Weekly Science Research Journal
ISSN 2321-7871

Impact Factor : 2.4210 (UIF) [Yr.2014]
Volume - 3 | Issue - 20 | 26th Nov - 2015

# INSTIGATION OF COMPUTER APPLICATIONS IN ARCHAEOLOGY

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**ABSTRACT:**

Archaeology is the scientific study of humans past. As the word scientific indicates not only the equipments used in the field of archaeology but also mentions the advancement in the technological development of Computer field. Computers have been used in the field of archaeology for many years and it has now become an essential widespread tool for archaeologists. As the use or operation of computers becomes increasingly necessary to the work of the archaeologist, which they require a clear understanding of the impact of information technology upon their discipline. This paper explains the influence and the development of computers on all aspects of archaeological research and interpretation, from survey, excavation and landscape to museums, education and communicating the past.

The instigation of the computers can begin with the appraisal at all stages of archaeological research and data analysis. The main themes to materialize are the potential of computers as active agents for thought rather than as just passive tools, and the symbiotic relationship between the development of digital technologies and archaeological theory.

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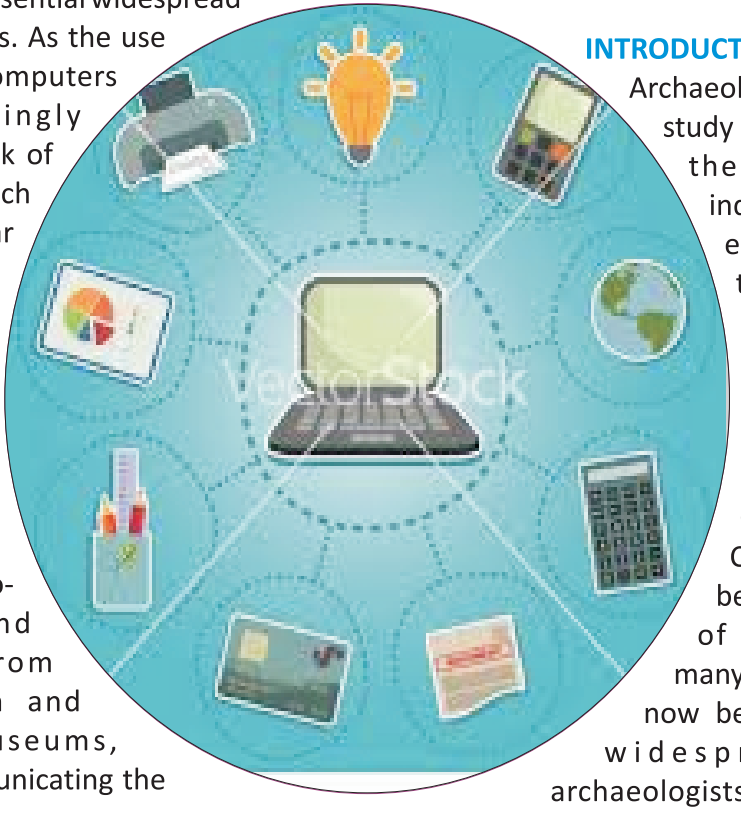
**Keywords:** Excavation, Data, Stratigraphy, Modelling, Artefacts, Pottery



## INTRODUCTION :

Archaeology is the scientific study of humans past. As the word scientific indicates not only the equipments used in the field of archaeology but also mentions the advancement in the technological development of Computer field. Computers have been used in the field of archaeology for many years and it has now become an essential widespread tool for archaeologists. As the use or operation of computers becomes increasingly necessary to the work of the archaeologist, which they require a clear

understanding of the impact of information technology upon their discipline. This paper explains the influence and the development of computers on all aspects of archaeological research and interpretation, from survey, excavation and landscape to museums, education and communicating the past.

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## Data and theory

The word 'data' is now in daily use in many different contexts and almost synonymous with the use of computers. That archaeologist 'collect data' and 'feed them into a computer' are almost taken as givens within everyday conversation to such an extent that to state that both archaeology and computers depend upon data is a meaningless truism. We need to probe a little deeper. What do we mean by archaeological data? Is there a direct relationship between them and data suitable for a computer? What is the relationship between both of these and the archaeological record, material culture, archaeological theory, interpretation, methodologies, analysis and meaning? Where do there concepts often associated with computing, such as 'technology', 'objectivity' and 'scientific', fit into the practice of archaeology and, specifically, what has been claimed as the sub-discipline of archaeological computing?

