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Teaching with Digital Archaeological Data: A Research Archive in the University Classroom

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Abstract Digital tools and techniques have revolutionized archaeological research and allow analyses unimagined by previous generations of scholars. However, digital archaeological data appear to be an underappreciated resource for teaching. Here, the authors draw on their experiences as university instructors using digital data contained in the Digital Archaeological Archive of Comparative Slavery (http://www.daacs.org) to teach in a variety of higher education settings, from method-intensive thematic courses for graduate students to general education science courses for undergraduates. The authors provide concrete examples of how they use digital archaeological data to accomplish a range of pedagogical goals. These include teaching basic artifact identification and simple statistical methods as well as developing skills in critical thinking, inference from data, and problem solving and communication. The paper concludes with a discussion of how archaeologists can use digital data to address ethical and curricular issues, such as preservation, professional training, and public accountability that are crucial to the discipline and relevant to the academy at large.

Keywords Pedagogy · Digital data · Ethics · African diaspora · Historical archaeology

Introduction: Where Digital Technology, Archaeology, and Education Meet

Digital archaeological initiatives have revolutionized archaeological research. The data generated by these initiatives can also transform how archaeology is taught in a

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wide range of postsecondary settings. This paper describes how and why we use the Digital Archaeological Archive of Comparative Slavery (DAACS)[1] to teach archaeological methods and theory in three pedagogical scenarios: an upper division course for archaeology undergraduates; a methods-intensive course for graduate students; and a course fulfilling a general-education science requirement for undergraduates.

Archaeologists have been quick to adopt the most current digital technologies to aid in the organization and analysis of archaeological data. With the introduction of dBase and increasingly inexpensive, large hard drives in the 1980s, many archaeologists began to tackle the basics of using digital technologies for large-scale data management. In the 1990s, the engagement with digital technologies expanded to include data analysis as larger, richer digital datasets and statistical programs made modeling and simulations viable to growing numbers of archaeologists. By the late 1990s, GIS and a range of mapping technologies from total stations to magnetometry and LIDAR allowed archaeologists to gather detailed digital landscape data and marry them with artifact data and images. A review of the literature on computer applications in archaeology at the time indicated a focus on databases and statistics, with some nascent attention to education and the potential uses of the Internet (Scollar 1999, pp. 5–7).

Archaeologists were particularly interested in the Internet for the myriad data management and delivery options it offered. Many archaeological Websites were (and still are) designed to provide site-specific information to the general public about specific excavations, digital type collections, or timely news and information on developing technologies that would be appropriate for use by archaeologists.[2] Some Websites exist on the bleeding edge of technology, with a focus on recording sites and preservation through detailed 3D laser scanning and other digital recording techniques. However, over the last decade, increasing numbers of archaeologists are beginning to employ the Internet as a way to collect, standardize, and share archaeological data generated by multiple principal investigators working on multiple sites. These Web-based digital initiatives range from the Archaeological Data Service (http://archaeologydataservice.ac.uk/) and The Digital Archaeological Record (www.tdar.org), both of which publish standards for data and meta-data collection and provide a platform for dissemination of data from sites in the UK and North America, to digital archives with tight temporal and region foci, such as the Chaco Digital Initiative (www.chacoarchive.org).

The majority of these Internet-based projects are geared toward the professional archaeologist. They offer a diverse range of resources, from detailed datasets and site narratives, to guidelines and resources for developing and managing digital data. However, few academic archaeologists appear to use this bounty to teach the quantitative methods and archaeological theory that are essential for deciphering the

[1] Available at http://www.daacs.org.

[2] Goals for archaeological web sites include public education and interpretation (Catal Hoyuk: http://www.catalhoyuk.com/); dissemination of data and research results (A Comparative Archaeological Study of Colonial Chesapeake Culture; http://www.chesapeakearchaeology.org/, New Philadelphia: http://www.histarch.uiuc.edu/NP/, Open Context: http://opencontext.org/); access to digital type collections (Diagnostic Artifacts in Maryland: http://jefpat.org/diagnostic/index.htm; Historical Archaeology at The Florida Museum of Natural History: http://www.flmnh.ufl.edu/histarch/gallery_types/, The Digital Archaeological Atlas of the Holy Land: http://daahl.ucsd.edu/DAAHL/) preservation and 3D modeling (CyArk: www.cyark.org; The Digital Archaeological Atlas of the Holy Land: http://daahl.ucsd.edu/DAAHL/; eWilliamsburg: http://research.history.org/ewilliamsburg/).

archaeological record. It also seems that there is little discussion of the ways in which these archaeological datasets and competencies contribute significantly to the training of future archaeologists or university education more generally.

Archaeologists working in academia most often emphasize the utility of computers and digital technology for delivering simulations or multimedia instructional tools (e.g., Fagan and Michaels 1992; Fagan 2000; Lock 2006; Molyneaux 1992; Martlew and Cheetham 1995; Campbell 1995; *cf*. Kilbride and Reynier 2002). Meanwhile, the literature on databases and digital archives emphasizes their role in the preservation of valuable archaeological information and the broad comparative research made possible by widely available datasets (Kintigh 2006; Kenny and Kilbride 2004; Digital Antiquity 2011). Very few models exist for effectively using digitally archived archaeological data in postsecondary education (for exceptions focusing specifically on creating and managing databases, see Jones and Hurley 2011; Kilbride *et al*. 2002; Archaeology Data Service 2011). The lack of models means that the difficult lessons associated with transforming a *research* tool into a *teaching* tool are often learned in isolation, with much trial and error. Digital archaeological data are best used within a structured framework. Simply exposing students to the data, especially at the introductory level, can even be counterproductive. With this article, we share some of the techniques and strategies that we have used to integrate digital archaeological data into our teaching.

The four authors have used DAACS to develop and teach a diverse set of courses from general education classes to methods-intensive graduate seminars (Fig. 1). Our individual research experiences with DAACS led us independently to develop undergraduate and graduate courses built around the archive and the large quantities of standardized data it can deliver. Through the development of structured exercises with clear goals, we have taught research methods and statistical techniques using DAACS data, while avoiding the frustration and confusion that can come from unstructured attempts by inexperienced students to use the archive.

The quantitative and reasoning skills necessary for testing hypotheses about the past are essential preparation for undergraduate and graduate students seeking careers in archaeology, whether in cultural resource management, a museum, or a university. However, Aldenderfer (1998) found that, as of the late 1990s, no undergraduate program in archaeology required its majors to take a quantitative methods class and only 60 % of graduate programs had such a requirement. This lack of engagement with the quantitative methods necessary for testing hypotheses about the past is arguably rooted in the postmodern turn archaeological inquiry has taken over the past 25 years. On a certain level, the DAACS curricula meld the subjects and skills that many students find intimidating (science and math) with something they expect to be less difficult (anthropology and archaeology). Thus, we cultivate the benefits of a scientific education using themes, such as plantation society, ethnic traditions and cultural change that students find compelling. Furthermore, the combination of analytical and problem-solving tools with real archaeological data moves us towards answers to postprocessual questions related to race, identity, class, and gender, questions that some may consider too “postmodern” and contextual to answer archaeologically (but see Agbe-Davies and Bauer 2010). Finally, we suggest that using real archaeological data to tackle real questions about the human past can help address recent academia-wide concerns about postsecondary education (Professor X 2008, 2011; Menand 2011; Arum and Roksa 2011).

