Multimedia Tools for the Investigation of Architectural History

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Abstract

This paper examines existing methods of teaching architectural history and identifies opportunities which are offered by computers for surveying, analysing and reconstructing the buildings of the past. A newly developed hypermedia system, 'Microcosm', is described and its use for teaching history is discussed.

The Teaching of Architectural History

History has always been regarded as a fundamental part of an architect's education. An understanding of the past helps to put the current architectural scene into context and architects have always used the buildings of history to inform their design thinking. Whether one refers to this as the use of precedent or as a case-based approach to design such an awareness is crucial to the ability of the architect to work in the present, and plan for the future.

Despite its position at the core of the curriculum architectural history is often taught in a rather unimaginative way. The past is viewed as a continuum populated by buildings which must be dated, located within a particular stylistic category and, if possible, attributed to an architect. There is a focus on the objects rather than on the process by which they were produced and, as a result, the theoretical ideas behind the buildings tend to be ignored. The historical knowledge of the student is judged on his or her ability to identify and classify a building by date, style and author, to briefly summarise its social and technological context, and to make simple comparisons between buildings.

Such an approach has certain advantages. By mainly focusing on the building as an object history can be viewed as a world of facts rather than as a domain subject to alternative interpretations. History courses can be assessed through straightforward examinations which test the student's grasp of these 'facts', perhaps even through the use of multiple choice questions.
It is generally acknowledged that essays provide a richer way of assessing a student's understanding of history but, for the essay to be anything other than a regurgitation of lecture notes, access is required to a good library and, if possible, to original texts, drawings and illustrations. There are few institutions which have a sufficiently comprehensive library to provide this material and even with those that do there can still be problems when a whole class of students tries to access the same material within a limited period of time. This can result in a reliance on few sources, usually second hand, and an essay which presents a pre-digested and unoriginal view of the topic.

Architectural history, both in research and teaching, provides numerous opportunities for utilising new technology, from computer-aided surveying and drawing on the one hand, to interactive multimedia applications for presenting material on the other. However, with the division of our culture into the arts and tile sciences, historians find themselves alienated from the world of science and, being untrained and ill at ease with its tools, tend to rely on traditional techniques to pursue their profession.

The information the historian uses comes from two primary sources, the building itself and associated texts, either by the architect, as with Serlio, Alberti and Palladio, or by contemporary writers. The buildings are analysed using hand surveys and drawings complimented by photographs, with texts being consulted, often following a translation. When history is presented the process is reversed and the universal output is an illustrated book. The only evidence of new technology in this process is the humble word processor which has now been adopted by most historians after some initial opposition.

**Opportunities Offered by New Technology**

There are three areas where new technology can aid the historian - recording existing buildings, analysing and reconstructing these buildings, and presenting the information thus generated in new ways. As I have described these techniques elsewhere (Day, 1992) so I will only summarise them here.

Photogrammetry is a surveying technique originally developed for the map-maker which has now been adapted for recording buildings. It offers an accurate way of capturing dimensional information from stereo pairs of photographs which are digitised in a photogrammetric plotter. This produces a drawing file capable of being read by a standard computer-aided design (CAD) system and has a number of advantages over traditional methods. It is extremely accurate, for example a recent survey that was carried out of Inigo Jones's Banqueting House in Whitehall, London was accurate to within 8mm on a facade 30 metres across. If one requires more detail of a particular part of a building the stereo photographs can be used to extract additional information at a later date and, as the photographs can be retained and replotted at any time in the future, the data has a permanence which is absent from hand surveys.
Accurate survey data can be invaluable when it comes to analysing the proportional systems used in a building. Throughout the Renaissance proportion, number and measure were used in order to regulate the spaces and elements of building into a harmonious whole (Rykwert & Tavernor, 1986). When analysing such buildings it is important to be able start from an accurate survey and avoid the kind of mistake that was made by historians at the church of San Martino a Gangalandi near Florence. What was through to be an early experiment in false perspective turned out to be a distortion of the whole building caused by settlement of the foundations, (Borsi, 1986).

A further advantage of the photogrammetric method is that the operator is not restricted to two dimensional data but can also extract the third dimension and therefore use the survey as the basis of a three-dimensional CAD model. It is then possible to use that model to reconstruct the building as it was originally, or to visualise it had it been finished according to the architect's original intentions.

The information described here is of a new kind. Increased levels of accuracy can be achieved and the modelling, rendering and animation facilities of computers provide the historian with material which previously was not available. They also offer new ways of organising and presenting information, from traditional as well as digital sources.

