Expanding Archaeology's Digital Frontier: Building and Testing a Tablet-Based Recording Module for Archaeological Research in Peru

I-Team UTRA Proposal - Parker VanValkenburgh - Assistant Professor of Anthropology

Background, Significance, and Synopsis of Research Goals

This application seeks funding to support collaborative research with four Brown University undergraduate students to develop, test, and deploy a customized digital recording module for archaeological laboratory research. Designing effective data recording systems has always been one of the greatest challenges of archaeological fieldwork. Windows for field projects are short; research teams are often large, with diverse levels of experience; and a good deal of archaeological data description relies on subjective interpretation of variables such as soil color and artifact forms and decoration. Yet the care with which archaeological data are recorded is also vital: contexts can only be excavated a single time, and so the process of field data collection can never truly be replicated. Similarly, materials studied in museums and laboratories may either degrade over time or become inaccessible due to external factors ranging from changing government regulations to social and political unrest.

During the past five years, mobile digital recording systems have provided novel solutions to some of these challenges, helping archaeologists improve both the efficiency of data collection and the integrity and richness of our datasets (Averett et al in press). Since 2014, I have partnered with a team of researchers at Macquarie University (Australia) that has developed one such solution – the Federated Archaeological Information Management System (FAIMS). FAIMS is an <u>open-sourced</u>, offline, multi-user platform for structured, free-text, geospatial, and multimedia data that runs on Android devices. Its core code handles synchronization of data among multiple users, versioning, backup, export, flow control and other automation. In turn, the FAIMS team works with research projects to tailor core code using XML "definition documents" that create customized "modules" that accommodate specific data and workflow requirements.

In 2014 and 2015, my team of 12 field archaeologists and 20 local workers deployed a FAIMS module called PAZC (Proyecto Arqueológico Zaña Colonial) to record data during our excavations at the *reducción* (colonial planned town) site of Carrizales, which have focused on understanding the impacts of Spanish colonial forced resettlement on the site's indigenous population (Figures 1 and 4). Excavators recorded both textual and photographic data using tablet computers, which synched nightly over WiFi with a server in our dig house. I was astonished by the results. Data integrity improved dramatically, through the use of drop-down menus and constrained fields; required fields all but eliminated the problem of missing data; and the project ultimately saved time by avoiding double data entry into spreadsheets.

Support from an I-Team UTRA grant would enable me to mentor a team of Brown undergraduate students in the development of a similar module for recording data from excavated artifacts in our field laboratory. Following three intensive field seasons of excavation at Carrizales, the Proyecto Arqueológico Zaña Colonial (PAZC) now faces the daunting task of analyzing the 50,000 ceramic sherds and thousands of other artifacts during a six-week laboratory field season in summer 2016. Based on my previous experience with FAIMS, I believe that a module designed for artifact analysis would greatly improve the efficiency of our data collection and enhance the consistency and richness of the resulting data. However, I do not possess the full range of skills and knowledge required to build such a tool by myself.

Currently, the vast majority of archaeological projects (including the PAZC) generate data on the form and decoration of artifacts by having team members thumb through "codebooks" that are filled with long lists of often confusing labels and then enter these labels directly into spreadsheets (Figures 2 and 3). A FAIMS module would simplify this process, directly integrating illustrations and photographs of representative artifact forms, decorations, and technological characteristics into scrollable lists (like those show in Figure 4), thereby eliminating the need for codebooks and allowing up to seven different students to work in parallel on our project tablet computers. Each tablet would sync to our project FAIMS server, where data will be aggregaged and exported to CSV files.

In addition to serving as a useful tool within the scope of a single archaeological research project, this module and the process of developing it will provide our research team with opportunity to contribute to the growing scientific literature on mobile recording platforms in archaeology. To date, none of the dozens of projects that have employed FAIMS has developed a module for artifact analysis. To systematically examine the performance of our new tool, we will conduct an experiment comparing the efficiency of data entry, accuracy of data output, and user experience to the project's previous, code-book based system, with the help of project members from Peruvian universities. We will then prepare a manuscript for co-publication in a peer-reviewed scientific journal in fall 2016 based on the results.