Fig. 1 The Digital Archaeological Archive of Comparative Slavery's home page (http://www.daacs.org). The Website's five main sections are described in the text

The Archive

Although all of the examples in this article specifically use DAACS, the techniques we discuss can be replicated using other available digital datasets. Each of the authors came to teaching with DAACS through the experience of conducting research with the archive. Inspired by our interactions with the Website and its data, we separately began designing classes that focused on teaching archaeological analysis and the archaeology of slavery using DAACS. The DAACS Website contains a spectrum of information from the contributing archaeological sites, including fine-grained quantitative information on artifacts and faunal remains, the stratigraphic and spatial contexts in which they were found, archaeological site plans, stratigraphic sections of major site features, and images of artifacts. The Website also includes information on the historical and archaeological context of each site, along with case studies illustrating how information in the archive can be used to address specific questions. Finally, the site provides easy-to-use queries that give students and researchers immediate access to the data either in HTML tables or for downloading into local statistical packages.

Based at Monticello and funded by the Andrew W. Mellon Foundation and the National Endowment for the Humanities, DAACS facilitates comparative archaeological research into the social and economic dynamics that shaped slave societies and the African-American experience in the Atlantic world during the colonial and ante-bellum periods. It does so by providing free access to standardized, comparable archaeological data from 55 domestic sites occupied by the enslaved residents of 23 plantations located in Virginia, Maryland, South Carolina, Tennessee, Jamaica, Nevis, and St. Kitts (Fig. 2). The project is a collaborative venture between Monticello and over 25 other archaeological institutions, which worked together to develop the data structures and classification and measurement protocols instantiated in the archive.[3]

DAACS has two overarching goals. The first is to facilitate the comparative study of regional variation in slavery and the archaeological record more generally by providing standardized artifact, context, and spatial data from multiple archaeological sites that were once home to people held as slaves. The second goal is to create usable and replicable standards for recording and digitizing archaeological data that can be used by archaeologists working on all types of historic period sites. Although the creators of DAACS are interested in how the archive can be used in the classroom, the archive's foremost mission is to leverage scholarly collaboration and comparative research through the data provided by the archive.

The DAACS Website is comprised of five modules. "About the Database" contains metadata about the archive that is essential to using the archaeological data. The "Research" module contains the site bibliography and examples of research papers using DAACS data. "About DAACS" describes the project, and includes news and updates. The majority of the archaeological data in DAACS can be accessed through, "Archaeological Sites" and "Query the Database." We focus briefly on these last two modules, highlighting the aspects that make the Website especially useful for teaching.

Researchers and students most often begin accessing DAACS data through the "Archaeological Sites" module. This module contains a suite of nine pages dedicated to each archaeological site in the Archive: Site Home; Background; Before You Begin; Chronology; Site Features; Harris Matrix; Site Images; Bibliography; and Plantation. The Background page contains a narrative written by the site's principal investigator, which includes a review of the excavation methods, research, and documentary record. The Chronology page provides an intrasite seriation chronology developed by DAACS staff which is comparable to other intrasite chronologies for other sites in the archive. The Site Features page summarizes the site's archaeological features. Downloadable photographic images and site plans in .dxf, .dgn, and .pdf format are available through the Site Images page. A Harris Matrix summary of stratigraphic relationships among contexts is also available for each site. Individual sites that were once part of an identified plantation are linked to a set of pages about that plantation. These Plantation pages provide background information about the entire plantation including links to maps, images, and other archaeological sites excavated at that plantation.[4] The format for each "Archaeological Sites" suite is

[3] Detailed information on the DAACS database and cataloging protocols can be found here http://www.daacs.org/aboutdatabase/.

[4] For example, Buildings o, r, s, and t were all located at Monticello, therefore each of these sites is linked to a suite of pages specifically about Monticello plantation.

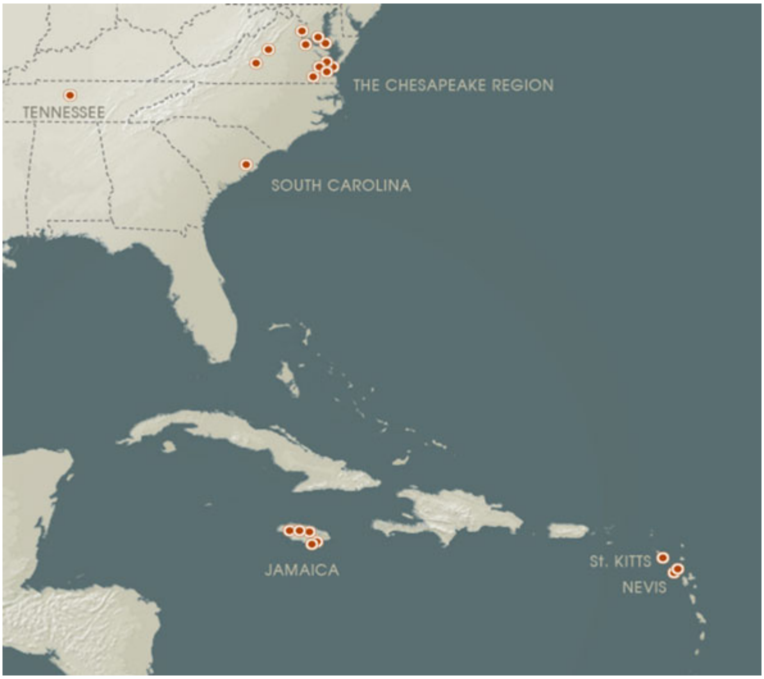

Fig. 2 DAACS contains data from over 60 sites of slavery located throughout the southeastern US and the Caribbean. The spatial and temporal breadth of these sites makes the data ideal for teaching archaeological methods and techniques, as well as about slavery

standardized and replicated for each site so that archive users can quickly grasp the archive's organization.

While the "Archaeological Sites" pages provide users with summarizing background information on each site, the "Query the Database" module provides direct access to all of the artifact, context, faunal, documentary, and image data. Since 2000, DAACS archaeologists have analyzed and digitized nearly two million artifacts, 16,000 archaeological contexts, and hundreds of site maps. Detailed measurement and descriptive data for all artifacts and contexts are available through the Website. These data conform to a single set of classification and measurement protocols, developed by DAACS staff and archaeologists working on the archaeology of slavery in these regions. These data are entered into a massive relational database (over 200 tables) programmed in SQL Server (Fig. 3). DAACS Website users can access to the artifact, faunal, contextual, spatial, image, and documentary data generated by DAACS staff using an easy to use point-and-click interface. The data are then offered in downloadable packages that can be saved to the user's desktop in Excel or ASCII formats. Users can also use the Query Bucket to save their queries throughout a single browsing session and download a selection of the stored files.

