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SKYSCAPE ARCHAEOLOGY AS A ROAD TO CULTURAL INSIGHT

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ABSTRACT

Archaeoastronomers have made great strides in development of research methodologies, yet there is limited curriculum available to train new practitioners. If we seek results that address current archaeological research questions, then our work must necessarily be pertinent to such questions and grounded in rigorous archaeoastronomy fieldwork and analytical methods. Furthermore, the inferences we create should be supported by the points of intersection between archaeoastronomical data and archaeological theory (Iwaniszewski, 2015). To achieve these objectives, practitioners must be aware of current archaeological research questions, trained in archaeoastronomy methods, and aware of the intersections between archaeoastronomical data and archaeological theory. Historical and ethnohistorical information from a wide variety of cultures demonstrate that visual astronomy may be interconnected with cosmovision, politics, ritual, religion, and economics in variable and unique ways. Research must be iterative and interdisciplinary. To illustrate variations in interdisciplinary sources, we briefly present two case studies. These case studies underscore the variability of sources supporting archaeoastronomy research; therefore, a curriculum and supporting instructional materials to train practitioners must by definition be interdisciplinary (see, e.g., Magli, 2016). Such a curriculum is under development for the University of Oklahoma's College of Professional and Continuing Studies (OU PACS). One key charter of OU PACS is interdisciplinary study. The OU PACS Archaeoastronomy program will integrate astronomy, anthropology, archaeology, history of science, and history of religion. The program is initially planned to include five (5) graduate courses offered as a graduate certificate. The program prominently features North American archaeoastronomy and will include a field methods practicum.

KEYWORDS: Archaeoastronomy, research epistemology, interdisciplinary studies, archaeoastronomy curriculum, online education, archaeoastronomy graduate certificate

1. INTRODUCTION

This paper discusses specific interdisciplinary challenges in archaeoastronomy research, and their implications for curriculum design. Progress continues in the development of standard methods for archaeoastronomy fieldwork, analysis, and interpretation. Notwithstanding, significant methodological variation continues to be manifested in published archaeoastronomy work (see, e.g., Aveni, 2001; Belmonte, 2015; Prendergast, 2015; Ruggles 1996, 2015). The lack of methodological consensus is well illustrated by varied perspectives regarding the evidence required to demonstrate intentionality or cultural pertinence for proposed lunar standstill alignments (González-García, 2016; Malville, 2016; Sims, 2016). It seems reasonable to suppose that variations in epistemology are driven, in part, by the varied disciplinary backgrounds and training and assumptions of archaeoastronomy researchers, as discussed by McCluskey (2015).

Unquestionably, continuing debate on the fundamentals of archaeoastronomy research methods complicates curriculum design. Furthermore, no two fieldwork-based archaeoastronomy research designs can be grounded in entirely consistent published peer-reviewed research due to the variations in research previously conducted for site(s) and culture(s). To illustrate this point, we briefly review two case studies. These demonstrate the benefit of ensuring that an archaeoastronomy curriculum includes explicit treatment of the varied epistemologies and taxonomies applied by related fields. Subsequently, we present an archaeoastronomy curriculum currently under development at the University of Oklahoma's College of Professional and Continuing Studies (OU PACS).

2. CASE STUDIES

To illustrate the variability of interdisciplinary sources supporting archaeoastronomy research, we briefly review two case studies, one at Chaco Canyon, New Mexico, and one at Inca sites in Peru.

Research at Chaco Canyon, New Mexico has demonstrated that 10th through 12th century CE monumental structures exhibit four orientation and placement traditions. Temporal analysis of these architectural traditions and photographically confirmed astronomical alignments provide evidence for shifting multi-cultural collaboration over time at Chaco, and highlight elevated cultural importance for solstices after 1100 CE (Munro, 2012; Munro et al., 2016).

The Inca Empire in the Peruvian Andes is replete with examples of intentional light and shadow effects, as well as orientations to key solar positions on the horizon. When such research data is taken in cultural context with reference to works such as those of Zuidema (1981), Bauer (1998), and Urton (1981) it emphasizes a society tightly interwoven with astronomy. Precise archaeoastronomical research methods and interpretation are key (Gullberg, 2009; Gullberg and Malville, 2016).

2.1. *Chaco Canyon, New Mexico*

Over the past decade, Munro and colleagues have conducted ongoing fieldwork at Chaco Canyon focused on validation of previously published archaeoastronomy findings, as well as on completion of an encompassing survey of all monumental "Great Houses" in the canyon. This work has relied on published and archived archaeological research for sites, theodolite survey, integration with ephemerides, and photo confirmation of predicted events.

