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By Jeanne E. Arnold and Michael R. Walsh

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On the cover: The 13DB627 site in Dubuque County, Iowa. The site is identified as a Late Paleo-indian through Woodland quarry/lithic reduction habitation. The site was excavated because it is within the proposed alignment of the Southwest Arterial Highway Project being sponsored by the City of Dubuque.

Photo by Mike Gregory.
EDITOR’S CORNER

Jane Eva Baxter

Jane Eva Baxter is the editor of The SAA Archaeological Record.

In our contemporary world, we are bombarded with information and constantly being offered new ways to manage information and share with others. This positive cycle of information consumes, for many of us, large parts of our everyday lives. Ways to archive, share, and manage information are integral to archaeological practice, and here too new technologies and formats are being created and adapted for archaeological use. This issue’s forum, edited by Sarah Kansa, uses zooarchaeology as a case study to showcase the variety of ways archaeologists can use digital mediums in the analysis, curation, and sharing of archaeological data. This comprehensive look at these mediums is valuable for archaeologists in many types of practice.

Our March issue is going to be a special issue requested by the Board of Directors at last year’s annual meeting. The Board charged the Public Education Committee with creating a special issue on careers in archaeology, and the committee membership has been working very hard to put an excellent group of contributors together. In May, the History of Archaeology Interest Group is presenting a special forum on archaeology and the New Deal, and we’ll start to see more contributions from individual authors in May and in the September and November Issues. These authors have been very patient and an excellent array of work is ready to come out in The SAA Archaeological Record.

If you are interested in contributing to The SAA Archaeological Record, I’d like to address a few questions that seem to come up regularly from potential contributors. First, while this is not a peer-reviewed venue, individual submissions do go through an editorial process prior to publication. Individual submissions are published in the order they were accepted, unless the editor arranges some of these works into a logical special section of an issue. The short of this is, while the deadline for publication in the guidelines says items are due one month before each issue, this is not a deadline for substantive papers, but rather for items not requiring the same editorial oversight, such as letters to the editor, calendar items, news and notes, and obituaries. It is a general rule with this system that individual articles are published within a year of receipt.

Second, like all SAA publications, The SAA Archaeological Record follows the SAA Style Guide: http://www.saa.org/AboutTheSociety/Publications/StyleGuide/tabid/984/Default.aspx. This guide should be used for formatting bibliographies, headings, and other structural elements of submissions. Finally, pictures are an integral part of The SAA Archaeological Record. We can try to work with you on particular photo formats, but ideally they’ll be sent as separate files (per the guidelines!) as a minimum of 300 dpi .jpeg files. As always, if you have ideas for an article, forum or other contribution to the SAA-AR please do not hesitate to contact me at jbaxter@depaul.edu

Happy New Year to one and all.
am pleased to send a direct message to the members of the SAA. In this column, I want to mention a number of our recent initiatives that have been conceptualized by a wonderful and creative Board of Directors whom you have elected. The Board usually meets twice a year but recently we set ourselves a third full Board meeting that was dedicated almost exclusively to some of the ideas and new directions we had been thinking about but rarely had time to develop, given the press of keeping all sorts of SAA business going at our regular board meetings. Among those issues was how we might make the process of participating in the various committees and activities of the SAA more open and involve as wide a range of members as possible. Out of that discussion, which included an enthusiastic desire that we especially wanted to involve our student population even more—as the future core members of the SAA—came the newly rolled out plan to have a Call for Volunteers to serve on committees. Most committees are also now charged with adding two students. I hope you received this Call, which went out in early November and was accepting expression of interest to serve until early December. As I write this, it is too early to tell what the response has been, although we expect that it may take at least a couple of years before this becomes a widely known and established practice. We have so often been asked how one might actually serve on a committee and we hope that this will prove to be a way that you all can express your interests and tell us what you would bring to the various committees of interest. We know that we have a very talented and committed membership and we are very much a volunteer organization.

Many have asked how this will now work? One member even asked who would (still?) be the “gatekeepers” of selection! To give you a sense of the magnitude of volunteer involvement, and that we are more about continued shifting of committee membership while retaining enough continuity, even with the potential renewal of committee members (we traditionally limited unbroken terms of service to two three year terms), we would be needing more than 100 new committee members this year. Usually, this task has fallen to the committee chairs and the President. We have now set the term limits to two years, and the selection process will involve more people and be more open. How will this work?

Each committee has a liaison on the Board of Directors, who will be even more involved in the workings, needs, and concerns of “their” committees. This liaison from the Board will work with the Chair of the different committees to select new members. Note that in “applying” to serve, members were asked to indicate “what you would bring to this committee.” From these statements and seeking to insure balance of all sorts, the Board Liaison will take suggestions from the committee chair and oversee the selection of new members. This will have to be done at the Board level, given that it is expected that some potential volunteers have “applied” for a position on more than one committee, and the Board will have to be in contact with each other to guarantee there are no double appointments. Of course, we expect this process to evolve and perhaps change, but the important points here are several: (1) the committee structure and activities of the SAA are core and integral to what we do, and we deeply value the contributions of all committees and their members; (2) the Board feels strongly that the time has come to be as open as possible in populating our committees and to be able to draw from our talented and willing members; and (3) more involvement of students in the SAA and more valuing of their perspectives and contributions was needed. In this sense, then, there are no single “gatekeepers.” From many years ago in the establishment of the SAA and in our bylaws, it has been noted that your elected Board members and officers take seriously the activities and initiatives of the Society, and that the committees are the means through which many of these activities are accomplished. It is through strengthening the relationships between the Board, through the greater involvement of Board Liaisons, and it is through opening up the processes whereby members can have a voice, contribute to the present and future of archaeology that we believe we can better learn what matters to members and how best to continue and improve upon what the SAA is and can do.
A Taste of Sacramento

The 76th Annual Meeting of the Society for American Archaeology will provide the stage for a wealth of networking in beautiful Sacramento, California. The venue will be the Sacramento Convention Center along with the co-headquarters hotels, the Hyatt Regency Sacramento and the Sheraton Grand Sacramento. You can explore the breadth and scope of the meeting through the Preliminary Program which is posted on SAAweb (www.saa.org) and was dropped in the mail at the end of December. If you already registered as a participant, don’t forget considering to register for events that appear for the first time in the Preliminary Program, some of which are highlighted below:

In addition to the symposia, forums, general sessions, posters, the Ethics Bowl, and exhibits, you can choose from activities including:

- Wonderful field trips—the Sacramento Riverboat Tour exploring archaeology and history on the Sacramento River and the Mines and Middens covering the prehistory and history of the Gold Country through Amador County in the scenic Sierra Nevada foothill region just east of Sacramento. For itineraries and details, please check out the descriptions of these tours in the Preliminary Program and register now!
- First time ever information session—Do You Want to Be an Editor? Join this one hour session on Friday with the chair of the Publications Committee and past editors to explore the opportunity of being an editor of an SAA serial publication.
- New for Students and Post-Docs! Are you on the job market? Here is the opportunity to have your résumé or CV reviewed by archaeologists in different employment sectors. Representatives from academia, museums, government, and CRM archaeology will be present to look over your résumé and make suggestions to tailor it for the most effective impact for different kinds of job situations. Bring a paper copy of your résumé or CV and stop by to talk one-on-one (or one-on-a-few) with established archaeologists about what works best for job applications in their particular work settings. Scheduled for 12 pm_1 pm on Thursday, March 31, it’s lunchtime, so SAA’s Résumé/CV Review sponsors will be providing a free lunch for the participants in this event. You can preregister for this lunch event. Spaces are limited, so register soon!

And About Meeting Abstracts

Just a reminder that as of last year, printed abstract books are no longer offered. The abstracts will be available electronically to all on the public side of SAAweb approximately one month before the meeting. They will be posted in a searchable pdf format so that you may browse/print at your leisure.

On site, near registration at the Sacramento Convention Center, at the 76th Annual Meeting, the Abstract Viewing Center will be reprised for you to reference the abstracts at your convenience through a bank of computers provided for that purpose. The Society would like to thank the Center for Desert Archaeology and Desert Archaeology Inc. for its sponsorship of the new Abstract Viewing Center. Without their generous support, this would not have been possible.

Abstract Extra for 2011!

Available for purchase only through advance registration...an SAA USB drive of the searchable pdf abstract file. Not available for purchase onsite. Add this to your registration online or via the registration form.
The Preliminary Program for the 76th Annual Meeting was mailed out to you in December and posted on the SAAweb. Contained in it is a jam-packed schedule of five days of archaeological data, discourse, and discussion that will take place from March 30 to April 3, 2011 in Sacramento, located in the heart of the Golden State. Over 2,200 papers and posters will be presented in 220 organized symposia, general sessions, electronic symposia, and forums. In addition, 54 poster sessions will be available for your viewing and conversational pleasure during 10 two-hour time periods distributed throughout the week.

The meeting will kick off at 6 pm on Wednesday evening, March 30th, with the President’s Forum on “NAGPRA and the Generation of New Research Questions and Practices,” and it will be followed by a welcome reception starting at 9 pm. A vast range of theoretical, methodological, and regional issues will be discussed in 25 concurrent sessions and symposia every day thereafter. Getting into full swing on Thursday morning, the meeting will conclude with exciting topics to be explored on Sunday morning, April 3. With so many options and so little time, it is imperative that everyone abide by the 15-minute time limit for each paper presented.

Samplings from the upcoming meeting include:

- Universities will battle it out during the Ethics Bowl on Thursday afternoon. It will be followed by an evening forum on “The Principles of Archaeological Ethics as a Living Document: Is Revision Necessary?” sponsored by the Committee on Ethics.
- Nine organized symposia will feature a diversity of California archaeologies including a two-part thematic exploration of “California: A Land Of…,” a centennial of 100 years of “Ishi: Repatriating the Story,” as well as “The Study of Indigenous Landscape Management Practices in California” and “SHPO Tales: California Case Studies.” Moving from north to south, these symposia also include “Archaeology Behind the Redwood Curtain: Recent Research on the North Coast of California,” “Bioarchaeological and Archaeological Perspectives on Migration, Diet and Health in Prehistoric Central California,” “The Sacramento River and Its Mounds: A Fresh Look at its Prehistory,” “Small Islands, Big Implications: The California Channel Islands and their Archaeological Contributions,” and the “Prehistoric Occupation in the Ballona Lagoon, West Los Angeles.”
- This is also a big year for technology with several symposia and sessions focused specifically on the applications of GIS, GPR, LA-ICP-MS, XRF, and portable XRF, including the “1st International SAA Symposium for Recent, International Advances in the Use of pXRF and other Portable, Field Technologies for Archaeochemical Studies of Sites in the Americas.”
- Distinguished colleagues who will be honored in symposia include Jane Buikstra, William Clelowl, Jeffrey Dean, Albert Dekin, Don Fowler, Lee Lyman, Carol Mackey, George Odell, Mary Pohl, and John Speth.

These are just a few of the thousands of intellectual, social, and professional opportunities that await you in California at the 2011 meeting!

Many thanks to the enthusiastic members of the 2011 Program Committee: Mark Allen, Michele Buzon, John Douglass, Rowan Flad, Max Friesen, Colin Grier, Ernesto Licón, Holley Moyes, David Robinson, Fraser Sturt, Christina Torres-Rouff, and Greg Wilson. See you all in Sacramento!
begin this essay with a storks and babies analogy – “So, mommy, where does meat come from?”

As today’s college generation grows increasingly distanced from the sources of their food, I increasingly encounter behavioral and knowledge disjunctions when teaching about hunting and hunter-gatherers. I say this despite the fact that my students have been reared with exquisitely detailed information about diet, nutrition, proper cooking techniques, the Food Channel, and have electronic access to information that makes them a remarkably well-informed and healthy generation of Americans. However, this knowledge goes hand-in-glove with Hog Hotels, expanded processing, and selective packaging. In some respects the ensuing essay is reminiscent of the communications faculty receive about incoming freshman classes at the onset of a new academic year, to wit: “They were born after this date . . .” and what follows is a litany of things, people, places, and events that they do not know, and which we cannot use as examples or assume are common knowledge—often summarized as the 20 Year Rule.

What follows are some insights into both my perceptions of how my students view meat/animal foods, and related strategies on how I get them to engage with the notion of an animal as a resource that can be totally or almost totally consumed—in an era before the Three P’s—mass Processing, Preservation, and Packaging. The goal is to transform their notion of an animal into that of a scarce commodity; one that does not allow for either flippant discard or picky part selection.

**Hunters and non-Hunters**

I looked out over the 40 students in my European Archaeology class. Today we were going to talk about the acquisition and processing of animal products among hunter-gatherers (and yes, scavengers as well); a topic near and dear to my heart, and central to an understanding of many hundreds of millennia of human (and pre-AMH) adaptation. So, I start the module with my standard question:

“How many of you either hunt, or have hunted and killed an animal, any animal?”

 Virtually no response.

“OK, how many of you have ever unintentionally hit something, other than a pet, with your car?”

Rabbits and squirrels were the common response. Finally, I observed, potential food animals for some of us, at least (as I simultaneously undertook a mental review of the pavement outlines from Flattened Fauna [Knutson 1987]), though this observation elicited a variety of facial distortions and grimaces. How could you eat something you just ran over? Unbeknownst to them, this was the perfect entrée to my first story—cars as hunting devices.

When I was growing up my family was poor; supplementing income and diet was essential. My father, who hailed from the mountains of Crete, worked late nights in restaurants, returning home between 2:30 and 3:00 AM. With the roads empty, he would deftly sideswipe rabbits with his car, retrieve them, and return with half a dozen neatly stacked in the car trunk. When I rose for school, I would find him busily skinning and butchering rabbit. He’d look up, remove the short stub of a Camel straight (not an animal product), utter the word Stifátho, and continue his work whistling happily. I would come home to rabbit stew for dinner, sometimes accompanied by the comment “no buckshot!” More importantly, even as a city kid, I learned rabbit anatomy, how to skin them, how to disarticulate them, and how to check for diseases by inspecting the organs—lessons I remember to this day.

**What Part of the Animal am I Eating?**

Actually, this is a question that many people do not ask, and to which they really do not want to know the answer. When teaching about hunting and meat processing, however, this information is actually fairly important. I will be the first to admit the differences between wild game and domestic animals. Domestic animals, in general, and barring comparison with extinct
megafauna, tend to be larger, slower, and—depending on your perspective—either dumber or more docile than their wild counterparts. That said, the majority of the meat occurs in much the same places. This knowledge, however, does not assist most of my students when I ask:

“Have you ever butchered, helped someone butcher, or watched someone butcher an entire sheep, pig, deer, goat, buffalo . . . .”

“Where on a cow/aurochs does a Sirloin Tip Roast (or some other cut with a relatively non-intuitive anatomical name) come from?”