In summary, several characteristics—common to many digital archaeological datasets—suit DAACS for classroom use. The thematic focus on slavery unites a large number of sites across multiple regions, giving the large database considerable coherence. Data standardization minimizes student confusion, supports comparative assignments, and allows easy aggregation of data across sites and across archaeological

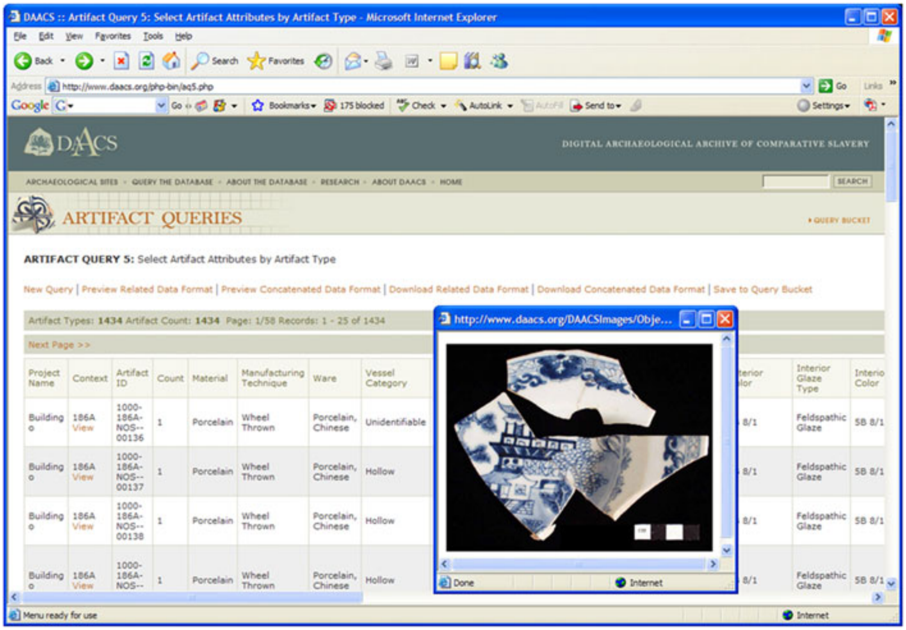

Fig. 3 All queries in DAACS provide downloadable, comparable data usable in the classroom. This figure shows results for a detailed query about ceramics, artifact Query 5 (http://www.daacs.org/resources/queries/form/artifact/aq5/)

institutions. Web access, and the fact that users download the data in dynamic, rather than static form (e.g.: maps are available as CAD files as well as digital image files; artifact inventories are spreadsheets rather than pdfs), facilitate dissemination and use.

How researchers use these data is the subject of the final section, below. Now we turn to the techniques for using this digital archive for teaching archaeology to three different audiences. Significant overlap among prior classroom experiences, strengths, and challenges for these groups indicates a pattern, and a need, that is pervasive in post-secondary education. We start with what might be the most obvious audience, students with limited experience, but a strong interest in archaeology.

Beginner Archaeology Undergraduates

Using digital archaeological data to teach a course for undergraduate concentrators is a natural. The students can be highly motivated and introducing data analysis early into an archaeology major's coursework is essential for developing critical thinking skills and argument-based analysis. It also allows students to begin the process of archaeological inference. They frequently encounter readings in which archaeologists build arguments based on data but the curtain is often closed around that data analysis. Through manageable data-analysis projects, students learn the iterative process of making arguments and supporting them with archaeological data. They learn how to identify artifact types, choose datasets and identify an appropriate statistical method to support their arguments. More importantly, because these classes have a broader focus than simply learning statistics, students are challenged to think critically about their readings and to meld method and theory through data-driven projects and classroom activities (Table 1).

Table 1 Student outcomes vary with type of activity and level of expertise

Activity	Audience	Skills built
Homework	General	Applying step-by-step instructions to simulated data
Artifact inventory	Beginner	Artifact identification
Laboratory exercise	Beginner	Calculating abundance indices Calculating averages Data selection Database techniques (downloading, merging, *etc.*) Spreadsheet techniques (calculations, sorting, *etc.*) Testing correlations
	Advanced	Experimental design Frequency seriation Graphical presentation of quantitative data Hypothesis testing Integration of background reading and experimental data Reconciliation of contradictory observations Spreadsheet techniques
	General	Applying step-by-step instructions to real data Calculating averages Calculating relative frequencies Graphical presentation of quantitative data Spreadsheet techniques
Presentation	Beginner	Graphical presentation of quantitative data Public speaking
	General	Graphical presentation of quantitative data Integration of background reading and experimental data Public speaking Teamwork
Paper	Beginner	Calculating relative frequencies Sample comparison
Exam	General	Comprehension of peer presentations Sample comparison

The first course to use DAACS data, "Unearthing the Household: Gender, Class and Ethnicity in Contemporary Archaeology," was taught at the University of Virginia in 2003, prior to the launch of the publicly accessible DAACS Website. In addition to working with data from slave quarter sites in the Chesapeake region of Virginia, students were given comparable data from a white worker's house at Monticello and three slave dwelling sites at the Hermitage Plantation, located near Nashville, Tennessee. The instructor also introduced the sites to the students during a lecture early in the class schedule.

Taught by Jillian Galle, the project manager of DAACS, the class was developed for first and second year undergraduates with little or no experience in archaeology. The goal of the class was to expose students to different theoretical approaches to gender, class, and ethnicity through the use of detailed readings, critical discussions, and hands-on analytical projects. The unit of analysis for the class project was the household, and the students were presented with artifact and architectural data from these eighteenth- and nineteenth-century household sites. In a writing assignment and oral presentation, students were asked to interpret and compare the archaeological data from multiple households while drawing on the theoretical approaches to gender, ethnicity, and class they were introduced to through assigned readings and class lectures.

Although Galle anticipated that students would not know any statistical methods, it quickly became clear that many did not even know how to use Microsoft Excel. She got the students comfortable using Excel while also introducing basic quantitative methods, through two projects. For the first project, students were taught how to date each household site using ceramic manufacturing dates (mean ceramic dates or MCDs) and tobacco pipe-stem bore diameters. Once students had mastered these dating techniques, they were taught how to calculate relative frequencies and abundance indices for specific artifact classes. They were then required to plot these data by the MCD and tobacco pipe dates generated during the first project. Since this class was specifically not a statistical methods class, and the overarching goal was to get students to learn how to combine theory with some basic analytical methods, no other statistical methods were taught. All statistical analysis and the resulting graphic presentations were conducted using Excel. For the second exercise, students were asked to look for evidence of ethnicity, gendered activities, and signs of differential access to material goods at each dwelling site. Drawing on class readings, lectures, and discussions, they first had to decide which artifact groups might be analytically useful in answering a set of questions about each household: Do specific artifacts or architectural patterns point to household composition or type? What sorts of activities took place at each site? Is there evidence of African descent or spiritual/religious practices at the site? Are there signs of gendered activity spheres? Next, students were asked to compare datasets from two or more sites, with prompting questions such as: What are the similarities and differences between the households? Did one household have greater access to goods than another? Does one appear to have been the center of certain gendered activities? Students were required to support their arguments using the data and the class readings.