The Research Team

Interdisciplinary collaboration among a team of students with diverse academic backgrounds will be essential to the successful completion of this project. My ideal team of student collaborators would include at least one student with significant experience in computer programming (including knowledge of Python and XML), who would serve as the module's lead developer. While some elements of our codebook have already been drawn (see figure 2), we will need to produce new drawings and photographs of different types of ceramic forms, decoration, and technological characteristics, requiring help from a student who has good command of hand-drawing as well as digital design. To carry out evaluations of user experience and performance characteristics, the team would also ideally include a student in the social sciences with interest in human-computer interaction and/or the design and execution of product trials. Finally, the team would benefit from the participation of an archaeology student with significant field experience, to provide assistance in the module's design and testing.

Because many of our Peruvian research partners do not speak English, it will be essential that our recording module contains both Spanish and English labels for artifact features. Therefore, it is crucial that at least one member of our interdisciplinary research team (other than myself) be fluent in Spanish. If possible, I would also prefer that all team members are at least conversant in the language, as we will be working closely throughout the project with Peruvian student researchers.

Mentoring Strategies, Research Environment and Research Plan

Since beginning the PAZC seven years ago, I have had the pleasure of mentoring two dozen Peruvian and American students on the project and I have found that they are most fulfilled (both academically and personally) when they are treated as full scientific partners on a multinational research team, rather than as field school students or volunteers. The crux of my mentoring philosophy will be to treat the UTRA team as junior colleagues and collaborators, while also providing them with the academic and social support necessary to learn about new areas of research and to adjust to life in foreign country. Our work will begin in Providence, focusing on the development of our recording module, as well as basic training for laboratory and field research. We will begin with a two-day orientation and planning session, held in the Brown Digital Archaeology Laboratory (BDAL) in the department of anthropology. The orientation will begin with discussions of a series of articles and book chapters that address the methods and aims of archaeological research. We will also read and discuss a forthcoming edited volume on mobile recording systems in archaeology (Averett et al forthcoming), which includes an article on the PAZC's deployment of FAIMS (Sobotkova et al forthcoming). We will then examine the PAZC's current recording system and lay out a plan for module development. During week one, the team will complete wire-framing; during week two, we will complete an early version of the module; and during week three, we will test and refine it. Throughout this time, I will meet with the UTRAs for one hour each weekday, followed by one-on-one, follow up sessions to discuss project progress and personal goals. Each student will be provided with workspace in the Digital Archaeology Lab. Because my office is directly opposite the lab, I will also be available on a daily basis to consult with students outside of our official meetings.

Following development and initial testing of our module, the team will travel to Lima, Peru to begin laboratory research. Project members will live in a shared house in a safe district of the city, Miraflores, where they will be joined by the Project director and four foreign Ph.Ds also working on the project. The project laboratory will be housed in the same building, and students will carry out laboratory research for approximately eight hours a day (9am-6pm, with a break for lunch), five days a week. Weekends will feature informal trips to archaeological and historical sites in Peru. Throughout this time, I will be working side by site with the research team in the lab, and we will be joined on a daily basis by up to ten Peruvian undergraduate and graduate students, all based in Lima. We will conduct experimental testing of the module and user interviews over the course of five days at the beginning of the laboratory season. Students will then be integrated into the larger archaeological research team, working side by side with our Peruvian collaborators while also beginning to work up the results of our experiments and interviews. Following completion of laboratory research, in week 9, we will attempt a novel deployment of our module, taking tablets to the field to test the system out on surface ceramics at the sites of Nieve Nieve and Avillay, two hours to the east of Lima. Finally, in week 10, we will begin to draft a research paper on the results of our module deployment, targeted for publication in a journal such as *Advances in Archaeological Practice* or the *Journal of Archaeological Science*. If the research team is able to continue in fall 2016, I hope to request a

Renewal so that we will be able to finish writing and submitting our co-authored paper for review.

Schedule
June 6th-26th: Stage 1 – Module Development in Providence
June 27th – July 4th: Stage 2 – Module Testing Experiments, in Lima, Peru
July 4th – July 31st: Stage 3 – Laboratory Research in Lima, Peru
August 1st-8th: Stage 4 – Module Deployment at Nieve Nieve and Avillay, Peru
August 9th-15th: Stage 5 – Drafting of Research Results in Lima, Peru
Fall Semester 2016 – Possible Renewal to complete co-authored research paper

Works Cited

Averett, J. M. Gordon, & D. B. Counts (Eds.). forthcoming. *Mobilizing the Past: Recent Approaches to Archaeological Fieldwork in the Digital Age:* University of North Dakota Digital Press in conjunction with Mukurtu 2.0 (Center for Digital Archaeology).

