8
Multimedia communication in archaeology – why and how

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8.1 A brief introduction

Multimedia has become one of today's major buzzwords in communications. This is primarily due to the ever increasing bandwidth available in public networks. This bandwidth, in conjunction with new communication protocols currently under development, enables exchange not only of plain text, but also of drawings, graphics, tables, and images. Moreover, even high-volume digital video information can be transferred in real-time.

On the other hand, archaeological research in very many cases suffers from information being unavailable at those places where it is really needed. Furthermore, archaeology typically needs visual information in addition to plain text. Thus, we are convinced that use of multimedia communication systems would be a well suited vehicle to make relevant information available world-wide in a timely manner. This holds for both reference material as well as on-line expert advice.

The remainder of the paper is organised as follows: Section 8.2 discusses possible archaeological applications of multimedia communication systems in different typical scenarios. The technology related issues are presented in Section 8.3. Finally, Section 8.4 gives some concluding remarks.

8.2 Three scenarios

This section is intended to demonstrate the use of multimedia communication systems in archaeology. There are obviously other areas of applications, such as teaching. However, we want to focus on those that are archaeology-specific.

One of the most important methods in archaeology is visual comparison. This is inevitably involved in dating types of pottery or analysing stratigraphic situation in excavations, for instance. Today, some important issues need to be discussed internationally, rather than on a national or even regional basis. This is simply because prehistoric artefacts must be dated with the traditional comparative historical-archaeological method.

In the following, we provide some typical examples to illustrate the potential usefulness of multimedia systems for archaeology.

8.2.1 Analysis of stratigraphic situations

One of the questions currently under discussion in Germany is the deviation of dates obtained using the radiocarbon method or dendrochronology from those indicated by the historical/archaeological chronology of Neolithic and Copper Age Central and South-Eastern Europe. To answer this important question it is necessary to analyse guide-forms of pottery in their stratigraphic situation. These guide-forms are used as contact-pottery in the European chronology.

One of the most peculiar pottery types of the Neolithic period is the gynaicomorphic pottery which was found in Twann at the *Kleine Hafner* near Zürich, Switzerland. Obviously, the stratigraphic information relating to this pottery is of major importance. This is particularly true in this case since the dendrochronology dates differed from those obtained by the traditional method. The adjustment of the chronological system was done using pottery from Hungary and other Eastern European countries. The archaeologist Jörg Petrasch calls for a comparative analysis of European prehistory with the Balkans, the Aegean, and West Turkey (Petrasch 1984). A detailed discussion of this issue is well beyond the scope of this paper. However, we do think that it would be most important to enable fast and broad availability of related new information, such as that obtained from new excavations. Today, typically there may be some delay even for short first reports to be published in journals, and it may take years until final excavation reports are published. At this early stage, a widely available and accessible multimedia information system would be extremely helpful, even if only very short notes and some photographs of the new excavation and the major artefacts were provided. Multimedia capability is crucial in this context, since photographs, drawings, and maybe video will be needed for a comparative analysis, rather than pure textual descriptions.

8.2.2 Supporting international projects

An international archaeological project is currently being planned jointly in the Netherlands (Stichting vor Bodenkartering/Wageningen) and in Germany (Westfälisches Museum für Archäologie Münster). This project aims to investigate the medieval field–system of the *Esche*. Esches are fields, whose yield had been improved by amelioration and artificial deposition. Currently, dating is one of the major points under discussion. Until now, according to German geographers, these fields had been dated to the Middle Ages. However, the latest archaeological investigations done by the *Staring-Centrum* in Wageningen/Netherlands suggest they date to the 16th century instead. The new project will analyse the archaeological situation beneath the Esche. This soil may be considered as an archive of an original medieval soil horizon. Thus, the focus is on the

stratigraphy. This research could be substantially supported by a continuous information exchange on Esch profiles in Germany and The Netherlands, respectively. Due to the very nature of the information to be exchanged, this would again call for a multimedia information system. In fact, a corresponding proposal will be submitted to the project leaders.

8.2.3 Analysis of artefacts

Every now and then archaeological museums receive artefacts without any accompanying information relating to the location of the discovery. If such artefacts need to be dated, no additional information is available: the artefact itself is the only source of information. A typical example that one of the authors has already had to deal with is that of a bronze needle. The one thing he did know was that such needles stem from the Bronze Age. For any further information, dedicated reference books are required. In Germany, for instance, there are volumes of the *Prähistorische Bronzefunde* (Prehistoric Bronze Finds). He would use these to look for comparable artefacts in order to date the needle, and to get some information on likely finding places. Having such books available on-line from a (possibly distributed) data base would be of great help, all the more so since a data base can be updated far more frequently than reference books.