Because one important goal of the course was to have students apply theoretical constructs to archaeological data, the class project and presentation (35 % of the final grade) required students to analyze archaeological data from two or more households using one of the theoretical approaches discussed in class. This project required that students produce a five to eight page paper describing their analytical methods and presenting graphic results that supported their conclusions. They were also required to make a ten minute classroom presentation that used graphics that resulted from their analysis.

As it turned out, the students in the class were so out-of-practice with basic mathematical functions that teaching these methods took much longer than anticipated and required several additional evening help sessions. After recovering from the shock of being asked to think analytically about data, the students were eager to engage with both the data and classroom readings to produce insightful projects. A number of students addressed questions of African spiritual and cultural signatures on slave sites while others tackled the identification of male and female activities through the archaeological record. Others compared slave dwellings to free white sites. The final presentations ranged from basic oral presentations with large poster-sized graphics to animated powerpoint presentations. Much to the surprise of the instructor not only did math strike fear into the hearts of her students but so did publicly presenting their analyses, something most of the students had so far been able to avoid by taking large lecture-style courses. Requiring presentations showed the students how different interpretations can be wrested from the same data and provided them with ideas for their final paper, in which they were asked to answer in one of three questions in a five-page type written paper. They received small datasets from a select number of household sites and were asked to use methods taught in class to help answer the question.

Many of the challenges encountered in “Unearthing the Household” were also encountered in Galle’s University of the West Indies, Mona class, “Research Methods and Techniques in Archaeology.” Like UVA students, many UWI Mona students had to learn (or relearn) spreadsheet skills and basic mathematical concepts. They were unfamiliar with the iterative process of data analysis and the subsequent use of those data to make inferences about the past. They, too, were uncomfortable with oral presentations. The classes required students to meld method and theory, critical thinking and data analysis, to produce well-argued, well-written papers and presentations. As the instructor discovered, not many students in either setting had been asked to make such connections in other courses. While initially daunted by the task, the students were eager for a course that taught them how to develop and defend arguments using multiple lines of evidence.

Research Methods and Techniques in Archaeology is a required research and methods course required for all second-year archaeology majors at UWI Mona. The class met twice weekly, with each session lasting two hours. The first class of the week was dedicated to lecture and discussions of the readings. The second class was reserved for lab and analysis sessions. Early in the semester, the lab sessions focused on ceramic identification and the subsequent inventorying of a collection curated by UWI. As the semester progressed, Galle used them to introduce analytical methods such as mean ceramic dating (MCD), pipe-stem bore diameter dating, and artifact abundance indices.

Four biweekly projects, with each building on the previous ones, were brought together in a final project and presentation. The first project required each student to create a detailed inventory of a subset of the Papine slave village ceramic assemblage, a collection that resulted from excavations in the 1980s. Galle merged the students’ inventories to create a master ceramic inventory for the site. For the second project students calculated an MCD for the entire site using the master ceramic inventory. In project three, students calculated abundance index measures for nine ware-type and vessel-form combinations, such as creamware teawares, creamware tablewares, Chinese porcelain teawares, utilitarian coarse earthenwares, *etc*. After calculating and plotting the indices, students wrote two-page summaries about the acquisition and use of imported ceramics at the Papine Village. Project four required students to engage directly with the DAACS Website to retrieve ceramic data for a single domestic slave site in the Chesapeake. They downloaded the data, merged them with the MCD file, and calculated a MCD and ceramic abundance indices for the site using skills from the prior three projects. They were then required to discuss their results in a short write-up.

In the end, students in Research Methods and Techniques in Archaeology embraced the challenge of a course that required them to develop hypotheses about the past and then to work with real archaeological data to test those hypotheses. Students worked especially hard on the artifact identification and analysis portions of the project, logging extra hours in the lab. They had not previously been exposed to lab work, which gave them the opportunity to handle and identify the artifacts. By taking the course beyond simple lab methods into one which then required them to use the data they generated, the students were able to experience the trajectory from fieldwork, to lab work, to analysis and interpretation. Today, four years after the class, four out of eleven students still work or volunteer as archaeologists in Jamaica.

Advanced Undergraduates and Graduate Students in Archaeology and Allied Fields

Since the debut of the DAACS Website in 2004, Fraser Neiman has taught several upper-level courses at the University of Virginia in which archaeological data analysis plays a key pedagogical role. Among these is “Archaeological Approaches to Atlantic Slavery.” The course explores how archaeological evidence in general, and archaeological data from DAACS in particular, can be used to enhance our understanding of slavery and the slave-based societies that evolved in English North America and the Caribbean from the seventeenth through early-nineteenth centuries. The class combines short lectures, discussion, and computer workshops. Prior coursework in archaeology is a suggested pre-requisite. Nevertheless, students arrive with a variety of backgrounds, since the course is cross-listed in the departments of architectural history and anthropology and is open to undergraduates and graduate students.

The course is structured around a series of three projects that give students the opportunity to discover and analyze temporal and spatial patterns in data from the DAACS Website and other sources. The first project builds and evaluates an archaeological chronology for three eighteenth-century sites at Utopia, just outside of Williamsburg, Virginia. The chronology project and the substantive and technical lessons learned from it then become the foundation for the other two projects: an examination of changes in the architecture of slave housing in the Chesapeake during the eighteenth and early-nineteenth centuries and changes in consumption of locally made, hand-built earthenwares vs. imported refined ceramics in slave quarters during the same period.

The reading list draws on both the archaeological and historical literatures and is designed to provide historical context, to sample previous archaeological research related to the project topics, and to provide the methodological tools required to use archaeological data to engage those topics. The methodological tools include both theoretical models, from which the critical links between historical processes and formal variation in the archaeological record can be developed, and simple data-analysis tools. Each project teaches specific analytical techniques and illustrates important lessons about the analytical process.

The course begins with an overview of the Atlantic slave trade and the new-world societies it helped to spawn in the sixteenth through nineteenth centuries, with special attention paid to slavery in the Chesapeake. Patricia Samford's recent monograph Subfloor Pits and the Archaeology of Slavery in Colonial Virginia introduces the archaeology of that region and the three Utopia quarter sites that are the focus of the first project (Samford 2007). The DAACS Website offers complementary background data on the three sites.

The original excavators of the sites assumed that they were successively occupied. The goal of the first project is to evaluate whether the proposed chronological order is correct and explore the possibility that the occupation dates might have overlapped. Here the methodological tools are key. The method on which the analysis relies is frequency seriation. The class explores the seriation model, the assumptions behind it, and how the correctness of a hypothesized chronological order from seriation can be objectively evaluated by assessing goodness of fit to the model and to independent evidence. Readings describe the connections between MCD, pipe-stem dating, and frequency seriation (e.g., O'Brien and Lyman 1999; Ramenofsky *et al.* 2009). The problem of sampling error is a particular focus. For example, students are introduced to the binomial distribution as a model of sampling error in estimates of type relative frequencies.

