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The Digital Archaeological Archive of Comparative Slavery

A Case Study in Open Data and Collaboration in the Field of Archaeology

JILLIAN E. GALLE, ELIZABETH BOLLWERK, AND FRASER D. NEIMAN

In January 2000 Monticello's Department of Archaeology embarked on an ambitious four-year initiative to use digital technologies to foster new kinds of information sharing and collaboration among scholars and to advance our understanding of the evolution of slavery in the Chesapeake Region during the 17th, 18th, and early 19th centuries. Nineteen years later, thanks to funding from the Andrew W. Mellon Foundation, the National Endowment for the Humanities, and numerous donors, the Digital Archaeological Archive of Comparative Slavery (DAACS, http://www.daacs.org) is the longest running, and continuously expanding, digital archaeological archive to date. The success of the Archive rests on three critical pillars that were inherent in its initial design: (1) the Archive would provide free and open access to fine-grained data on all artifacts and their archaeological contexts, including complete archaeological data sets; (2) all data in the Archive would be created using the same set of explicitly defined and completely documented classification and measurement protocols and hierarchical data structures developed by archaeologists working in the field and instantiated in a Structured Query Language (SQL) database; and (3) the Archive would focus on a specific culture-historical context: slave societies of the British Atlantic world.

At the time DAACS was conceived by Fraser Neiman (1999), archaeologists had excavated scores of sites and hundreds of thousands of artifacts associated with slavery across North America and the Caribbean. The majority of this fieldwork was accomplished by the research arms of history museums in pursuit of concrete details to add to the sketchy picture of slave life derived from documents (e.g., Monticello, Stratford Hall, St. Mary's City, Colonial Williamsburg, Mount Vernon, Poplar Forest, The Hermitage) and by cultural resource managers intent on salvaging archaeological data from destruction by the modern development of well-known sites. Information from these early decades of fieldwork and research was put to good use in educational venues, where it has served to enlarge historical memory to include slave life (Kelso 1997) and to guide accurate museum reconstructions of the vanished physical environments in which slaves lived and worked (Chappell 1989, 1999; Armstrong 2011). Successful scholarly applications were more limited. Despite demand for synthetic analysis from archaeologists and especially social historians (Walsh 1997; Morgan 1998), the best work in the late 1990s was still limited to site-specific treatments of archaeological data, accompanied by speculations about relationships with larger regional trends outlined by social historians using the documentary record (Franklin 1997).

Although the causes of this situation were complex, one of the biggest hurdles was the difficulty researchers faced in gaining access to archaeological data in a form that made quantitative comparisons possible. Most of the detailed evidence required to build convincing syntheses was buried in field notes, finds lists, and artifact storage boxes. Moreover these important metadata were scattered in archaeology labs around the region. The only apparent exception to data sets with this problem also proved the rule. Synthetic analyses of archaeological evidence derived from systematic comparisons among multiple sites that did exist were based on architectural evidence (Samford 1996, 2000; Neiman 2008). Unlike the complex and multidimensional information associated with a ceramic or faunal assemblage, a house plan was easily distilled on a single, measured drawing.

The lack of readily accessible comparative data hobbles archaeological research, not only on issues of slavery in the early modern

Atlantic world but also across time and space. A key problem is the use of incommensurate classification and measurement protocols by different investigators or by the same investigator at different times. One of the most difficult parts of integrating data produced by multiple sources as identified by multiple archaeological studies is the use of nonstandardized terms, measurements, and methods of recording information by different researchers (Kintigh 2006; Watrall 2011:171–172; Kansa et al. 2014; Kintigh et al. 2014:879; Freeman 2015; Kansa 2015:226–227). This lack of standardization means that researchers who want to compare data created from different projects spend many hours tracking down analysis codes or trying to understand how data were collected and recorded instead of analyzing it (Atici et al. 2013; Faniel et al. 2013; Kansa et al. 2014; Kansa 2015:226–227). In addition, once a researcher has worked out the idiosyncrasies of a data set the additional information that puts the data in context is not necessarily passed on for future use. The larger problem caused by the lack of standards in the terms and categories used for data collection, however, is that it prevents researchers from performing comparative quantitative analyses across sites. Determining the meaning of data codes cannot facilitate comparative research if the terminology used to describe data varies from project to project. Creating data that are consistent only within one project or a few projects limits their usability. There is also the threat of losing digital legacy data stored in unsupported formats (Ross and Gow 1999).

Without access to comparable digital data, the long-term, multigenerational trends that the archaeological record is uniquely good at revealing remain inaccessible. The unavoidable focus on single sites makes regional variation invisible. These issues were pervasive at the start of the DAACS project and remains relatively unresolved in the discipline of archaeology as a whole. Making progress requires simultaneous exploration of diverse approaches (King 2009; Kintigh 2009; Spielmann and Kintigh 2011; Galle 2012). The Digital Archaeological Archive of Comparative Slavery forges one such approach.

Structuring Goals and Historical Issues

The fundamental purpose of DAACS is to convert archaeological artifacts and data into evidence that can be brought to bear on important questions in the cultural, social, and economic history of British North America and the Caribbean. Slavery powerfully shaped nearly all aspects of life in these regions. The archaeological record, a physical remnant of dynamic strategic relationships among slave owners and slaves, offers uniquely systematic evidence about change over time in the conflicting strategies enslaved and enslaver used to further their own and their families' interests. Strategic outcomes were affected by a variety of circumstances. Three factors were key: slave origins in Africa, demography in the plantation setting, and the niche that plantations occupied in the Atlantic economy and consequent variation in slave work routines required for economic success (Ortiz 1947; Berlin 1998; Morgan 1998). Note that recent scholarship has explored the role of Native American slaves in Virginia and the broader British Atlantic (Gallay 2003; Hatfield 2008; Everett 2009; Gallay 2009; Shefveland 2016). The sites of enslavement in DAACS were likely home to both enslaved Natives and Africans, but without detailed historical demographic research it is difficult to tease apart the ethnicity of individual enslaved persons or communities.

From its inception, DAACS (2017g) targeted sites from places and times that would strengthen our ability to assess how variation in these factors affected the trajectory of historical change in each region. The regions represented in DAACS received different proportions of enslaved Africans from different areas within West Africa. For example, roughly 60% of Africans imported into the lower Chesapeake in the early 18th century came from the Bight of Biafra. In contrast, the majority of slaves imported into the upper Chesapeake, including Maryland, came from Senegambia (Walsh 2001). The majority of Africans brought to Jamaica were from the Gold Coast and adjacent Bight of Benin (Morgan 2006). On the other hand, people enslaved and brought from Angola were the majority group in early South Carolina (Morgan 1998).

The demographic experience of enslaved Africans imported into each of the DAACS regions was also highly variable. Slave populations in the Chesapeake experienced demographic stability early (Kulikoff 1986), largely due to a more benign disease environment. The more deadly environments of South Carolina and Jamaica meant higher death rates, with heavy African importation required to meet labor demands. As a result, the relative frequency of newly imported Africans in the population was lower, sex ratios more balanced, and rates of family formation higher in the Chesapeake than in any of the other regions (Morgan 1998).

The archaeological sites in DAACS were also chosen to deliver sharper insights into the effects of variable labor regimes on the dynamics of slave societies. The labor requirements of tobacco and later small-grain agriculture typical of the Chesapeake differ. So do the requirements of Caribbean sugar cultivation, which differ from the rice and indigo regimes of South Carolina. Different work routines select for different labor management strategies, which in turn potentiate different strategies of slave resistance (Morgan 1998). The archaeological record can uniquely inform these differences, provided that scholars have access to systematically collected data with associated contextual information from spatially and temporarily diverse sites.

Research Foci

Four aspects of everyday life in the early modern Atlantic world were initially singled out as likely foci for research based on Archive data, and we (Neiman and Galle) kept them in mind when selecting sites for DAACS. The first set of issues related to the arrangement and use of domestic architectural space. Of particular interest were patterns of change and variation in the amount of influence enslaved individuals had over their living conditions. How much control did they have over the size and composition of their residential groups? How did African slaves manage to establish and nurture families and, later, multigenerational kin networks? As task differentiation increased, did task-based residential groupings emerge?

A second cluster of historical issues revolved around consumer goods and the extent of slave participation in a burgeoning "consumer revolution" that swept the Atlantic world in the late 17th and 18th centuries (Carson 1994). How variable was access to costly ceramic and glass vessels or fashionable clothing accoutrements like buttons, buckles, and beads? What were the payoffs to enslaved individuals for such access, and did they change over time? To what extent did the trajectories of change in preferred styles and uses of consumer goods diverge among slaves living in different regions and subject to different labor demands and labor management strategies?

A third set of key questions revolved around subsistence (Bowen 1996). What were the determinants of variation in the quality of food from domestic mammals and fish with which the enslaved were provisioned by owners? What caused variation in slave mobility across the landscape, as measured by the habitat preferences of wild species that they foraged? How did the extent to which reliance upon wild resources vary with the quality of the provisioned diet and the amount of geographical mobility they enjoyed? What were the ecological and social determinants of species preferences among slave foragers?

