An Introduction to
Digital Discovery: Exploring New Frontiers in Human Heritage

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1 Introduction

This opening paper provides a brief introduction to both this volume and the conference that generated it. Since many of the delegates who attended the conference were new to Computer Applications and Quantitative Methods in Archaeology (known simply as CAA), and many who will read this volume may also be unfamiliar with CAA, I will begin with a brief introduction to the organization, followed by an overview of this *Proceeding*s volume, and then a discussion of the 2006 conference.

2 Computer Applications and Quantitative Methods in Archaeology

Computer Application and Quantitative Methods in Archaeology began in 1973, at a time when large mainframe computers were beginning to be made available as computational tools. When CAA was founded, relatively few archaeologists were using computers in their research. Just a few years later, the first desk-top computers appeared, but until the early 1980s they were strictly hobbyist toys. The number of people who had the vision to see the potential of computers for archaeology was small for many years, but slowly grew through the 1980s. With the continuous stream of development in hardware and software, and the advent of electronic communication and networking, archaeology and related heritage fields were revolutionized. Now, few archaeologists can imagine functioning without computer-based technology, whether it is the desk-top computer (and all that it brings), or the computer chips in a range of technology tools (from total stations to satellites for remote sensing), or the use of advanced visualization to "see the past" in new ways.

CAA was formed by an early group of visionaries who *could* image the potential of computers in archaeology. It began as a small conference at the University of Birmingham, UK, in 1973, which marked the first in the continuing series of annual conferences. Participation in the organization increased over the years, particularly as practitioners from other nations were attracted to the conferences. In 1992, the first CAA conference held outside the UK took place in Denmark. Since then, the annual conferences and meetings have rotated to cities throughout Europe. The 2006 conference marks another milestone, the first CAA conference held outside of Europe.

CAA is an international organization that brings together practitioners and methods from a range of domains and perspectives in the service of a common interest. Initially, the CAA founders and delegates were largely from archaeology, computer science, mathematics, and statistics, but over the years the group has expanded to also attract scholars and students in architecture and design, history, museum studies, biological anthropology, education, and other domains. The goal of the organization and its conferences is to provide a forum in which to share ideas and methods for computer applications in archaeology and related approaches to human heritage.

The annual CAA conference and meeting provides the premier venue for the presentation and dissemination of state-of-the-art computer and quantitative applications for research and education in world heritage. CAA participants are among the leading developers of these new computational models and technologies. As newer and more sophisticated computer-based technologies become available, computer scientists together with archaeologists and other heritage professionals are better able to collaborate on a broad spectrum of research problems, and thus develop innovative solutions problems old and new. Such collaborations can lead to new tools useful in reanalysis of old data as well as the generation of new data. To learn more about the CAA, visit the organization's website (http://caa.leidenuniv.nl/).

3 Conference Proceedings

For each CAA conference, an effort is made to produce a conference proceedings volume (for a list of those volume titles and contents, go http://caa.leidenuniv.nl/proceedings/proceedings_contents.htm). The volume in hand represents a continuation of that custom. However, these proceedings differ somewhat in approach by limiting the number of papers that could be included in the volume by employing a scholarly peer review process. The rationale for this approach is based on three considerations. First, the cost of publishing large volumes has grown very high as the number of contributions and pages have grown larger. It is simply not cost effective to print everything submitted. Second, related to the first item, to keep the number of pages, and therefore costs, down, some proceedings have had to severely limit the length of each paper. Consequently, there is too little space to publish informative presentations of even the best papers. By limiting the number of papers published, those that are printed can have more space for more thorough discussions. Third, articles not published in peer-reviewed sources are given comparatively little academic

credit and, therefore, there is relatively little incentive for an author(s) to take the time to write a paper as a significant contribution—rather than a summary of conference presentation—for publication in the proceedings. There is also less value in the proceedings as research sources to scholars looking to cite reviewed literature, and concomitantly, perhaps, less appeal to libraries to purchase the proceedings for their holdings.

In consequence of these considerations, the decision was made to take a two-pronged approach for the proceedings. First, the printed volume is a peer-reviewed publication. All papers accepted for publication were vetted by two, or in some cases three, peer reviewers. Second, a digital publication format was used and is included as a CD-ROM at the back of this book. Included on the CD are all of the papers in the print volume, but color figures were allowed in the digital format. Also included on the CD is a set of papers that did not go through the peer review process. Those papers tend to be shorter and more preliminary in nature. Even so, all of those papers were vetted by the editors, and not all submissions were accepted for the CD. All papers, in both formats were edited for English and consistency, both internally and with the style established for the publication.

Even with the peer-review process, the volume is still large. Of the many papers submitted, 44 were ultimately accepted for publication and are contained herein, grouped into sections. The first two sections of the book represent papers from symposia specifically organized for the conference: Social Modeling and Simulation, organized by Mark Altaweel, and Network Analysis, organized by Gary Lock and John Pouncett. I am grateful to those organizers for working with the authors in their sessions to present collections of papers that elaborate on the conference presentations. The other papers were grouped on the basis of content theme or dominant application. These groupings are intended to provide a quick guide to the reader interested in particular types of papers, but it should be noted that many of the papers could have been placed into another group because of the use of multiple methods or approaches.