Well, if they can separate “sir” (or sur) from “loin” they might get close. Easier still, and finally some hands go up: Rump and Shoulder Roasts are usually distinguished by those who know that there are front and rear legs on a quadruped . . . but there are still folks in my classes who do not know where ham or bacon actually comes from on a pig . . . . This notion of meat “packages,” and what parts of the animal are considered usable and in what ways, is very important. Moreover, the way they are perceived can be cultural—various Europeans and Asians butcher meat differently than do U.S. butchers, and certainly into different cuts than nineteenth century Plains Indians did. I begin to hand out USDA meat butchering charts for beef and pig (Figure 1).

Where’s the joint?

Knowing where meat cuts come from, though, is different than knowing how to disarticulate an animal without an electric bandsaw. Employing stone tools, an intimate knowledge of articular surfaces, joints, and connective tissue is essential to successfully reducing an animal into portable and usable packages for transport/storage. In fact, even basic anatomical knowledge has almost drifted into the realm of the arcane. Having been raised by restaurant workers and in restaurants, I was exposed to butchering even before I applied myself to hunted fowl, small game, and the occasional larger animal. Without access to steel tools such as saws, or large, sharp cleavers, one views large animal butchering quite differently. With the advent of “boneless” packaged meats we have collectively become even further distanced from the anatomical sources of our meat food.

Organ and other Non-traditional Meats

Organ-derived food is not de rigueur amongst my students, even at a large land grant university with a substantial agricultural research emphasis. This is counterintuitive to a person raised by Mediterraneans, who grew up with a large number of other immigrants of similar and different national, ethnic, and religious identities. Whether from pastoral mammals or fowl, organ meats were always found on display in local meat markets and delicatessens, much as they are still found across Europe, and they regularly found their way to our family table. Chicken, beef/calf, and sheep/lamb livers were readily purchased and often consumed. Yes, I know these heavy metal traps are now touted as “bad” for you so, while I have minimized my annual consumption, I still relish chicken liver with rice pilaf, calf’s or lamb’s liver with onions (Figure 2A and B), foie gras, or a ramen appetizer. My descriptions of beef heart, kidneys, and gizzards in stuffing, and tongue sandwiches on rye with mustard bring looks of abject horror and disgust. Worse yet is the tale of waking on Sunday morning to the smells and sights of my father whipping up a hearty breakfast of scrambled eggs and pan fried sheep brains—a delicacy I was strongly encouraged to at least taste if not consume heartily with the regular admonition that it “was good for me.” It actually smells like bone marrow when it’s being cooked, another animal product I personally enjoy.

While organs comprise a rather specific class of potential foods, I have also found that certain parts of an animal are likewise not considered desirable fare, further inhibiting my ability to discuss essential aspects of hunting behavior and the processing and use of animals. Only a minor departure from the consumption of brain is, of course, the consumption of an animal’s head. In fact, one can extend this discussion to the use of those parts of the animal not associated at all with the abdomen and upper legs, where the majority of muscle meats are normally found. So, those body parts found at the extremes are now avoided; hocks/feet, tail, and heads.

“How many of you have ever tasted ham hocks?”

“How about pig’s feet (pickling implied)?”

“Have any of you ever tried oxtails?”

In several cycles of European Archaeology, with its substantial span of hunter-gatherer time encompassing Homo sapiens sapi-
ens and earlier hominids, or various modules on hunting and gathering, I have rarely had a hand go up indicating that they had tried any of these treats. I have not yet had the temerity to broach the preparation and consumption of (non-human) male or female sexual organs, since some would probably find this heinous (but see the excellent Catalan recipe for cloves of garlic with parsley and bull’s . . . [Andrews 1999:114–115]; also Figure 3 for a different type of dish). However, I do regale them with two small stories, one of my mother’s particular fondness for chicken and turkey necks, which she would pick clean of meat when the opportunity arose. Among my favorites, however, is the story of my wife’s Polish grandfather (dziadzia), a laborer in the Chicago stockyards. She remembers his stories of lunch—vats of boiled pigs’ heads from which he could select one, and pick the flesh from the face—at the time there were few other jobs where among the perks was a free hot lunch including meat!

Meat or No Meat, Dark and Light Meat

“How many of you are Vegan or Vegetarian?” Anywhere from 10 to 15 percent of the class raise their hands. In truth these folks have actually had meat in the past, but have not viewed it as a dietary staple in some time. Since this is often a deeply seated philosophical position, I focus more closely on the variable contributions of meat as recorded in ethnographic accounts of hunter-gatherers. Of significance here is the notion held by many students that meat is not necessary to a diet at all—which depending on local resource availability and cycling can be fatally false.

I then ask about categories of meat they either will or won’t consume and find that they increasingly partition their definitions of consumable meats. So, there is the minority of outright carnivores. Then, there is the red meat/other meat cadre—no beef or lamb, and certainly no wild game such as bear, moose, elk, antelope, etc. This partition can also extend to fowl—where goose and duck are categorized as “red” meats. The most common rationale for not eating such meat is that it is too “strong tasting.” That leaves pork, chicken, turkey, some veal, and many fish as consumable commodities. Unless, of course, the meat is “dark”—yes, there’s the rub! Not all “white” meats are completely “white,” they are “dark.” The overt outcome of such selection is that certain components of otherwise acceptable foods are rendered unacceptable, such as chicken or turkey thighs and their associated lower legs, which because of their dark color, are not considered to be usable. Even the darker parts of pork tenderloin are not considered consumable by some students.

Blood and Marrow

These are separate aspects of animal (by)product consumption that many do not find either regular or desirable parts of their diet. In fact, animal blood, particularly from beef and lamb, is euphemistically categorized as “gravy” and “juice,” or with menu-derived grammatical malapropism “with au jus.” So, when I ask whether any have had kisłka—a coagulated blood sausage with barley filling (particularly good fried, with fertilized eggs), I get a variety of facial indications of disgust, expressions which become even more distorted as I describe holiday dinner with my Polish in-laws and the consumption of czarnina—a duck’s blood soup! So, unless blood is transformed from “blood” to “gravy” or “juice” (by any other appellation), it is not an acceptable and consumable byproduct of animal butchery.

And so it goes with bone marrow. The cracking of bones for marrow is an integral part of any discussion of early hominid scavenging, or the use of animal (and at times even human) bone by hunters. While marrow has abundant nutritional value, of primary concern is that many do not know what it is, where it’s found, let alone have they volitionally consumed it! For example, nobody in my recent class of 200 admitted to having sucked marrow out of goat long bones (surprise . . . ). Thus, my experience with the males in my family competing for the partially melted, browned, and still sizzling marrow from the bone cavities on a pile of rare steaks is something not even remotely imaginable . . . .

Sausage

The notion of eating entrails is a particularly repugnant topic. Frankly, even my own eclectic

Figure 2. (Left) Lamb organs, liver and heart, before cooking (Right) Lamb liver with onion and garnish prêt a manger. Yes, this was Sunday lunch at the Lovis household. (Photo by W. A. Lovis).

Figure 3. Natalie Hermanek contem -
tastes do not extend to tripe, and menudo, which I at least admit to tasting on multiple occasions. At a certain level most know that “natural” sausage casings are made from washed and cleaned small intestine, although they would rather view it as a human manufactured product: “They don’t still use REAL intestine for that, do they?” Well, I explain, only if it is not eaten whole as chitterlings (chitt’lins)! This discussion, of course, transcends several subtopics. The casing is from an organ, but then, there is the filling! I’ve already mentioned kishka under the blood topic, and facial parts when relating the story of my wife’s grandfather. So I ask how many have actually read the labels on their cheaper hot dogs or sausages, or know what is allowed in these products. I remember a major debate in the Midwest about whether pig lips, eyelids, snouts, and tongue could or could not be used for filler in hot dogs. I urge my class manek for permission to use the photo in Figure 3.

So where does this leave us? Clearly, the notion that every part of an animal can be totally consumed literally from head to tail, inside and out, is a totally foreign concept to many of today’s college students. They lack the firsthand experience to fully appreciate just how important a single animal, whether hunted or scavenged, can be in a world either before animal domestication and standardization, or which is out of synchrony with U.S. agribusiness and a global meat market. In many ways this makes them poorer, and certainly less capable of understanding either other cultures or their own humble and more austere origins. I certainly hope that my stories not only transcend the 20 Year Rule, but simultaneously provide them with insights into how other people’s worlds differ from their own—worlds where one doesn’t have the luxury to choose not to eat meat, or not eat dark meat, or . . . .

Acknowledgments. I thank Samuel Hensold and Natalie Hermanek for permission to use the photo in Figure 3.

References Cited
Andrews, Colman

Knutson, Roger M.

FROM THE PRESIDENT

There are other initiatives in the works, as well. Task Forces are being established to consider the role and activities of “professional development” for both the general membership and also for students. There is a new student event at the Sacramento meeting for a “Bring your resume/CV” session with a box lunch. And although the SAA, like most comparable organizations, is having to watch its fiscal commitments during this time of both economic challenges and even changes in our revenue streams, we nonetheless are taking some key steps to better serve the members. So, do watch for a probable new system for the submission of papers and sessions for the annual meetings; note that our Executive Director has negotiated excellent arrangements for forthcoming meetings in Memphis (2012), Hawai’i (2013), Austin (2014), and San Francisco (2015); and some new developments in our publications program. Don’t forget, you Latin Americanists, that there will be a Conferencia Intercontinental in Panama in January 2012, where the SAA goes to Latin America!

As President in the last months of my term, I will be pleased to hand over these and other initiatives to incoming President-Elect Fred Limp in Sacramento, with deep thanks to a creative and energetic Board for their ideas and commitment to making the SAA an even stronger organization.

ANNOUNCEMENT

The Archaeology and Physical Anthropology Programs at the National Science Foundation have set aside funds to provide for an “Integrative Paleoanthropology Grant.” Contingent on available funds a single grant for a maximum of $1,000,000 and a duration of up to five years is envisioned for 2011. The goal of the competition is to further innovative, integrative research to elucidate the principles which underlie hominin biological and behavioral evolution over deep time. The competition is intended to stimulate integrative research which crosses normal disciplinary and intellectual boundaries in original ways and this aspect is a central criterion and requirement of the competition.

Details may be obtained from the NSF web site www.nsf.gov by typing “Integrative Paleoanthropology Grants” in the search box in the upper right hand corner of the introductory screen. Proposals must be submitted by April 15, 2011. Dependent on availability of funds and applicant response, a longer term annual competition is planned.
STORING, SHARING, AND ANALYZING VISUAL DATA: PERSPECTIVES FROM ZOOARCHAEOLOGY

TRANSFORMATIONS IN DIGITAL COMMUNICATION AND COLLABORATION
RECENT PERSPECTIVES FROM ZOOARCHAEOLOGY

Iain McKechnie and Sarah Whitcher Kansa

Iain McKechnie is a Ph.D. Student in the Laboratory of Archaeology, University of British Columbia, Vancouver, Canada. Sarah Whitcher Kansa is the Executive Director of the Alexandria Archive Institute and the Editor of Opencontext.org in San Francisco, California, USA.

Introduction to the Special Issue

As in many disciplines, digital technologies and networks are rapidly transforming how zooarchaeologists communicate, collaborate, and share knowledge within and outside the discipline. Technical advances, reduced storage costs, and the Web’s pervasiveness have enabled researchers to access an ever-increasing quantity and diversity of information, creating new possibilities for integrative and collaborative zooarchaeological research. Never before have the technical tools been better suited to addressing core disciplinary goals and challenges than the contemporary moment.

In August 2010, an international group of zooarchaeologists gathered to share and discuss advances in collaboration, communication, and information management during a symposium at the 11th International Council for Archaeozoology (ICAZ) conference in Paris, France. The presentations and posters in the session, nine of which are presented in this special issue, detail current projects using digital technologies to document, assess, integrate, and communicate zooarchaeological research.

Contributors to the session addressed three primary themes (1) the pressing need and emerging solutions for collaborative participation in information management, (2) new visualization tools to aid osteological identification and three-dimensional replication, and (3) the use of digital social networks to facilitate, support, and promote disciplinary practice.

Key to sharing high-quality data is good database design and documentation. In this issue, Jones and Hurley describe the challenges of teaching zooarchaeology students to “think like a database,” an increasingly central task in archaeological management practice. Callou and colleagues discuss the National Inventory of Heritage database in France, which innovatively combines both modern (ecological) and archaeological information to track the “biodiversity” of animals and plants over the past 40,000 years. Similarly, Pavao-Zuckerman and colleagues showcase their user-friendly database of over 1,800 assemblages in Arizona. Both datasets are regionally comprehensive and highly visual, helping users efficiently navigate a huge amount of previously disparate information. Spielmann and Kintigh’s tDAR project aims wider than zooarchaeology but focuses on fauna to showcase the technical flexibility their data repository has for accommodating discipline and researcher-specific recording conventions (“ontologies”) thus enabling full “data integration.”

Two papers present digital visualization methods that enhance osteological identification and replication. Betts and Maschner create a virtual reference collection using 3-D models, which enables geographically dispersed Arctic researchers to access additional tools for osteological identifications. Weber and Malone showcase technological advances in low-cost 3-D laser scanning, providing a glimpse into current and future possibilities of highly accurate 3D replication for teaching and research.

Online communication between researchers is increasingly vital to supporting and promoting zooarchaeological practice. Papers by Morris and Law highlight the growing role of social/professional networks in facilitating the flow of scholarly information, summarizing current needs and identifying remaining gaps. Kansa and Kansa discuss BoneCommons as an example of how social media can serve professional researchers, but also warn against creating “information islands,” with poor discoverability and interoperability.

#INTRODUCTION, continued on page 29
The Internet is becoming an ever more readily accepted part of our professional lives. As zooarchaeologists, we are fortunate now to be able to freely access a range of data repositories, to join social networks and mailing lists to share information with our colleagues, and to have opportunities to comment more or less informally on our research and that of others through blogs. This paper has two main aims, firstly to evaluate how zooarchaeologists in Britain are engaging with the Internet in their professional lives, and secondly to suggest some future directions for digital zooarchaeology.

The obvious benefit the Internet offers is that it is a great medium for communication. The advantages of putting research and datasets online include easier accessibility, especially for workers outside of academia or in institutions with limited journal subscriptions, as well as improving the visibility and impact of the work. The citation advantage of open access research has been explored in some detail, summarized neatly by Swan (2010), and despite what skeptics say, putting your research online does increase the chances of it being cited. This doesn’t necessarily mean using Open Access journals (so-called “gold OA”); it can also mean self-archiving publications either on an institutional profile page, or using a service such as academia.edu, a state of affairs known as “green” OA (Harnad et al. 2004). Zooarchaeologists are fortunate to have the Zooook social network (http://zooarchaeology.ning.com), initiated by James Morris, which provides a system for sharing papers with other workers through a third-party host (see Morris [2009] for details).

