35mm and large format slides with pictures used by historians and students of art and architecture. Then there are all the "born digital" online publications whose number is increasing every month. In my field of Archaeology, we have *Internet Archaeology*, which has become one of the liveliest and most-cited outlets for new scholarship. And let's not forget that Google is creating a free, online library of millions of books from renowned libraries of universities such as Stanford, Michigan, and Virginia.

Scholars in the humanities have not been slow to realize the enormous potential of the information technology. The generation of the 1960s, of which I am a proud part, thought it would revolutionize the world in terms of politics. Instead, it turned out that as we passed the dreaded threshold of 30, history had another and arguably more important project in mind for us: the Digital Revolution. In the 1980s, Bitnet came along and enabled us to embrace e-mail and the Internet a decade before our fellow citizens did. Hypertext was developed by academics to link texts and images on local machines. By the late 1980s, Gopher, which linked academic databases over the Internet, laid the groundwork for the World Wide Web. The Web was indeed developed in the first instance by Tim Berners-Lee to facilitate scholarly communication by making it possible to do Hypertext-like scientific applications on a Gopher-like Internet platform.

So, the 1960s generation developed revolutionary tools to improve scholarly discovery and communication, and then these tools spread to the general culture in the form of e-mail and the World Wide Web. They are now bringing about the kind of peaceful, enlightened political and cultural revolutions that we dreamed about when we were college students protesting racism and the Vietnam War in the 1960s, as Barack Obama can attest! But they have also brought fundamental changes to the way we do History and the humanities.

A case in point is the Rome Reborn Project. It bears all the marks of the Digital Age in which it was started. It is built on a foundation of information technology, the Internet, and collaborative teams doing holistic research. Its goal is to create scientific 3D digital models illustrating the development of the city of Rome from the first settlement in the late Bronze Age (ca. 900 B.C.E.) to the dramatic depopulation of the city in the early Middle Ages (ca. 552 C.E.). The term "scientific" in the preceding sentence means that the models are authored by qualified experts and that they offer their users transparency as to

the sources and quality of the information on which they are based.

Of course, this is an enormous undertaking, and one that will require hundreds of man-years to create. "Rome wasn't built in a day," and virtual Rome certainly won't be, either. In fact, the project was conceived in 1974, was first publicly proposed in 1986, and got its first funding and started in 1996. And it has taken twelve years to create a rough sketch of how Rome looked in just one year, 320 C.E. But if I, as its 59-year-old director, can look optimistically to living long enough to see significant progress made on the project, that is because of digital technology. Up to now, the project has been conducted by a relatively small group of invited participants. But thanks to the new technology, we hope soon to open up the project to all qualified contributors, who can submit their work for peer-review and see it published as part of the overall temporal-spatial model of the city in an online journal dedicated to world cultural heritage. In so doing, we hope to speed the day when it will be possible to track Rome's development over the first 1500 years of life in The Eternal City.

Why model ancient Rome? I am frequently asked this question, and I respond in two ways. The first emphasizes the word "model," the second "Rome."

Let me start with "Rome." When I used to teach Roman Civilization to classes of hundreds of students at UCLA, I always began the course by asserting, "the Romans were the Americans of the ancient world." Ancient Rome, like the United States, was (or, at any rate, came to be) a tolerant, multicultural, meritocratic society that controlled the enormous territory stretching from northern England to southern Iraq. It maintained its empire far longer than did that of any other ancient people—for at least six or seven hundred years. It did so because, in contrast to those empires, which were based on oppression of conquered peoples, the Roman Empire was based on cultural assimilation. And, arguably, in terms of the things that really matter in our private and public life such as religion, language, law, and government, Rome's influence in large part survived its decline and fall. The city of Rome was the capital of this far-flung empire, and it reflected in miniature the peoples, values, and cultures found within its borders. So, when we study Rome, we study ourselves—and I would be the first to add, "warts and all."

Why *model* an ancient city like Rome? A 3D model is a form of visualization. Across all branches of knowledge today, scientists have found that next to logical and quantitative analysis, visualization is a powerful tool for understanding and discovery. Our surgeons use MRI to see inside our bodies before removing a tumor so they can remove just the diseased tissue and get as much of it as possible. Economists model commercial activities consisting of thousands or millions of individual transactions so that they can "see" emergent patterns that would be impossible to detect using any other method. Astronomers sent the Hubble Telescope into space to look millions of light years back in time so that they could detect features of the Universe that cannot be seen by the most powerful telescope on Earth. Only when we see such data can we understand and analyze it. Often, only when we have a visualization do we even become aware of features always present but never apparent to the naked eye or unaided mind.