Archaeologists and historians have also been intrigued by the possibility of identifying African cultural and religious influences in material remains of the period (Sobel 1987; Ferguson 1992; Franklin 1997). It has been suggested that nearly all categories of material culture excavated from sites associated with enslaved populations belong to arenas of traditional African practice, from patterning in the processing of animal bones (Bowen 1996) and the unusual contextual associations of artifacts (Samford 1996; Russell 1997) to techniques used in the construction of locally made ceramics (Deetz 1988; Ferguson 1992:1–32; Deetz 1999:78–90; Mouer et al. 1999). Those important and tantalizing issues had been addressed only in a largely anecdotal fashion at the time of the Archive's inception. Data in DAACS now make it possible to document shared similarities among sites that might betray common African traditions or the later emergence of African American social identities in each region. They can also reveal the extent of regional variation in similarities that might be correlated with the origins of enslaved Africans within Africa.

These four historical issues remain central to the structure of DAACS and the research that is produced by DAACS staff. While they guide DAACS research and eligibility criteria for inclusion in the Archive, the archaeological data in DAACS can be used to address any research question a scholar brings to the data. The manner in which DAACS data are collected and structured allow these and numerous other historical questions to be addressed in a systematic way for the first time.

Designing DAACS

The ability to address these questions and meet our goals relied on making systematic and complete archaeological data, analyzed using the same set of classification and measurement protocols, publicly accessible. The general approach that DAACS adopted has been to use the internet to facilitate communication and community building among researchers, based on shared engagement with large amounts of fine-grained data, conforming to explicit protocols that researchers themselves helped devise. Hence the initial step for the DAACS project in 2000, when the founding grant was awarded from the Andrew W. Mellon Foundation, was to engage leading archaeologists and historians working on slave societies to help us identify the major research issues and the kinds of data required to address them. These scholars were brought to Monticello for a series of meetings to discuss everything from the overarching research questions bedeviling the field to the minutiae of which specific data attributes should be recorded for material culture such as beads, buttons, and tobacco pipes. These scholars make up the DAACS Steering Committee, an advisory committee that has grown over the past 18 years as the archive has expanded and which continues to help shape the archive's direction (DAACS 2017b).

By 2001 DAACS staff and collaborators had delineated data structures for both artifacts and the excavation contexts in which the artifacts were found, along with explicit classification and measurement protocols and data structures for both artifacts and contexts. It was clear from the outset that existing collections management

software packages with archaeological components were not sufficiently robust to contain the hierarchical relational data that DAACS aimed to collect and deliver to users. As a result we undertook the development of the DAACS database, initially a Structured Query Language database (MSSQL Server) backend with an accompanying Visual Basic data-entry client. SQL is a programming language designed to manage and modify (e.g., query, insert, delete) data held in a relational database management system. At its inception, the DAACS SQL Server backend contained roughly 200 related tables, including authority tables. It resided on a single server at Monticello.

The database has grown, and today its data structures and cataloging protocols are rigorously defined and documented on the DAACS (2017c, 2017d) website. The database has since moved to a PostgreSQL (an open-source system) platform. A Ruby-on-Rails interface (Rails combines the Ruby programming language with HTML, CSS, and Javascript to build complex websites and applications) delivers data to the website via queries and facilitates a new internet-accessible data-entry interface for accredited DAACS collaborators. This significant programming development is discussed in greater detail below.

Once programming for the DAACS client-server application was completed in 2001, artifacts and field records from sites across the Chesapeake were brought to the DAACS lab at Monticello for analysis. Twenty archaeological sites from across Virginia were carefully chosen for initial analysis to provide representative temporal and geographical coverage. Site occupations spanned the late 17th century into the early 19th century, making it possible to study African American experience in the Chesapeake over a century-long time scale, a span represented by no single site. Equally important, the sample included sites from both the Coastal Plain and Piedmont provinces, making it possible for the first time to study systematically regional variation. Finally, the site's principal investigators, and the institutions that housed the collections, were eager to share their data publicly, which was not the case for all eligible sites.

The sites in the initial sample fell into two groups. Group 1 comprised sites with no digital record or with an incomplete and incon-

sistent digital record. They included five sites from Mulberry Row at Monticello, dating from the late 18th and early 19th centuries; two important early 18th-century sites in James City County (44JC298 and 44JC546); one site from Stratford Hall (ST116); and the Pope Site, a mid-18th-century site in Southampton County. For these sites, all components of the digital archive were created from the ground up, from the identification and cataloging of every single artifact in these assemblages to the digitization of the original paper field records, the creation of digital site maps from individual paper context maps, and the digitization of slides and photographs. The artifacts and archival records for each site were brought to the DAACS lab at Monticello, where DAACS archaeological analysts, trained in the minutiae of DAACS cataloging protocols, identified and digitized the materials and entered those data into the DAACS database.

The second group of sites had relatively complete and consistent digital artifact catalogs. They included sites from Colonial Williamsburg (Richneck Quarter and Palace Lands Quarter), Poplar Forest (North Hill and Quarter site), Monticello (Sites 7 and 8), Mount Vernon (House for Families and South Grove), and Utopia (Quarter Sites 2, 3, and 4, excavated by the James River Institute for Archaeology). For these sites, all beads, buckles, buttons, ceramic and glass vessel sherds, tobacco pipes, and utensils were individually cataloged by DAACS analysts using the protocols and standards established with the help of the DAACS Steering Committee. For all "general artifacts," nails, window glass, brick and mortar, charcoal, toys, tools—any artifact not falling into the previously listed "special artifact classes"—we digitally mapped the existing digital artifact catalog entries onto the DAACS data fields and corresponding artifact lexicon. We then transferred the newly DAACS-standardized data into the DAACS database. Context records, site plans, and photographs were digitized from the original paper and film records. For all sites, the faunal remains were analyzed by Joanne Bowen and Steve Atkins at Colonial Williamsburg's Zooarchaeological Laboratory, and their data were entered into the faunal module of the DAACS database.

As the first sites were being analyzed and entered into the database, we developed the DAACS website from which the data being collected would be served to the public. DAACS Steering Committee members, as well as students and nonaffiliated archaeologists, were enlisted to test the interface and help refine its design. Using a simple point-and-click interface, written in Hypertext Preprocessor, website users were able to run sophisticated SQL queries that return data from multiple sites. All of the data returned on both contexts and artifacts conform to the same set of measurement protocols, and the complex hierarchical relationships among them are encoded in the same relational database schema. The use of standardized protocols and a single schema enabled the systematic quantitative comparison of hundreds of thousands of artifacts from 10 sites in multiple regions excavated by different archaeologists over many decades for the first time. That number has grown to over 2 million artifacts from 85 site and growing. No other digital archive of archaeological information delivers such detailed, standardized data presented for seamless statistical comparison of assemblage content within and among sites and regions and across decades of excavation.

While all the artifact and context data were entered using standardized terminologies, DAACS also provides users with a suite of eight different web pages dedicated to each archaeological site in DAACS. The *Site Home* page provides a site map and brief facts at a glance. The *Site Background* page provides a detailed summary of site excavations and describes field and laboratory methods used for data collection and curation. It describes the excavations conducted over all field seasons and summarizes any documentary evidence of prior occupations of the site. It also discusses any previous research or analysis that has been done on artifacts or the site's occupational history. Web links to citations for site reports and associated gray literature are included if researchers want more detailed information.

One of the ways DAACS documents the variation between sites is with the *Before You Begin* page on the website. Each site has a *Before You Begin* page that outlines key pieces of information or variation in the data set that may impact analysis. Some of the *Before You Begin* pages are very straightforward and list only a few bullets that outline basic

information on measurement and screening techniques (https://www.daacs.org/sites/ashcombs-quarter/#before). Other sites require a page that provides a detailed documentation of decisions DAACS staff made during data entry to help the data set conform to DAACS protocols, including how analysts handled missing artifacts and contextual information (https://www.daacs.org/sites/house-14/#before). Most important, this page documents any major differences in the way the artifact data were generated so researchers know how the data have been entered.

Another considerable challenge in comparing artifacts between different sites lies in understanding the chronology of the site and how it relates to other sites on a temporal scale. To address this challenge, each site in the archive has a *Chronology* page and a *Harris Matrix* page. DAACS staff use a multivariate statistical technique called correspondence analysis (CA) to analyze ceramic data from each site to create occupational phases for each site, and they calculate terminus post quem and mean ceramics dates for these CA-derived phases. The *Chronology* page describes the CA method used and presents the resulting occupational phases and dates. These phases are applied to the detailed Harris Matrix for each site, which are created by DAACS staff using the stratigraphic relational information contained in the site's context information. Finally, a *Site Images and Maps* page provides users with access to download images and site maps in pdf, dxf, and dgn formats.