Students learn how to use Excel pivot tables to create type counts at different levels of aggregation (context, stratigraphic group, features, and feature groups or structures) from downloaded DAACS data. They use Hunt and Lipo's VBA for Excel macro (see http://www.lipolab.org/seriation.html) to make frequency seriation diagrams for ceramic and pipe-stem bore diameter frequencies in the different assemblages. They also compute MCDs and pipe-stem dates. Finally, they learn how to create scatter plots in Excel to compare the chronological orders from MCD and pipe-stem analyses. These dates are computed for each feature at Utopia III and IV and the three structures (or feature groups) at Utopia II.[5] Students use frequency seriation diagrams to assess the goodness of fit of the resulting order to the frequency-seriation model, to compare the MCD and pipe-stem based orders, and to frame an argument for the occupational history of the three sites that best accounts for the patterns they discover.

The project is challenging because of the large amount of data, the less-than-perfect fit of those data to the seriation model, and the partially discordant results from MCDs and pipe-stem dates. The class discusses the possible causes of these disagreements and how they might be resolved. The upshot is that nonlinearity in the regression of pipe-stem bore diameters on time, specifically a flattening of the curve in the second half of the eighteenth century, is responsible for the apparent overlap between Utopia and III and IV pipe-stem bore diameter means. Conversely, small sample size and sampling error in type frequencies for the Utopia II assemblages create the apparent overlap in MCDs with Utopia III. The tentative conclusion is that the traditional picture of successive occupation for the three sites, with little or no overlap, is probably correct. However, there are two larger methodological lessons:

[5] Higher levels of aggregation are necessary at Utopia II because of small sample sizes.

that all inferences about the past are based on models, and that conclusions based on one set of data and/or model need to be checked using independent data and/or models. In the words of the famous biologist Richard Levins “our truth is the intersection of independent lies” (Levins 1966).

The second project considers the variable use of subfloor pits in domestic structures that housed slaves in the eighteenth and early-nineteenth century Chesapeake. The multiple subfloor pits that are common on Chesapeake quarter sites are a primary focus of Samford’s (2007) monograph. It offers a comprehensive review of current hypotheses for the ubiquity of these features: that they were for root crop winter storage, that they were “hidey holes” for concealing illicit resources from owners, and that they were Africanisms and/or ancestor shrines. Neiman (2008) provides a complementary view: the “safe-deposit box hypothesis” that ties the pits to game-theoretic models of indirect reciprocity, reputation, and the evolution of cooperation.

Using data from DAACS and reading and lectures focused on South Carolina and the British Caribbean, the class discovered important regional differences. Eighteenth century Chesapeake houses are larger than their contemporaries in the Caribbean and South Carolina and subfloor pits are unique to the Chesapeake. Discussions focus on the possible causes of the differences and their implications for evaluating the various hypotheses about the ubiquity of the pits in the Chesapeake.

The class then turns to two sets of data. The first set is culled from the DAACS Website and the reading, with houses assigned to 20-year periods. It documents change over time in floor area and the number of subfloor pits for a sample of slave houses in the Chesapeake with occupations spanning the late seventeenth through early nineteenth centuries. Two strong patterns emerge. Mean house size shrinks at the end of the eighteenth century. At the same time, the frequency of pits under the houses declines to one or often none. Students assess the extent to which the various hypotheses about subfloor pit function can account for this correlated pattern of change in both variables. A key lesson learned is that a hypothesis that might initially seem to offer a plausible account of the use of an individual pit (e.g., it is a shrine) will not necessarily be capable of explaining patterns of change over time, which is precisely what the archaeological record is so good at revealing.

The second dataset examines variation in the size and placement of pits within a sample of slave houses whose occupations range across the eighteenth century. These include the three Utopia sites, Richneck, and JC298, all included in DAACS, along with PW1199, a recently salvaged mid-eighteenth-century site (Crowell 2006). Students use the skills developed by the first project to establish mean ceramic and pipe-stem dates. Further assembly of the second dataset requires collaborative work in class to decide which variables related to pit size and placement will be measured, the protocols to be used in making the measurements, and what the measurements might mean. For example, both the literature and the inspection of site plans suggest that densities of subfloor pits increase within a structure with greater proximity to the nearest fireplace. The class considers how this trend can be quantified, for example in histograms of distances, and what differences among possible patterns in the measurements might imply for the various hypotheses about subfloor-pit function. A critical lesson here is how hypotheses about subfloor-pit function that have survived evaluation with the house size and pit count data can be further evaluated by looking at spatial patterning within houses. Again, students see that plausible-sounding interpretations of individual pits cannot necessarily explain variation in spatial patterns across multiple structures.

In the final segment of the course, the focus shifts to the ways in which archaeological evidence can be used to advance understanding of the variety of means and motives shaping participation by enslaved people in the larger consumer economy. This segment draws on two theoretical models. The first, derived from recent agent-based modeling in economics, suggests that markets, especially markets mediated by cash, increase both wealth and inequality (Epstein and Axtell 1996; Beinhocker 2006). The second suggests why greater inequality and higher levels of interaction with strangers that accompany market participation might induce individuals to divert resources into the acquisition of more costly ceramics as "costly signals" (Bliege Bird and Smith 2005; Galle 2010). Connecting these models to archaeological data requires measuring variation rates of artifact acquisition and discard using colonoware (a hand-built, low-fired earthenware), refined ceramics (refined earthen wares, stonewares, and Chinese porcelain), leaded glass (stemmed and non-stemmed table vessels), and metal buttons. Students compare these artifact classes using an abundance index in which the denominator class is wine bottle glass (e.g., Galle 2010).

Galle (2010) documented a significant increase in discard rates for refined ceramics and metal buttons in the last few decades of the eighteenth century on site occupied by people enslaved in the Chesapeake. The class project aims to clarify how early the trend can be detected by examining sites that were occupied before the American Revolution. The sites are JC 298, Utopia II, III, and IV, Richneck, and Palace Lands, all in the Tidewater region. Students also collect data from PW 1199, which serves as a useful Piedmont comparison (Crowell 2006). Using the bottle–glass index, students chart variation in discard rates for the artifact classes mentioned above. The assemblages for the analysis aggregate the contents of subfloor pits associated with each structure (these are called "feature groups" in DAACS) and the contents of large extra-mural pits within each site. Students date these assemblages using the methods learned in the first project and plot the bottle–glass index values against chronological orders. They revealed evidence for increasing discard rates for all the artifact classes, save colonoware, which decreases over time. PW1199 emerges as something of an outlier, suggesting lower levels of market participation near the frontier.

Interaction with students during the course and evaluations afterwards make it clear that many found learning how to select, manipulate, and analyze archaeological data, or data of any sort, challenging, exhilarating, and utterly novel. A key feature that helped insure all students could meet the challenges was to offer a series of informal Sunday-afternoon workshops before each project was due. These allowed the instructor to work one on one with individual students to build confidence, especially for those who were initially put off by quantitative data. The workshops quickly became a venue in which students helped one another, ensuring that everyone acquired the skills necessary to succeed with the projects. Students were excited by the prospect of analyzing data in novel ways that speak to the historical and anthropological issues raised in the reading and lecture. They shared a sense that they were discovering something new and are close to "the cutting edge." They often lamented the lack of engagement with data in other courses. One student wrote in a recent anonymous evaluation: "I wish more archaeological courses like this (practical skills, data analysis, *etc*.) were offered at UVA, and in this manner for that matter, grounding one in both theory and method. The course material has been deeply engrained and I will use its content for years to come."