This research program has yielded some negative results; it has not identified convincing evidence in support of lunar standstill hypotheses previously published for Chaco. In addition, published equinox alignment claims for the site known as Pueblo Bonito have been determined to be non-functional due to horizon elevations. Survey validation and photo confirmation of the claimed equinox alignments at Pueblo Bonito was attempted and failed (Munro, 2012, pp. 132—137, 216—220). In light of the number of previously claimed alignments at Chaco that are demonstrably non-functional, we have come to the view that photo-confirmation of alignment claims is an important and underutilized tool, as discussed by Malville and Ninnemann (2017).

The work has expanded upon and reinforced a convincing pattern involving four architectural traditions linked to cosmology. Three of these are orientation traditions among Ancestral Pueblo monumental structures, to the cardinal directions, to the east-southeast, and to the south-southeast. The fourth is a consistent pattern of construction of monumental "Great Houses" at observation points for solstitial horizon foresights, especially for structures built after 1110 CE, as shown in Figure 1. There is well-constrained dating of the architecture at Chaco. Temporal analysis of the astronomical alignment findings provide support for archaeological theories of multi-cultural collaboration at Chaco, as well as highlighting significant changes in cultural intent during the period after 1100 CE (Munro, 2012; Munro et al., 2017).

Figure 1 June solstice sunrise interacting with a horizon feature at Rabbit Ruin

2.2. *Solar Associations with Inca Huacas*

Gullberg has performed multiple seasons of fieldwork-based archaeoastronomy research at Inca sites in Peru. In contrast to studies at Chaco, where centuries elapsed between construction of monumental architecture and historical documentation of the sites, fewer than 100 years elapsed between the rise of Pachacuti and his empire, and its eventual conquest by Spanish conquistadores. There is a rich history of archaeoastronomy, however, and it is both to the horizon, similar to Chaco, and as well internal to many huacas (shrines).

One example can be found at a huaca called Lacco. Lacco is a large granite outcropping that includes three caves with solar orientations. One of these is a cave with its opening on the southwest face that includes a light-tube aimed for a carved altar. The light-tube is oriented to receive direct sunlight at the time of the zenith sun, as shown in Figure 2.

Figure 2 Lacco altar at the time of the zenith sun

An example regarding horizon events is found at a small, obscure huaca that we refer to as the Huaca of Solar Events. Two circles, one larger than the other, were sculpted from the granite in such a manner that they can serve as a visual guide to the positions on the horizon for each of the principle annual sunrises and sunsets. Tangential lines drawn between them point to the four solstice sunrises and sunsets and a line drawn across them does likewise for the two equinoxes. There additionally are the remains of carved seats positioned to view each principle event.

The Incas also constructed solar pillars on the horizons of Cusco for calendrical purposes to mark dates such as those for planting, harvesting, and religious festivals. Extant examples are above the palace of Qwespiwanka, which thrived on a site near the present-day village of Urubamba in the Sacred Valley. They indicate the June solstice sunrise when viewed from a large granite boulder near the center of the palace courtyard.

Research shows that there are many huacas throughout the regions extending away from Cusco that exhibit astronomical orientations. The most common are for the June solstice sunrise, followed by those for sunrise at the December solstice. There are other orientations for June solstice sunset and December solstice sunset, to a lesser extent the equinox sunrises and sunsets, and as well a few for sunrise or sunset at the time of the zenith sun and the anti-zenith sun.

Astronomical alignments in carved rock huacas were found to be oriented toward the June solstice sunrise 63% of the time at the sites studied. Some sites had more than one orientation. The frequency of alignments toward the December solstice sunrise was found to be 56%; the June and December solstice sunset alignments were 38% and 25%, respectively (Gullberg, 2009; Gullberg and Malville, 2016).

2.3. *"Knowing the Literature" and Implications for Curriculum Design*

We do not believe a strict processual model for archaeoastronomy research is achievable or desirable. However, we do see a structural approach founded on "knowing the literature" for each research question to be a useful framework to support iterative interdisciplinary research, including fieldwork-based archaeoastronomy. With the benefit of hindsight, we see that a significant weakness of some published work that has been subsequently nullified by reassessment (for example with respect to equinox alignment claims at Chaco's Pueblo Bonito) is that they were inadequately grounded in peer-reviewed published work from varied disciplines pertinent to the culture or site(s) of interest. This can be as simple as a failure to consider well-demonstrated dating of archaeological sites, and as complex as over-stressing the importance of aesthetics (as provided by well-developed art history) without due consideration of less subjective factors from other disciplines, such as engineering. We suggest that it is critically important to develop familiarity with a broad sample of the literature for any given site or culture of interest across disciplines.