When the DAACS website launched in 2004, it contained data from nine of the sites in the initial grant proposal: Monticello's five Mulberry Row sites, Colonial Williamsburg's Richneck Quarter, Mount Vernon's House for Families, and Stratford Hall's ST116 and 44JC298. Development of the database and cataloging protocols took an entire year, substantially longer than anticipated in the initial grant proposal to the Mellon Foundation. Perhaps more significant, assemblage sizes were vastly underestimated in the initial proposal, in some cases with collections two or three times larger than initial assessments. By the end of 2005 analysis and data entry for all 20 sites from the initial grant was completed and the sites were launched on the DAACS website.

MAP 2. Archaeological sites currently in the Digital Archaeological Archive of Comparative Slavery (www.daacs.org)

DAACS Expansion

As of early 2019 the DAACS website serves complete archaeological data from more than 85 sites of slavery excavated in Maryland, Virginia, North and South Carolina, Tennessee, Mississippi, Jamaica, Nevis, Barbados, Dominica, Montserrat, St. Croix, and St. Kitts (Map 2). These data include millions of records on artifacts and their archaeological contexts. To ensure data accuracy and reliability archaeologists and zooarchaeologists trained and certified by DAACS are the sole creators of these data. The process is time-consuming but ensures that Archive users have easy access to detailed, comparable data that conform to a single standard.

Since the online launch of the archive in 2004, DAACS has developed its content and audience by establishing collaborative relationships with archaeologists and students working throughout the

Atlantic world. Much of this expansion has been funded by grants from the Mellon Foundation, the National Endowment for the Humanities (NEH), and Save America's Treasures. In other cases, the DAACS endowment, established in 2001 with a challenge grant from NEH and matches from several generous donors, has covered the cost of adding new sites. Some principal investigators who want to include their sites in DAACS have provided funding.

Expansion outside of the Chesapeake began in 2004, when a second grant from the Mellon Foundation allowed DAACS to broaden its geographical scope to include sites related to slavery in the Carolinas and the Caribbean. Between 2004 and 2008 we focused on including sites from Jamaica, Maryland, South Carolina, and Virginia. Among the significant sites added during this grant were assemblages from Leland Ferguson's (1992) excavation at Middleburg Plantation in South Carolina, from Barry Higman's (1998) groundbreaking excavations at Montpelier Planation in Jamaica in the 1970s, and from Douglas Armstrong's (2011) work at Seville Plantation in Jamaica. Collections from the United States traveled to the DAACS lab at Monticello, while DAACS staff relocated to Kingston, Jamaica, for five months in 2006 to catalog the Jamaica collections curated by the University of the West Indies, Mona, and the Jamaica National Heritage Trust.

A number of long-term collaborations emerged from the second Mellon grant that contributed to the Archive's continued growth. In 2008 Monticello's Department of Archaeology received funding from NEH to contribute nine additional sites from Monticello's Mulberry Row over a period of three years. DAACS's relationship with the South Carolina Institute of Archaeology and Anthropology, forged during our work on the Middleburg assemblage, led to a collaboration funded by Save America's Treasures that allowed the Institute to rehouse and inventory the Yaughan and Curriboo Collections, the first major excavations of slavery-related contexts in the South Carolina Low Country (Wheaton et al. 1983; Wheaton and Garrow 1985). After one year of collections work, the Yaughan and Curriboo assemblages traveled to the DAACS lab at Monticello,

where they were cataloged and digitized into DAACS. The sites went live on the DAACS website in 2014.

DAACS's work with Armstrong's assemblage from Seville, Jamaica, branched into two separate longer-term collaborations: one working with Armstrong and his students on new sites in Barbados and Jamaica, and another with the University of West Indies and the Jamaica National Heritage Trust on new excavations and collections from Jamaica. Our collaborations in the Caribbean have led to the DAACS Caribbean Initiative (DCI), a long-term research project devoted to collaborative field research on plantations and associated slave villages on the islands of Jamaica, Nevis, and St. Kitts. The DCI has grown to focus on fieldwork in Jamaica and serves as a model for uploading recently excavated material online within months of excavation. In addition to DCI-sponsored excavations, Douglas Armstrong, Hayden Bassett, and Sean Devlin are working with DAACS to publish their field data within months of excavation (Figure 4).

The DCI received a major boost when DAACS was awarded a NEH-JISC Transatlantic Digitization Collaboration Grant, which funded a partnership with the International Slavery Museum, Liverpool, and the University of Southampton to conduct archaeological surveys on 18th-century village sites inhabited by enslaved populations on Nevis and St. Kitts. The resulting data from five village sites on Nevis and St. Kitts were launched on the DAACS website in 2010, only 18 months after fieldwork. In 2012 the International Slavery Museum launched a detailed, publicly oriented website dedicated to the project (National Museums Liverpool and International Slavery Museum 2017).

DAACS Satellite Laboratories

Throughout all of the preceding collections work, the emphasis remained on replicating DAACS cataloging standards. This goal was relatively easy to achieve as analysis was conducted by DAACS and Monticello staff at Monticello or by DAACS staff working remotely in the Caribbean, all using a single instance of the DAACS SQL

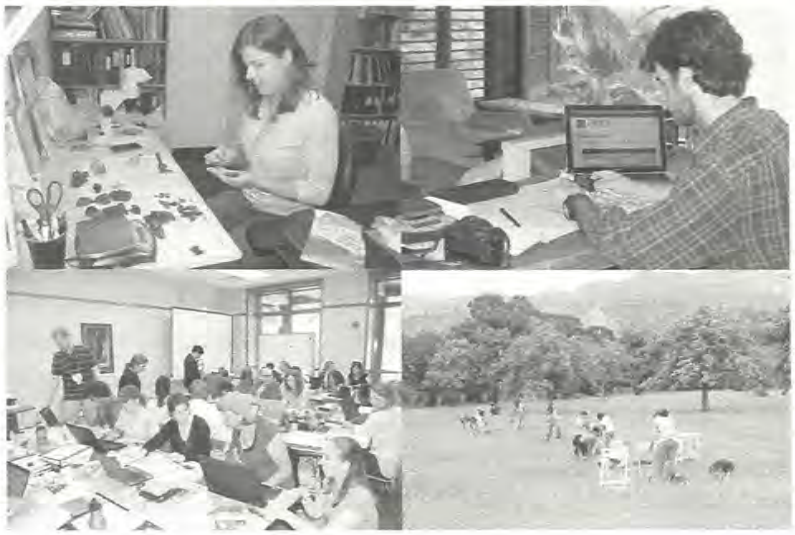

FIGURE 4. *Clockwise from lower left*: A DAACS Research Consortium training workshop on Monticello; Leslie Cooper, senior DAACS archaeological analyst, cataloging artifacts at DAACS Lab at Monticello; Hayden Bassett, cataloging artifacts into the DAACS database in Falmouth, Jamaica; the DAACS/UWI, Mona, Archaeological Field School, Jamaica, 2011. (Photos: Jillian E. Galle, Fraser D. Neiman, and Madeleine Bassett)

server database housed on a server at Monticello. As early as 2007 archaeology programs excavating sites of slavery expressed interest in using DAACS as their main archaeological database. In 2008 Kevin Bartoy, then director of archaeology at The Hermitage, the home of Andrew Jackson, located outside of Nashville, Tennessee, approached DAACS about establishing a satellite DAACS lab there. He wished to analyze previously excavated assemblages from domestic sites of slavery at The Hermitage and make them available to the public via the DAACS website. A successful Institute of Museum and Library Services grant in 2007 allowed Bartoy to establish a DAACS Satellite Lab at The Hermitage. An instance of the DAACS database was installed at The Hermitage, and four Hermitage archaeologists received three weeks of cataloging and protocol training at the DAACS lab at Monticello. These archaeologists then returned to The Hermitage, where they began cataloging into the Hermitage's DAACS database. The plan was to digitally transfer their data into Monticello's DAACS database when the project was completed. A subsequent NEH grant to The Hermitage in 2008 facilitated the start of a major effort to catalog into DAACS the complete archaeological assemblages from 12 domestic sites of slavery at The Hermitage. The closure of The Hermitage's Archaeology Department in 2009 led to the transfer of the NEH grant to DAACS. A second NEH grant, this time awarded directly to DAACS in 2014, is allowing for the completion of The Hermitage project by June 2019.

At the same time The Hermitage was setting up a DAACS satellite laboratory in Tennessee, other museums and universities began to use the DAACS database as their primary method for managing their archaeological collections. The archaeology departments at Washington and Lee University, Mount Vernon, and Drayton Hall chose DAACS as their primary cataloging system. Staff from each department spent at least four weeks in the DAACS lab learning DAACS cataloging protocols and standards. The DAACS SQL server database was installed on dedicated servers at each institution. In spring 2013 Eleanor Breen and Mount Vernon launched the Mount Vernon Midden website (http://www.mountvernonmidden.org/), which contains archaeological data delivered from the DAACS database. Numerous graduate students, after training at DAACS, also installed the DAACS SQL server database on their laptops for use at their own sites. Other museums, organizations, and individuals approached DAACS about adopting the DAACS database but were daunted by the technical skills required to install and manage their own version of the database.