Comparing to the other fields, the uses of Computers in Archaeological fields is still in a very early stage. The first archaeological applications of electronic data processing were done by Peter Ihm and by Gardin and Garelli in France around 1958 or 1959. Subsequently there have been major developments of involvements of computers in archaeology can be seen from North America, and about the same number in the rest of the world, and many smaller ones. Naturally not anything really spectacular things have come out of this early stage of uses of computer. Results have always been interesting, and in some cases important contributions to archaeological problems have been made.

## Objectives

Generally, computers applications used in the field of archaeology are drop under the broad headings of data storage and retrieval or of multivariate statistical analyses.

The two most important tasks we face with respect to these applications are

- Developing optimum procedures for coding our data, and
- Getting a better control of mathematics.

Both involve much that can be done only by the archaeologists themselves; for only the people working with the data can say what kinds of things may be important to record about it, and certainly no one else can learn our math for us.

In recent years, it has become clear that archaeologists will only be able to harvest the full potential of computer technology if they become aware of the specific pitfalls and potentials inherent in the archaeological data and research process. Archaeoinformatics (AI) science is an emerging discipline that attempts to uncover, quantitatively represent and explore specific properties and patterns of archaeological information. Fundamental research on data and methods for a self-sufficient archaeological approach to information processing produces quantitative methods and computer software specifically geared towards archaeological problem solving and understanding.

AI science is capable of complementing and enhancing almost any area of scientific

archaeological research. It incorporates a large part of the methods and theories developed in quantitative archaeology since the 1960s but goes beyond former attempts at quantifying archaeology by exploring ways to represent general archaeological information and problem structures as computer algorithms and data structures. This opens archaeological analysis to a wide range of computer-based information processing methods fit to solve problems of great complexity. It also promotes a formalized understanding of the discipline's research objects and creates links between archaeology and other quantitative disciplines, both in methods and software technology. Its agenda can be split up in two major research themes that complement each other:

1. Fundamental research (theoretical AI science) on the structure, properties and possibilities of archaeological data, inference and knowledge building. This includes modeling and managing fuzziness and uncertainty in archaeological data, scale effects, optimal sampling strategies and spatio-temporal effects.
2. Development of computer algorithms and software (applied AI science) that make this theoretical knowledge available to the user.

**AI Science contributes to many fundamental research topics, including but not limited to:**

- advanced statistics in archaeology, spatial and temporal archaeological data analysis
- bayesian analysis and advanced probability models, fuzziness and uncertainty in archaeological data
- scale-related phenomena and scale transgressions
- intrasite analysis (representations of stratigraphy, 3D analysis, artefact distributions)
- landscape analysis (territorial modelling, visibility analysis)
- optimal survey and sampling strategies
- process-based modelling and simulation models
- archaeological predictive modelling and heritage management applications
- supervised and unsupervised classification and typology, artificial intelligence applications
- digital excavations and virtual reality
- archaeological software development, electronic data sharing and publishing

AI science advocates a formalized approach to archaeological inference and knowledge building. It is interdisciplinary in nature, borrowing, adapting and enhancing method and theory from numerous other disciplines such as computer science (e.g. algorithm and software design, database design and theory), geoinformation science (spatial statistics and modeling, geographic information systems), artificial intelligence research (supervised classification, fuzzy logic), ecology (point pattern analysis), applied mathematics (graph theory, probability theory) and statistics.

**Archaeological data codes**

The kinds of codes we especially need to develop are those for describing physical objects, both for data storage and retrieval and for statistical analyses. This is particularly so for broad classes of materials such as pottery, chipped stone, ground or polished stone, metals, terracotta objects, coins and fibers and textiles. It can also be useful to encode patterned concatenations of objects, for example structures or burial arrangements. For any specific study, the most efficient coding will depend on the range of variations shown in a specific body of data. But for each of the broad classes of materials mentioned above, there are substantial universal similarities in what it is relevant to describe and in the limits of variation.