4 CAA 2006 Fargo

The 34th Annual CAA Conference and Meeting was held April 18-22, in Fargo, North Dakota, USA (www.CAA2006. org). This was an historic event in that it was the first time CAA had met outside of Europe. CAA 2006 Fargo was hosted by North Dakota State University (NDSU), and the specific entity responsible was the Archaeology Technologies Laboratory (ATL) (http://atl.ndsu.edu/) of the Department of Sociology, Anthropology, and Emergency Management at NDSU. The primary conference venue and headquarters were at the Ramada Plaza Suites and Conference Center (http://www.ramadafargo.com/). The Ramada provided excellent conference facilities, with high-speed Internet connections in all the rooms and wireless connections throughout most of the building. A secondary venue was at North Dakota State University where one workshop and one panel took place.

The CAA 2006 Fargo conference organizers sought to create a conference experience that would serve several functions. Some of these functions are common to all CAA conferences: to unite an international group of professionals and students from a variety of disciplines for the benefit of archaeology; to allow a forum for presentation, dissemination, and discussion of the latest information and innovations in computational and quantitative methods with application to archaeology; and to attract people who as yet have had little exposure to the power and utility of current and developing technology. Additional functions were unique to CAA Fargo: to attract a larger attendance by North Americans than has been typical for the European CAAs; to promote advanced research and education in human heritage in North America; and to stimulate the formation of a CAA North America Chapter. I would simply note that we had an extraordinarily large turnout of North Americans at CAA 2006, many of whom vowed to attend CAA in 2007 and subsequent years. Consequently, there will certainly be future CAA conferences in North America. And, I am pleased to report that CAA North America (CAA-NA) was formed in the aftermath of CAA 2006.

4.1 Conference Theme

The theme for CAA 2006 Fargo reflects the general aims of the conference and the uniqueness of its place. It reflects the American experience: exploration of new frontiers. The theme highlighted the fact that the United States was celebrating the bicentennial of the epic journey of exploration undertaken by Meriwether Lewis and William Clark in 1804-1806, which traversed the Dakota Territory. The territory was, of course, already occupied by Native American populations whose ancestors had explored those same lands many millennia earlier. Indeed, the exploration of new frontiers is a hallmark of the human experience; it is what has pushed humans to spread throughout the world. The conference theme, then, is a human theme: the exploration of frontiers and resultant discoveries that change our understanding of the world. In ages past, the frontiers were of land and sea; today we face frontiers of knowledge. For the new exploration of new frontiers, we need new methods for discovery, and today those methods are preeminently digital. The theme also expressed awareness of the broadening umbrella that covers all concerns with computer applications for *human heritage*—a heritage that is both cultural and biological. Thus the theme of CAA 2006 — *Digital Discovery: Exploring New Frontiers in Human Heritage*.

4.2 Conference Logo

The conference logo is a stylized representation of a digital surrogate, which is defined as a three-dimensional (3D) computer model of an archaeological artifact that is produced using laser scanning. The colored sections of the logo represent the surrogate's polygon surface, while the white curves represent the surrogate when viewed as a wiremesh. The artifact represented in this design is a ceramic pot used by the Mandan people of the upper Missouri River region in central North Dakota. The Mandan farmed this region of

the northern Great Plains long before the arrival of Euro-American settlers, and they were there when the Lewis and Clark Expedition came through the region. Therefore, the CAA 2006 logo is representative of the exploration of the frontiers of archaeological research as well as the cultural heritage of the local region in which the conference was held.

4.3 Joint Conferences

The CAA 2006 conference also saw alliances with other organizations: the Electronic Cultural Atlas Initiative, and the Web3D Consortium. Each of these organizations held meetings in association with CAA 2006.

The Electronic Cultural Atlas Initiative (ECAI). ECAI was formed in 1997 as an informal, international, collaborative group that now consists of several hundred affiliated academics, information technology specialists, librarians, and others. ECAI was organized to create a format for an electronic cultural atlas, and to advance teaching and research in the humanities and social sciences through increased attention to place (including latitude and longitude, and place names) and time (dates and periods). In many ways a clearinghouse of internet-accessible, geo-temporal resources, ECAI has as a goal the development and promotion of standards and software to encourage online publication of digital cultural atlases.

Administratively centered at the University of California, Berkeley, the organization holds two meetings a year at locations around the globe (see www.ecai.org). In 2003, ECAI held one of its annual conferences in conjunction with CAA in Vienna. The CAA 2006 conference organizers extended an invitation to ECAI to again meet jointly with CAA, and that invitation was accepted.

Web3D 2006. CAA 2006 Fargo also linked with the Web3D Consortium (http://www.web3d.org/), which had the 2006 International Web3D Symposium at Loyola College - Columbia, Maryland, April 18–21. The Web3D Consortium is a member-funded industry consortium committed to the creation and deployment of open, free standards to foster the development of real-time 3D across applications, networks, and XML Web services. The Consortium works closely with the ISO (International Standards Organization), MPEG (Moving Picture Experts Group), and W3C (World Wide Web Consortium) standardization bodies. Consortium members can participate in Working Groups and interact with other members working on 3D platforms and applications for the Web. The X3D specification is the current focus of much Consortium attention. X3D is an open standards, XML-enabled, 3D file format to enable real-time communication of 3D data across all applications. A more refined standard than VRML, X3D allows developers in archaeology and a range of other disciplines to achieve more sophisticated products.