While the expansion of the DAACS program outside of Monticello confirmed that the database was fulfilling the professional needs of historical archaeologists, it grew increasingly difficult to keep the satellite DAACS database synchronized with the home DAACS database at Monticello. By the early 2010s the importance of making DAACS a cloud-based resource, in which users could enter data into a single instance of the DAACS database via an internet-based browser, was clear.

DAACS Research Consortium

In March 2013 DAACS was given the chance to develop such a cloud-based resource through a third major Mellon grant for a project called the DAACS Research Consortium (DRC). The DRC is an innovative attempt to create for the discipline of archaeology the promise of what has been called "contributed cataloging," devising ways for many scholars to contribute to a larger project, while providing them with novel venues in which to publish their work and their data (Waters 2009). This project is the critical first step in creating a network of collaborating scholars linked by DAACS software, protocols, and analytical skill, and interacting at levels that have hitherto been possible only within a single campus.

Over the course of two years DAACS, in collaboration with the University of Virginia's Institute for Advanced Technology in the Humanities (http://www.iath.virginia.edu), Convoy, Inc. (http://www.weareconvoy.com/), and DRC partners, developed a new open-source software infrastructure that allows geographically dispersed DRC members to digitize, analyze, and share their data with one another and eventually with the wider archaeological community and the public via the DAACS website. The old DAACS MS-SQL server database at Monticello was migrated to a new PostgreSQL database. Prior to the migration, DAACS staff fine-tuned the backend data structures and authority terms, using input from our DRC partners. DAACS staff also translated copies of the remote instances of the DAACS database running in the archaeology departments at Mount Vernon and Drayton Hall and with several graduate students, into the Monticello SQL server backend. This process was arduous due to minor, nonshared variations in table structure and authority terms that had crept into each backend database since its creation. It affirmed the decision to move the new DRC database architecture and its single, shared PostgreSQL backend.

Programmers at the Institute for Advanced Technology in the Humanities developed an internet-accessible frontend data-entry application, written in Ruby-on-Rails code, that incorporated HTML/

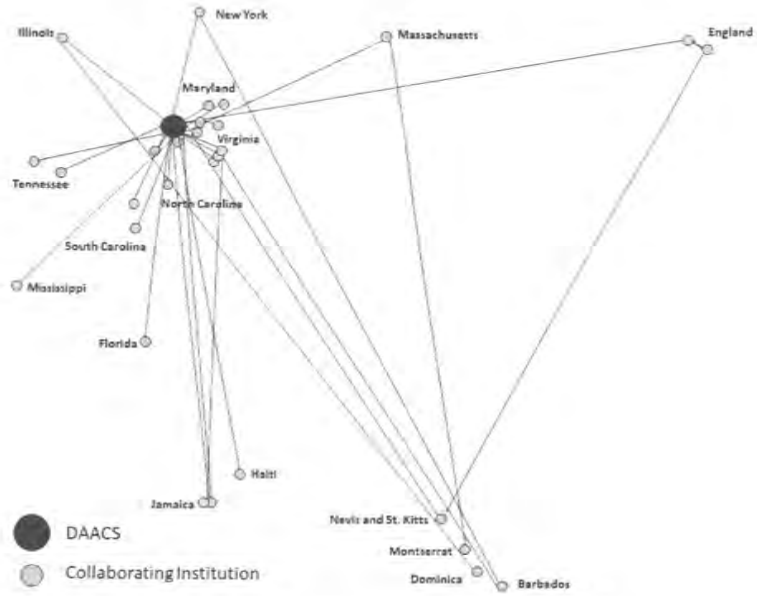

FIGURE 5. DAACS collaborator network as of March 2017. (Graphic: Jillian E. Galle, Fraser D. Neiman, and Elizabeth Bollwerk)

CSS and Javascript frontend components. The DRC Application, available to DRC partners with a log-in, is an easy-to-use database with a robust query module (www.daacsrc.org) that allows data entry into a single DAACS database, ensuring comparability and ease of launching data on the DAACS website. Funding in 2017 from the NEH's Office of Digital Humanities provided for an expansion of the database user interface offered to DRC partners. The expansion helped forge new scholarly collaborations with government organizations, museums, and CRM firms seeking to make their data publicly accessible. The Expanding DRC grant also allowed DAACS to provide free in-depth training programs in DAACS database use and cataloging protocols, which is making new kinds of scholarly collaboration and data sharing possible.

Our partners in the DRC include faculty and their students at leading graduate programs focusing on the archaeological study of early modern Atlantic slave societies (Figure 5; DAACS 2017e). The consortium also includes scholars from research institutions that hold

major archaeological collections from those societies. All DRC partners entering data into DAACS are required to undertake significant training at the DAACS lab at Monticello. Trainees take material culture assessments, or quizzes, throughout their time at Monticello and must pass a thorough material culture examination before they are certified to enter data into DAACS for presentation to the public. These material culture assessments are critical to ensuring the accurate identifications and quality of data in DAACS.

The ongoing DRC project aims to contribute to a larger effort to explore and perfect ways to use the internet to advance scholarly collaboration and knowledge of the past in the discipline of archaeology. Its design brings together recent threads in humanistic and scientific scholarship. The first is the concept of "contributing cataloging" (Waters 2009). DRC explores how archaeologists at scattered institutions might contribute comparable and accurate data to an integrated database and share the results with colleagues and the public. The second thread originates in the sciences, where many fields have benefited from the establishment of "core facilities" that house costly informatics, analytical infrastructure, and expertise that can be shared (Farber and Weiss 2011). The third thread is the growing recognition in the sciences, social sciences, and humanities that researchers have ethical obligations to make the entire research process more open to colleagues, other stakeholders, and the general public (Miguel et al. 2014). Openness is an ethical issue because it impacts the legitimacy and credibility of all archaeological inquiry and the well-being of all who participate in it (Lupia and Elman 2014; Marwick 2016). At DAACS we strive for transparency in all aspects of the process of creating and publishing the data. The *About the Database* section of the DAACS (2017a) website provides dozens of documents and manuals outlining how DAACS data are created.

Data Dissemination, Preservation, and Literacy

The data generated through these processes—whether sites are cataloged by DAACS archaeologists in the DAACS lab or digitized by DAACS Research Consortium members at their home institutions or

field sites—are made available through the DAACS website to anyone, anywhere in the world. There are two primary ways of navigating the website: a series of dropdown menus and a map of sites created with a Google Maps interface. The context and artifact data are made available in point-and-click data queries. These queries are tied to SQL code that retrieves the data from the database. Context and artifact queries enable researchers to subset artifact queries by context or chronological phase. These queries can be easily run with data from multiple sites in the archive. The aggregated data sets are available as html tables and downloadable as .csv files that can be analyzed in any statistical program. In addition, DAACS also makes digital map files in CAD formats from each site accessible for those who want to do their own spatial analyses.

Providing aggregated data sets of artifact and contextual data that have been cataloged and recorded in a database using a single, standardized set of protocols from over 85 archaeological sites is a unique offering of DAACS. There are other projects, including the Chaco Research Archive (www.chacoarchive.org), that provide access to standardized, aggregated data that have been reanalyzed using a standard set of protocols. A variety of other digital archaeological projects also provide access to various types of archaeological data, including collection finding aids that have not been analyzed using standardized protocols (Pylos Regional Archaeological Project, http://classics.uc.edu/prap/; Archaeological Data Service), individual object records, general information on archaeological sites, but not necessarily artifacts (Digital Archaeological Atlas of the Holy Land, https://daahl.ucsd.edu/DAAHL/), or aggregated data sets from different sites that are downloadable but are not immediately interoperable (the Digital Archaeological Record, https://www.tdar.org/; A Comparative Archaeological Study of Colonial Culture, http://www.chesapeakearchaeology.org/; Open Context, https://opencontext.org/). The Digital Index of North America Archaeology, made available through Open Context, provides a web-based index of data pertaining to over 450,000 archaeological sites in North America. While all of these projects are valuable, when determining which archive or

repository to use it is important for archaeologists to consider how the different goals and methods impact the types of data offered.

Besides making archaeological data available, DAACS is committed to maintaining the long-term health and sustainability of the database. This concern was one of the driving forces behind the move to PostgreSQL. Long-term sustainability and access to archaeological data is a major issue noted by multiple researchers (Kintigh and Altschul 2010; Kansa and Kansa 2011; Watrall 2011). DAACS's endowment guarantees minimal DAACS staffing and the maintenance of the DAACS website and ensures that data are migrated, programs upgraded, and servers replaced on a regular basis. DAACS then draws on grant funds to tackle larger projects that the endowment cannot support.