**The Development of Hypermedia and Multimedia**

When Apple launched Hypercard in 1987 it received enthusiastic reviews, although many commentators were unsure of its exact use. The idea was that you could put information - text or pictures - onto 'cards' which were then organised into 'stacks'. A stack could represent a fairly simple set of data, such as an address book, or a gazetteer of restaurants in a particular town and contained the usual searching tools available within a standard database. However the stack's author could also provide built-in links which gave the user a new way of moving through the information. By creating 'buttons' which were linked directly to specific pieces of data the user could, for example, click on a city block on a map and immediately access a list of all restaurants within that block. By clicking on the name of a restaurant he could then go to the current menu that was on offer, from there to a review of the food in a national food guide, and so on. By utilising the inherently graphical nature of the Macintosh interface, buttons could be placed anywhere within text or graphics, and interlinked to provide a sophisticated data set which was easy to use.

Since then the multimedia capacity of computers has expanded considerably. As well as conventional text and graphics it is now possible to include sound, computer animation and video, all of which can be linked together and displayed simultaneously. Although the creation of multimedia productions can be very time consuming they are ideally suited to situations where the user requires access to information in a variety of formats and where there is no single, predefined route through that information. Teaching is an obvious example of such an application and computers can now take on the role that was defined but never satisfied by the teaching machines of the 1950s.
Such applications are clearly of use when it comes to teaching architectural history. They combine the graphical and textual information required by a history which is primarily visual, and they offer flexible ways of navigating, through that information. Indeed a number of teaching packages have been developed using both Hypercard and Supercard, although these do tend to concentrate on graphic images with limited amounts of text. However standard hypertext systems have some disadvantages. Buttons have to be put in manually, a process which is very time-consuming; links have to be fixed at each end, with a resulting inflexibility; and text which is in a read only format, perhaps on a CD-ROM, cannot be used as it is impossible to make a link from that data.

These problems are a result of the closed nature of the hypermedia systems being used and we are currently working with an alternative implementation of the ideas behind hypermedia using a product called 'Microcosm' (Fountain et al, 1990).

A Description of Microcosm

Microcosm is an open hypermedia system which was designed to allow the user to browse through large bodies of multimedia information by following links from one place to another (Davis & Rush, 1991). Microcosm differs from other offerings in that it is an open system which allows a number of autonomous processes to communicate with one another through a system of link passing. These links exist independently of the documents to which they refer and so there is no mark-up of the kind usually associated with traditional hypermedia systems. Rather there is a link database which exists separately from any of the material which is being accessed and which holds information about the source anchor, or button, the destination anchor, and any attributes of the link itself. The following diagram illustrates the basic Microcosm model.
Microcosm comprises a series of modules which operate independently and communicate with one another. The two key elements are the viewers, which allow Microcosm to view documents or drawings in their native format, and filters which receive messages, take an appropriate action, and then pass the message onto the next filter in the chain. The database which holds all the links between a user's action, such as selecting a button, and an outcome, such as viewing a text or drawing, is one such filter.

In most systems the source anchors have to be individually specified but this not so in Microcosm. Here source anchors can be generalised and so a completely new document which is entered into the system, without any mark-up, can have access to all the links that have already been defined for words within that document. So, for example, if one had already defined a link between the name of a particular architect and a list of his buildings then that link could be accessed from a completely new document, even if it were on a CD-ROM or video disk. When such a feature is combined with text retrieval facilities which allow one to search an entire document, or set of documents, to find all instances of a particular reference one has an extremely powerful tool for the historian. Microcosm deals with text retrieval by compiling an index after stripping out all the non-substantive words and word-endings. It is therefore possible to do a word-search very quickly and be offered a summary table which lists those documents which contain the selected word, rank-ordered in terms of the number of times it has occurred. New links to that word can then be created by the user if required.

As well as dealing with text Microcosm can handle, bitmapped images, sound, Video and computer animation. At the moment the links from the bitmaps, such as photographs, are dealt with as conventional buttons, but work is being undertaken to provide a graphic searching facility where images are coded and can therefore be classified and located similarly to text. This will then be linked to the AutoCAD Viewer to provide direct access to survey drawings.

It is clear that with Microcosm, and similar products, there are new opportunities available to help with the teaching of architectural history. There are two separate advantages: multimedia products allow very large quantities of information from a variety of sources to be combined, and hypermedia applications, such as Microcosm, allow that information to be searched and accessed flexibly and comprehensively. To illustrate how these tools might be applied I will describe some work that we are currently carrying out on the 15th century Renaissance architect Leon Battista Alberti. This illustrates the kind of package that could be constructed on other significant architects.

1, Leon Battista Alberti - Theory into Practice

When Leon Battista Alberti published De re aedificatoria (On the Art of Building) in the middle of the fifteenth century it was the first modern treatise on the theory and practice of architecture. Unlike Vitruvius's De architectura, which was written to record a passing era some 1500 years earlier, Alberti was concerned with the buildings of the future. The Ten Books dealt with both theory and practice and set out
procedures for the design and construction of new buildings as well as the repair and maintenance of existing ones. Alberti moved to architecture after a successful career as a diplomat and man of letters and the elegant Latin of his prose, directed at patrons as well as architects, helped to establish the subject as an intellectual and professional discipline. It provided architecture with a proper theoretical context and was one of the foundation stones for the buildings of the Renaissance.