We believe that these brief examples provide an impression of the potential usefulness of a multimedia communication and information system.

8.3 Some technical issues

The need for advanced multimedia communication systems has long been realised by the CEC. The Research and Development programme RACE (Research and Technology Development in Advanced Communications Technologies in Europe) focuses on the development of communication systems and pilot applications capable of effectively handling the requirements of multimedia communication. EuroBridge is one of the projects within RACE. It aims to establish a uniform communication platform providing all communication-related services to all kinds of multimedia applications. This platform will be able to run over a variety of different networks (Local Area Networks such as ethernet as well as public data networks, e.g. JANET), under different versions of UNIX (the major operating system for workstations, also available for PCs and the Macintosh).

All communication services implemented are based on international standards. However, in many cases considerable extensions are being implemented to enable true multimedia communication. Services provided directly to the user or to a multimedia application will be briefly discussed.

The services FTAM (File Transfer, Access and Management) and RDA (Remote Database Access) have been implemented in a way that enables them efficiently to retrieve large amounts of data from a remote database. RDA is used to search the database for appropriate information. In case of large documents, FTAM is used to transfer the information from the database to the user. It may also be used to update the database. It is anticipated that FTAM will mainly be used by multimedia applications rather than directly by human users.

The electronic messaging standard MHS (Message Handling Service) provides for multimedia documents. However, no implementations of a multimedia MHS service are available yet. EuroBridge is implementing user agents with the capability of submitting/receiving, storing, and interpreting arbitrary multimedia messages, possibly including voice and video as well. It is anticipated that MHS will mainly be used for interpersonal communication. However, it may also be employed as a transfer service for multimedia documents, which may be arbitrarily structured.

Integration of Hypermedia capabilities into MHS messages is another task. The term 'Hypermedia' refers to a multimedia document's capability to overcome the limiting sequential structure of a normal document. That is, the reader can more or less arbitrarily navigate through the document rather than being forced to follow the pre-defined hierarchical structure of sections and paragraphs. In doing so, the reader is guided by links that point from one part of the document (a word, a figure) to another one. A Document Control Structure (DSc) is currently being defined. This holds all structure information related to the following bodyparts of the message. This feature will be particularly useful if reference books are to be browsed.

The Directory Service (DS) provides a functionality roughly equivalent to the white pages plus the yellow pages plus telephone enquiries. In a data network, this service is used to locate potential communication partners as well as resources. For a discussion on further usefulness of this service for archaeological applications see Jakobs and Kleefeld 1990.

Finally, the video conferencing service should be mentioned. At present, this service works over local ethernet and FDDI networks, and over public ISDN networks. It allows participation of up to eight people in a conference. In addition, a joint editing tool is provided to enable on-line modification of documents. The video quality is adequate over one ISDN B-channel (64 kbps), and quite good over the FDDI (100 Mbps).

These services are utilising both standardised and newly designed communication oriented protocols. While the first are required for backward compatibility, the latter are essential since almost all of today's protocols date back to the mid-seventies and do not provide functionality sufficient for today's very demanding applications. For instance, dedicated mechanisms are required to support the needs of applications involving more than one sender and one recipient (i.e. applications requiring group communication functionality). Moreover, a certain communication quality (Quality of Service, QoS) has to be guaranteed to certain applications. A video conference application, for instance, may well tolerate loss or corruption of some information – a viewer won't even

realise that some pixels on the screen are red instead of green for a second. However, such applications are very demanding in terms of bandwidth. A thirty second black and white video clip is about 5 MB. In colour, this may easily rise to 15 MB. On the other hand, a sample book of, say, 1000 pages, 65 lines per page and 65 columns, plus some graphics comes to approximately 5 MB of data, but no loss of data can be tolerated. The communication oriented layers will have to manage these problems.

There is, of course, a simple alternative that may be helpful in many cases. CD-ROMs are becoming a popular storage medium for high-volume data. Some of the benefits achieved by using multimedia communication systems may in many cases also be accomplished by using information stored on CD-ROM. However, there are some possibly severe disadvantages:

- updating will be difficult
- there is no way to store additional new information on CD–ROMs. Bibliographic data bases on CD–ROM, for instance, are updated every six months at best, but still are an additional six months behind the on-line version.
- no interactive video conference is possible
- CD-ROMs do not provide for an interactive discussion with remote experts. Multimedia communication systems do.

8.4 Some concluding remarks

The use of advanced communication and information systems has become an important factor in many different professional fields. We have tried to indicate why we think archaeology may well be one of these fields. We feel that there are a huge number of potential benefits for researchers, excavations, museums, and projects. One of the major obstacles of archaeological research – the extremely slow information flow – could be efficiently overcome if such advanced communication and information services were used to a greater extent.

References

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