Another necessary step to making data useful is ensuring users know how to interact with and analyze them. Part of the DRC workshops entailed short courses on data querying using Navicat, a SQL code-writing tool and data analysis using the statistical software program R. We choose R because it is widely used among statisticians, data miners, and (increasingly) archaeologists, is open source, and has an active and welcoming online community of users. In addition to university faculty members using DAACS to teach graduate and undergraduate courses (Agbe-Davies et al. 2013; our more detailed discussion of this below), DAACS staff members also teach data analysis workshops to students and archaeological professionals. These courses and workshops have revealed what we consider to be two major challenges for historical archaeology and the archaeological discipline as a whole. First, there is a lack of training in formulating research questions and methods for evaluating them (i.e., using statistical analysis). This is an issue regardless of whether the data are from new excavations or legacy collections, although archaeologists seem to struggle more with formulating research questions using legacy collections or digital archives. As highlighted by other recent collaborations (Arbuckle et al. 2014; Kansa et al. 2014), users need to go through the process of managing, integrating, and analyzing data before they can be considered "data literate" and understand what

aspects and operations of data collection and preservation are necessary to make it comparable and usable on a larger level. Increasing data literacy enables researchers to better understand the processes that are necessary for data collection and management because they are more aware of what is needed to evaluate hypotheses and draw conclusions from data.

Second, there is a lack of training on how to use specific software applications like Excel, Tableau, and R to analyze data to answer proposed research questions. This problem can be categorized as a lack of digital literacy or "the ability to use information and communication technologies to find, evaluate, create, and communicate information" (Visser 2012). While working to become more data literate is vital, providing training in the use of specific digital tools is equally important because the proper use of software tools is an integral part of the research process. Moreover improving digital literacy among archaeologists enables well-documented, transparent, and reproducible data analysis workflows, which are critical if archaeology is to be a part of the Open Science movement (Marwick 2016).

Outcomes: Scholarly and Educational Impacts

Over the past 19 years DAACS has grown into the largest and longest-lived archive of downloadable, commensurate archaeological data for any specific region or time period. Evidence for the success of the DAACS project can be found in several different domains. The first is the history of positive endorsement by the scholars who sit on peer-review committees for the four grant-giving institutions, in addition to Mellon, from which DAACS continues to receive significant financial support: NEH, JISC, SAT, and IMLS.

DAACS has also been influential in the field of digital archaeology. It was the inspiration for the highly successful Chaco Research Archive (CRA) project, founded by Stephen Plog and based at the University of Virginia. Together DAACS and CRA have helped clarify the overlapping but complementary niches occupied by "research archives" and "preservation archives" in the discipline of archaeol-

ogy (Plog 2010; Galle 2012). The former, like DAACS and CRA, aim to catalyze collaboration among scholars studying particular cultural and historical periods. The latter, like the Digital Archaeological Record in the U.S. (http://www.tdar.org/) and the Archaeological Data Service in the U.K. (http://archaeologydataservice.ac.uk/), aim to preserve digital data for the long term from any and all cultural and historical contexts (Richards 2008).

Besides CRA, DAACS has also inspired scholarly partners to carry on our mission to make historical archaeology data accessible from other regions of the United States. In 2016 DAACS began a two-year NEH-funded partnership with Charles Cobb and colleagues at the Florida Museum of Natural History. The Digitizing Franciscan Missions from La Florida project adapts and expands DAACS's database fields and protocols to encompass the physical variability in material culture from 16th- and 17th-century Spanish Mission sites in Florida. The data from these sites will be entered directly into the DAACS PostgreSQL database by our trained collaborators at the Florida Museum of Natural History and served out through a dedicated Comparative Missions Archaeology Portal (CMAP) website. This project has served as a valuable testing ground for DAACS to expand beyond the British Atlantic.

Research takes time, and although digital resources are often perceived as producing instant results, research using digital sources takes as long as scholarly work derived from nondigital sources. DAACS's influence on archaeological scholarship is evident in an accelerating stream of journal articles, monographs, and theses that make use of the data that the DAACS website offers. DAACS data figure importantly in recent comparative work on change and variation in the architecture of houses and quartering areas for enslaved people (Samford 2007; Neiman 2008) and assemblage content (Heath and Breen 2009) in the Chesapeake. Scholars have used DAACS data to chart for the first time variation in the means and motives of enslaved people to participate in the wider consumer economy in the Chesapeake (Galle 2006, 2010; Bloch and Agbe-Davies 2017) and to discover and explain striking contrasts in

patterns of consumption on domestic slaves sites in North America and Jamaica (Galle 2011, 2017).

Archaeologists have begun to use DAACS measurement protocols and data to provide a wider context necessary for understanding the uniqueness of archaeological patterns in their own data at the regional or site level. Examples include studies of domestic sites occupied by enslaved Gullah peoples on the South Carolina Coast (Barnes and Steen 2012), enslaved agricultural laborers at Thomas Jefferson's Poplar Forest Plantation in Virginia (Heath 2012), enslaved industrial workers at Monticello (McVey 2011), middling tobacco planters in Virginia (Zevorich 2006), free townspeople in North Carolina (Gabriel 2012) and enslaved laborers on sugar plantations in Antigua (Rebovich 2011). Archaeological sites featured in DAACS have yielded insights into the social and economic dynamics behind the spatial organization of sugar plantations in Jamaica (Bates 2007, 2014, 2015, 2016, 2017; Armstrong 2011) and the effects of plantation location and crops on market access for enslaved people (Reeves 2011). DAACS data have also yielded new insights into the economic and social determinants of variation among both enslaved and free households in the use of particular classes of material culture, for example English clay tobacco pipes (Barca 2012) and locally produced and marketed, wheel-thrown coarse earthenwares in the Chesapeake (Bloch 2011, 2015, 2016). Furthermore, each year since 2006 a new crop of masters and doctoral students have contributed data to DAACS and engaged directly with DAACS data for their theses and dissertations (Fashing 2005; Galle 2006; Bloch 2011; McVey 2011; Rebovich 2011; Barca 2012; Breen 2013; Brown 2014; Bates 2015; Bloch 2015; Freeman 2015; Hacker 2016; Joy 2016; Bassett 2017; Beier 2017; Smith 2017; Harris 2019; dissertations in preparation by Joy; Platt; Stroud-Clarke).

Some of the most innovative and compelling uses of DAACS data have come from historians, not archaeologists. Historians have used DAACS data to document surprisingly frequent access to firearms by enslaved people in North America (Morgan and O'Shaughnessy 2006). They have also mined DAACS for systematic evidence of lit-

eracy among enslaved populations in the form of writing slates and slate pencils (Bly 2008). DAACS also figures importantly in historians' reflections on the ways archaeological data might advance their understanding of changing slave lifeways (Morgan 2006, 2011). Thus open-source data archives, like DAACS, offer some of the best opportunities for building interdisciplinary research opportunities for data analysis and dissemination.

Recent authoritative reviews by archaeologists have highlighted DAACS's role in advancing the cause of digital data sharing and collaboration in archaeology (Richards 2008; Arkush 2011). They have also pointed to the potential of DAACS data to advance the study of the experience of Africans and their descendants, both in the Americas (Fennell 2011) and in the larger African diaspora (Singleton 2010), as well as DAACS's potential to enhance public understanding of history and archaeology (Little 2007; Gonzalez-Tennant 2011). DAACS's Caribbean research has been featured in several popular publications, including *Jamaica Journal* (Francis-Brown 2009) and a cover story in *American Archaeology* (Bawaya 2010). DAACS data and research have also driven numerous exhibits, both online and in museums.

Archaeologists at universities across the country are using DAACS for teaching. Colleagues at Syracuse University, Northwestern University, the University of North Carolina, DePaul University, the University of Virginia, the University of California at Santa Cruz, and the University of the West Indies have developed courses that feature student projects built around the analysis of DAACS data. These courses range from general introductions to archaeology to graduate-level seminars focusing on the archaeology of slave societies. They vary widely in the extent to which they emphasize anthropological and archaeological theory, analytical methods, and historical issues, although they share the common and widely validated premise that learning outcomes benefit from serious engagement with complex archaeological data. Agbe-Davies et al. (2013) make this case and provide details, while the DAACS (2017f) website provides access to syllabi from several undergraduate and graduate courses that use DAACS data.

Conclusions

Nineteen years after its inception DAACS's structuring goals have largely been met. We have discovered that there is still much work to be done when it comes to making legacy collections accessible and usable. In addition to continuing to make legacy collections publicly accessible through the Archive, in the coming decade DAACS's efforts will focus on three critical, underserved areas in historical archaeology: (1) making data management and analysis a more accessible and familiar practice for students and archaeological professionals, (2) providing material culture resources and training that emphasizes the importance of standardized identification and measurements, and (3) helping interested archaeologists access and use the DAACS database for their own curatorial and analytical needs. Archaeologists have an ethical obligation to ensure that the data they produce through excavations or collections reassessments are transparent and accessible to the public. If the field of archaeology wants to be taken seriously in the Open Science/Open Source movement, practitioners must embrace preparing data not only for curation but also for sharing and reuse (Faniel et al. 2013; Freeman 2015; Kansa et al. 2014; Marwick 2015, 2016). DAACS is well-poised and eager to help historical archaeologists, and the archaeological discipline, meet these goals and obligations to our professional colleagues and the general public.