Sobotkova, A., Ross, S., Ballsun-Stanton, B., Fairbairn, A., Thompson, J., & VanValkenburgh, P. forthcoming. Measure twice, cut once: cooperative deployment of a generalised, archaeology-specific field data collection system. In E. W. Averett, J. M. Gordon, & D. B. Counts

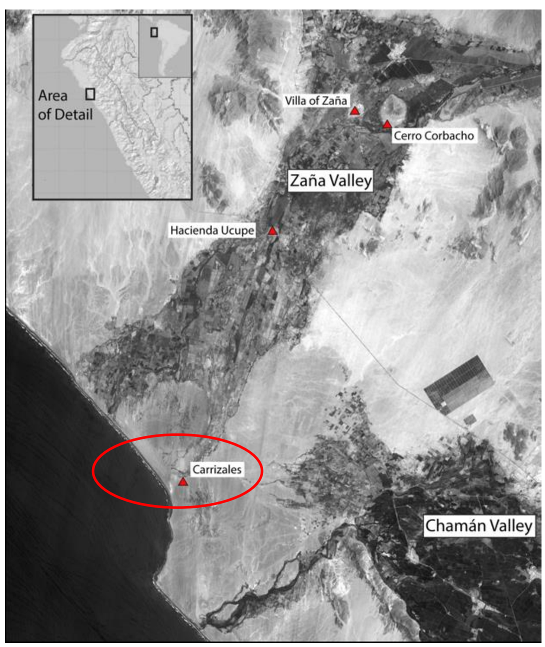

Figure 1 – Map showing location of Carrizales within Peru and the Zaña Valley. Backround is 2007 Aster Satellite Image, a Product of NASA.

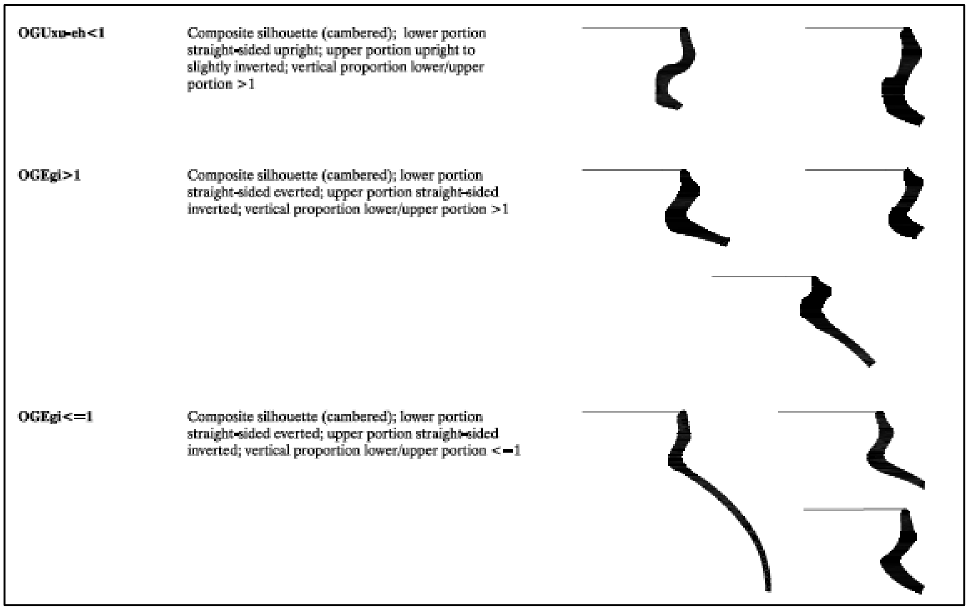

Figure 2. An example of rim profiles the project ceramic codebook. Codes in left column, description in middle column and profile in right column.