Blogging archaeological research may help the researcher, not just in raising their profile or the profile of their research, but also by providing an immediate form of output that is widely recognized as personal, informal, experimental, and open to discussion through the comments area below the blog post. Price (2010) provides a review of three different approaches to blogging, emphasizing that the “best academic blogs are multivoiced, drawing either on multiple writers or on the multiple voices of the feedback they generate” (Price 2010:140).

In zooarchaeology, little has been made thus far of the other great advantage of the Internet, the ability to explore data and interpretations in a way that is, in the words of Andrew Sherratt (1993:194), both “post-textual” and “fun.” It may be the case that this stems from an ideological distance between zooarchaeologists and the rather more post-processual archaeologists who have tried this kind of work, notably Ruth Tringham (e.g., Tringham 2004). An increasing number of more post-processual research concerns among zooarchaeologists, evidenced by recent books like the late John Evans’s Environmental Archaeology and the Social Order (2003), and James Morris and Mark Maltby’s Integrating Social and Environmental Archaeologies (2010), gives hope that the situation may soon change, however.

The Survey
In April 2010, I carried out a survey of British zooarchaeologists (defined in the loosest possible terms as either zooarchaeologists who are based in Britain or those who work on British material). The intention of the survey was to assess how British zooarchaeologists are currently using the Internet, and what their attitudes to it may be. The survey was advertised by e-mail among colleagues, on my blog (http://matthewlaw.wordpress.com), on the ZOOARCH mailing list (www.jiscmail.ac.uk/lists/zoarch.html), and on the Zooook social network. 33 complete responses were received.

The respondents were overwhelmingly zooarchaeologists who are interested in vertebrate remains, although a good proportion was also interested in mollusks (Table 1). This isn’t any surprise given the emphasis on vertebrate remains among the members of the ZOOARCH list and on Zooook.

As Table 2 shows, there was a fair balance of research staff and students among the respondents, but also a similar...
number of freelancers, a sign that some at least are gladly seizing the opportunities that online communities offer to those traditionally excluded from access to academic journals in terms of broadening access to zooarchaeological research and datasets.

All of the respondents were members of the ZOOARCH list. Membership of Bonecommons (http://www.alexandriaarchive.org/bonecommons) and Zoobook was very popular among those surveyed as well. Individual respondents also added the ISOGEOCHEM mailing list (http://list.uvm.edu/archives/isogeochem.html), the BoneTools mailing list (http://www.wbrg.net/), and the online forum at http://www.archeozoofr to the list of online communities they had joined (Table 3).

Unsurprisingly, as Table 4 shows, all the respondents use e-mail to talk and collaborate with their colleagues. Perhaps more surprisingly, use of other online collaboration tools is not so common. The two other services that respondents mentioned were Huddle, online document management software (http://www.huddle.com), and the voice over Internet telephone software Skype.

Table 5 reveals that most people use the groups they have joined to find research articles, and the facility on Zoobook to upload and share hard-to-find papers is of particular note here (Morris 2009).

Online metric databases are fairly well used, which is encouraging for those who take the time to make this information available; however, the majority of respondents have not contributed to any databases (Tables 6 and 7). Other databases mentioned by respondents were the Paleobiology Database (http://paleodb.org/), the Environmental Archaeology Database of the Archaeology Data Service (http://ads.ahds.ac.uk/catalogue/specColl/eab_eh_2004/), and the Bugs Coleopteran Ecology Package (http://www.bugscep.com/). As Table 8 shows, all of those who responded agreed that online initiatives make their work easier.

A substantial minority have blogs of their own, and a slight majority have online profiles at their institutions (Tables 9 and 10). The majority of respondents believe that the Internet is helping them to raise their professional profile, although almost a third are uncertain (Table 11). Most of those surveyed have not established research collaborations with people they met online (Table 12).

A sizeable majority think it’s important to make primary datasets freely available online; however, opinions were more mixed about blogging research (Tables 13 and 14). Many of the comments given in association with the question of blogging suggested that time was the key issue keeping people from starting a blog, although one respondent added that they do not themselves read any blogs, and wouldn’t expect anybody to read theirs.

Table 15 shows that, even with the increase in electronic publication options, print is still highly valued. Almost three quarters of respondents feel that a book is a more prestigious form of publication than an open access publication, although one person was at pains to explain that they felt that this was how their peers viewed the situation, rather than their own view. Despite that, a very sizeable majority said that they would publish conference proceedings online as an open access publication if the process was sufficiently straightforward (Table 16).

Overall, a picture emerges of a profession that is open to the possibilities the Internet offers their own research, but which is wary of investing time in online projects that will receive little recognition from funding bodies and tenure...
committees. One respondent commented that although they had answered predominantly in the negative with respect to their own online presence, they intended to change that situation soon.

Where Next?

So what now for digital zooarchaeology? I would like to see more datasets online. The survey reveals that as a group, we consume more than we contribute (of course, that’s probably true of traditional printed output too), but sharing data not only makes research easier, but in doing so increases the breadth and quality of comparisons within the research. For this to work in the best possible way, standards for presenting the huge range of data that comes out of zooarchaeological research need to be established. The International Council for Archaeozoology [ICAZ] doesn’t currently have a working group for digital data standards; perhaps it should.

Somewhat against the spirit of web democracy, I think that in order to improve the acceptability of online publication, and to maintain its visibility against the noise of the World Wide Web, zooarchaeological data needs to be published in as few repositories as possible, and critical to making the right choice of which ones to support is the issue of sustainability. There is little point building an awesome library of archaeological data that is free only for all that information to disappear if the funding runs out. Too many websites have been established and filled with useful information only to be abandoned or worse taken offline. A key problem here is reliance on free third-party service providers: flickr and YouTube may make communicating research easier, but there is no guarantee of permanence or stability, as demonstrated by the closure in 2009 of Geocities, or the social network platform Ning’s decision in 2010 to no longer offer free hosting. Happily, some initiatives like OpenContext (http://www.opencontext.org) are being archived by schemes designed to prevent just that, and which provide stable addresses that can be used as references offline in print.

Attitudes to Open Access publication can be expected to change. In the case of some types of publication, and especially those like this volume which are very much concerned with changing technology and current situations, the faster publication timetable OA offers make it the most suitable route. Open Access does not entail a lowering of academic standards either, as OA publications may still be (and often are) peer-reviewed. Nor does publication have to be a straight choice between Open Access and traditional print: print on demand publications could be produced to complement online publications, similar to the system offered by the
British Library for doctoral theses that are already digitized in the ETHOS (Electronic Theses Online—http://ethos.bl.uk/) scheme.

Data doesn’t have to end with tables and the interpretative publication. I would love to see more imaginative use of zooarchaeological results, employing the concept of database narrative, where the zooarchaeologist guides users through their data in different thematic ways—presenting the same information with interpretations geared towards taphonomy, economy, ritual or environment, and where opposing interpretations can be voiced and explored.

The complaint we all have, however, is that unless we’re paid specifically to do this, it takes up too much time. Here I suspect the solution lies in normalizing digital archaeology, and in the steady trickle of requirements for an online component in funding applications. Although the survey was limited to zooarchaeologists, the issues presented apply to the wider archaeological community, and many of the problems are common to scholarship in general. The mere fact that this paper was accepted for the ICAZ conference, that there was an entire session on archaeozoology in a digital world, and that the survey received so many considered and positive responses, suggests that there is reason to be hopeful that more and more zooarchaeologists will be taking advantage of the possibilities offered by the Internet.

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References Cited

Evans, John G.

Harnad, Stevan, Tim Brody, François Vallières, Les Carr, Steve Hitchcock, Yves Gringras, Charles Oppenheim, Heinrich Stamerjohanns, and Eberhard R. Hilf

Morris, James

Morris, James, and Maltby, Mark (editors)
2010 Integrating Social and Environmental Archaeologies; Reconsidering Deposition. Archaeopress, Oxford

Price, David H

Sherratt, Andrew

Swan, Alma
2010 The Open Access Citation Advantage: Studies and Results to Date. Technical Report, School of Electronics & Computer Science, University of Southampton. http://eprints.ecs.soton.ac.uk/id/eprint/18516, accessed October 15th 2010

Tringham, Ruth
Archaeological materials are best understood when they can be revisited over the long term and following new discoveries, analyzed by multiple experts, and subjected to new analytical techniques. However, artifacts recovered from archaeological excavations are subject to numerous conditions and constraints that are deleterious to their preservation, reduce their analytical value, and make it difficult for them to be shared with other scholars. Currently there is greater sensitivity to transfer of artifacts and other cultural heritage due to political activities in Iraq, and the highly publicized looting of antiquities there. While these laws are broadly understood as intended to protect items of aesthetic and artistic value, they may nonetheless apply to items more purely of research value. Animal bones, for instance, are not generally of aesthetic value but are invaluable tools for reconstructing past economies and ecologies, and provide unique insights into ancient perspectives on the relationships between humans and animals. Due to their abundance in excavations and perceived lack of glamour, materials such as animal bones are considered to be disposable and are more frequently subjected to destructive techniques, such as genetic testing, isotopic analysis, and radiocarbon dating. For the same reason, they may not be stored in the controlled environment of a museum, and there is little effort put into their long-term preservation. Even when such artifacts can be exported for study, they may not be for financial or practical reasons. It is thus necessary to preserve essential information about these remains while still allowing informative analyses and respecting cultural-heritage laws.

To satisfy these goals, we began a project creating 3D digital models of individual elements of these skeletons through 3D laser scanning (Figure 1) with the NextEngine scanning and software platform, and reconstituting the data into physical 3D replicas of the original bones utilizing additive manufacturing techniques of “building.” Previous uses of 3D scanning as a tool in zooarchaeological frameworks (e.g., Betts et al. 2010, and this volume; Niven et al. 2009) largely have been conceptualized for virtual comparative collections to provide indispensible models of bones to individuals without access to physical collections due to distance from a laboratory or the rarity of certain taxa. In our case, we are capturing 3D data of unique, excavated artifacts. Since 2006, we have compiled a library of complete scans of several hundred...
bones (Figure 1), and have printed a total of 14 replicas of original bones using the 3D scanned data. We believe our goals have been met for cheap and efficient storage, accurate preservation, enhanced analytical potential, and the creation of shareable data. Our total library occupies 180 GB of digital space, easily stored on a single, portable, US $200 external hard drive. These models are quickly and cheaply shared, infinitely reproducible as digital data, and can be transformed into accurate physical replicas; in these ways the materials can be shared as virtual and tangible models.

The strength of the method as an aid to preservation and research lies in the models’ fidelity to the original materials, and advanced capacity for research and comparison. Essential features of the bones are captured in digital format, which can be examined with computer-aided techniques in ways that are not feasible with physical objects. These 3D models are, to some extent, future-proof because new techniques for studying equid taxa can be applied to the digital models or 3D replicas at any future date.

**3D Scanning and Building**

Non-contact three-dimensional (3D) scanning methods are nondestructive and produce highly accurate 3D digital representations that are readily shared, infinitely reproducible, and cheaply and efficiently stored. Optical scanning systems (used here), typically use one or more digital cameras and specialized visible lighting (laser lines, patterns of white light, etc.) to extract and compute the exterior surface shape (and sometimes also the color and shading) of an object. NextEngine (2010) is a highly portable optical laser triangulation scanner robust enough for use in field archaeological conditions and, at roughly U.S. $3000 for a complete hardware and software scanning system, revolutionary in its affordability. Comparable systems sell for 10 times as much money without comparable gains in accuracy or effectiveness (cf Slizewski and Semal 2009). NextEngine illuminates the object being scanned with multiple linear laser beams that sweep the surface of the object. The shape of the lines is observed by two cameras in the scanner, and a computer program triangulates the location of the points from this information. During scanning, visible light digital photographs are taken through multiple color filters to produce an accurate full-color texture map that is applied to the 3D geometric data. Under ideal conditions for surface opacity and lighting, a NextEngine HD scanner can produce scan data with .13mm accuracy, and can capture an object’s full-color appearance (“texture map”). Virtual models thus retain visual information (such as burn marks or bleaching), enhancing their utility for research.

When a tangible reproduction of an object is required, reconstruction of the virtual model into physical form can be readily achieved using “3D printing,” or “additive manufacturing.” This technology builds objects from 3D digital models by digitally decomposing the model into a stack of two-dimensional “slices,” then depositing layers of material under computer control in the shape of each slice. A variety of additive manufacturing processes exist, but one particular variant very well suited to the replication of ceramic and bone archaeological materials is the ZCorporation 3D process, which uses ink-jet technology to deposit adhesive that binds thin layers of plaster powder together, and has the capability of building full color models by depositing colored adhesive. This process can build objects as large as 355 x 254 x 203 mm with a resolution of .12mm in all three dimensions.

**Model Fidelity and Accuracy**

The accuracy of the models can be seen in Figure 2, which shows measurement error for all 3D printed and digital model measurements relative to the measurement taken from the original physical object (the horizontal axis at zero error). Standard deviations of measurement-error for both the virtual and 3D printed replica are under 5 percent and 3 percent, respectively. No significant trending is indicated,
suggesting that neither the 3D printing nor the 3D scanning are systematically distorting measurements.

The error is less for the 3D prints, making the printed material values closer to the original bones. We posit that the virtual measurements may be the most accurate of the three, and that the outliers indicate errors introduced by manual measurement of physical objects (original and 3D printed replica) with mechanical measurement tools. Inspection indicated that these errors could be accounted for by inconsistent measurement placement and orientation, as well as transposition of measurement values into incorrect columns.

The capacity for the digital models to enhance standardization and accuracy of recording is shown in Figure 3. The proximal phalanx is shown in Rhinoceros (2010), a surface-based design software package. The virtual model can be precisely oriented in virtual space and once oriented, distances from any vertex to any other (in this case for greatest length) may be obtained with essentially infinite precision. The virtual model can be annotated, for instance by highlighting and labeling vertices or surfaces as landmarks for measurement, reducing sources of subjectivity in measurement. This approach trades the uncertainty introduced by the vagaries of manual mechanical measurement of the physical object for the uncertainty introduced by the capture and processing of the laser scan data, which at least is likely to be less variable. The virtual model may also be “sliced” in any orientation (Figure 4) at any point to inspect and measure a cross section, and surface area and volume measurements can be easily made.