Archaeologists are currently debating among themselves about the degree to which the features we find important for establishing categories of artifacts, and the categories themselves, could

ever be demonstrated to be close to those really "in the minds" of the dead makers and users of those objects. Whether or not this will ever be possible, at least we should not put unnecessary obstacles in the path toward such a goal. Furthermore, for a wide variety of statistical techniques, we need to be able to generate numbers from the basic data file which will be reasonable expressions of the resemblance to one another of objects or of sets of objects; based either on all their recorded features or on some definite subset of their features. Both of these considerations imply that descriptive codes should always be reasonably related to human judgments made by workers experienced with the corpus of objects. Features judged to be quite similar should have this similarity reflected in their coding, and similarities in "syntactic" arrangements of features on objects should also be reflected, even though the specific features may differ.

## Statistical studies

Scientific progress in archaeology, as in any other discipline, requires building abstract, generalized and transferable knowledge about the processes that underlie past human actions and their manifestations. Quantification provides the ultimate known way of abstracting and extending our scientific abilities past the limits of intuitive cognition. Quantitative approaches to archaeological information handling and inference constitute a critical body of scientific methods in archaeological research. They provide the tools, algebra, statistics and computer algorithms, to process information too voluminous or complex for purely cognitive, informal inference. They also build a bridge between archaeology and numerous quantitative sciences such as geophysics, geoinformation sciences and applied statistics. And they allow archaeological scientists to design and carry out research in a formal, transparent and comprehensible way.

Currently, universities based in the UK provide the largest share of study programmes for prospective quantitative archaeologists, with many institutes in Italy developing a strong profile quickly. In Germany, the country's first lecturer's position in AI science ("Archäoinformatik") was established in 2005 at the University of Kiel (Benjamin Ducke, now at Oxford Archaeology). This was in 2005. Actually the first and only position of a regular junior professorship for "Archäoinformatik" is established in the field of Classical Archaeology at Freie Universität Berlin. There is now the center for studying "Archäoinformatik" in Germany.

The most important platform for students and researchers in quantitative archaeology and AI science is the international conference on Computer Applications and Quantitative Methods in Archaeology (CAA) which has been in existence for more than 30 years now and is held in a different city of Europe each year.

## Other applications

❖ One special field of computer work is on decipherment of ancient writing systems. An early attempt to decipher, Maya hieroglyphs by Evreinev, Kosarev, and Ustinov at Novosibirsk was unsuccessful and strongly criticized by others, including Knorozov. Current work in Mexico on a concordance of Mayan inscriptions is not aimed toward instant decipherment and is likely to be far more useful. At least two computer projects involving Minoan writing are presently under way." A KWIC index of American Antiquity, a major American journal, has been produced by Dee F. Green'S but is not yet published. According to Irwin Scollar the annual and cumulative indexes of the Bonnerlahrbuch and a concordance of aerial photos of archaeological sites are all being compiled by computer at the Rheinisches Landesmuseum, Bonn. Perhaps the most unusual computer application so far in archaeology is in connection with the work of G. Hawkins, who used computed ancient stellar positions

for his study of the astronomical significance of Stonehenge. James Dow has also used this program for research on possible stellar bases for orientations of ancient cities and temples in Mexico. Undoubtedly many more special applications of computers in archaeology will appear, in addition to their major uses for data storage and retrieval and for statistical and formal analysis of data.

- Database management systems, both for research and for official databases such as Sites and Monuments Records, now including graphic image data.
- Quantitative analysis using statistical analysis or spreadsheet software
- Geographic Information Systems (GIS), linking data to maps
- Surveying and graphic display of excavation, topographic and geophysical data
- On-site recording of excavations and post-excavation analysis
- Graphic display, including building reconstructions and 'fly-past' simulations
- Computer-assisted learning
- Internet access for electronic mail, WWW resources, electronic archives and software download.

## Conclusion

For past few years we have face an increasing number of computer applications applying in archaeological projects and researches that uses computer techniques to help archaeologists in their work. Database management systems and surveying, graphic display of excavation reality is used to reconstruct archaeological sites, to preserve these sites from uncalculated damages and to help the archaeologists in the reconstruction of broken artefacts. But the virtual and augmented reality in the archaeology is not only important to the archaeologists, but it is also important to the visitors of museums and archaeological sites. Using this computer application tools they can see and understand the ancient place in a more interactive and animated way. Obtaining a realist image of an archaeological site is very important to the archaeologists, so the illumination of the archaeological sites are become a very important subject in the computer applications for the archaeology. As a final remark we can see that this relation between these two distinct areas was fruitful.

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