Undergraduates Fulfilling General Education Requirements

Given the descriptions of DAACS data and its application in settings with advanced students (above) or researchers (below) it may seem that this material could be too complex or inaccessible for a general-interest audience. Certainly, the first glimpse of the archaeological data presented in Excel spreadsheet files can overwhelm such students. At the same time, the richness and diversity of the archaeological data, along with its standardization and thorough description, provide important opportunities for practicing analytical thinking and argumentation. These quantitative data are an effective compliment to the particularistic or anecdotal observations that may be more comfortable or familiar to many undergraduates not concentrating in the physical or biological sciences. It is possible to bridge these worlds, however. In the first meeting of "Archaeology: Unearthing History," Mark Hauser provides students with a list of objects recovered from Houses 13 and 14 from Seville Plantation in Jamaica. These items include a strike a light, a cowrie shell, and a tobacco pipe. Using Web-based and library resources, students are asked to track down images of these items, provide a brief history on the object's intended use, and an example of one other place in the world from the same era, where such things could be found. This brief exercise highlights specific ideas or meanings which students can begin to generalize to the tabular data.

Instructors and curriculum committees anticipate that general education courses will benefit students by introducing them to new domains of knowledge. Another aim is to impart the conceptual and analytical tools of those areas of study with the idea that such skills will be more broadly applicable, both inside and outside of the university setting. There are unique challenges associated with using digital archaeological data in teaching general education classes for undergraduates given the unruly nature of archaeological data and intricacies of making meaningful and significant comparisons among datasets. The DAACS database provides access to an abundance of archaeological data while the onus is on the instructor to develop the comparative framework that allows students to develop meaningful inferences.

What follows is a discussion of a course developed in 2005 by Hauser and Anna Agbe-Davies when both were on the faculty at DePaul University. "The Science of Archaeology" was initially a component of a traditional archaeological field school. Given its popularity, especially among students seeking an alternative to laboratory courses in the physical and biological sciences, the instructors were asked to tailor this class to be taught on campus, during the regular academic session. The course was to be pitched to a general student audience with no archaeological experience and no intention of further archaeological study. Challenges quickly emerged: first, to fulfill the goals of science curriculum, including instruction in hypothesis development, testing, and interpretation; second to provide a hands-on learning experience with real data; and finally, as best as we could, to mirror field school learning experiences in the classroom. Each turned to DAACS to provide the raw material with which to accomplish these objectives.

In addition to 2 h of lecture a week, the course included 2 h of laboratory sessions during which students completed exercises that reinforced concepts covered in lecture and readings. Topics included relative and absolute dating methods in archaeology, how sites are mapped, and site formation processes, familiarizing students with the procedures that produced the data they would get from DAACS. In the fifth week of the ten-week term, the instructors began to introduce students to those data. The students calculated dates using pipe-stem bore sizes and ceramic manufacturing dates. Once they had established temporal contexts for analysis, they used ceramics and faunal remains to study foodways using their assemblages.

Students worked in groups of three to five to complete the analyses required for the final project. Four weeks' worth of homework assignments and lab exercises familiarized students with three sets of data in DAACS: clay tobacco pipes, ceramic vessels, and faunal remains. Agbe-Davies has experimented with the order in which these datasets are introduced. Progressing from simpler (pipes) to more complex (fauna) is beneficial in that it builds student confidence and delays complex questions until later in the course, when participants are more adept at using the spreadsheets and summarizing their findings. However, starting with the most difficult dataset first allows the longest possible period to work with this information before the final project is due. Agbe-Davies and Hauser have used many of the DAACS sites for this course, but found that Monticello sites l, o, r, s, and t, Richneck (with each group of students assigned a single site phase), Palace Lands, and Mount Vernon's House for Families strike a good balance between providing sufficient quantity of materials to produce patterns, but not so much material as to be overwhelming.

The pipe data were used to estimate dates of occupation for each group's site or phase. Students learned how to create and interpret histograms of pipe-stem-bore diameters and to apply commonly used dating formulae, also using the bore diameters (see Barber 1994). Assignments encouraged reflection on the range of dates produced by the different techniques and the effect of site formation processes and excavation techniques on the results.

The ceramics lab directed students first to develop MCDs for their phase or site, to determine a terminus post quem, and to compare the two dating techniques (South 1977; Miller 2000). The MCDs, in particular, required a refresher in basic techniques such as sorting into categories and averaging groups of numbers. In the final project, this information was to be integrated with the dates produced by the pipe analyses and the site Harris Matrices provided on the DAACS Website. Students were also instructed to compare the proportion of sherds from flat form and hollow form ceramics, with an eye towards combining these findings with faunal evidence to discuss food preparation and consumption at these sites, again, for the final presentation. The preceding analyses were mandatory. The groups also received a series of open ended questions to encourage independent exploration of their unique datasets using information about maker's marks, the provenience of various vessel forms, and evidence for postmanufacturing modification.

The primary task with the faunal data was for each group to describe its assemblage using several different quantification measures (number of identified specimens, minimum number of individuals (MNI), and meat weight). The fundamental question was "what species provided the most food?" Results were to be presented in tables and graphs, applying skills learned in a prerequisite course ("Quantitative Reasoning") to represent quantitative data effectively. Again, open ended questions encouraged exploration of the data beyond these required tasks. Students were invited to suggest what season(s) their assemblage might represent, or other explanations for the presence of animal bone besides consumption by humans.

Practical considerations shaped several decisions about what students would be expected to do. For example, Agbe-Davies and Hauser have both elected to download and edit the data, eliminating categories of information that were not relevant to the analyses students were performing. In contrast, Galle had her UWI Mona students engage directly with the DAACS Website to retrieve ceramic data for a single domestic slave site in the Chesapeake. They were expected to download the data, merge it with the mean ceramic date file, and calculate a MCD and ceramic abundance indices for the site.

Most analyses for the Science of Archaeology were performed on artifact counts. However, in the case of the faunal project, we found that students sometimes spontaneously inquired about the relationship between bone fragments and whole animals, even before being introduced to the contrast between NISP and MNI. Therefore, it reinforced their own intellectual curiosity to have them use information about bone element, bone symmetry, bone location, and bone size to estimate MNIs for their assemblages. Conversely, Hauser, when requiring students to perform analyses based on ceramic vessels (as opposed to sherds), provided those derived quantities to the students.

Students produced better results with highly-structured assignments. Labs, lectures, readings, and homework were all coordinated to address the research potential of each class of data. Weekly labs included tasks and questions that required the students to explore the historic context and generally familiarize themselves with the DAACS Website content with a bearing on their projects (i.e.: maps, Harris Matrices). Each dataset provided to the students was accompanied by the same set of site formation and taphonomic questions about the archaeological data: how many items do the discarded artifacts represent; does the way the site was excavated effect the amount of data present; what are some similarities and differences among possible units of analysis (sites, phases, or features)? The repetition and parallel organization for each assignment were meant to help students recognize the similarities between the different kinds of analyses.