The Cheaper and Easier World of 3D Scanning and Building

Beyond the NextEngine laser triangulation scanner, Rhinoceros 3D modeling software, and the Z Corp. Spectrum Z510 3D printer employed in this study, there are a wide range of scanning, modeling/analysis, and 3D printing tools available on the market, though prices are often many thousands of dollars. Fortunately, access for archaeological use is becoming easier as university engineering and design departments and industrial service companies are increasingly investing in these tools. 3D printing services are now easily and inexpensive obtained from numerous online companies (Redeye 2010; Shapeways 2010), which provide upload of model files, instant quotations, a selection of materials and finishes, and deliver within days. 3D scanning services are available but still quite expensive, and thus justified only for the rarest and most difficult to scan items. Inexpensive (Rhinoceros 2010) and free, open source (Netfabb 2010) software packages are available, which have many of the same capabilities found in the costly industrial tools, and which have vibrant user groups willing to assist new users and help to customize software for novel uses. Similarly, inexpensive hobby-oriented 3D printer kits (Bowyer 2010; Fab@Home 2010; MakerBot Industries 2010) and 3D scanner kits (David 2010) are available, which though currently capable of building (or capturing) only small, relatively inaccurate models, have exploding international user communities and very rapid technological advance. Finally, advances in technology have made possible smaller, cheaper, and more readily accessible machines for realizing virtual 3D models. A new global social trend toward collaborative tinkering with technology has led to the emergence of “hacker spaces” or “maker spaces” (FabLab network 2010; Hackerspaces 2010)—community technology laboratories worldwide—which frequently have modest, and sometimes quite sophisticated, 3D scanning and 3D printing tools, and skilled users often willing to donate time to interesting projects.

The variety and accessibility of these resources should enable almost any archaeological materials, regardless of aesthetic value, location, portability, or exportability, to be accurately documented in 3 dimensions, shared, replicated, and analyzed. This has the benefit of reducing the aesthetic bias in preservation and storage so that data from “common materials” can be more easily retained for future analysis and com-
The ability to print the digital models is vital as some archaeological research, educational, and promotional activities are boosted by the ability to touch and present physical objects. Manipulation and study of cheap, reproduction artifacts can also help to generate interest among younger students in archaeological disciplines. Fun and creative use of 3D data—such as creating perishable (but accurate) models in cheese or chocolate—may be useful for engaging the public.

References Cited
Fab@Home 2010 Fab@Home, the open-source personal fabricator project. Electronic document, http://fabathome.org, accessed November 19, 2010.

Notes
1. Under the co-direction of Dr. Glenn Schwartz, the Johns Hopkins University, and Dr. Hans Curvers, the University of Amsterdam.
2. An equid is any member of the genus *Equus*, such as a horse, ass, or zebra.
3. The results of genetic testing carried out by Sophie Champlot and Eva-Maria Geigl at the Institut Jacques Monot are pending.
The developing “digital world” of archaeology holds great promise for expanded communication of and collaboration on archaeological projects. The number of projects that take advantage of digital technologies to share and integrate data is on the rise; the Alexandria Archive Institute (http://www.alexandriaarchive.org/) and Bone Commons (http://www.alexandriaarchive.org/bonecommons/), Open Context (http://opencontext.org/), and the Chaco Research Archive (http://www.chacoarchive.org/cra/) are just a few of the digital archaeology collaboration spaces currently available. Clearly, archaeologists are more focused on increasing data sharing and on integrating data from multiple sources. However, for these digital communication/collaboration projects to fully realize their potential, all archaeologists, whether in the field or in the lab, need the skills that allow them to be effective in the digital world. Aside from the obvious (though always shifting) technical proficiencies, students need to develop conceptual models for understanding archaeological data that facilitate such collaboration. The most fundamental, and useful, such model is the relational model of data (Keller 2009). This model is the basis for the relational databases that are the foundation of virtually all current and emerging data-sharing projects.

Despite the importance, usefulness, and ubiquity of the relational database, when we informally surveyed our colleagues, we learned that only a few American graduate (or undergraduate) anthropology programs explicitly cover relational databases anywhere in the curriculum. Even more surprisingly, many of the archaeologists we spoke with were using flat files (e.g., Excel spreadsheets) instead of relational databases, and quite a few didn’t exactly know what a relational database was. Given the importance of relational databases in digital data-sharing, this is distressing.

Our opportunity to engage with this issue came in autumn of 2009. One of us, an assistant professor at Utah State University, was assigned to develop and eventually teach a class in zooarchaeology for graduate and advanced undergraduate students, and decided to use this course to introduce zooarchaeologists-in-training to basic database thinking. The challenge in this situation would be to keep the relational databases as a structural, rather than a content, area of the class; and to assist with this, a librarian with expertise in teaching database skills joined the project.

The choice to include a focus on relational databases in a zooarchaeology class may be surprising, but we feel we had a strong case for it. The students in this class were primarily drawn from Utah State’s MS in Cultural Resource Management program, which seeks to prepare students for leadership careers in private and government archaeology; or advanced undergraduates in the Anthropology major, which focuses on applied anthropology. Few of these students are likely to pursue zooarchaeology beyond the class; they will, however, encounter faunal assemblages and zooarchaeological data in their archaeological careers. At the same time, this was the first exposure that many of these students had to raw archaeological data, and, therefore, there was an opportunity for them to conceptualize the data relationally from the beginning rather than having to unpack their understanding of the data later on. In other words, by linking the learning curve of thinking relationally to the learning curve of doing zooarchaeology, we hoped both would be made easier. We saw this as a “now or never” scenario for teaching relational database concepts.

We thus developed a course with three learning objectives. The first two are typical of zooarchaeology courses: to provide students with basic identification skills (with a special focus on distinguishing human from nonhuman bone, a skill of great importance for any archaeologist) and to introduce them to how zooarchaeological research can inform larger archaeological questions. The third (and much more unusual) objective was that “students will understand relational databases as a means of organizing zooarchaeological data”.

Emily Lena Jones is Assistant Professor in the Anthropology Program at Utah State University.
David Hurley is the Digital Services Manager for the Albuquerque/Bernalillo County Public Libraries.
Implementing the Objectives

In order to best teach relational database thinking without shorting the other learning objectives, we decided to use relational databases as a framework for the class, rather than as a content area per se. We started with an orientation to relational data, and then used this as an organizational framework for the rest of the class content. This allowed us to talk about databases without significantly impacting the class time devoted to the more traditional class goals.

The power of a relational database lies in the relational structure of the data—that is, in explicitly defining the relationships between discrete data elements. Compared to a flat file, where all the data is treated as properties of the individual specimen (a very simplified example can be seen in Figure 1), the relational model offers greater analytical flexibility by preserving multiple access points (in other words, data can be analyzed based on any property) while ensuring data integrity (Keller 2009 discusses this in more detail).

The orientation to databases therefore focused on helping students understand the types of relationships that are made explicit in the relational model. We made the orientation heavily visual, and integrated it with a general discussion of different types of zooarchaeological data. For instance, Figure 2 shows an example of a one-to-many relationship. An individual specimen can, logically, only have one element identification. It is either a tibia, or some other element. One specimen can only have one element. An element identification, however, can logically be applied to more than one specimen. There can be more than one specimen identified as tibiae in a given collection. Hence, the relationship between specimen and element is one-to-many.

Other times, the relationship is what is called many-to-many. For example, a specimen can have multiple modifications; it can be burned, weathered, and have multiple types of cutmarks. Likewise, all these modifications can logically (and likely will be) applied to multiple specimens (Figure 3). Hence, the relationship between specimen and modification is many-to-many.

We started the class off with this visual recap, focusing on how individual relationships (as seen in Figures 2 and 3) contribute to a complex whole. This orientation, when we talked about the fundamental relationships, was the only class time devoted solely to database information. After this first class, all discussion of databases was embedded in a discussion of zooarchaeological data. As we moved through the traditional class goals, every time we discussed a new kind of zooarchaeological data, we included in our discussion an exploration of how this data related to other zooarchaeological data. In this way, during the course of the class, we built a hypothetical zooarchaeological database.

The examples we provide in Figures 2 and 3 are rather clear cut, but often understanding relationships between data elements (and even what constitutes a discrete data element) requires analytical effort. Engaging in this effort provided students a deeper understanding of the data, while also resulting in a dataset that can be analyzed with a broader set of tools, notably Structured Query Language (SQL) and GIS. Approaching zooarchaeological data this way would, we hoped, teach students to embed relationships in their data collection from the outset, rather than the more limited, but still more common, flat file approach, which treats all data as the property of the individual zooarchaeological specimen.

In addition to quizzes (which involved both specimen identification and questions about database relationships), seminar readings, and the hypothetical database, students also completed a small analysis project, including the creation of a small relational database. The goal here was to have the
students put all three learning objectives, in a limited way, into practice.

Results
From a student satisfaction perspective, the database experiment was a success. Student evaluations provided no negative feedback about the database portion of the class, and 13 of 15 students had something positive to say about it. This was a surprise, given that this was the first incarnation of a brand-new class, and given that the project portion of the class was far from perfect.

Assessing what students actually learned about databases was a more difficult task. The database that the students produced was only moderately successful as a class project, perhaps not surprisingly. Students were overwhelmed by this task, and eventually one technologically savvy student took over database creation; the final product is thus not an accurate way to assess students' learning on databases. In retrospect, we think having students create their own database in the course of the class was too much to ask, and in future incarnations of the class we will provide them with a pre-made database to work with. We don't feel that this will take away from the database learning objective, given that our goal was not to teach students to create databases, but rather to introduce them to the fundamentals of database thinking.

When student learning is assessed in these terms—that is, did students learn relational database thinking—our results are much better, although more data would be useful. Quiz performances suggest that students, at least during class, learned the basic concepts of relational databases; even students who struggled with identification were able to master database relationships. In the final quiz, students averaged 89 percent on the database relationship questions. We are curious, however, about the persistence of their mastery. Will students who took this zooarchaeology class, for example, perform better in the GIS class (which relies heavily on databases, although data relationships aren't explicitly taught)? We look forward to pursuing this question further.

Conclusions
We are convinced that relational database thinking both needs to be, and can effectively be taught, somewhere in the graduate curriculum—and probably in the undergraduate curriculum as well. However, the particular method for integrating databases into an analysis class presented here was, of course, designed for our situation at Utah State University. While we are pleased with our initial results, and plan on continuing to integrate databases into our zooarchaeology class, this would not necessarily be a desirable curriculum in other programs. While our experience suggests that zooarchaeology classes may be a surprisingly good fit for this—we were able to teach a basic introduction to relational database thinking without impinging on the straight zooarchaeological content—there is no reason why such teaching couldn't easily be incorporated into other archaeology classes instead of or in addition to zooarchaeology.

There is, however, a big caveat. There is a difference between teaching database creation and teaching database thinking. The students in this class did not learn how to program a database, and trying to create a database was, from the instructor's standpoint, detrimental to the class. Next time this class is taught, we plan to provide them with the basic database for their project. What the students did learn was relational database thinking—the big picture concepts. Database relations, we found, provided an easy and effective way to organize the straight zooarchaeological material in the class, and the students now have the groundwork set to become relational database users, rather than relying on flat files. We thus hope that these students are more prepared to be archaeologists in a digital age.

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References Cited
Keller, A. H.
2009 In Defense of the Database. The SAA Archaeological Record 9(5)26–32.
For the past several years archaeologists, archaeozoologists, and computer scientists have collaborated on creating a Web-based, public-access cyberinfrastructure, tDAR (the Digital Archaeological Record; McManamon and Kintigh 2010; http://tdar.org). tDAR not only serves as a digital repository providing preservation and access to archaeological datasets uploaded by users, but also allows users to integrate them by combining datasets recorded using different protocols into a single dataset with analytically comparable observations.

Our original motivation to develop tDAR derived from a collaborative effort by Southwestern archaeologists at Arizona State University to synthesize regional-scale archaeological data on socioeconomic change. Rather than simply synthesizing the conclusions of many separate analyses, our objective was to create integrated datasets of original observations that could be subjected to new analyses focused on larger spatial and temporal-scale questions. Not surprisingly, our efforts at synthesis were frustrated by the practical difficulties of acquiring the original datasets and then of integrating them. Given that they were collected by different investigators from across the US Southwest. As we developed the integration capabilities of tDAR, archaeozoological data have been our specific focus.

In this paper we briefly discuss (1) data archiving in tDAR, (2) the development of general ontologies for archaeozoological variables, and (3) results of a pilot analysis of Southwestern faunal databases that is informing our software development and helping refine protocols for integrated analyses of faunal data.

**Archiving Databases in tDAR**

tDAR not only allows users to discover and download data and documents of interest, but also to contribute their own archaeological data. In contributing an information resource, one uploads a file and enters the archival and semantic information—metadata—that will enable it to be discovered by a search and permit its long-term preservation and scientific use. As we discuss below, detailed metadata make it possible for observations to be made comparable across databases. For databases (and spreadsheets), the metadata includes information describing the individual columns, along with the coding sheets that provide the semantic labels for encoded values. For example, a column labeled “Taxon” encodes information on a bone’s taxonomic assignment and in that column the database value 101 may represent “Lepus.” A translation function in tDAR creates a dataset with both the value labels and the original numeric codes.

**Developing Faunal Ontologies**

We recognize that there is significant variation in how researchers code archaeological data, including fauna. Our goal is not to standardize what individual analysts do, but instead to make it possible to integrate their data with those of others using a shared conceptual framework for analysis. We feel that it is essential to maintain the data as they were originally encoded, along with the associated coding keys. To accomplish that goal while enabling integration, we employ “ontologies.” In tDAR, ontologies are sets of hierarchically organized concepts. For example, “burning” might have been recorded by one analyst as “burned/unburned,” while another may have effectively subdivided “burned” into charred, burned, and calcined. If communities of researchers agree upon a shared ontology, e.g., for the variable burning, “charred” and “calcined” are subcategories of “burned” (Figure 1), the data integration tools of tDAR allow an analyst to map the individual translated codes in their databases (e.g., *calcined*) to ontology values (in this case, *burned*) used by other analysts. The result is that variables recorded differently in different databases can be integrated because the original encodings are mapped to shared values.

Developing general ontologies involves a community of
users moving toward a consensus on a framework. Over the past year we have had two opportunities to convene the North American Faunal Working Group (FWG), comprised of faunal analysts working in the southwestern and eastern U.S., and to meet with a British Faunal Working Group organized by Archaeological Data Services in York, England. One objective of these meetings was to develop general ontologies for the variables that archaeozoologists typically code. For most variables this proved to be a relatively straightforward process for both groups. There was general agreement that there should be a first-level option often at the level of presence/absence, as well as indeterminate, or unrecorded values. Beyond that, for most variables there was a second level of greater specificity regarding presence (e.g., charred, burned, or calcined). The general ontologies developed by the faunal working groups are now publicly available in tDAR.

Mapping to Ontologies and Data Integration

Data integration in tDAR requires that the variables of interest have been mapped to the shared ontologies for those variables. Ideally, the original analyst would perform these mappings; however, a tDAR user can create these mappings her or himself. Datasets to be integrated are then moved into the user’s workspace. tDAR’s integration tool allows the analyst to choose the variables to be integrated as well as the level at which integration is to take place. For example, while two datasets may have specific degrees of burning intensity coded (e.g., charred, burned, calcined), the analyst may only be interested in the presence or absence of burning. In that case, as illustrated in Figure 2, selecting “burned” would include all those cases coded to a more specific “burned” value. Likewise, if an analyst were interested in comparing artiodactyls and lagomorphs, she could choose only those taxonomic values. Cases coded to more specific taxonomic levels under artiodactyl or lagomorph (e.g., *Antilocapra* sp. or *Lepus* sp.) aggregate up. The output from the integration can be exported as an Excel file that can be uploaded into a statistical package for further analysis.