#_Art	Tipo	Cat_Gen	Estilo	Periodo	Cat_Fun	Form_G(	Perf_Bord	Cocc	Cond_Sp	Cond_Sp	Dc_Tec_	SLIP	Wt	D_Bord
2	N	OTH	UKN	UKN	NOB	UKN	OGEgi<=1	CN	NE				7.66	
3	O	WCW	UKN	UKN	NOB	UKN		CO	NN		PA		6.98	
4	O	OTH	UKN	UKN	NOB	UKN		CN	NN		PA		2.56	
5	N	PIP	INK	LHC	NOB	UKN		CN	NN		PA	BLB	1.78	
6	RY	OTH	UKN	UKN	NOB	UKN		CR	NN				4.86	
1	RN	WCW	MCL	UKN	NOB	CNR	OG-CHE-Uge>>1	CO	NN		MO		79	10
2	O	PIP	INK	LHC	NOB	UKN		CN	WW		IM		13.9	
1	O	BOT	COL	ECO	STO	TTE		CO	WW				96.04	
1	H	OTH	UKN	UKN	NOB	HMS		CO	SS				3.98	
1	O	VID-PANP	COL	ECO	NOB	UKN		CO	NE		VID		3.2	
2	R	OTH	UKN	UKN	NOB	UKN	NOB	CO	EE				5.8	NOB
3	R	OTH	BBW	UKN	NOB	UKN	SXEH	CN	EE			BLB	7.2	13
4	O	BOT	COL	COL	STO	TTU		CO	EN			CRM	62.5	
1	R	OTH	UKN	UKN	NOB	UKN	SCU	IU	EE		PA		8.5	22
1	O	PAL	UKN	UKN	NOB	UKN		IA	WW		PS	BLK	1.42	
1	O	PAL	UKN	UKN	NOB	UKN		CO	NE	EN	PS		2.4	
1	B	VID-PANP	COL	ECO	SER	UKN		CO	NN		VID		0.68	
1	O	PAL	UKN	UKN	NOB	UKN		IA	NN		PS	CRM	2.82	
1	A	OTH	COL	COL	NOB	UKN		CO	NN		MD		4.02	
2	O	VID-PANP	COL	ECO	SER	UKN		CO	EE		VID		1.56	
3	O	VID-PANP	COL	ECO	SER	UKN		CO	EE		VID		0.9	
4	O	PAL	UKN	UKN	COO	UKN		CO	NS		PS		3.78	
1	RY	OTH	UKN	UKN	NOB	UKN		CO	NE	EN			3.12	7
2	O	PAL	UKN	UKN	NOB	UKN		CN	NS		PS	CRM	1.46	
3	O	PAL	UKN	UKN	NOB	UKN		CN	NS		PS		1.82	
1	O	VID-SBB	COL	COL	SER	UKN		VI	NN				0.6	
2	RY	BBW	UKN	UKN	NOB	UKN	NOB	CN	WW			BLB	0.5	NOB
3	R	BBW	UKN	UKN	COS	UKN	SGE	CN	WW			BLB	4.9	11.5
1	O	PAL	UKN	UKN	NOB	UKN		CN	WW		PS	BLK	1.1	
2	O	BBW	UKN	UKN	NOB	UKN		IO	NE		PA	BRN	20.8	
3	O	OTH	UKN	UKN	NOB	UKN		CN	WW		MO	BRN	2.1	
4	O	OTH	UKN	UKN	NOB	UKN		CO	NE		MO	CRM	0.8	
5	D	DKK	UKN	UKN	NOB	UKN		IY	NC			BLK	4.3	
6	O	PAL	UKN	UKN	NOB	UKN		CO	EE		PS	BLB	3.1	
7	O	PAL	UKN	UKN	NOB	UKN		IA	NS		PS		4.7	
8	O	PAL	UKN	UKN	NOB	UKN		IA	WW		PS	BLB	1.7	
9	O	PAL	UKN	UKN	NOB	UKN		IY	WW		PS		6.5	
10	O	PAL	UKN	UKN	NOB	UKN		CO	WW		PS	BLB	2.9	
11	R	OTH	UKN	UKN	NOB	UKN	NOB	CN	NE			CRM	1.7	10

Figure 3. Screen capture of section of ceramic form data sheet, showing some of the 42 variables that the PAZC ceramic classification system records per artifact