Although the options for analysis were tightly circumscribed, the students were still independently developing hypotheses and testing those hypotheses through the analysis of archaeological material. They were further expected to demonstrate their understanding of the strengths and weaknesses of the techniques that they used, information that was to be found in their reading assignments and lectures, but could also be independently discovered, through critical assessment of their results. Recently, Agbe-Davies has attempted to use DAACS data in a more open-ended fashion for an undergraduate assignment in "Archaeology of African Diasporas" at UNC-Chapel Hill. These students have greater familiarity with archaeological methods and/or African American topics than the Science of Archaeology students, but nevertheless still require substantial preparation and guidance to make meaningful connections between their chosen research questions and the archive data.

The cumulative results of the students' analyses have been presented as posters, final papers, and as PowerPoint presentations. These contributed to up to 20 % of the final course grade. The one constant has been that the students must successfully communicate their findings to an audience of their peers, rather than to the professor only. Initially, groups were required to analyze two sites or phases and compare them. In later iterations, Agbe-Davies took to assigning a single assemblage to each group and integrating the comparative element into the final exam. This created an incentive for students to actually pay attention to and learn from their peers' presentations.

The explicitly comparative framework of these activities challenges received wisdom and commonsense ideas about the lived experience of slavery and the representativeness of forms peculiar to a particular region or era. For example, in trying to understand the context of Seville, an estate in Jamaica dating ca. 1670s–1780s, many students begin with impressions of slave life derived from popular media. With DAACS, students were asked to critically engage such ideas by confronting materials that the enslaved actually left behind, specifically by comparing data from Jamaica with data from Virginia. Thus, their understanding of slavery is expanded beyond renderings of plantation life in the antebellum American south.

The course provided a venue for students to use and reinforce critical thinking skills and numeracy. Working with real data tables made students, many of whom had been avoiding their science requirement, use the mathematical skills developed by the prerequisite courses. It was not at all unusual to hear someone say "I never thought I'd have to use this again!" each time we met in the computer lab. Many of these students, though bright and articulate, were not comfortable calculating averages from mixed fields, or using other measures such as percentages. Interestingly, students often could perform calculations or analyses with the small practice datasets presented in a book (Barber 1994) for homework assignments, but had difficulty applying those same techniques to larger datasets organized in spreadsheet files during labs. Students also had a sense that averages are a poor measure of a skewed distribution of values, but needed experience working with samples to understand that skewing itself does not invalidate data—that sometimes the slant of a sample is where its meaning lies. Working with real data, when they had a stake in the final outcome, made these mathematical points more concrete for students.

Pedagogical Benefits of Teaching with Digital Archaeological Data

The examples above illustrate the benefits for students when instructors teach with digital archaeological data. The authors now turn to the benefits that accrue to the discipline when we have better-trained practitioners and a more clearly-defined relevance within the academy as a whole. We conclude with some thoughts on how teaching and research intersect in the archaeology of slavery.

For Archaeology

Teaching with digital archaeological data is different from traditional archaeological teaching in several important ways. The hands-on aspects of the analyses improve student retention of substantive information. Wrestling with the complexities of real data highlights aspects of the scientific process for students who may not otherwise be forced to contemplate the construction of knowledge. Digital data from real sites combine the best characteristics of site simulations with those of field or laboratory experiences using excavations or artifact collections. Finally, teaching with DAACS supports the ethical standards and aims of our discipline, in terms of our obligations to our students and to the archaeological record.

We share the belief that teaching students archaeology with real data is an important compliment to teaching them about archaeological discoveries by experts (Baxter 2009, p. 55; Perkins *et al.* 1992, p. 159). A student who has tallied the 154 sherds from Richneck's first phase and discovered the preponderance of hollow vs. flat ceramic vessels is more likely to retain that fact than a student who has received the same information via a lecture or assigned reading. He or she will also more readily connect this fact to the idea that this pattern may reveal something about African-American foodways (Ferguson 1992, p. 106). That student has also been compelled to think about the relationship between fact (hollowforms are more prevalent than flatforms on this African-American site) and hypothesis (that the high proportion of hollow forms is indicative of African-American foodways). He or she may try to extend the application of the hypothesis (is this pattern found on other African-American sites, or on contemporaneous sites occupied by other ethnic groups?).

Furthermore, a student who has experienced first-hand the ways in which data acquisition can influence results is then ready to consider the representativeness of the data that underlie other arguments that they encounter. A student who only experiences archaeological data via readings and lectures may be tempted to attach cultural significance to the fact that 130 beads were recovered from Utopia II, while only one came from ST 116. However, when both the instructor and the student have access to information about how the sites were excavated, the instructor has the opportunity to call attention to all of the factors—past and present—that shape the archaeological record.

Through sustained engagement with a complex dataset, students begin to see the connection between data collection, organization and interpretation. For example, students in the Science of Archaeology read several articles on foodways in the African Diaspora, including a study of the fauna from Richneck (Franklin 2001). Frequently, students responsible for analyzing data from Richneck worry that they have done the assignment incorrectly because their tables do not match those included in the assigned reading. It is that this point that they learn to appreciate how the selection of samples for analysis can substantially alter results. They also have a very concrete demonstration of the difference between two quantification techniques—biomass (used in the article) and meat weight (used in the class projects).

Teaching with DAACS data also provides an opportunity for students to learn how knowledge is produced in a scientific manner. One important means by which this is accomplished is letting them grapple with ambiguous and sometimes contradictory data. For example, the dates of construction or occupation span from a site's "Background" pages may not correspond to the dates suggested by artifact analyses summarized on the "Chronology" pages. Furthermore, stratigraphic relationships among deposits may appear to contradict the sequences suggested by the artifacts contained therein. How can these discrepancies be reconciled? Datasets that fail to fall neatly and unambiguously into place open the door for more detailed discussions about the relative strengths of the various analytical techniques and the process by which analysts decide among competing interpretations.

Of course, at the most prosaic level, teaching archaeological methods with DAACS addresses a major barrier to addressing complex concepts and methods in introductory courses—the lack of artifact identification skills among novice learners. Nothing illustrates this better than the analysis of historic ceramics. There are 68 distinct named ceramic wares and types included in the DAACS database. In order to develop the skills required to identify these materials, students would need significant hands-on experience. Instead, we have maximized our course time by focusing on learning some basic terminology and dating techniques. Students can then immediately apply these skills to the entire database of ceramics. With the finds already identified, students are able to move directly to developing higher order skills and answering questions that get at bigger issues.