Ancient cities like Rome are no exception. They have mainly disappeared from view, leaving behind only random remains and literary descriptions. Even the best preserved of

ancient Roman buildings—the Pantheon or Colosseum come to mind—have been so changed over time that you must delve into long scholarly reports to begin to imagine with your mind's eye what they looked like and how they actually functioned. Or, you had to do so before 3D digital graphics came along in the 1990s. Since then, it has been possible to “see” the Pantheon, Colosseum or, potentially, the entire city with the same clarity as a surgeon gets when looking at the MRI of an internal organ. And what you see not only has an emotional impact but also often gets your creative juices flowing. For example, one old problem in the study of ancient Rome is whether when you entered into the vast space of Trajan's Forum, you could see the enormous statue of the Emperor Trajan atop his column at the end of the long axis. This question arises because the column stood behind the Basilica Ulpia (an enormous three-story public building). Was the basilica tall enough to block a view of the portrait of the emperor on the column? Wouldn't the emperor have wanted people to see him looming up as they entered his impressive public space, his expensive gift to the citizens of Rome?

Once we have a 3D model, we can simulate a visitor entering Trajan's Forum, and we can prove that it was, as expected, possible to see Trajan's statue: the basilica didn't block it. So far, so good. But once we have the model of the entire city, we can see something we never even thought to ask: you could also see Trajan's statue when you entered the Forum of Julius Caesar. This is quite unexpected, but, once we think about it, quite natural. Caesar's forum was next to Trajan's. It underwent two major building phases: in the first, it was constructed by Caesar and finished by his adopted son, the Emperor Augustus. In the second, it was rebuilt by Trajan. So, Trajan had a stake in Caesar's forum as well as in his own. As the Roman archaeologist who first observed this fact when exploring our model put it, “Trajan got a twofer!”

So, the 3D model of the city of ancient Rome permits a kind of experimental or experiential history. It made it possible to, in effect, travel back in time and test out a hypothesis (in this case, that you could see Trajan's statue upon entering his forum) that would otherwise have had to remain in the realm of speculation. It also made possible an unexpected new discovery. For this reason, I like to compare scientific 3D models to microscopes or telescopes: models not only illustrate what we knew when we started creating them, they also have the potential of revealing new knowledge that was always lurking below the surface of the facts but which, to emerge and be grasped, needed to be visualized in 3D.

I vividly recall that when we first started to make the Rome model, a distinguished Classicist at Brown University said to me: “Bernie, don't think that by creating a digital model of Rome, you will be improving the status of Classics among the disciplines. What you'll really be doing is helping the field of Classics to stay alive in the twenty-first century.” When I asked him what he meant, he said that by the year 2000, many disciplines would be using models and visualizations. Classics needed things like Rome Reborn just to keep pace.

Now, we can look back and see that my colleague was right. Visualization has become a standard tool in most of the sciences. Video games have long since trumped movies as the preferred form of entertainment of young people. We even know from Steven Johnson (author of *Everything Bad is Good for You*) that video games are good for children, implicitly teaching them not only hand-eye coordination but, more importantly, how to explore,

experiment, and think inferentially.

Visualization is just starting to come to History and the humanities. Now that Google Earth has decided to include Rome Reborn as a layer that all its 400 million subscribers will be able to access, I can safely predict that visualization is here to stay and is about to take off in terms of quality and quantity. It makes little sense for ancient Rome to be the only ancient site offered in Google Earth. A precedent has been set and, I hope and imagine, a demand for more such models kindled. Google Earth offers an ideal platform on which we can publish such work, be it of Giza in Old Kingdom Egypt, Athens in the Age of Pericles, or Monte Albán at the height of Zapotec culture. Google Earth is freely available, has a vast installed user base, and supports not only the 3D model but also related scholarly documentation through an information bubble that is attached exactly to the spot in a model where elucidation or explanation is needed. We digital humanists are eager to provide models, and our students increasingly expect and demand them. Let me conclude by expressing the hope that Google Earth will provide the wherewithal to fulfill the digital dreams of students and scholars alike.

Further Reading

Bernard Frischer and Anastasia Dakouri-Hild, editors, *Beyond Illustration. 2D and 3D Technologies as Tools for Discovery in Archaeology*, British Archaeological Reports (Archaeopress, Oxford, 2008).

Colin Ware, *Information Visualization. Perception for Design*, second edition (Elsevier, San Francisco, 2004).

Links

Rome Reborn project web site: www.romereborn.virginia.edu

Ancient Rome 3D in Google Earth: <http://earth.google.com/rome/>

Institute for Advanced Technology in the Humanities: www.iath.virginia.edu



View of Rome Reborn model from the Palatine across the valley of the Circus Maximus to the Aventine (Rome Reborn version 2.0 [alpha]; model copyright 2008 by The Regents of the University of California. All rights reserved. Image courtesy of Procedural Inc.).