Figure 3 and Figure 4 provide a simple comparative illustration, based upon our two case studies, of the variable nature of source material available for interdisciplinary assessment. As depicted, the research at Chaco described in section 2.1 has been conducted in the context of an extraordinarily robust body of published archaeology (see, e.g., Lekson, 2006; Mathien, 2005). That body of literature is supplemented by a variety of published work from other disciplines, with special focus on anthropology, the history of religion, and past interdisciplinary archaeoastronomy work. In contrast, while Inca sites are well studied archaeologically, there is a much broader range of published historic period literature to include anthropology of descendant peoples in Peru, as well as historical accounts of Inca culture from the perspective of conquering 16th century Spaniards (see, e.g. Bauer, 1998; Urton, 1981; Zuidema, 1981).

For any given site or culture, the availability of peer-reviewed literature to assess is driven by temporal factors, available physical evidence, and the history of academic research. Publication of work that does not incorporate a broad scope of pertinent peer- reviewed research from associated disciplines is fraught with risk, and undermines the potential for archaeoastronomy findings to be taken seriously by colleagues working in those disciplines.

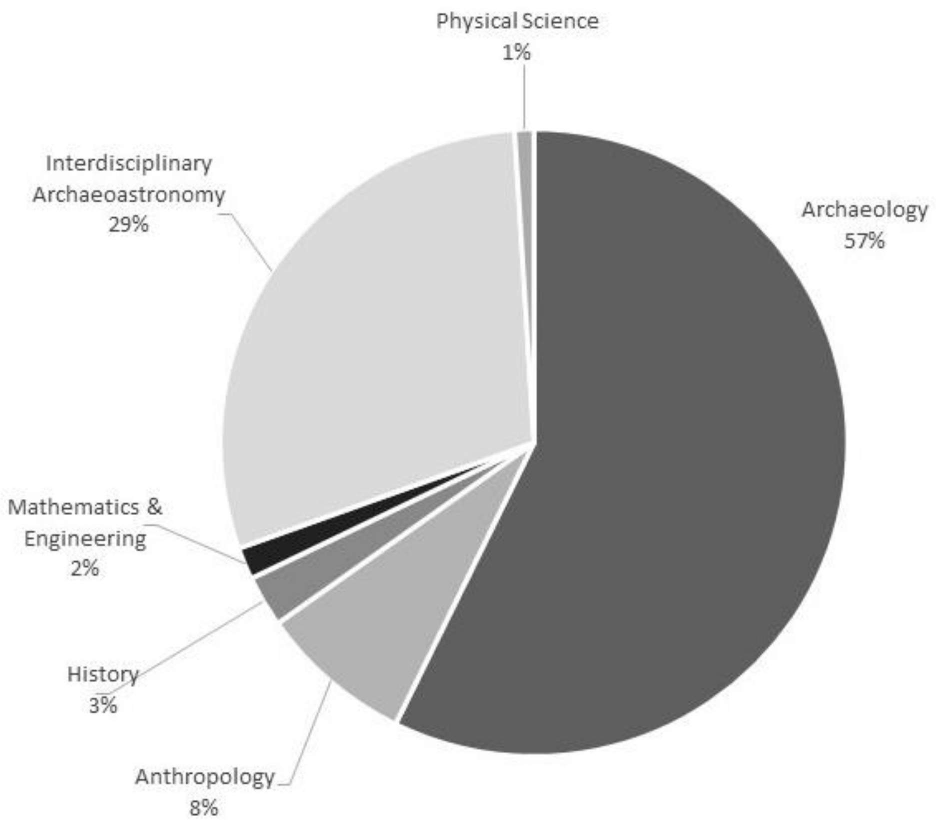

Figure 3 Source analysis for Munro's work at Chaco Canyon

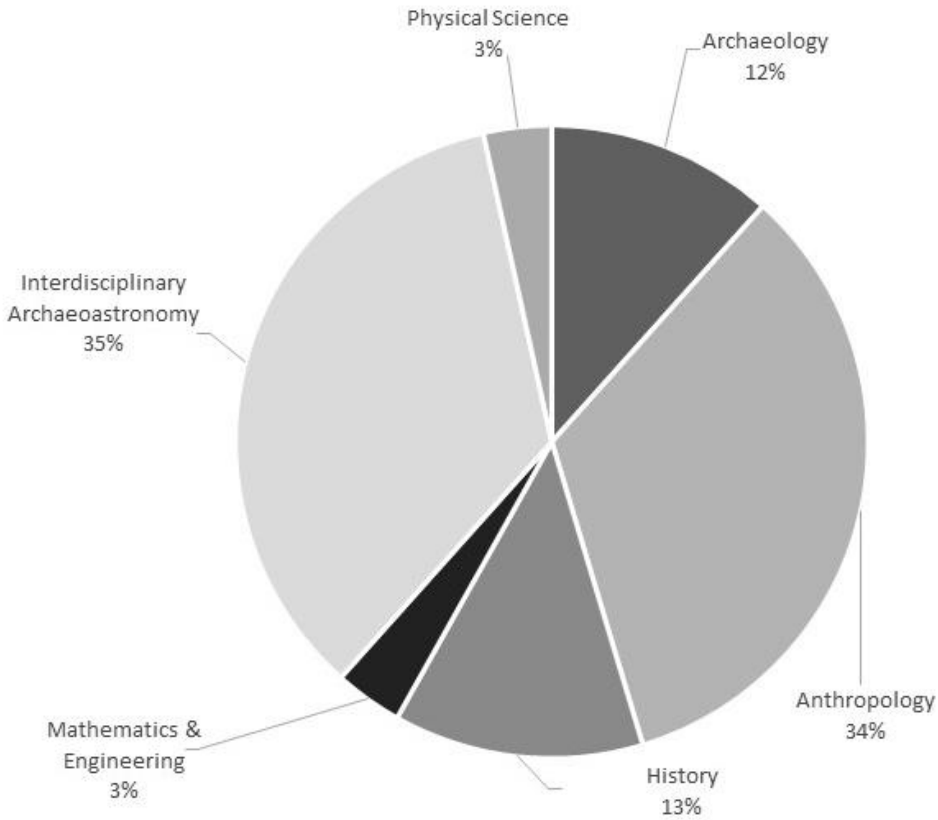

Figure 4 Source analysis for Gullberg's work on the astronomy of Inca huacas

3. THE PLANNED OU PACS ARCHAEOASTRONOMY CURRICULUM

The authors are currently developing a five-course archaeoastronomy curriculum to be offered as a primarily online program through OU PACS. These courses will be offered as graduate certificate program. The certificate will provide individuals who have earned degrees in other fields (e.g. astronomy, archaeology or anthropology) with the training necessary to apply archaeoastronomy tools and techniques. Given that OU PACS emphasizes holistic learning, our objectives are to use archaeoastronomy research as a training ground for interdisciplinary research methods, as well as to train archaeoastronomy practitioners.

The five courses under development include *Archaeoastronomy and Methods*, *Archaeoastronomy of Chaco Canyon and Cahokia*, *Latin American Archaeoastronomy*, *World Archaeoastronomy,* and *Field Work in Archaeoastronomy*. The courses include reviews of the evidence for astronomical associations among a wide variety of selected sites and cultures from around the world. The courses will include visual motions of celestial objects in the day and