Teaching with digital archaeological data engenders a series of teachable moments wherein instructors can discuss key archaeological principles in context. Such ends may be accomplished using simulation exercises or excavation and laboratory experiences. We find that teaching with datasets like DAACS provides the best of both worlds. Many simulations lack the complexity of real archaeological data. We have also found that students seem to be less interested in content that they perceive to be "fake." Asking students to address real questions with real datasets was central to, for example, Research Methods and Techniques in Archaeology. From the beginning, students understood that the class would be doing real analytical work—investigating questions that had not previously been asked of the archaeological record and the datasets. This was demonstrated by the first exercise in which they inventoried a collection that had never been cataloged. In this sense, there was a true feeling of discovery in the lab setting.

Finally, teaching with digital data addresses several of the Society for American Archaeology's Principles of Archaeological Ethics—namely, Stewardship, Records and Preservation, and Training and Resources (Society for American Archaeology 1996; Baxter 2009, p. 39). Digital exercises have the benefit of being repeatable. Students can make mistakes, back-track, and try again. Over the course of several project repetitions, instructors can anticipate student responses to the data and organize a class accordingly. While excavation and labwork are important components of archaeological training, teaching with digital archaeological data preserves the *in situ* archaeological record. It also promotes the long-term preservation of existing data, insofar as it contributes to the justification for the maintenance of digital archives. Such benefits are multiplied by the expectation that students who receive instruction using digital archives such as DAACS, and go on to become archaeological professionals, will be inclined to use and develop such data in their own research and teaching.

Teaching with digital archaeological data responds directly to the principles for curricular reform established by the Society for American Archaeology Task Force on Curriculum. Lessons grounded in DAACS datasets allowed students to build critical competencies in "basic archaeological skills" such as observation and inference, stratigraphy, familiarity with field recording techniques, the creation and use of data tables, and technical writing (Bender 2000, p. 37). The case studies above also demonstrate how other Task Force goals, such as "written and oral communication" (including computer literacy) and "real world problem solving" are developed using DAACS. Thus, digital data can play a vital role in the education of future professional archaeologists.

For Higher Education

Digital archaeological data belong in the classroom even if the students being taught have no further formal engagement with archaeology. Recent analyses of higher education express concern about a gap between what college students learn and what they should learn to succeed in the workplace of the future. It is true as Anne Pyburn (2000, p. 121) noted, that degree programs, like anthropology—and archaeology—that do not lead clearly and obviously to entry level employment are under siege in the modern academy. The public may perceive such degrees as "frivolous," but recent research shows that students of the liberal arts, especially in the social sciences and humanities, demonstrate greater intellectual growth and better preparation for employment after college than students in preprofessional degree programs (Arum and Roksa 2011). Employers expect higher education to develop specific attributes, including teamwork, problem solving, time management, analytical thinking, and strong communication skills (Ramaley and Haggett 2005, p. 9), and teaching archaeology with digital data can be a part of that process.

In the Science of Archaeology, the opportunity to subject assemblages to multiple kinds of analytical modes fostered a certain amount of peer-teaching. Different students "got" different concepts and techniques and then were motivated to provide explanations that fit their peers' learning styles, perhaps better than those devised by the instructor. Likewise, responsibility for large datasets—for example, the more than 67,000 faunal specimens from Phase 3 of Richneck—compelled students to work together and develop strategies for teamwork.

At the opposite end of the spectrum, small samples played a role as well. Hauser found that the assemblages from Monticello's Mulberry Row, with lopsided quantities of some artifacts, and the complete absence of others required students to move beyond simple comparisons. It also required that they infer specialized functions of buildings and think about possible internal differentiations within the enslaved population at that plantation. Neiman evoked the effects of sampling to good effect with advanced students (see above), but even non-specialist students came to recognize quite quickly that, for example, an estimated date based on five pipe-stems should be scrutinized closely.

The assignments using DAACS have compelled students to practice getting their ideas across using multiple communicative formats. Writing was important, but so too were oral presentations and the effective use of tables, charts, and graphs. Students had to communicate their results to their instructor, but also within their working groups and to an audience of their peers. Overcoming resistance to public speaking and increasing skills with the use of numerical data in argumentation were two beneficial outcomes of the DAACS projects. Finally, students who had created new data (as did participants in Galle's Research Methods and Techniques in Archaeology) or were analyzing datasets that their peers did not have access to (as was the case for participants in Agbe-Davies's version of the Science of Archaeology) were in an unusual position in an introductory level class: they had something novel to say and they were the experts. This kind of experience can be galvanizing for students who are accustomed to absorbing knowledge, not creating it.

For Future Research

Students are also using DAACS data in research. A host of graduate students are engaging with the archive for their masters and PhD. research. Topics include the production and distribution of American-made utilitarian stoneware and coarse earthenwares (Bloch 2011, 2012), GIS-based analyses of the relationship between plantation land use and the material culture of slavery on plantations across colonial Jamaica (Bates 2011; Bates and Galle 2012), Chesapeake slave participation in economic markets (Galle 2006), and a comparison of an eighteenth-century enslaved worker's village and the barracks occupied by enslaved soldiers at the Cabrits Fort in Dominica (Beier 2011).

Archaeologists have tended to use data from DAACS to explore a broad spectrum of temporal and regional variability. For example, a recent study of architectural and residential groups on plantations investigates the ways in which economic and social changes throughout the region impacted labor regimes that relied on slavery (Neiman 2008). Comparative analyses of costly consumer items such as refined teawares and fashionable buttons and buckles, are allowing researchers to explore the extent of slave participation in a burgeoning "consumer revolution" that swept the Atlantic world in the late eighteenth century (Galle 2010, 2011). The archive is making it possible to document shared similarities among sites that might betray common African traditions or the later emergence of a common African-American social identity in the Chesapeake, building on ideas about patterning in the processing of animal bones (Bowen 1996), the postmanufacture modification of artifacts and their unusual contextual associations (Samford 1996), and the techniques used for producing locally made ceramics (Armstrong 1999; Deetz 1988; Ferguson 1992).

Researchers have also used DAACS data to upend long-held beliefs about the structure of "slave societies" (Berlin 1998). Historians have used data on the distribution of gun parts on archaeological sites throughout the Chesapeake to aid their arguments regarding the arming of enslaved Africans during the American Revolution (Morgan and O'Shaughnessy 2006). Faunal data are being used to identify the factors determining variation in the quality of food provisioned by slave owners and how the extent to which slaves relied upon wild resources varied with that quality and their degree of geographical mobility (Sawyer and Bowen 2012; Clites *et al*. 2009). The faunal research is a good example of how teaching and research complement each other when using DAACS data. Working with the faunal data brings into relief the kinds of points that one tries to make in a traditional archaeology class. For example, archaeology is challenging much of the conventional wisdom about provisioning on plantations, misconceptions such as: all food was provided by owners; only the worst quality food was provided; or sufficient food was provided because "planters would not want to damage such valuable property." However, when students see the high numbers of wild animals in their assemblages, it reinforces for them what archaeologists are now learning about slave diet as well as the range of activities and resources that contributed to that diet.

Here, two goals—to teach archaeological and more generally scientific methods, and to increase students' knowledge about such subjects as slavery, the nature of identity, and cultural change—come together. We have seen significant growth in our students' knowledge and skills throughout these classes, making a strong argument for the incorporation of digital archaeological data into the archaeology curriculum.

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