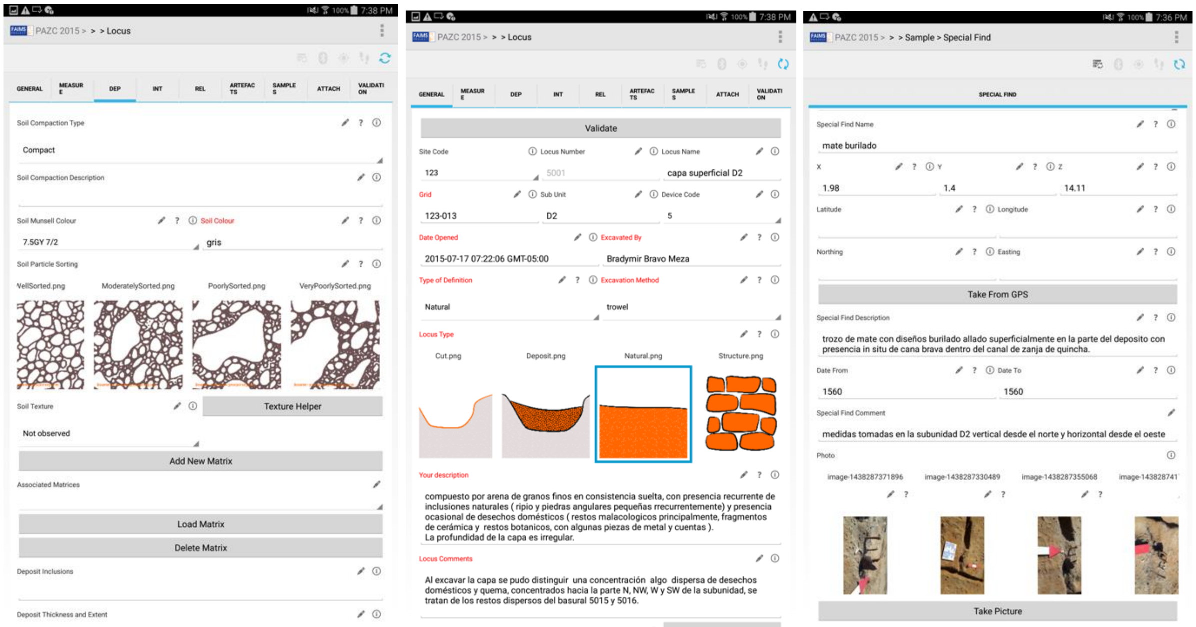

Figure 4. Screen captures from different tabs of PAZC FAIMS module, showing integration of photographs and drawings.

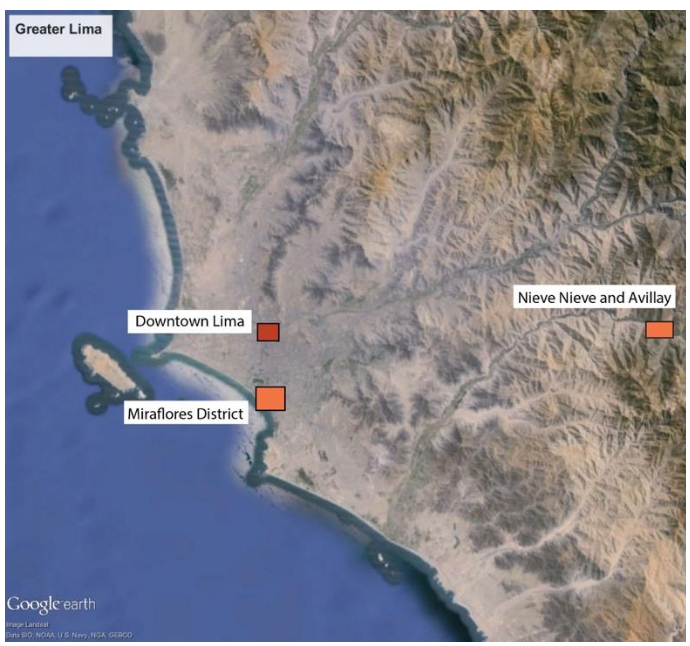

Figure 5. Map of Greater Lima, showing Locations of Miraflores, Nieve NIeve and Avillay