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IMPACT OF MODERN TECHNOLOGY IN ARCHAEOLOGICAL RESEARCH METHOD

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Abstract : In recent decades, few areas within the social sciences have experienced the transformative impact of modern technology as profoundly as Archaeology. The integration of computers, advanced electronics, and satellite technology has fundamentally changed both the practice of field archaeology and the methods of archaeological analysis and interpretation. This paper aims to explore how technological advancements have reshaped archaeological research, facilitating a less destructive approach to fieldwork while enabling scientists and researchers to construct a more comprehensive understanding of our historical narrative.

Keywords: History, Archeological, Survey of History, CAD, Technology, Computers

1.0 Introduction

Computers have significantly evolved since their initial role as advanced calculators designed to support military and scientific endeavors. Today, the impact of computers and information technology is evident across all research disciplines. One of the most significant developments that has promoted the adoption of computers among historians and other humanists is the advent of the Internet, which enables remote access to various machines and information sources. Resources such as library catalogs, databases, electronic texts, and software archives exemplify this accessibility. Information is typically available through user-friendly websites on the World Wide Web, where documents are stored in standardized formats. These documents primarily consist of text but can also incorporate graphics, audio files, videos, and links to other documents, thereby creating a hypertext environment. Since the 1970s and 80s, archaeologists globally have increasingly utilized computers. Initially, their applications included cataloging, mapping, storage, and publication. By the mid-1980s, the scope of computer use expanded to include terrain mapping, Geographic Information Systems (GIS), and the creation of hybrid maps that integrate satellite imagery and contour plans. The application of a diverse array of computer-based information processing software has opened up avenues for addressing complex archaeological challenges, both theoretical and practical.

2.0 Computational Archaeology

Computational Archaeology (CA) refers to the practice of utilizing traditional archaeological data within specialized computer software applications. As a relatively recent field, it is sometimes referred to by alternative names such as archaeological informatics or archaeoinformatics. The designation 'computational archaeology' typically pertains to advanced mathematical techniques that can only be executed through computational means. Nevertheless, CA extends beyond mathematics; in the realm of archaeology, software can recreate an entire archaeological site layer by layer, reconstructing absent structures into an engaging, three-dimensional visual experience.

Computational Archaeology (CA) is evolving in two primary domains: Theoretical and Applied.

2.1 Theoretical Computational

Archaeology This domain emphasizes the investigation of the structure, potential, and characteristics of archaeological data, as well as its interpretation across various disciplines to enhance the overall knowledge framework. The theoretical perspective involves modeling the inherent uncertainties present in archaeological data, determining optimal sampling strategies, and addressing scale and spatio-temporal effects.

2.2 Applied Computational

Archaeology This domain is focused on the creation, development, and implementation of specialized software and algorithms that translate theoretical insights into practical applications for researchers. CA serves as an advanced tool for archaeologists, enabling them to manage and analyze the vast and intricate datasets that the field of archaeology continues to accumulate. Data presentation can serve as a significant analytical resource through the use of visualization tools. Graphic software can generate detailed stratigraphic sections directly from electronic measurements collected in the field. These views can be manipulated and color-coded to highlight specific features. Consequently, distribution patterns that indicate the deposition of artifacts or their potential uses become readily observable.

3.0 Global Positioning Systems

The Global Positioning System (GPS) is a satellite-based radio-navigation system that comprises 24 satellites along with ground support facilities. While it is managed by the United States military, it is accessible for civilian applications. GPS enables users to obtain precise information regarding their location and speed anywhere across the globe. It is one of three satellite-based radio-navigation systems currently in operation. The Russian Federation has developed the Global Orbiting Navigation Satellite System (GLONASS), which also utilizes 24 satellites and offers accuracy comparable to that of GPS. Additionally, the European Union initiated its Galileo program, also referred to as the Global Navigation Satellite System (GNSS), with the launch of its first satellite in December 2005.