Pilot Analysis

In preparation for a recent meeting of the North American FWG Spielmann undertook an integrated analysis of nine Southwestern faunal databases. tDAR now houses at least 17 Southwestern faunal databases representing over 220,000 faunal specimens in tDAR.

The intent of the pilot was to investigate patterns in faunal resource depression between A.D. 1200 and 1400, the period represented in most of the current tDAR Southwestern faunal databases. Investigating regional-scale faunal resource depression has been a goal of the tDAR project since its inception. The results of the pilot, however, pertain more to determining the comparability of datasets, which is necessary for faunal data integration to be viable both practically and scientifically.

Temporal information. Integrating multiple archaeological datasets requires project-level metadata on the period of time the site or sites date to. In addition, if a single dataset contains multiple time periods, it is critical that temporal information be contained in the dataset so that observations pertaining to each period can be distinguished. Two large and interesting Southwestern faunal datasets currently in tDAR were not useable in the pilot, for example, because they contained data spanning a 200-year period and the file did not contain temporal information.

Ontology mapping. A review of how taxonomic categories were mapped by different analysts to the Southwestern general taxonomic ontology revealed some variation in mapping. For example, some analysts mapped codes to both the “large mammal” and “artiodactyl” categories, while others only used “artiodactyl.” And some mapped to “small mammal” while others mapped to “small unid. animal.” Prior to undertaking an integrated analysis, an analyst should be aware of different patterns in ontology mapping.

Taphonomy. Archaeozoologists routinely collect data relevant to taphonomic processes (e.g., fragment size, condition, weathering, and animal gnawing), but these data generally are not readily accessible. The integrated analysis of multiple datasets requires that we first evaluate the degree to which zooarchaeological remains from different sites have been subject to similar taphonomic processes. Controlling for taphonomic processes will allow us to identify patterning in the zooarchaeological record that is not due to biases, and
perhaps to reveal patterning that we did not previously have
the ability to detect. tDAR makes this possible by making
available the full faunal datasets, complete with variables
related to taphonomy, and an integrative tool that allows
these variables to be analyzed by taxonomic category across
multiple datasets.

When faced with information on fragment size, condition,
weathering, and animal gnawing, however, it is not immedi-
ately obvious how to take this rich information and evaluate
taphonomic comparability. We are thus preparing a propos-
al in part to fund the development of a protocol, which we
will invite the archaeozoological community to evaluate, for
determining the degree to which faunal datasets are tapho-
nomically comparable.

Context. It is well-documented that people may choose to dis-
pose of different animal taxa or different portions of taxa in
different contexts. Thus, context must be controlled in inter-
site comparative or synthetic analyses. As with temporal
information mentioned above, control for context requires
that intelligible contextual information be included in the
project metadata as it pertains to site type, and within
datasets themselves as it pertains to the excavation context of
individual specimens.

As with taphonomy, controlling for context is not as straight-
forward as it might appear. In working with contextual in-
formation from across the Southwest, it is clear that some con-
textual coding schemes are far more detailed than others. An
integrated analysis is thus likely to allow only broad control
over context (e.g., intra-mural vs. extra-mural; midden vs.
pit). Moreover, even where contextual information is simi-
larly detailed across the sites of interest, sample size issues
are likely to require the aggregation of multiple contexts. At
this point we do not know whether controlling for broad con-
texts of faunal deposition is sufficient for integrated analysis.
To our knowledge there has not been a systematic analysis of
patterning in faunal disposal at the regional or subregional
level, and thus this is a second area in which we are propos-
ing to undertake research.

Results of the pilot. The datasets in tDAR that spanned the
A.D. 1200–1400 period range were largely from the Zuni
area. After exploring a few taphonomic variables and the
ontology mapping differences discussed above, as a first
evaluation of whether resource depression had occurred over
time, Spielmann calculated the artiodactyl index (Artiodactyl
NISP /Lagomorph NISP) for the Zuni sites in the sample.
These data are provided in Table 1 and Figure 3.

As Table 1 and Figure 3 indicate, even within the Zuni area
the artiodactyl index is quite variable and does not pattern
temporally (from left to right in Table 1 and bottom to top in
Figure 3). In discussion with Kintigh, whose datasets these
were, it became clear that (1) intensity of long-term settle-
m ent on the landscape, (2) site type (e.g., post-Chacoan great
houses vs. village settlement), and (3) proximity to higher
elevation areas (Figure 4) all likely played a role in long-term
artiodactyl availability on this landscape.

In moving forward we do not harbor any illusions as to data
integration and analysis being a straightforward undertak-
ing. Nonetheless, the rewards of being able to address
regional-scale anthropological research questions at a depth
and breadth that have not thus far been possible using zooar-
chaeological data are compelling.

Conclusion
Inquiry on a regional scale requires changing archaeological
practice to promote a new approach to data sharing that
includes the adequate documentation of these data so that
they are broadly useable in scientific analyses. tDAR pro-
vides a technical infrastructure for the preservation of and
access to archaeological data, and has prototyped data inte-
gration tools that empower synthesis. What is necessary now
is the accumulation of large numbers of well-documented

<table>
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<th>Zuni</th>
<th>Rudd Creek</th>
<th>El Morro</th>
<th>Cibola PIII</th>
<th>Cibola PIV</th>
<th>HARP</th>
<th>UCLPP</th>
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<td>1200-1300</td>
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Figure 3. Zuni artiodactyl indices.
datasets and analytical protocols that allow us to assess the comparability of these datasets, and commitment to understanding the particular contexts from which these data are derived. We invite SAA and ICAZ members worldwide to upload their projects into tDAR so that they may be shared and to experiment with the integration tool.

Acknowledgments. We thank the Faunal Working Group members from North America and Britain for their insights concerning faunal integration. The work reported here has been supported by grants from the National Science Foundation (04-33959, 06-24341) and a grant jointly funded by the National Endowment for the Humanities (PX-50022-09) and the Higher Education Funding Council for England of the United Kingdom acting through the Joint Information Systems Committee (JISC). Development of the Digital Archaeological Record has also been funded by grants from the Andrew W. Mellon Foundation. Any opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect those of the National Science Foundation, the National Endowment for the Humanities, the Joint Information Systems Committee or the Mellon Foundation.

References Cited
McManamon, Francis P., and Keith W. Kintigh
BoneCommons (http://alexandriaarchive.org/bone commons/) was developed in 2006 by the Alexandria Archive Institute (http://alexandriaarchive.org/) as an open access system to advance communication and sharing of scholarly content within the global zooarchaeological community. It works as a community hub to enable sharing and discovery of images, conference presentations, and papers.

Because web-based dissemination costs are now so low, social media systems generally permit a great range and diversity of content to be shared. One can just as easily post an image, a 140-character “tweet” or an entire thesis. Social media technologies such as blogging, podcasting, and wikis lower barriers for individuals to reach a global audience. These same low barriers also enable social media to be more conversational because commentary and continued conversation are easily supported.

However, the potential removal of the “gatekeeper” (i.e., editorial oversight of print publication) means that any and all content can be shared. Thus user-generated content can run the gamut from distracting commentary to valuable research content. This openness and ability to rapidly publish anything sometimes lies in tension with professional expectations for quality and vetting of material. Any attempt to apply social media in scholarly contexts must confront these issues, and balance the affordances of easy, rapid dissemination with the imperative of maintaining professionalism and quality (see also Harley et al. 2010). BoneCommons represents our attempt to adapt social media to scholarly communications in zooarchaeology.

Stepping Back: What do Users Need?

The original BoneCommons was a forum aimed at facilitating discussion and contact between zooarchaeologists worldwide by offering a place to post papers, ideas, images, questions, and comments. As more content was added to the site, browsing and searching became challenging, impacting the site’s mission of providing “easy access to quality content.” This, together with spam and security issues made the site too costly to maintain on a volunteer basis. Informed by new social media technologies, a better understanding of what users need, and lessons learned about “under the hood” requirements for professionally oriented web dissemination, we undertook a major remodel of BoneCommons in 2009.

This remodel was timely, as we were engaged in a two-year study exploring how open technologies can best meet the needs of the diverse communities of scholars working with digital archaeological content. While the study’s focus on primary analytic data prompted significant changes to OpenContext (http://opencontext.org), an open access data publishing system that we developed and maintain, some aspects of it also directly informed our reconfiguration of BoneCommons.

One of the key outcomes was the importance of linking primary analytic data with other datasets and scholarly content. Analytic data is created as part of broader research programs that typically result in published scholarly syntheses. These syntheses can both be enriched by access to primary data and help make primary data themselves more intelligible and meaningful. Our study highlighted the need to reference and cite across these various forms of content (which, on the Web, involves hyperlinks). We also noted that users demand efficient search and discovery functions, as well as the ability to easily export data from one application to another.

With these needs in mind, we remodeled BoneCommons in 2009 with new software that offered better functionality, design, and security. The new BoneCommons is built with free, open source content management software offered by Omeka (http://omeka.org/), an ideal solution for a system with little funding and outside technical support, and offers the following features:

- Clear citation and stable linking for every item.
- Standard Dublin Core library metadata and digital library protocols to facilitate archiving.
- A contribution form for users to upload their own content and relevant metadata (“information about information”).
- A clean and professional appearance (as opposed to the forum-style of the old site).
In BoneCommons, all contributions are vetted by the site’s editor. This oversight does not substitute for peer-review, since BoneCommons is not intended to replace journals or conferences. Rather, BoneCommons can be more relaxed in reviewing content because much of the material posted in BoneCommons was vetted elsewhere (by conference review committees or publishers), and BoneCommons’ review process mainly addresses relevance and completeness of metadata, especially around citation. In cases where researchers post images to BoneCommons in order to seek help with identifications, vetting need not be too onerous. Thus, we have tried to retain social media’s efficiencies for rapid publishing while adapting social media to better meet professional needs, especially with regard to citation and editorial oversight.

Monitoring user searches in BoneCommons helps us address search and discovery needs. Figure 1 shows that searches monitored over three months resulted in a classic power law graph, where a few topics dominate and the rest fall into a “long tail” of topics that cannot be categorized. Nearly half the searches requested people or publications, while the remaining 51 percent of searches used more idiosyncratic terms. This long tail of search terms, each of which occurs only rarely, highlights the great breadth of user interests. These results help demonstrate the importance of continual improvement in search and discovery services, since researchers are often looking for very specific “needles” in increasingly large and complex “haystacks.”

Adapting BoneCommons to better meet user needs has helped improve the site’s impact. At the same time, professional acceptance of web-based scholarly communications is increasing in zooarchaeology. After the 2006 ICAZ international conference, abstracts of conference papers and posters were posted to BoneCommons. Presenters were given the option of posting their communications on BoneCommons, but only a handful chose to share in this way, opting instead to wait years for print publication. By the time of the next ICAZ international conference (August 2010), the community’s perception of sharing research openly on the Web had clearly changed. Of 700 oral and poster communications, over 120 were posted to BoneCommons in the four weeks following the conference.

Many scholars now embrace the medium as a way to communicate their work in one way or another, whether it takes the form of sharing PDFs of publications, commenting on another researcher’s work, or responding to a question. The change in BoneCommons use took some years to occur, but it is important to note because it demonstrates that the perceived barriers to adopting technologies in the “static” world of academia are not insurmountable.

**Beyond BoneCommons**

The variability of research interests and the multidisciplinary nature of scholarship highlight the need for scholars to draw upon a diversity of information sources and services. Our challenge is to find ways to facilitate use of distributed resources by the research community. We are experimenting with various ways of making BoneCommons function in a landscape of distributed information sources and services. One example of how web resources can be linked to facilitate information access is the relationship between BoneCommons and ZOOARCH, an email list dedicated to zooarchaeology-related discussion. ZOOARCH prohibits attachments, so subscribers often post images on BoneCommons and share the link on ZOOARCH. Connecting the two resources in this way facilitates discovery and discussion across user communities (see Figure 2).

BoneCommons sees more active participation from its links with conversations on ZOOARCH. When postings come to users by email, they are more directly tied into everyday workflows. Furthermore, Figure 2 demonstrates how scholarly expectations can compel people to use social media, where the response of the third researcher to “ask the expert” drew that person into the conversation with the expectation that he would reply out of perceived scholarly obligation.

**Opening Information Silos**

BoneCommons and ZOOARCH offer different, complementary services. Rather than attempting to create the perfect resource, we should instead be targeting our funding and technological know-how to facilitating information flow between resources so that synergies can emerge. Sadly, though many web resources exist, they tend to stand in relative isolation from each other; that is, you have to know about each one and visit them to see their contents. Thus, though the Web has allowed people to share vastly more information than before, much of it is trapped within “information silos.”

Building for “mashups” (simple ways of combining data from different web sources) can help mitigate this problem.

**Figure 1**: The “long tail” of 1132 searches leading to BoneCommons (searches from April – June, 2010).
of isolated resources. For example, BoneCommons displays a feed from the ZOOARCH list's server, in essence drawing related content from one resource to another. This “machine-readable” data facilitates web-based scholarly communications, allowing easy aggregation of relevant content so users of BoneCommons, for example, can immediately access content published by another source.

Machine-readable data can also help address an important need identified in our user-needs study—linking between primary analytic data and other research outputs, such as conference presentations and articles. Currently, we are experimenting with bringing relevant primary data to the BoneCommons community hub via Open Context’s machine-readable data services to (see Figure 3). Open Context is an open access, web-based system that publishes editorially verified datasets, many of which are linked to print publications. It contains a variety of project datasets that span geographic regions, time-periods, and areas of specialization (Kansa 2010). Since only a portion of its content will be relevant to a given community, Open Context offers sophisticated services for querying machine-readable data. This allows BoneCommons to request a filtered subset of Open Context content so that only zooarchaeology-related data appears on the BoneCommons site. BoneCommons’ “Datasets” page (Figure 3) draws relevant data from Open Context, demonstrating how a customized data “feed” can flow from one web resource to another so that relevant research content from multiple sources can be drawn together in useful ways.

A Vision for Distributed and Collaborative Resources

Machine-readable data facilitates aggregation so that community hubs can offer rapid and efficient access to high-quality information from multiple, trusted web sources. Such aggregation benefits researchers facing tremendous time pressures. By allowing information to escape a given silo and enter a new context, machine-readable data helps bring relevant content to users rather than expecting users to go to that content.