night sky, and archaeoastronomy field survey and interpretation methods. Common themes will include the use of astronomical principles in monumental design and city planning, using astronomical stories to encode socially important cultural reference information, linkage to ritual practices including pilgrimage, and functional uses of sky knowledge to include navigation and the development of agricultural and ritual calendars. We also intend to explore the human use of astronomical observation and prediction in diverse ways, highlighting visual astronomy's role in the development of religion, social hierarchy, and science. Selected archaeoastronomy "false positives" will also be included in the curriculum to assist students in development of advanced analytical and critical thinking skills.

The Field Work course will require an onsite practicum. It will consist of three components: online contextual and site literature review, a one-week onsite field survey with faculty that includes preliminary collaborative data interpretation, and optional post field-school research publication. We will stress the benefits of framing research questions in collaboration with archaeologists who are active and reputable researchers for the culture and site(s) in question. We intend to provide students with hands-on survey, data integration, interpretation, and publication experience at sites within North America. During the fieldwork course students will develop horizon sketches, conduct compass and clinometer surveys, collect GPS and photographic data, and conduct theodolite surveys of architecture and horizon features. Data reduction will be performed collaboratively to identify structural orientations, structural alignments, and horizon foresight potential for celestial object interactions. After field survey and data reduction is completed, students may optionally participate in the publication of results.

4. CONCLUSION

The issues to be managed in conducting interdisciplinary research in general, and fieldwork-based archaeoastronomy research in particular are complex, and will remain so. Training students to understand the challenges inherent in framing research questions and research designs with reference to pertinent source material from all related disciplines is just a start. Explicit treatment of varied taxonomies, methods, and standards of evidence from supporting disciplines should be core elements of any archaeoastronomy curriculum. In addition, teaching demonstrated best practices for the interdiscipline, as well as directly communicating the status of open methodological debates within the archaeoastronomy community, are essential.

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