3.1 GPS Projection:

The Earth's ellipsoidal surface must be transformed into a flat representation for mapping purposes. This transformation involves projecting the ellipsoid onto a two-dimensional surface to create a map. Various ellipsoids are utilized in different regions, and a GPS system typically incorporates a complex selection of these ellipsoids. To effectively use a GPS device in conjunction with an existing chart, one simply needs to identify the ellipsoid or datum associated with the chart and configure the GPS accordingly. Once set to the correct datum, the GPS coordinates will accurately align with the map. It is important to recognize that a map is inherently a projection, which means it is a compromise; accurately representing a three-dimensional surface like an ellipsoid in two dimensions is not feasible. Some projections aim to preserve the true lengths of meridians, albeit at the expense of distorting areas near the poles. For instance, the Mercator projection amplifies the differences between meridians in proportion to the length of the parallels to achieve an orthomorphic projection. Understanding how these projections influence distance measurements across various regions of the Earth is crucial. For example, the Universal Transverse Mercator (UTM) projections are only reliable within approximately 5° of longitude before inaccuracies arise. Therefore, it is essential to consider the limitations of the projections relevant to the specific area of interest.

3.2 GPS in Archaeology:

Traditionally, the acquisition of three-dimensional data for excavation units, artifacts, and features within these units has relied on theodolites or total stations to establish a datum point and an intersecting baseline. The locations of in situ artifacts and features are determined in relation to this datum point. Throughout the excavation process, continuous measurements from the baseline are necessary to accurately document the 3D positions of artifacts and features before their removal or destruction. In recent years, various studies have investigated the application of GPS technology in archaeology, offering both innovative approaches and enhanced efficiency in data collection. GPS has proven effective in determining site locations and establishing baselines for excavation units in several of these studies. However, the majority of recent archaeological applications of GPS technology have focused on terrestrial sites. Chapman and Van de Noort (2001) conducted experimental research to assess the feasibility of using differential GPS (DGPS) for surveying points in archaeological prospection within wetland areas of the British Isles. By observing differential desiccation—the varying rates at which the ground dries—manmade features in wetland environments can be identified, which are often undetectable through conventional aerial reconnaissance.

4.0 CAD:

Computer-Aided Design, was initially created for architectural and engineering applications. Today, it is utilized across various fields and integrates effectively with archaeological point data obtained from diverse sources, such as Total Station surveys and GPS (Global Positioning System) measurements. CAD software allows users to produce both 2D and 3D vector-based drawings while employing a coordinate referencing system, where x and y denote position and z indicates height. These coordinates can pertain directly to the drawing or reference an excavation site plan, and in the context of a regional survey, they may correspond to National Grid coordinates or UTM25 (Universal Transverse Mercator) coordinates. The drawings can incorporate multiple layers of information, which can be edited and manipulated individually or collectively, enhancing the capabilities of traditional pin-bar drafting techniques that utilized transparencies over a base sheet with registration pins for accuracy. The software offers a wide array of functionalities, enabling users to scale, rotate, distort, skew, and realign elements within the drawing. Additionally, users can choose from various line types and represent objects as either wireframes or solid models. Raster images can also be imported to serve as backgrounds or textural components within the vector-based framework.

5.0 Image Capture:

The acquisition and examination of image data play a crucial role in the archaeological process, with digital technologies significantly enhancing data collection methods, particularly through aerial and satellite photography. Advanced software applications have introduced innovative processing and analytical techniques for these images. For instance, challenges such as aligning oblique photographs of uneven landscapes can be addressed using the rectification feature of the Bonn Archaeological Software Package (BASP), a collaborative toolkit that has been under development since 1973 and includes functionalities for seriation, clustering, correspondence analysis, and mapping. Airphoto30 is an affordable orthophoto software that enables users to correct distorted aerial images and create relief models of the terrain, merging the precision of maps with the detail found in photographs. The process of utilizing multiple images to achieve precise measurements and generate digital terrain models (DTMs) is known as photogrammetry, supported by a variety of available software. Additionally, image editing tools like Adobe Photoshop are commonly employed.

6.0 Conclusion

The benefits of incorporating computers and modern technology into archaeology are significant and cannot be overlooked. These advancements streamline various aspects of the field, from exploration and excavation to analysis, archiving, and publication, ultimately saving time, money, and effort. The integration of these technologies has made archaeology more approachable for the general public. Modern surveying techniques have allowed for a reduction in the scale of excavations while still providing extensive information and artifacts comparable to larger digs. This is due to the ability of contemporary exploration methods to identify areas with the highest potential for discovery. Consequently, excavations have become less invasive, as the size of the dig can be minimized. Three-dimensional recording enables students and enthusiasts to examine fragile artifacts, such as Babylonian clay tablets, in a virtual environment without physical contact. Additionally, virtualization facilitates the digital reconstruction of historical cities, buildings, or communities using existing archaeological data, enhancing comprehension for the general audience. The publication of archaeological findings on websites has further broadened access to this information.

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