By virtue of being based on the Omeka software application, BoneCommons itself publishes machine-readable data and is open for aggregation by other sites. Beyond the ZOOARCH list and Open Context, many other web resources can offer machine-readable data. Looking to the future, more widespread adoption of even very simple types of machine-readable data services such as the “Open Search” protocol can have a great impact for researchers. Open Search enables cross-site searching so relevant data can flow across different sites. Because few web resources will ever be able to achieve the scale and comprehensiveness necessary to meet the needs of highly specialized research interests, such services are needed to help users look beyond one site and efficiently search across many trusted and high-quality scholarly repositories. Such services can be useful building blocks for more sophisticated kinds of data integration and analyses pooling data from multiple sources.

Our experiments with BoneCommons demonstrate useful ways to adapt and deploy social media and machine-readable data to meet researcher needs. We look forward to seeing online reference collections and other data providers offer similar machine-readable data services. By making high-quality web resources that are open to reuse and aggregation, we can network zooarchaeological information services in ways that better reflect the vibrancy and collaborative spirit of the zooarchaeological community.
Acknowledgments. We would like to thank the International Council for Archaeozoology (ICAZ) for facilitating the development of BoneCommons in 2006. The work presented in this paper is funded by grants from the William and Flora Hewlett Foundation, the National Endowment for the Humanities and the Institute for Museum and Library Services.

References Cited
Harley, Diane, Sophia Krzys Acord, Sarah Earl-Novell, Shannon Lawrence, and C. Judson King.
Kansa, Eric C.
Kaplan, Andreas M., and Michael Haenlein

Notes
1. The term “social media” describes web-based applications that facilitate the creation and exchange of user-generated content (Kaplan Haenlein 2010), or publicly-available information published by end-users.
2. This study was funded by a grant from the National Endowment for the Humanities and Institute for Museum and Library Services’ Advancing Knowledge: The IMLS/NEH Digital Partnership program.
4. https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=zooarch

Throughout the session, it became clear that many of these initiatives share complementary insights and goals and have much to learn from each other as well as from similar initiatives in archaeology and museum practice. Audience discussion highlighted the considerable variability in how zooarchaeological information is recorded, described, and archived (see also Driver 1992) as well as the need for academic and CRM-based incentives to make primary data accessible. Others noted how granting agencies and repositories are now requiring submission of all digital information and researcher expectations are shifting toward greater transparency and accessibility. As a wave of zooarchaeological researchers approach retirement, such changes are urgently needed as primary zooarchaeological data is highly vulnerable to loss and fragmentation. The projects presented here demonstrate how researchers are making serious collective efforts to improve communication and access in zooarchaeology and beyond.

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References Cited
Driver, Jonathan C.

Notes
1. ICAZ is a scholarly organization which hosts quadrennial conferences concerning zooarchaeology: http://www.alexandria archive.org/icaz/index.htm.
2. A growing list of such resources can be found on the ICAZ website: http://www.alexandriaarchive.org/icaz/about_links.html.
STORING, SHARING, AND ANALYZING VISUAL DATA: PERSPECTIVES FROM ZOOARCHAEOLOGY

ZOBOOK
ARCHAEOLOGISTS CONNECTING THROUGH SOCIAL MEDIA

James Morris

James Morris is Doctor of Zooarchaeology at Museum of London Archaeology.

The last decade has seen the rise and evolution of Internet-based communication tools with sites such as Myspace, Facebook, and Twitter. These new forms of social media have quickly been embraced and many individuals now utilize them on a daily basis to keep in touch with friends and family. Recently, with the launch of sites such as academia.edu (www.academia.edu), social networks are now being used to maintain and develop professional relationships. This article discusses the creation, use, and implications of a particular website, the Zooarchaeological Social Network, nicknamed “Zoobook.”

Laying the foundations

Although concerned with the past, archaeology, like any other discipline, is subject to the ebb and flow of human activity in the present. The story of Zoobook starts with the recent global recession. In the United Kingdom, one of the effects was the lack of new building activity, which was highly detrimental to the UK’s cultural resource management (CRM) archaeology companies, which now carry out over 95 percent of all archaeological work in the UK (for further information on commercial archaeology in the UK see Darvill and Russell [2002]). This resulted in the loss of over 15 percent of the archaeological workforce, approximately 660 jobs (Aitchison 2009a, 2009b). To ascertain the specific effect on archaeozoologists, two surveys were conducted by the author in April and August 2009. The opportunity was also taken to include questions on the demographic, employment, type of work, and challenges faced by CRM zooarchaeologists (Morris 2010).

In the April survey participants were asked to grade suggestions for help they would like to receive, if possible. The results highlighted problems that would not be unfamiliar to many archaeologists, especially the lack of funding opportunities for publications, access to faunal reference material, and unpublished reports. As one participant stated when asked what challenges they faced: “retaining quality of work that will be [of] use to future generations rather than just being a ‘sausage machine.’ Getting data made accessible and available to others.”

Access to unpublished CRM generated literature is an issue the archaeological community is currently grappling with (Bradley 2006). In the UK initiatives such as the Online Access to the Index of Archaeological Investigations (OASIS, http://oasis.ac.uk/) are starting to make “grey” unpublished literature available, but the task is a mammoth one. Currently OASIS holds 5,381 reports, but to put this in context between 2003 and 2006 over 3,000 archaeological investigations were made each year (data from the Archaeological Investigations Project, http://csweb.bournemouth.ac.uk/aip/aipintro.htm). One of the problems materials specialists face is that the majority of the CRM reports posted online do not facilitate the extraction of the specialist information and often do not contain the raw data necessary. In the UK projects, such as the Animal Bone Metric Archive (http://ads.ahds.ac.uk/catalogue/specColl/abmap/), do allow for the downloading and manipulation of raw data, but currently such archives are the exception rather than the norm.

There therefore appeared to be a need to facilitate the easy sharing of archaeozoological unpublished literature, with the option to also share the associated datasets. A site that enables this is the excellent BoneCommons website (www.alexandriarchive.org/bonecommons). However, one of the issues raised was that many UK CRM companies were happy for zooarchaeologists to share reports and data among their peers but did not want the information posted openly on the Internet before the excavation had been fully published. This is an issue because of the long lead time often associated with CRM excavation publications, although the situation is gradually improving. An additional issue raised was access to electronic resources, such as journal articles. Readers who are members of the zooarch@jiscmail.ac.uk mailing list will have noticed a rise in requests for articles and other information in electronic form. What therefore seemed required was an electronic site that would allow the sharing of documents, but within a closed members-only environment.

Building a Place

With recent advances in social networking software coupled with developments in online storage it was possible to build such a site. Using the Ning social network (www.ning.com), which at the time was freely available online, Zoobook was created and launched at a meeting of the Professional Zooarchaeologist Group UK on August 15, 2009. The site had been
STORING, SHARING, AND ANALYZING VISUAL DATA: PERSPECTIVES FROM ZOOARCHAEOLOGY

developed in discussion with the administrators of BoneCommons and the zooarch jiscmailing list. It was not designed to be in competition with either service; rather, it was hoped it would complement them. To facilitate this, a feed from zooarch@jiscmail.ac.uk was placed on the home page of the site and a link to BoneCommons created.

The site was designed around a structure, which would be familiar to many who use social networks (Figure 1). Members are required to register on the site and login each time they visit. To join, individuals email a request to the site that is then approved by an administrator; this maintains the sites closed environment and also maintains security against spammers. The features include: “Home page”—where the latest activity is listed; “My page”—Each member gets their own home page which they can customise and add documents to (Figure 2); “Forum”—where subject specific discussions can be started (Figure 1); “Events”—which allows members to post conference and meeting details, members can also RSVP; “Groups”—This allows the establishment of specific interest groups. They can be open or private, members can post messages and documents on them; “Photos”—members can upload photos and organize them into specific albums. The site also allows member’s images from www.flickr.com to be added; “Chat”—this allows instant messages, or webcam conversations to take place between members who are currently logged onto the site; “Translate”—This allows members to translate the site pages from English to one of 19 other languages. Although not perfect, this does facilitate a global community.

The site has also developed a number of specific resources that may not normally be seen on a social network: “BoneCommons”—This page allows BoneCommons to be accessed and browsed while still logged in to the Zooarchaeology Social Network; “Members shared files”—Using a facility supplied free by www.box.net, members can post up to 1Gb of files into an online folder. This page shows an RSS (Really Simple Syndication) feed of the documents in member’s folders; “Resources”—This page contains specific reference documents that have been uploaded onto the site and are available for members to download, for example, Cohen and Serjeantson’s 1996 Bird bone manual. Such resources have been approved by their authors.

The sharing of documents online can be problematic and the author is aware of the many issues a site of this nature may raise regarding copyright. The procedure adopted for the site is one of co-operation within the zooarchaeological community. If a file, such as a pdf of an article, is posted by a member who is not the author, if the author requests it the file is removed from the site. However, we have found our specialist community is a very supportive one, and once authors are aware, they often offer to share more of their work.

Figure 1. The forum discussion area of the site. The main tool bar for the different areas of the site is located at the top of the screen.

Growth and Development

When the site was originally created it was with UK-based zooarchaeologists in mind and the author envisaged perhaps 50 or so members joining. However, the site appears to be providing a useful service as, since its launch, membership has steadily grown and developed. At the time of writing it now has over 630 members, 26 percent (169) from North America. Although the majority of the visits are made from the United Kingdom, USA, and mainland Europe, the site now has members from 76 separate countries (Figure 3). It has been successful in connecting zooarchaeologists in America, Europe, and Asia, but the location of the membership does show either a lack of zooarchaeologists in Africa and parts of Asia, or our inability to reach individuals based there. Perhaps this is an area that deserves further research as zooarchaeologists in these regions may be isolated and in need of the community’s support.

The site has now grown to contain over 7,600 pages, with over 19,500 separate visits. On average, members spend over four minutes on the site, with a page view of 51 seconds. Over 15 percent of the members have visited the site more than 100 times and the site is visited approximately 1,400 times a month.

Future Challenges and Electronic Dreams

When setting up and running the site a light touch in its development and administration was adopted. Since its success is ultimately determined by its members it was decided at an early stage to allow the site to grow and develop as the community saw fit. This also means letting the site fail if that is what members wish. Facilities such as the translation program, the ability to upload photos, and the members shared
files pages are all present due to requests and development helped by site members. However, the site will face future challenges. When set up the hosting company and software were free to use and funded by advertising revenue, but at the time of writing an end to free hosting has been announced. This means that in the future the site may have to be paid for in some manner. The challenge is to try and do this through non-intrusive methods, such as advertising, keeping access for the community free. This illustrates one of the challenges of using Internet-based media, as it is often changing and rarely archived. Additionally, with large datasets archaeology may become affected if net-neutrality ends and a two-tier system where content providers have to pay is introduced (Wyatt 2010).

The development and implementation of the site shows how the archaeological community is eager to embrace new technology and communication media. This may be related to the constant technological adaption archaeologists have undertaken, for example the discipline has been greatly served by the use of database software to record and analyze. In the 1970s it was hard to predict how database and mapping software would become such a ubiquitous tool; now it is difficult to predict what technological advancements may affect our discipline in the future. However, the authors’ experience with the Zooarchaeological Social Network has shown it is possible to experiment with new technologies and make them useful to our community, and that archaeologists are willing to embrace new and innovative methods of communication. Part of the sites success appears to be in enabling members to quickly, easily, and, importantly, at no cost, share data. Such activities can only aid in the discipline’s development and recently other specialists such as archaeobotonists (http://archaeobotany.ning.com/) and bioarchaeologists (http://bioarchaeology.ning.com) have developed similar sites. However, as a note of caution, although such developments are welcome within specific archaeological fields and serve a useful purpose, they may also proliferate the isolation of specialists from the wider archaeological community if we are not careful. This is why it is important for social media sites such as Zoobook to work alongside open access websites such as boneCommons.

To join the Zooarchaeological Social Network please email invite@animalbones.org for a link.

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References Cited

Aitchison, Kenneth  
2009b Archaeology and the Global Financial Crisis. Antiquity 83:319

Bradley, Richard  

Darvill, Timothy, and Russell, Bronwen  

Morris, James  

Wyatt, Edward  
For many years, zooarchaeologists have recognized the utility of archaeofaunal data to modern challenges, including informing wildlife management, environmental conservation, and habitat rehabilitation decisions (Lauwerier and Plug 2004; Lyman 1996, 2006; Lyman and Cannon 2004; Martin and Szuter 1999). Increasingly, conservation biologists and managers turn to archaeologists and environmental historians for information on past species ranges, communities, and habitats (Meine 1999). Despite this mutual interest, and given that archaeologists struggle with the dissemination of research results and primary data within our own professional community, the difficulties of reaching audiences and users beyond our disciplinary boundaries are great.

Open-access web-based applications are an important part of the new frontier of knowledge-sharing in the digital world, and provide the best opportunities for interdisciplinary and interprofessional communication and dissemination of research data. In 2004, Pavao-Zuckerman, with colleagues Charles Adams and Rich Lange of the Arizona State Museum, received funding from the Arizona Game and Fish Department⁴ to build a GIS-linked database of zooarchaeological remains from the state of Arizona that could be used to inform modern habitat reconstruction and conservation decisions. The primary result of this project was the creation of “FaunAZ: Arizona’s Archaeofaunal Index” (http://faunaz.asu.edu) (Figure 1).

The original goal of the grant project was to create a stand-alone GIS-linked database that could be used by wildlife managers, biologists, and others to inform modern wildlife conservation issues. Because of concerns about the security of archaeological site locality information, the initial plans for FaunAZ did not include a web component. As the project developed, however, it became clear that the instant and open-access that only a web-based application can provide was critical if the data was to reach our intended audience. Moving toward a web-based and open-access application was only possible with cooperation and collaboration with AZSITE: Arizona’s Cultural Resource Inventory (http://azsite.arizona.edu), and the Arizona Archaeological Records Office. AZSITE already maintains an on-line fee-for-service GIS-linked state archaeological records database that has for many years been a model for other state archaeological records offices. Collaboration with AZSITE permitted the piggybacking of FaunAZ onto the existing AZSITE structure and application. As a result of this arrangement, the project avoided significant duplication of effort in terms of populating a new database with site records and locality information that already exist in AZSITE. Working with AZSITE, however, required permission from, and collaboration with, the AZSITE Board, the AZSITE decision-making body. This was particularly the case given the sensitive nature of AZSITE data. As a result of this consultation, certain restrictions on data access and site locality information were built into the FaunAZ web application.

By working with AZSITE and the AZSITE Board, we constructed FaunAZ to be accessible to archaeologists, the target community of wildlife managers, as well as the general public free-of-charge, and without compromising sensitive archaeological data such as site locality information. FaunAZ can be accessed by anyone with an internet connection without special arrangements or permissions.