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References

Doctoral dissertations in preparation that were referenced in this chapter include the following: Brandy Joy, University of South Carolina, Columbia; Sarah E. Platt, Syracuse University; Sarah Stroud-Clarke, Syracuse University.

Agbe-Davies, Anna, Jillian Galle, Mark Hauser, and Fraser Neiman

2013 Teaching with Digital Archaeological Data: A Research Archive in the University Classroom. *Journal of Archaeological Method and Theory.* DOI 10.1007/s10816-013-9178-3.

Arkush, Elizabeth

2011 Explaining the Past in 2010 (The Year in Review). *American Anthropologist* 113(2):200–212.

Armstrong, Douglas V.

2011 Rediscovering the African Jamaican Settlements at Seville Plantation, St. Ann's Bay. In *Out of Many, One People: The Historical Archaeology of Colonial Jamaica*, James Delle, Mark A. Hauser, and Douglas V. Armstrong, editors, pp. 77–101. University of Alabama Press. Tuscaloosa.

Arbuckle, Benjamin S., Sarah Whitcher Kansa, Eric Kansa, David Orton, Canan Çakırlar, Lionel Gourichon, Levent Atici, Alfred Galik, Arkadiusz Marciniak, Jacqui Mulville, Hijlke Buitenhuis, Denise Carruthers, Bea De Cupere, Arzu Demirergi, Sheelagh Frame, Daniel Helmer, Louise Martin, Joris Peters, Nadja Pöllath, Kamilla Pawłowska, Nerissa Russell, Katheryn Twiss, and Doris Würtenberge

2014 Data Sharing Reveals Complexity in the Westward Spread of Domestic Animals across Neolithic Turkey. *PLOS ONE* 9(6):e99845. https://doi:10.1371/journal.pone.0099845.

Atici, Levent, Sarah Kansa, Justin Lev-tov, and Eric Kansa

2013 Other People's Data: A Demonstration of the Imperative of Publishing Primary Data. *Journal of Archaeological Method and Theory* 1(3): 1–19.

Barca, Kathryn

2012 "The Best Kind of Long Ones": Tobacco Smoking at George Washington's Mount Vernon. Master's thesis, Department of Anthropology, George Washington University. Washington DC.

Barnes, Jodi, and Carl Steen

2012 Archaeology of the Gullah Past. *South Carolina Antiquities* 44:86–95.

Bassett, Hayden

2017 *The Archaeology of Enslavement in Plantation Jamaica: A Study of Community Dynamics among the Enslaved People of Good Hope Estate, 1775–1838.* Doctoral dissertation, College of William and Mary. ProQuest, Ann Arbor MI.

Bates, Lynsey A.

2007 *Surveillance and Production on Stewart Castle Estate: A GIS-Base Analysis of Models of Plantation Spatial Organization.* B.A. Honors Thesis with Highest Distinction, Department of Anthropology, University of Virginia, Charlottesville.

2014 "The Landscape Cannot Be Said to Be Really Perfect": A Comparative Investigation of Plantation Spatial Organization on Two British Colonial Sugar Estates. In *The Archaeology of Slavery: A Comparative Approach to Captivity and Coercion*, Lydia W. Marshall, editor, pp. 116–142. SIU Occasional Paper No. 41. Center for Archaeological Investigations. Carbondale IL.

2015 *Surplus and Access: Provisioning and Market Participation by Enslaved Laborers on Jamaican Sugar Estates.* Doctoral dissertation, University of Pennsylvania. ProQuest, Ann Arbor MI.

2016 Provisioning and Marketing: Surplus and Access on Jamaican Sugar Estates. In *Archaeologies of Slavery and Freedom in the Caribbean: Exploring the Spaces in Between*, Lynsey A. Bates, John M. Chenoweth, and James A. Delle, editors, pp. 79–110. University Press of Florida. Gainesville.

2017 Exploring Enslaved Laborers' Ceramic Investment and Market Access in Jamaica. In *Material Worlds: Archaeology, Consumption, and the Road to Modernity.* Barbara J. Heath, Eleanor E. Breen, and Lori A. Lee, editors, pp. 192–213. Routledge. London.

Bawaya, Michael

2010 An Examination of Slavery: Archaeologists Are Studying Changes in Slaves' Lives in the Caribbean and the United States. *American Archaeology* 14(2):12–18.

Beier, Zachary

2017 *All the King's Men: Slavery and Soldiering at the Cabrits Garrison, Dominica (1763–1854).* Doctoral dissertation, Syracuse University. ProQuest, Ann Arbor MI.

Bloch, Lindsay
2011 *An Archaeological Study of Common Coarse Earthenware in the Eighteenth-Century.* Master's thesis, Department of Anthropology, University of North Carolina at Chapel Hill. ProQuest, Ann Arbor MI.
2015 *Made in America? Ceramics, Credit, and Exchange on Chesapeake Plantations.* Doctoral dissertation, University of North Carolina at Chapel Hill. ProQuest, Ann Arbor MI.
2016 An Elemental Approach to the Distribution of Lead-Glazed Coarse Earthenware in the Eighteenth-Century Chesapeake. *American Antiquity* 81(2):231–252.
Bloch, Lindsay, and Anna Agbe-Davies
2017 "With Sundry Other Sorts of Small Ware Too Tedious to Mention": Petty Consumerism on U.S. Plantations. In *Material Worlds: Archaeology, Consumption, and the Road to Modernity*, Barbara J. Heath, Eleanor E. Breen, and Lori A. Lee, editors, pp. 119–140. Routledge. London.
Berlin, Ira
1998 *Many Thousands Gone: The First Two Centuries of Slavery in North America.* Harvard University Press. Cambridge MA.
Bly, Antonio T.
2008 "Pretends He Can Read": Runaways and Literacy in Colonial America, 1730–1776. *Early American Studies: An Interdisciplinary Journal* 6(2):261–294.
Bowen, Joanne
1996 Foodways in the 18th-Century Chesapeake. In *The Archaeology of 18th-Century Virginia*, T. R. Reinhart, editor, pp. 87–130. Special Publication no. 35, Archaeological Society of Virginia. Richmond.
Breen, Eleanor E.
2013 The Revolution before the Revolution? A Material Culture Approach to Consumerism at George Washington's Mount Vernon VA. Doctoral dissertation, University of Tennessee, Knoxville. ProQuest, Ann Arbor MI.
Brown, David A.
2014 *An Enslaved Landscape: The Virginia Plantation at the End of the Seventeenth Century.* Doctoral dissertation, College of William and Mary. ProQuest, Ann Arbor MI.
Carson, Cary
1994 The Consumer Revolution in Colonial British America: Why Demand? In *Of Consuming Interests: The Style of Life in the 18th Century*, Cary Carson, Ronald Hoffman, and Peter J. Albert, editors, pp. 483–700. University Press of Virginia. Charlottesville.
Chappell, Edward
1989 Social Responsibility and the American History Museum. *Winterthur Portfolio* 24:247–265.

1999 Museums and American Slavery. In *I, Too, Am America: Archaeological Studies of African-American Life*, Theresa A. Singleton, editor, pp. 240–260. University Press of Virginia. Charlottesville.
Digital Archaeological Archive of Comparative Slavery (DAACS)
2017a About the DAACS Database. http://www.daacs.org/about-the-database/. Accessed 2 March 2017.
2017b Collaborating Scholars. http://www.daacs.org/aboutdaacs/acknowledgements/collaborating-scholars/. Accessed 2 March 2017.
2017c DAACS Cataloging Manuals. https://www.daacs.org/about-the-database/daacs-cataloging-manual/. Accessed 2 March 2017.
2017d DAACS Database Structure. https://www.daacs.org/about-the-database/database-structure/. Accessed 2 March 2017.
2017e DAACS Research Consortium Members. https://www.daacs.org/aboutdaacs/acknowledgements/daacs-research-consortium-members/. Accessed 2 March 2017.
2017f Doing Research and Teaching with DAACS Workshop Materials. https://www.daacs.org/research/workshops/. Accessed 2 March 2017.
2017g Project List: Archaeological Sites Currently in DAACS. http://www.daacs.org/about-the-database/project-list/. Accessed 2 March 2017.
Deetz, James
1988 American Historical Archaeology: Methods and Results. *Science* 239:362–367.
1999 Archaeology at Flowerdew Hundred. In *"I, Too, Am America": Archaeological Studies of African-American Life*, Theresa A. Singleton, editor, pp. 39–46. University Press of Virginia. Charlottesville.
Everett, C. S.
2009 "They Shalbe Slaves for Their Lives": Indian Slavery in Colonial Virginia. In *Indian Slavery in Colonial America*, Alan Gallay, editor, pp. 67–109. University of Nebraska Press. Lincoln.
Faniel, Ixchel, Eric Kansa, Sarah Whitcher Kansa, Julianna Barrera-Gomez, and Elizabeth Yakel
2013 "The Challenges of Digging Data: A Study of Context in Archaeological Data Reuse." In *JCDL 2013 Proceedings of the 13th ACM/IEEE CS Joint Conference on Digital Libraries*, 295–304. ACM. New York. http://dx.doi.org/10.1145/2467696.2467712.
Farber, Gregory K., and Linda Weiss
2011 Core Facilities: Maximizing the Return on Investment. *Science Translational Medicine* 3(95):95cm21.
Fashing, Maria. T.
2005 Recognizing Variability in Eighteenth-Century Plantation Diet through Pattern Analysis. B.A. honors thesis, Department of Anthropology, College of William and Mary, Williamsburg VA.