For a student of architectural history Alberti is an ideal subject for study. He has built a limited number of buildings, written Ten Books, which place his built work within a theoretical context, and has had a lot written about him in the subsequent centuries. A multimedia database of his work would therefore include the following:

Photogrammetric survey drawings
Original illustrations
Photographs/video clips of the buildings as they exist now
CAD models and animations showing the buildings as originally constructed
CAD models and animations showing the buildings as intended by Alberti
Extracts from the Ten books
Commentaries on Alberti by other authors

With a product such as Microcosm it is possible to take this material and organise it in two distinctly different ways. The first, known in Microcosm as a Mimic, is to set up a predetermined route, or to be more accurate a set of possible routes, which can be used by a student to browse the material in a predetermined way. This is very similar to the kind of interactive display that could be put together with a traditional hypermedia system, such a Hypercard. The second is to build on this application by letting the student use the system to access information through the use of the powerful search and link tools that are available within Microcosm. The student therefore becomes, in effect, a researcher and uses the tools at his or her disposal to become familiar with the subject area in general, to develop some ideas, and then to test these ideas against the available texts and images.

Using this technology the student can be given access to up-to-date and accurate material from a wide range of sources which makes it feasible to compare visual and textual descriptions in ways that are just not possible with traditional media. It is also possible, for example, to access an AutoCAD drawing while viewing a text and then, if necessary, extracting accurate dimensional information from the drawing in order to test an idea about proportions. By separating the link information from the data files it becomes possible to use the growing body of knowledge that is already becoming available on CD ROM. For example one of the by-products of an exhibition we are currently preparing on Alberti is that the original survey data and many of Alberti’s texts and translations will be marketed in this format. By using Microcosm it is possible to integrate that information directly into a hypermedia application and thus provide the student of architectural history with a tool that is capable of yielding results that would be of considerable interest to the serious researcher.
Conclusion

New technology has become a familiar sight in the design studio, the laboratory and even in the library. However with a subject like architectural history where the task of the researcher, and of the student, is to consider large quantities of textual material supplemented by relevant illustrations there is still a reliance on traditional methods. As original material is often in short supply students tend to work with limited references and the subject tends to be dealt with as a chronology of facts rather than a set of theories which use the evidence of the past to construct alternative views.

The techniques that have been described here illustrate how new technology can be used to broaden the base of material that is available for theory building. Photogrammetry allows accurate surveys to be carried out which can be stored as digital information. CAD offers ways of analysing that information and reconstructing photorealistic models of how buildings might have looked. Hypermedia applications, such as Microcosm, provide a particularly useful way of accessing that information. These techniques offer a number of real benefits. The student can begin to deal with the material at a number of levels simultaneously and switch between these levels at will. So, for example, he could follow a predetermined route through the information picking up the main thread of an argument as one would through the use of an introductory textbook. However, if he became interested in a particular building, he could examine survey drawings showing the building as it exists today and check out some of the proportional relationships for himself. He could also consult the architect's description of the building in translation and, if necessary, in the original language. This allows the student to begin to strip away the layers of meaning that have been attached to a building and examine original sources rather than second or third hand speculations. It gives the student the means to carry our original research and offers tools which can help compare competing theories by looking at the actual evidence rather than by having, to take what is offered by way of support to a particular argument.

The tools and techniques that have been described here are fairly sophisticated, although the computer hardware necessary to run a package like Microcosm is becoming increasingly inexpensive. There are copyright issues related to the use of textual material in digital format but these will be overcome, to a large extent, as increasing amounts of core material becomes available on CD. It may be that for the junior student such technology is overkill and all that is required is an inexpensive introductory text that can be bought in the local book shop. However for the more serious student, particularly at postgraduate level, the tools here would offer real benefits. Only the very best libraries can offer reliable access to the texts that are necessary for even quite modest research and digital media have so many advantages over the printed page that this format is likely to proliferate, particularly for specialist works where printing costs can be avoided altogether.

Once the material becomes available electronically it makes sense to use hypermedia to manipulate it as one then has the benefits of large quantities of data coupled with tools to extract information with ease. Viewing the information in new ways may well bring new theories, as any theory is simply a new way of looking at what already exists. The technology can also help to integrate history with the design studio through
the use of common resources and skills, such as CAD, to reconstruct and examine the buildings of the past. However perhaps the greatest benefit of the kind of system described here is that it begins to break down the rigid chronology of traditional architectural history. It allows material to be brought together and gives a student the tools necessary to explore it in new ways.

References


Rykwert, J. & Tavernor, R. (1986); Sant’ Andrea, Mantua; Architects Journal, 21 May 1986 (pp 36-57)
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