FaunAZ: Arizona’s Archaeofaunal Index

FaunAZ includes all vertebrate zooarchaeological remains from all archaeological sites reported in AZSITE within the state of Arizona, exclusive of tribal lands. To date, FaunAZ includes nearly 7,000 records of zooarchaeological remains from over 600 sites in Arizona. In addition to lists of vertebrate species recovered, FaunAZ includes, when available, bone counts (reported as the number of identified specimens, or NISP). The database is searchable by scientific and common name, site name and number, as well as by time.
STORING, SHARING, AND ANALYZING VISUAL DATA: PERSPECTIVES FROM ZOOARCHAEOLOGY

Figure 1: Screen capture of FaunAZ: Arizona’s Archaeofaunal Index, website query.

Figure 2. Back-end SQL server integration of FaunAZ with AZSITE: Arizona’s Cultural Resource Inventory, the state site files database.

The majority of zooarcheological data from the state is published in cultural resource management reports. Populating the FaunAZ database, therefore, required accessing the original hard-copy archaeological reports. Fortunately, the Arizona State Museum serves as the archaeological repository for the state of Arizona, and curates all CRM project reports associated with the Museum’s repository collections. The archaeological records office also maintains reports submitted to that office as part of the state’s archaeological permitting procedures. A small army of graduate students entered data from these reports (and other publications, including theses and dissertations), including taxonomic identification and bone count, using a back-end data entry module designed specifically for FaunAZ with the goal of minimizing data entry errors. Using object-oriented programming, a series of commands limit the taxonomic designations available to the data entry staff based on their most recent input. Via a series of nested, exclusive, drop-down menus (Figure 4), the scientific Class must be chosen first, and then the user is presented with a menu including only taxonomic Orders that belong within that Class, then Families within that Order, and etc., down to the taxonomic level of species.

As mentioned above, working with AZSITE necessitated additional security measures. As much of the intended audience are not archaeologists, it was decided that sensitive archaeological data would not be given in FaunAZ. Spatial data is provided only down to the USGS 7.5’ map quad and only nonlocational information relating to faunal remains is available through FaunAZ. Future development will allow the user to bore down to the section level (1 square mile). Users must subscribe to AZSITE to access more detailed information about individual sites and locality information.

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Limitations and Challenges

Given the scope of the project (nearly 1,800 sites with faunal remains recorded as present), it was not possible to confirm the accuracy of the faunal data reported in FaunAZ. The accuracy of zooarchaeological analysis is influenced by the skill and training of the individual researchers who contributed the original data, but no attempt was made to confirm the taxonomic identifications made by this large community of faunal analysts.

The goal of the project was to be comprehensive within state geographical boundaries exclusive of tribal lands, but this was far more idealistic than realistic. A surprising number of archaeological sites, particularly those investigated before the formation of a statewide archaeological records office, are not currently recorded in AZSITE. We relied on institutional memories, and referrals from faunal analysts statewide, to track down faunal assemblages not reported in AZSITE. As a result of our efforts, many new sites were also added to the main AZSITE application. We continue to receive (and welcome) input from users who know of unpublished faunal reports that are currently missing from our database.

Taxonomic Limitations

Given time and funding constraints, we were only able to include vertebrate (mammals, birds, herpetiles, and fish) remains in the FaunAZ database. No invertebrate remains are included, although the project could be extended to include invertebrate remain with additional funding. The database also only includes archaeological remains—paleontological or other remains not associated with past human activities were not included in FaunAZ.

The vagaries of changing taxonomic designations were also problematic for FaunAZ. Many older reports of zooarchaeological materials use taxonomic designations that are no longer valid. The preferred taxonomy used in FaunAZ is that employed in ITIS, the Integrated Taxonomic Information System (http://www.itis.gov). However, for the convenience of users, FaunAZ also recognizes commonly used, but currently invalid, synonymous scientific designations. ITIS was also used as the source for accepted common names.

Diverse Audience

Because FaunAZ was intended to be used by non-archaeologists, it was important to explain the limitations of archaeological data to an untrained audience. We use a disclaimer statement on the FaunAZ website to inform users about several key issues, including the movement of exotic species by humans long distances in the past, and the site discovery bias that is inherent in interpreting data collected primarily through cultural resource management activities. We urge users that, before these data are employed in policy or practical applications, they should consult with archaeologists who can help distinguish human effects from natural species occurrences.

Final Thoughts

In addition to building the FaunAZ database and search interface, one goal of the grant project was to demonstrate the utility of zooarchaeological data to conservation biology and management decisions. Our case study was the Homol'ovi cluster, a community of Ancestral Puebloan villages located on or near the Little Colorado River in northern Arizona. Faunal remains from these communities are indicative of extensive riparian and wetland habitats that
Figure 5. Recovery of razorback sucker (Xyrauchen texanus) zooarchaeological remains as recorded in FaunAZ.

Arizona Archaeological Records Office recently went live with AZSITE Public (http://azsitepublic.asu.edu/), a free “public” version of AZSITE that, like FaunAZ, protects sensitive site locality and other archaeological information while providing public access to archaeological research results.

The success of the FaunAZ project hinged on collaboration and consultation with individuals who brought a diversity of skill sets and interests to the table. Throughout the project we relied on archaeologists, wildlife managers, AZSITE Board members, experts on computer programming and database design, GIS consultants, and web designers. The project took a great deal of time, and funding, but it is, fundamentally, a system that could easily be replicated and, more importantly, improved upon in other regions in the service of the dissemination of archaeological research.

References Cited
Lauwier, R. C. G. M., and I. Plug (editors)  
Lyman, R. Lee  
Lyman, R. Lee, and K. P. Cannon (editors)  
2004 Zooarchaeology and Conservation Biology. The University of Utah Press, Salt Lake City.
Martin, P. S., and C. R. Szuter  
Meine, C.  

Notes
1. AZGF Heritage Fund Grant #I05009, awarded to B. Pavao-Zuckerman, R. Lange, and E.C. Adams, Arizona State Museum, University of Arizona.
2. The back-end SQL server FaunAZ database, integration with AZSITE, back-end user entry module, and front-end manager entry module were built by John F. Chamblee with input from Rick Karl, John T. Murphy, and Zhongxiang Xia.
3. Including Ashley Blythe, Dan Broockmann, Elisabeth Cutright-Smith, Melanie Dedecker, Kacy Hollenback, Lauren Jelinek, Lauren Milligan, Meredith Reifschneider, Chris Roos, and AJ Vonarx.
NATIONAL INVENTORY OF NATURAL HERITAGE WEBSITE RECENT, HISTORICAL, AND ARCHAEOLOGICAL DATA

Cécile Callou, Isabelle Baly, Olivier Gargominy, and Elodie Rieb

Officially designated as “Reference Centre for Nature and Biodiversity” in France, the National Museum of Natural History (Paris-France) is responsible for the scientific and technical coordination of the natural heritage inventory. The natural heritage inventory is an information system that displays online information on the natural heritage (http://inpn.mnhn.fr; Figure 1)—animal and plant species from past to present times, habitats, protected areas, and geology heritage—in metropolitan France and overseas territories—French Polynesia, Wallis & Futuna, New Caledonia, French Guiana, French West Indies (Martinique, Guadeloupe, St Martin & St Barthelemy), St Pierre et Miquelon, Reunion Island, Mayotte, and French Southern, and Antarctic Territories. Data come from various databases held at the Paris Museum or from partners such as scientists, national and regional authorities, nonprofessional naturalists and nature protection organizations. Archaeozoological and archaeobotanical inventories of France (12AF) database is one of these databases, dedicated to bioarchaeological data: zooarchaeological data—mammals, birds, fish, amphibians, reptiles, marine, and terrestrial molluscs, arthropods, insects, and even worms and parasitic microorganisms—and archaeobotanical data—mainly charcoals (anthracology), seeds and fruits (carpology), but also pollens (palynology). This association between recent, historical, and archaeological data in the same website is currently a unique case in the world.

To manage this important information without being overwhelmed, the National Museum of Natural History built a database to consolidate data by taxonomic, geographic, or administrative registers. The establishment of common reference tables is one of the cornerstones that allows communication between these various sources of geographic, biological, and contextual information. Specific frames of reference are regularly updated, especially relating to chronology, taxonomy and geography. With this system, it is possible to produce syntheses, distribution maps with different resolution, ecological statistics, and factsheets for specialists and the general public.

This project has the required collaboration between scientists and computer specialists (database managers, webmasters, specialists for geographic information systems, developers, modelling specialists, etc.). The Natural Heritage Service (Service du Patrimoine Naturel; director - J.-Ph. Siblet) is a service of the National Museum of Natural History specialized in data management. It is responsible for the development and sharing of methodological tools primarily designed for the French government, local authorities, protected area administrators, and NGO. On the one hand, it collects data on species, geological areas, or objects, and on the other hand to monitor the state and evolution of biodiversity. It coordinates and leads the information collection network for the natural heritage inventory and validation of data manages of the national natural heritage inventory and the development of summaries and repositories and making them available to various recipients in suitable formats.

Why Gather both Ancient and Recent Data?

To understand biodiversity and better manage its future, it is necessary to know its recent evolution in connection with the development of human societies. Animal bones and plant remains from the last twenty millennia are an original source of information on the history of biodiversity and its interaction with human societies. When compared with our knowledge of the diversity of current populations, they highlight past extinction scenarios and biological invasions, in particular during the Holocene period, when the influence of climatic factors took second place to human factors. Fur-
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Figure 1. Homepage of the National Inventory of Natural Heritage website: http://inpn.mnhn.fr.

ther, they provide information not only on the presence, absence, or abundance of species, but also on the way they have been used by human societies. However, collecting both past and present data together is rarely realized, and most databases dealing with biodiversity treat only the last few hundred years, as in "classic" Biodiversity databases, or only the last few 300 years for specimen collection databases. Thanks to I2AF database, we can understand biodiversity through an extended span of time, from the Upper Palaeolithic to present day.

Bioarchaeological information has considerably increased during the last twenty-five years thanks to efforts engaged by several institutions of research (French National Centre for Scientific Research —CNRS, Universities, National Museum for Natural History, with the support of the Ministries of Culture and Research), in the interface of the human Sciences and the life Sciences, and thanks to the important development of the rescue archaeology, particularly through the work of the French National Institute for Preventive Archaeological Research (INRAP).

For ancient data only, the website synthesizes of three recent national bio-archaeological programs¹ (Callou et al. 2009). This work was possible thanks to institutional partners and, above all, bioarchaeology specialists. Other new programs will enrich the system in the future.

The I2AF Database as a Heritage Collection

Since the 1980s, the important development of rescue archaeology has generated the production of many reports rich in bioarchaeological data but hardly accessible to researchers. Kilometers of archives of “grey” literature exist inside various archaeological services, a very small number of which are published. The risk that this literature will disappear is quite worrying. For these reasons, it was absolutely urgent to collect these data, to benefit from new technologies, to preserve it for the long-term, and make it available for all potential users.

Since 2006, I2AF database has been integrated as an official collection of the National Museum of Natural History with a nominated curator (currently: C. Callou). Like the Museum collections, this database thus became a collective, long-term database independent of all research bodies; each item of information can be easily traced and is always linked to its originator or program. This exceptional system brings research units to become potential users of this tool, in the same way as any other French or foreign user. This status ensures access to the data inline with intellectual property law and scientific practices. New or sensitive data, such as data from grey literature, are protected for a period of 5 years.

In the same period, a partnership agreement between the Museum and the French Ministry of Culture and Communication (MCC) was signed and this agreement facilitates access to all archaeological literature (excavation reports). Furthermore, I2AF and the MCC’s archaeological heritage database (PATRIARCHE), which contains information on all the archaeological activity in France, can already inter-operate.

A Brief Description of the I2AF Database

The database contains information about the site—geographical information, type of archaeological operation, name(s) of the person(s) in charge of archaeological excavations, date(s) of the excavations—and information about the structures or stratigraphic units in which animal bones and plant remains were found (description, elements of dating, cultural, climatic and physico-chemical period, name(s) of the person(s) in charge of the bioarchaeological study). Further information such as the location of the material collected and details on the fauna/flora spectrum, e.g., the absolute frequency of each taxon, is listed in the inventory.

Officially created in 2004, the database contains more than 4,500 archaeological sites and 44,000 archaeological contexts. The oldest period is currently the Upper Palaeolithic, but broadening the chronological period is possible.
At present day, all the work is concentrated on metropolitan France but we have recently started with some overseas territories (the French West Indies). The quantity of data for fauna and flora is more than 150,000. There are 2,743 animal species, dominated by birds (29 percent), mollusks (25 percent), mammals (18 percent), and insects (16 percent), but by the more classical “number of identified skeletal parts (NISP),” mammals dominate (69 percent), followed by birds (16 percent), mollusks (6 percent), and fish (4 percent). There are 1,170 plant species. More than 4,500 bibliographic references have been collected and recorded, of which 85 percent belong to the grey literature (academic works, archaeological reports, zooarchaeological, or archaeobotanical reports). These references have therefore rarely been used in scientific publications or exhibitions.

**From the I2AF database to the INPN website**

Only a portion of the I2AF database information is present on the INPN website, concerning species and subspecies. For a full data access for research purposes, a query can be sent to the curator at this address: http://colhelper.mnhn.fr. On the INPN website, two access levels exist: consultation of mapping by department (administrative region in France) and by chronological period (Palaeolithic, Neolithic, Iron Age, and so on) and texts about species are free access for all visitors; a login access for scientists, under specific conditions, gives access to more details about archaeological sites, especially all elements of dating and not only chronological periods.

The homepage of the website presents several texts about biodiversity—news, programs, presentations—and access to menus: information, search, assessments, and downloads. Research can be done for a species, by entering the scientific name, the vernacular name, or only a part of the name, and also at the various French administrative subdivisions (region, department, and district) and protected areas.

The default page for each species, presenting the species distribution at the department level, directly integrates data from the whole database, for both the past and present. For each species (as for the wolf; Figure 2), an access to several tabs exists: taxonomy, protected, or regulated texts (with direct access to all the laws and regulations for the species selected: national legislation of national scope, of regional scope or of departmental scope, European community texts and international conventions), repartition data, ecological statistics, and factsheet. A specific tab is devoted to past data: only archaeological data at the moment, but soon also, historical data.

In the “History and archaeology” tab, the timeline shows the presence of species according to each period. In the selected example, the extinction of reindeer *Rangifer tarandus* (Linnaeus 1758) on the French metropolitan territory is obvious from the Mesolithic (Figure 3). On this map gray dots correspond to the archaeological sites analyzed; the colored dots indicate the presence of the species. Thanks to checkboxes, one or more periods may be selected. A click on a dot allows one to obtain some information on the archaeological site(s) present on the territory of a district, such as a general description of the site (name, localization) and a diachronic synthesis of animal and plant species identified within the site. A login allows more complete access.

Technically, numerous developments of the site are in progress. This will allow, for example, the overlapping of distribution maps of two species (plant, animal, or mixed), but also the superposition of maps illustrating the river system or, essential for the prehistoric data the maximal limit of frozen soil.