Ferguson, Leland
1992 *Uncommon Ground: Archaeology and Early African America, 1650–1800.* Smithsonian Institution. Washington DC.
Fennell, Christopher C.
2011 Early African America: Archaeological Studies of Significance and Diversity. *Journal of Archaeological Research* 19(1):1–49.
Francis-Brown, Suzanne
2009 Disinterring History at Papine. *Jamaica Journal* 32(1/2): 66–80.
Franklin, Maria
1997 *Out of Site, Out of Mind: The Archaeology of an Enslaved Virginian Household, ca. 1740–1778.* Doctoral dissertation, University of California, Berkeley. ProQuest, Ann Arbor MI.
Freeman, Mark A.
2015 "Not for Casual Readers": An Evaluation of Digital Data from Virginia Archaeological Websites. Master's thesis. University of Tennessee, Knoxville.
Gabriel, Jennifer L.
2012 *New Data, Old Methods: A Functional Analysis of Colonial Era Structures on the "Wooten Marnan Lot" at Brunswick Town, North Carolina.* M.A. thesis, Department of Anthropology, East Carolina University, Greenville NC. ProQuest, Ann Arbor MI.
Gallay, Alan
2003 *The Indian Slave Trade: The Rise of the English Empire in the American South, 1670–1717.* Yale University Press. New Haven CT.
Gallay, Alan (editor)
2009 *Indian Slavery in Colonial America.* University of Nebraska Press. Lincoln.
Galle, Jillian E.
2006 *Strategic Consumption: Archaeological Evidence for Costly Signaling among Enslaved Men and Women in the 18th-Century Chesapeake.* Doctoral dissertation, University of Virginia, Charlottesville. ProQuest, Ann Arbor MI.
2010 Costly Signaling and Gendered Social Strategies among Slaves in the 18th-Century Chesapeake. *American Antiquity* 75(1):19–43.
2011 Assessing the Impacts of Time, Agricultural Cycles and Demography on the Consumer Activities of Enslaved Men and Women in 18th-Century Jamaica and Virginia. In *Out of Many, One People: The Historical Archaeology of Colonial Jamaica*, James Delle, Mark Hauser, and Douglas Armstrong, editors, pp. 211–242. University of Alabama Press. Tuscaloosa.
2012 Will Today's Graduate Training in Historical Archaeology Predict the Future of Digital Research Archives? Society for Historical Archaeology Blog. http://www.sha.org/blog/?p=1684. Accessed 2 March 2017.

2017 The Abundance Index: Measuring Variation in Consumer Behavior in the Early Modern Atlantic World. In *Material Worlds: Archaeology, Consumption, and the Road to Modernity*, Barbara J. Heath, Eleanor E. Breen, and Lori A. Lee, editors, pp. 162–191. Routledge. London.
Gonzalez-Tennant, Edward
2011 *Archaeological Research and Public Knowledge: New Media Methods for Public Archaeology in Rosewood, Florida.* Doctoral dissertation, University of Florida, Gainesville. ProQuest, Ann Arbor MI.
Hacker, Stephanie N.
2016 Slave Subsistence Strategies at Thomas Jefferson's Monticello Plantation: Paleoethnobotanical Analysis and Interpretation of the Site 8 (44AB442) Macrobotanical Assemblage. Master's thesis, Department of Anthropology, University of Tennessee, Knoxville.
Harris, Khadene
2019 A Hard Kind of Freedom: Land Labor and Material Culture in Postemancipation Dominica. Doctoral dissertation, Northwestern University.
Hatfield, April L.
2008 *Atlantic Virginia: Intercolonial Relations in the Seventeenth Century.* University of Pennsylvania Press. Philadelphia.
Heath, Barbara J.
2012 Slave Housing, Household Formation and Community Dynamics at Poplar Forest, 1760s–1810s. In *Jefferson's Poplar Forest: Unearthing a Virginia Plantation*, Barbara J. Heath and Jack Gary, editors, pp. 105–128. University Press of Florida. Gainesville.
Heath, Barbara, and Eleanor Breen
2009 Assessing Variability among Quartering Sites in Virginia. *Northeast Historical Archaeology* 38(1):1–28.
Higman, B. W.
1998 *Montpelier, Jamaica: A Plantation Community in Slavery and Freedom, 1739–1912.* University of the West Indies Press. Mona, Jamaica.
Joy, Brandy
2016 *A Study of the Material Diversity in the Carolina Colony: Silver Bluff, Yaughan, Curriboo, and Middleburg Plantations.* Master's thesis, Department of Anthropology, University of South Carolina, Columbia. ProQuest, Ann Arbor MI.
Kansa, Eric, and Sarah Whitcher Kansa
2011 Toward a Do-It-Yourself Cyberinfrastructure: Open Data, Incentives, and Reducing Costs and Complexities of Data Sharing. In *Archaeology 2.0: New Approaches to Communication and Collaboration*, Eric Kansa, Sarah Whitcher Kansa, and Ethan Waltrall, editors, pp. 57–92. Cotsen Institute of Archaeology Press. Los Angeles.

Kansa, Eric, Sarah Whitcher Kansa, and Benjamin Arbuckle
2014 Publishing and Pushing: Mixing Models for Communication Research Data in Archaeology. *International Journal of Digital Curation* 9(1):57–70.
Kansa, Sarah Witcher
2015 Using Linked Open Data to Improve Data Reuse in Zooarchaeology. *Ethnobiology Letters* 6(2):224–231.
Kelso, William M.
1997 *Archaeology at Monticello.* Monticello Monograph Series. Thomas Jefferson Memorial Foundation. Charlottesville VA.
King, Julia A.
2009 The Challenges of Dissemination: Accessing Archaeological Data and Interpretations. In *Archaeology and Cultural Resource Management: Visions for the Future*, Lynne Sebastian and William D. Lipe, editors, pp. 141–167. School for Advanced Research. Santa Fe NM.
Kintigh, Keith W.
2006 The Promise and Challenge of Archaeological Data Integration. *American Antiquity* 71(3):567–578.
2009 The Challenge of Archaeological Data Integration. In *Technology and Methodology for Archaeological Practice: Practical Applications for the Past Reconstruction. BAR International Series S, 2029*, pp. 81–86, Archaeopress, Oxford.
Kintigh, Keith W., and Jeffrey H. Altschul
2010 Sustaining the Digital Archaeological Record. *Heritage Management* 3(2):264–274.
Kintigh, Keith W., Jeffrey H. Altschul, Mary C. Beaudry, Robert D. Drennan, Ann P. Kinzig, and Timothy Kohler
2014 Grand Challenges for Archaeology. *Proceedings of the National Academy of Sciences of the United States of America* 111(3):879–880. doi:10.1073/pnas.1324000111. http://www.pnas.org/content/111/3/879.short.
Kulikoff, Allan
1986 *Tobacco and Slaves: The Development of Southern Cultures in the Chesapeake, 1680–1800.* University of North Carolina Press. Chapel Hill.
Little, Barbara. J.
2007 What Are We Learning? Who Are We Serving? Publicly Funded Historical Archaeology and Public Scholarship. *Historical Archaeology* 41(2):72–79.
Lupia, Arthur, and Colin Elman
2014 Openness in Political Science: Data Access and Research Transparency. *PS: Political Science & Politics* 47(1):19–42.