Web3D 2006 addressed a wide range of 3D technologies on the Internet, ranging from languages, tools, and high performance 3D graphics, to human-computer interaction issues and the latest mobile applications. The linking of CAA 2006 with Web3D 2006 was electronic, made possible by Access Grid®. Interested parties in Fargo were able to hear and see presentations in Columbia and provide questions and comments for the presenters.

4.4 CAA 2006 Delegates

The delegate count for CAA 2006 was 280, 85 of whom registered under the student category. The five nations with the largest representation at CAA 2006 were the USA, Canada, the United Kingdom, Italy, and Germany. The delegates represented 31 nations and 33 U.S. states. CAA has long been a student-friendly organization, and every year provides a set of bursary (financial) awards to help support a group of students to attend the conference. CAA has also long encouraged financially disadvantaged scholars to attend by offering modest levels of support.

4.5 Conference Events

The CAA conference ran from April 18 though 21. During the four-day conference event, participants presented 193 papers and 18 posters. In addition, CAA 2006 featured four workshops, seven symposia, and five panels on a variety of topics related to digital heritage. The conference began on Thursday, April 18, with a day of Workshops and Roundtable Panels, and the joint conferences sessions of *ECAI* and the *Web3D Symposium*.

On the 19th, the conference formally commenced with the Welcoming Session at which short remarks were provided by Mr. Cole Carley, Executive Director of the Fargo-Moorhead Convention and Visitors Bureau, and Dr. Thomas J. Riley, Dean, College of Arts, Humanities and Social Sciences at NDSU, as well as the Conference Chair (the author). At the evening Reception for CAA 2006, held at the Plains Art Museum in downtown Fargo, the delegates were welcomed by remarks from a set of distinguished speakers: U.S. Senator Kent Conrad, who represents the State of North Dakota in the U.S. Congress; Mr. Bruce Furness, Mayor of the City of Fargo; Dr. Joseph Chapman, President of North Dakota State University; and Mr. Edward Pauley, President of the Plains Art Museum. The conference finale was the Closing Dinner the night of April 21 at the Ramada Plaza Suites and Convention Center. After the meal came the entertainment, which was provided by a group of Native American powwow dancers, and dance music from a live band, with the dancing initiated by two couples giving a display of American swing dancing of the mid 19th century. The celebration went well into the night.

The Closing Dinner was also marked by a short ceremony. Dr. Hans Kamermans had stepped down from his position as Secretary on the CAA Steering Committee, an office he had held since 1994. Dr. Nick Ryan, long-time Steering Committee Chairperson, presented Hans with a few small tokens of the organization's esteem and appreciation

for his long and valued service. On behalf of the society of CAA members over the years of your service, thank you, Hans.

4.6 Post Conference Tour Activities

At the close of the conference, there was an option for a two-day journey across North Dakota. The tour group, led by Tom Riley and the author, visited archaeological and historic sites, museums, and scenic vistas of the Northern Great Plains. The tour group traveled west to the city of Bismarck, the state capital, on the Missouri River, to visit the North Dakota State Heritage Center, which is the state museum. They then followed the Missouri River to the northwest, along the route traveled by Lewis and Clark's Corps of Discovery in 1804. A visit to the Double Ditch archaeological site gave a glimpse of a Native American village site from the 1600s, with its traces of the earth lodges, midden heaps, and defensive ditches that surrounded the village. Ken Kvamme, who has mapped the site using geophysical prospecting, contributed his expertise to the visit. From there the tour continued to parallel the river, until stopping at the Lewis and Clark Interpretive Center and the constructed replica of Fort Mandan, which was built by the Lewis and Clark party to over-winter in 1804-1805. From there the group went west, stopping at Knife River Indian Villages National Historic Site to visit the sites of villages occupied by the Hidatsa Indians in the 16th through middle 19th centuries. Then they progressed west again, across the sparsely populated rolling plains, with a stop at the Knife River Flint (KRF) Quarries which provided a very high quality flint for prehistoric stone throughout a very large area of the northern Plains for thousands of years. After spending the night near the Theodore Roosevelt National Park (TRNP), the tour continued with a drive through the North Dakota Badlands in the TRNP. After the park, it was back east, to the Missouri River again and Fort Abraham Lincoln State Park. There the tour stopped at On-a-Slant, a Mandan Indian village from the late 1700s with six replicas of Mandan earth lodges and a small museum.

For those who stayed in Fargo the day after the conference, there were other options of things to do. Many visited the 17th Annual Woodlands and High Plains Traditional Powwow held April 22 at North Dakota State University. Those who stayed the night were able to see a special showing of the movie *Fargo*. Still others enjoyed some shopping, museums, and sights in the tri-cities of Fargo, West Fargo, and Moorhead.

5 Acknowledgments