Scientifically, the consequences of this important collection of ancient data are essential. It allows discussion of the national archaeological research policy from the perspective of biodiversity data, by the underlining of a lack of study for some regions, for some periods or even for some taxonomic groups. It also indicates new themes of research, at the national and European level.
The site has deeply changed the perception of the history of biodiversity, on the one hand of naturalists sensu lato, and on the other hand of bioarchaeologists. It no longer seems to be a succession of moments, with intervals for periods less studied, but a continuum of phenomena. With this project, a true linking of disciplines exists.

Acknowledgments. Such a work of inventory is never made alone. We thank all the archaeologists for their participation and the floral and faunal specialists for their work. This publication is a result of the session Archaeozoology in a Digital World: New Approaches to Communication and Collaboration of the 10th ICAZ 2010 conference (Paris, 23-28 August 2010).

References Cited
Callou, Cécile, Isabelle Baly, Cholé Martin, and Elsa Landais 2009 Base de données I2AF, Inventaires archéozoologiques et archéobotaniques de France. Archéopages 26:64–73.

Notes
1. Authorship of providers is always linked to corresponding data. In this way, it is possible to retrieve data by program.
2. The important shift is explained by the fact that archaeobotanical data were collected only recently (since 2008).
VIRTUAL ZOOARCHAEOLOGY OF THE ARCTIC PROJECT (VZAP)

Herbert D. G. Maschner, Matthew W. Betts, and Corey D. Schou

Archaeological faunal data are becoming critical to investigating global change, biodiversity, endangered species, resource management, and other modern topics of applied ecological sciences (e.g., Lyman 1996, 2006; Lyman and Cannon 2004; Maschner et al. 2008, 2009). Yet this growing ability for zooarchaeologists to contribute to some of the world’s most pressing questions is hampered by inadequate, widely distributed comparative collections, oftentimes with proprietary access, or which are located in regions too distant for many scholars to access. This is especially true in the arctic where the handful of adequate collections are inaccessible to many scholars (because of geography) and because of the marine mammal protection act, the endangered species act, and the migratory waterfowl act, cannot be easily or even morally replicated elsewhere. In an attempt to democratize science, to make access to a comprehensive reference collection possible for researchers from any field in any location, and to bring research access to students of archaeology and residents of the arctic, the National Science Foundation Office of Polar Programs funded the Virtual Zooarchaeology of the Arctic Project (VZAP) in two awards totaling $1.33 million (NSF ARC-#0808933 2008-2011; NSF ARC-# 1023321 2010-2012). VZAP is a collaborative project between Idaho State University and the Canadian Museum of Civilization, and with the critical support of the Burke Museum at the University of Washington.

The ultimate goal of the project is to provide an online research tool for the identification of vertebrate material found in northern archaeological sites. VZAP is designed specifically as an aid to zooarchaeologists—a comprehensive reference to the many limited zooarchaeological reference collections throughout North America. It is to be used to fill in holes in taxonomic representation and individual diversity that exist in many collections, while providing a valuable anatomical reference that can be used by students and teachers. The project consists of three main components: (1) laser scanning of complete vertebrate skeletons to develop high-resolution interactive 3D models, (2) high-resolution photography of complete vertebrate skeletons from multiple anatomical positions, and (3) a media-rich website to allow the dynamic exploration of the virtual reference collection. We have had considerable success toward these ends as the database is now populated with 79 specimens from 67 taxa, with nearly 12,000 images and over 3000 3D models. The alpha version of the website went live in the spring of 2010 (http://vzap.iri.isu.edu/) and now has been used by over 1,500 unique IP addresses, resulting in nearly 500,000 page and image downloads. A full description of VZAP and its science can be found in Betts et al. (2011).

Methodologically, VZAP requires both high-resolution digital images and 3D laser surface scans (Figure 1). The 3D scans provide the details of shape and morphology, while the digital photographs provide the texture and minute structures (e.g., nutrient foramina, haversian canals) that cannot be easily captured with modern scanning technology. To increase the realism and usability of the models, we use texture mapping to merge the two forms of media into a single 3D image. Depending on the scanner technology used, accuracy approaches ±10 microns for the final 3D model output (Figure 2). Our imaging pipeline for the development and presentation of the faunal element images requires a number of stages:

1. A specimen is catalogued to record its disposition and life history data. For example, data are recorded as to known age, sex, life history, location of death, collection location, curation history, and ownership.

2. An element is then identified, weighed, and photographed. All photographs are captured at a resolution of 3072 x 2048 pixels using a macro lens. Six to twelve angles representing standardized anatomical views are taken.

3. Every individual digital view is than transferred to a data-
base created for each specimen and is then coded as to symmetry (side) and anatomical orientation.

4. A 3D model is produced using laser scanning techniques. In the past we used NextEngine and Cyberware model scanners, but the current phase of the project uses a Konica Vivid 9i laser scanner and medical imaging (CT scanning). A single element might require up to a dozen individual scans for a complete image. The scans are then merged into a single solid model. Basic metric data for each specimen is automatically calculated at this time.

5. A texture map is created by overlaying the 2D digital images on the 3D model. This process creates the realism critical to the creation of the final digital versions of each element. Under normal conditions six photographs are sufficient, but for extremely complex elements, such as crania, many more photographs are necessary for texture mapping to attain complete coverage.

6. Finally, we render our models into a distributable file format, carefully controlling the lighting intensity and angle, reflection properties of the model material, and its initial orientation. The models are distributed in 3D PDF format, which can be used by anyone with a modest computer and the popular Adobe Reader plug-in. The 3D PDF format has several advantages to web-based viewers, including the ability to change render and lighting modes, conduct complex measurements, and add morphological labels and annotations. We have capitalized on the latter feature to produce a series of instructional models that provide detailed labels for anatomical features and landmarks for the mammalian skeleton. Similar instructional series are planned for fish and birds.

The images and models are then uploaded to our custom hierarchical and relational database system. In addition to our proprietary database, we have developed a custom graphical user interface for the website, the Dynamic Image Engine (DIE). The DIE is both a database query tool and a media delivery device. Because zooarchaeologists primarily work by visual comparison of shape, size, and texture, we have designed the DIE to stream hundreds of high resolution images to an interactive “element wall” which incorporates “deep zoom” magnification technology. To support our deep zoom capabilities, VZAP implements a custom compression technology that seamlessly streams progressively higher resolution images as the user magnifies the viewing window. To facilitate this feature, our database automatically generates a low and a medium resolution file when we upload a high-resolution image. Selecting an image with the mouse displays an interactive menu where the user can view the complete taxonomy and all attached metadata, call-up additional images of anatomical orientations, or other elements from the same species or related species, and download all related 3D models (Figure 3).

We believe the Dynamic Image Engine represents a new way to interact with a visual media collection. Because images are the primary gateway to access and manipulate the collection, it negates the need to use tedious text-based lists or tables with links to media. For zooarchaeologists, the primary users of the database, it provides a more traditional and natural experience because it mimics the way a real faunal reference collection is stored and uses those familiar visual cues as a means of navigating the system. In essence, the element wall is designed to imitate the visual experience of working with boxes and trays of bones in a real faunal reference laboratory. Furthermore, the images can be organized in any combination of taxa, elements, ages, symmetries, and other categories. This allows for the rapid creation of multiple specialized synoptic reference series, which can greatly increase the efficiency of taxonomic identifications.

Figure 1. VZAP scanning technician, Nicolas Clement, inspects edits 3D models of newly scanned elements.

Figure 2. A complete 3D model of a sea lion humerus (Eumetopias jubatus) after the texture map has been applied in ZBrush software.
Like all scientific reference collections, the intellectual merit of VZAP is tied to its ability to facilitate research and education. As demonstrated by our workshop and survey results (http://vzap.iri.isu.edu/ViewPage.aspx?id=249), VZAP addresses real and debilitating shortcomings in the ability of northern researchers to conduct analyses on osteological collections. We believe VZAP will enable southern archaeologists and other researchers who study osteological reference collections to conduct their research more accurately and efficiently. This will facilitate studies into the region’s past and will directly result in increased ability to reconstruct cultural, ecological, and palaeoclimatic regimes in northern regions. Furthermore, VZAP will provide an enduring virtual library of northern biology that will last for decades. It will directly contribute to training of arctic-focused zooarchaeologists and vertebrate biologists, and will assist these researchers in conducting analyses that may otherwise have been impossible for them to undertake. Put simply, VZAP leaves a legacy of infrastructure that will continue to benefit northern research and education well into the future. Beyond these important contributions to northern research, this project will result in the first anatomically comprehensive virtual vertebrate reference collection ever created. The significance of such research is in the new ways in which researchers, teachers, and students will interact with the virtual collection.

We recognize that, fundamentally, we are proposing a new way of conducting and teaching zooarchaeological and vertebrate analysis. Our preliminary interaction with the collection, and our workshop experiences, suggest that such a project has the potential to revolutionize the way that zooarchaeologists, paleontologists, and vertebrate biologists teach, learn, and conduct their research. We are surprised by the quick adoption of the technology in zooarchaeology classrooms, where the models and images have been used to discuss vertebrate anatomy with a level of interactivity previously unavailable. We have already had numerous requests to expand the collection to include domesticates, southern and exotic taxa, and extinct species from around the world.

The development of virtual repositories and museum collections is only in its infancy. The types of protocols we are developing in this project will aid the greater academic and museum communities as they attempt to broaden access to their collections and allow non-invasive study of rare, fragile, or culturally sensitive artifacts and materials. In short, while the project is firmly focused on enabling research, we are also developing a new way for casual learners to interact with and explore museum collections, with a level of detail and freedom not possible until recently. Returning to the primary objective of VZAP, to enable, promote, and teach northern zooarchaeology, we submit that this type of infrastructure will also contribute to faunal research conducted elsewhere in the world by providing an educational resource and reference specifically devoted to vertebrate osteology and zooarchaeological analysis, and creating aids to the identification of taxa which occur both in northern and temperate regions. More generally, we hope that VZAP promotes much needed interest in developing virtual archaeology and museum collections and the integration of disparate, interdisciplinary, data into single searchable archive.

References Cited

Lyman, R. Lee
Lyman, R. Lee
Lyman R. L., and K.P. Cannon, editors
Maschner, H. D. G., M. Betts, K. L. Reedy-Maschner, and A. Trites

Note

POSITIONS OPEN

POSITION: ASSISTANT OR ASSOCIATE PROFESSOR IN ANTHROPOLOGY OF THE CITY (TENURE-TRACK/TENURED)
LOCATION: DETROIT, MICHIGAN
The Department of Anthropology at Wayne State University is proud to announce a newly funded faculty hiring initiative focusing on the Anthropology of the City. We will be hiring three additional faculty members in the current academic year. We invite applications for a full-time, tenure-track or tenured anthropological archaeologist specializing in historical and/or urban archaeology at the Assistant or Associate level. Regional and theoretical specialization is open, with a preference for candidates with interests that complement those of existing faculty, for candidates interested in research and teaching in a four-field environment with a strong applied focus, and particularly for candidates interested in developing a research agenda in the Detroit area linking to the Gordon Grosscup Museum of Anthropology. Experience in museum anthropology, community-based research, CRM, or public archaeology will be viewed positively. This faculty member will be expected to maintain an active externally funded research program, to involve undergraduate and graduate students in his/her research, cultivate extensive community partnerships, and facilitate student practicums and internships. The teaching load is two courses per semester. The successful candidate will teach undergraduate and graduate courses in anthropological archaeology, historical archaeology, and other areas of specialty. Because this is a newly created position, we will begin reviewing applications on January 10, 2011 and will continue reviewing these until a successful candidate is identified. Our formal online application process is now posted. For preliminary inquiries, you may contact us at anthropology-ofthecity@wayne.edu or call Marilyn Moore (313-577-6277). Please apply at: jobs.wayne.edu/applicants/Central?quickFind=192419. To apply, please submit a curriculum vita, letter of application, a writing sample of no more than 10,000 words, and the names and contact information for four references by January 10, 2011. We will continue reviewing applications until a successful candidate is identified. WSU is an equal opportunity/affirmative action employer.

POSITION: TENURE-TRACK ASSISTANT PROFESSOR IN MARITIME ARCHAEOLOGY
LOCATION: GROTON, CONNECTICUT
The Anthropology Department, in the College of Liberal Arts and Sciences at the University of Connecticut, seeks to hire a tenure-track assistant professor in maritime archaeology to begin August 23, 2011. Duties will include teaching, research, and service. The successful candidate's primary academic appointment will be at the Avery Point campus with the possibility of work at UConn's main and/or other regional campuses across the state. UConn Avery Point is located on Long Island Sound and offers a variety of undergraduate programs to a diverse student population, as well as a graduate program in Marine Sciences. Faculty research at UConn Avery Point is primarily oriented toward the ocean and things maritime or marine. UConn maintains a small but active research diving program at Avery Point, and the university is an institutional member of the American Academy of Underwater Sciences. For a detailed description of UConn Avery Point and its programs, please visit http://averypoint.uconn.edu/avery_point/index.php. The new faculty member will make an active contribution to the Maritime Studies Program and the Department of Anthropology. She or he will teach undergraduate courses in the Anthropology major, the Maritime Studies major, and the Maritime Archaeology minor, and will also have the opportunity to carry out graduate teaching and training in collaboration with faculty at both the Avery Point and Storrs campuses. Geographic and temporal focus is open. Minimum Qualifications: The successful candidate will have an active research program in archaeology related to the maritime world, that is, to the material remains of people and their activities on, under, near, or associated with the sea. Geographic and temporal focus is open. Other minimum qualifications include the completion of all requirements for the Ph.D. in Anthropology or a related discipline by the start date of employment; a strong record of research and publication; and the ability to teach courses in anthropology, archaeology, and maritime studies. Equivalent foreign degrees are acceptable. Preferred qualifications: Ph.D. in Anthropology or a related discipline in hand at the time the application is submitted, a strong record in obtaining research funding, and demonstrated ability to contribute through research, teaching, and/or public engagement to the diversity and excellence of the learning experience. This is a nine-month, tenure-track position that will report to both the Anthropology Department Head and the Director of the Avery Point campus. Salary will be commensurate with background, qualifications, and experience. Applicants should visit Husky Hire at www.jobs.uconn.edu to upload (1) a letter of application, which should include a statement describing research plans and teaching interests; (2) a curriculum vita; (3) selected scholarly papers and publications; and (4) the names and contact details of three referees willing to provide letters of reference. The University of Connecticut is an equal opportunity/affirmative action employer, and actively solicits applications from under-represented groups, including minorities, women, and people with disabilities. Applications received by January 15, 2011 will be given preference in the screening process. The University of Connecticut is an EEO/AA employer. Search # 201131.
Settlement and Subsistence in Early Formative Soconusco: El Varal and the Problem of Inter-Site Assemblage Variation

Richard Lesure
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ISBN: 978-1-931745-78-9 (cloth), 978-1-931745-79-6 (paper)

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