Marwick, Ben
2015 How Computers Broke Science—And What We Can Do to Fix it. *The Conversation.* https://theconversation.com/how-computers-broke-science-and-what-we-can-do-to-fix-it-49938. 9 November.
2016 Computational Reproducibility in Archaeological Research: Basic Principles and a Case Study of Their Implementation. *Journal of Archaeological Method and Theory* 24(2):1–27.
McVey, Shannon L.
2011 A House but Not a Home? Measuring "Householdness" in the Daily Lives of Monticello's "Nail Boys." Master's thesis, Department of Anthropology, University of South Florida, Tampa.
Miguel, E., C. Camerer, K. Casey, J. Cohen, K. M. Esterling, A. Gerber, R. Glennerster, D. P. Green, M. Humphreys, G. Imbens, D. Laitin, T. Madon, L. Nelson, B. A. Nosek, M. Petersen, R. Sedlmayr, J. P. Simmons, U. Simonsohn, and M. Van der Laan
2014 Promoting Transparency in Social Science Research. *Science* 343(6166): 30.
Morgan, Philip D.
1998 *Slave Counterpoint: Black Culture in the Eighteenth-Century Chesapeake and Lowcountry.* Published for the Omohundro Institute of Early American History and Culture, Williamsburg, Virginia. University of North Carolina Press. Chapel Hill.
2006 Archaeology and History in the Study of African-Americans. *African Re-Genesis: Confronting Social Issues in the Diaspora*, Jay B. Haviser and Kevin C. MacDonald, editors, pp. 53–61. Left Coast Press. Walnut Creek CA.
2011 The Future of Chesapeake Studies. In *Early Modern Virginia*, Douglas Bradburn and John C. Coombs, editors, pp. 300–333. University of Virginia Press. Charlottesville.
Morgan, Philip. D., and Andrew. J. O'Shaughnessy
2006 Arming Slaves in the American Revolution. In *Arming Slaves: From Classical Times to the Modern Age*, Christopher Leslie Brown and Philip D. Morgan, editors, pp. 180–208. Yale University Press. New Haven CT.
Mouer, Daniel L., Mary Ellen N. Hodges, Stephen R. Potter, Susan L. Henry Renaud, Ivor Noel Hume, Dennis J. Pogue, Martha W. McCartney, and Thomas E. Davidson
1999 Colonoware Pottery, Chesapeake Pipes and "Uncritical Assumptions." In *I, Too, Am America: Archaeological Studies of African American Life*, Theresa Singleton, editor, pp. 47–82. University Press of Virginia. Charlottesville.

Neiman, Fraser D.
1999 The Digital Archaeological Archive of Slavery in the Chesapeake. Grant proposal to the Andrew W. Mellon Foundation. Manuscript, Thomas Jefferson Foundation, Department of Archaeology, Charlottesville VA.
2008 The Lost World of Monticello in Evolutionary Perspective. *Journal of Anthropological Research* 64:161–193.
National Museums Liverpool and International Slavery Museum
2017 The Archaeology of Slavery. http://www.liverpoolmuseums.org.uk/ism/slavery/archaeology/index.aspx. Accessed 5 March 2017.
Ortiz, Fernando
1947 *Cuban Counterpoint*. Knopf. New York.
Plog, Stephen
2010 Sustaining Digital Scholarship in Archaeology. In *Online Humanities Scholarship: The Shape of Things to Come*. Jerome McGann, editor, pp. 273–279. Rice University Press. Houston TX.
Rebovich, Samantha A.
2011 *Landscape, Labor, and Practice: Slavery and Freedom at Green Castle Estate, Antigua*. Doctoral dissertation, Department of Anthropology, Syracuse University. ProQuest, Ann Arbor MI.
Reeves, Matthew
2011 Household Market Activities among Early Nineteenth-Century Jamaican Slaves: An Archaeological Cast Study from Two Slave Settlements. In *Out of Many, One People: The Historical Archaeology of Colonial Jamaica*, James A. Delle, Mark W. Hauser, and Douglas V. Armstrong, editors, pp. 183–210. University of Alabama Press. Tuscaloosa.
Richards, Julian D.
2008 Internet, Archaeology on. In *The Encyclopedia of Archaeology*, pp. 1526–1529. Academic Press. New York.
Ross, Seamus, and Ann Gow
1999 Digital Archaeology: Rescuing Neglected and Damaged Data Resources. A JISC/NPO Study within the Electronic Libraries (eLib) Programme on the preservation of electronic materials. Project Report. Library Information Technology Centre, South Bank University. London. http://eprints.gla.ac.uk/100304/1/100304.pdf. Accessed 12 June 2018.
Russell, Aaron E.
1997 Material Culture and African American Spirituality at The Hermitage. *Historical Archaeology* 31(2):63–80.
Samford, Patricia
1996 The Archaeology of African-American Slavery and Material Culture. *William and Mary Quarterly*, 3rd series, 53:87–114.

2000 *Power Runs in Many Channels: Subfloor Pits and West African–Based Spiritual Traditions in Colonial Virginia*. Doctoral dissertation, University of North Carolina, Chapel Hill. ProQuest, Ann Arbor MI.
2007 *Subfloor Pits, and the Archaeology of Slavery in Colonial Virginia*. University of Alabama Press. Tuscaloosa.
Shefveland, Kristalyn
2016 *Anglo-Native Virginia: Trade, Conversion and Indian Slavery in the Old Dominion, 1646–1722*. University of Georgia Press. Athens.
Singleton, Theresa A.
2010 African Diaspora in Archaeology. In *The African Diaspora and the Disciplines*, Tejumola Olaniyan and James H. Sweet, editors, pp. 119–141. Indiana University Press. Bloomington.
Smith, Hope
2017 Adorned Identities: An Archaeological Perspective on Race and Self-Preservation in 18th-Century Virginia. Doctoral dissertation, Department of Anthropology, University of Tennessee, Knoxville.
Spielmann, Katherine A., and Keith W. Kintigh
2011 The Digital Archaeological Record: The Potentials of Archaeozoological Data Integration through tDAR. *SAA Archaeological Record* 11(1): 22–25.
Sobel, Michel
1987 *The World They Made Together: Black and White Values in 18th-Century Virginia*. Princeton University Press. Princeton NJ.
Visser, Marijke
2012 Digital Literacy Definition. American Library Association. http://connect.ala.org/node/181197. 14 September.
Walsh, Lorena
1997 *From Calibar to Carter's Grove*. University Press of Virginia. Charlottesville.
2001 The Chesapeake Slave Trade: Regional Patterns, African Origins, and Some Implications. *William and Mary Quarterly*, 3rd series, 58(1):139–170.
Waters, Donald J.
2009 Archives, Edition-Making, and the Future of Scholarly Communication. https://mellon.org/media/filer_public/30/9d/309de9a1-94fa-40fb-bb1f-f087333e8658/djw-archives-edition-making-2009.pdf. Accessed 12 June 2015.
Watrall, Ethan
2011 IAKS: A Web 2.0 Archaeological Knowledge Management System. In *Archaeology 2.0: New Approaches to Communication and Collaboration*, Eric Kansa, Sarah Whitcher Kansa, and Ethan Waltrall, editors, pp. 171–184. Cotsen Institute of Archaeology Press. Los Angeles.
Wheaton, Thomas, Jr., and Patrick Garrow
1985 Acculturation and the Archaeological Record in the Carolina Lowcountry. In *The Archaeology of Slavery and Plantation Life*, Theresa A. Singleton, editor, pp. 239–269. Academic Press. Orlando FL.

Wheaton, Thomas, Jr., Patrick Garrow, and Amy Friedlander
1983 *Yaughan and Curriboo Plantations: Studies in Afro-American Archaeology.* Report to National Park Service, Southeastern Regional Office, Atlanta, from Soil Systems, Inc., Marietta GA.
Zevorich, L. M.
2006 Ceramic Analysis of a Middling European American Planter Site in Virginia Using the Digital Archaeological Archive of Comparative Slavery. *Journal of Middle Atlantic Archaeology* 22:91–102.

[FIVE]

Integration and Accessibility

A Case Study of the Curles Neck (44HE388) Legacy Data

BARBARA J. HEATH, MARK A. FREEMAN, AND ERIC G. SCHWEICKART

For the past decade, faculty and graduate students in the historical archaeology program at the University of Tennessee, Knoxville, have undertaken collections reassessments of significant plantation sites excavated from the 1960s to the 1990s in Virginia. These sites include Newman's Neck (44NB180) in Northumberland County and the Hallowes Site (44WM06) and Nomini (44WM12) in Westmoreland County (Heath et al. 2009; Hatch et al. 2013, 2014; Hatch 2015; McMillan 2015; McMillan et al. 2015; Heath 2016). With support from the Virginia Department of Historic Resources (VDHR) through the Threatened Sites Program, the authors are currently conducting a multiyear reassessment project to increase access to and better preserve collections relating to archaeological research conducted at Curles Neck (primarily 44HE388 but also 44HE636 and 44HE677). The site was excavated from 1985 to 1997 under the direction of L. Daniel Mouer, formerly of Virginia Commonwealth University (VCU). Located along the James River east of Richmond, Curles Neck was occupied by some of Virginia's most prominent planters—the Harrises, Bacons, and Randolphs—as well as enslaved and free laboring families and individuals. Excavations there produced a wealth of information about an important place that was continuously occupied from the frontier era of the 1640s to the outbreak of the Civil War (Mouer 1988, 1991, 1997, 1998).

The Curles Neck project ran for 12 field seasons. Researchers were able to target areas of the site with the most archaeological poten-

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