

ALL DATA ARE NOT CREATED EQUAL: RECONCILING ARCHAEOLOGICAL SCALE WITH HUMAN BEHAVIOR

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ABSTRACT

Because archaeological site structure is inextricably linked to the size of our analytic units, Middle Atlantic archaeologists are in need of more appropriate scales of data collection and spatial analysis to further our understanding of prehistoric human behavior at short-term campsites. Although researchers encounter similar distributional phenomena in the archaeological record, they rarely produce data sets that lend themselves to comparative analyses. This study calls for a shift to human-scale analytic units based on anthropometric data and ethnoarchaeological insights of hunter-gatherer behavior. Demonstrating the specific benefits of excavating short-duration campsites using smaller collection units than the ones commonly employed in the Middle Atlantic region, this research asserts that archaeologists are missing valuable behavioral data. Additionally, small artifacts are the most important class of evidence for identifying the locations of past activities, but are systematically overlooked during excavation and analyses. Data from two Pennsylvania rockshelters are used to demonstrate that there is behaviorally meaningful data encoded within their arcing distributions of tools, debitage, animal bone, pottery, and charcoal; but that our scales of resolution need to be adjusted to capture and compare this information and to make investigations relevant to ethnographic insights.

KEY WORDS: hunter-gatherer campsites; rockshelters; archaeological units; comparative spatial analysis.

INTRODUCTION

In researching the history of rockshelter archaeology in the Middle Atlantic region, I came to the conclusion that archaeologists must be more conscious of their methodological choices in excavation and the resulting analytic ramifications. Despite progress in understanding hunter-gatherer behavior from ethnoarchaeological research, researchers typically fail to incorporate these insights into their methodologies. Instead of searching for behavioral evidence in spatial data, they fumble with site typologies from assemblage-based analyses. Comparative spatial analyses of site structure offer hope for moving past the use of site typologies and toward discussions focused on issues of human behavior and spatial patterning. It is, after all, the spatial dimension that provides the link between archaeological remains and the behavioral systems that produced them (Nicholson and Cane 1991).

This presentation derives from my dissertation research at Temple University, which focuses on the behavioral interpretation of spatial structure at rockshelters. I examine the excavations at two rockshelters in Pennsylvania's Ridge and Valley Province, Mykut Rockshelter in Huntingdon County and Camelback Rockshelter in Monroe County. These upland sandstone overhangs are separated by just over 200 miles, but more importantly, were investigated using identical excavation and analytic methods, making them the first data sets from Pennsylvania and the greater Middle Atlantic region to provide comparable detailed spatial data on artifact distributions from short-term campsites.

Ethnographic Insights into Rockshelter Use

Much of the human behavior that takes place at rockshelters is related to camp activities like food preparation, eating, socializing, maintenance of hunting gear, and sleeping. But, as Gorecki states, "...what is said about a rockshelter is often hypothetical, and to some degree subjective; a mixture of assumptions and facts" (1988:159). Ethnoarchaeology provides a wealth of clues that if used properly, can carry rockshelter studies forward by highlighting organizational principles and the multiple dimensions of short-term camp behavior. Ethnographic accounts of rockshelter use are few; however, they can provide us with important insights regarding the behavioral evidence that may be encountered in the archaeological record.

Behavioral inference from excavated rockshelter deposits is anything but straightforward. Archaeologists need to be realistic with respect to what they might interpret from the material record of rockshelters. The following ethnographic insights should be considered:

- Seasonality influences rockshelter usage (Graham 1993, Nicholson and Cane 1991)
- Archaeological resolution at rockshelters should be sensitive to behavioral and formational processes at a human scale (Binford 1983)
- Waste management behaviors are influenced by occupational duration, abandonment circumstances, and seasonality (Politis 2007)
- Hearths serve as focal points for activities at rockshelters and short-term camps (Binford 1983, Galanidou 2000)
- Secondary discard typically occurs on the talus slope of rockshelters (Gorecki 1991:243)
- Sleeping typically occurs along the backwall of rockshelters (Gorecki 1991)
- Cooking areas are typically near the dripline (Gorecki 1991)
- Shifting activities in rockshelters prevent static occupational surfaces (Gorecki 1991:255)
- Rockshelters restrict the possible range of activities, sometimes leading to the formation of adjacent open activity areas (Gorecki 1991:256, Nicholson and Cane 1991)
- Spatial regularities exist in hunter-gatherer camps (Nicholson and Cane 1991:348)

The Behavioral Significance of Small Artifacts

With respect to artifact class distinctions, smaller sized primary refuse (items < 6 mm) like lithic debitage and fine bone fragments have proven to be most informative about where the activities that produced them took place (Hull 1987, Keeley 1991, Stevenson 1991). It is widely accepted that artifact size plays a major role in the spatial arrangement of artifacts. In addition to natural formation processes, frequently used sites like rockshelters and other persistent places on the landscape are subject to cultural transforms like waste management (Tani 1995), trampling, scavenging, and reoccupation. Small artifacts are likely to escape cleanup efforts but may be more susceptible to transport by natural agents of wind, water, and needle ice (Hilton 2003). Since they can easily be redistributed both horizontally and vertically, care must be used when analyzing the spatial distribution of small artifacts to infer cultural formation processes. Small items, however, should be sought and collected to detect cultural patterning. Zones of discard become apparent only when the degree of fragmentation and artifact size are considered with

respect to spatial context. The point to be made here is that small artifacts have the potential to yield behavioral information, but post-depositional effects must be assessed in order to arrive at meaningful interpretations during spatial analyses.

Analytic Tools

Those of us who study prehistoric hunter-gatherers and early agriculturalists in the Mid-Atlantic region are experiencing disciplinary stagnation in attempts to integrate short-term hunter-gatherer campsites into prehistoric settlement systems because we do not see nor systematically capture the spatial variation in the archaeological record. Fumbling with site typologies, researchers find that their data sets are not capable of supporting the types of behavioral interpretations they would like to make. By adopting and adhering to a strict site-structural approach to excavation and spatial analysis, however, they can obtain the data needed to make interpretations about past human behavior. With total stations and mapping software becoming commonplace in both academic and CRM archaeology alike, the question is not who has the analytic tools at their disposal to capture and compare behavioral clues—but who knows how to use them effectively? Just possessing these tools does not bring your data up to specifications for behaviorally informative comparative analyses; in fact it is more complicated to employ these tools to their fullest capacity—but well worth the work and effort when it comes to capturing formational evidence within the data. Ultimately, I want to convince you that there is much more to see and learn about the archaeological record at short-term campsites by using more detailed excavation and analytic techniques, but first we need to review some basic physical and behavioral principles that produce and affect the artifacts we find in the archaeological record.

The Behavioral Significance of Human Scale

I would argue that the 1 meter square test unit has become the standard archaeological analytic unit more for the sake of convenience than because it facilitates behavioral interpretation. An excavation scale should be employed that will allow for meaningful comparative analyses of spatial patterning among rockshelter and open-air sites alike. Only then will we be able to accomplish what Montag (2001) set out to do in her recent rockshelter research: to recognize and compare what she calls “household activity sets” from different site contexts.

Researchers would do well to reassess the minimum size of their collection units by realizing the scale at which recognizable patterned variability exists. One vector of influence resulting in patterned artifact and feature distributions is the habitual body movements of humans while engaged in performing specific activities like cooking, stone tool working, bone processing, refuse management, and other camp-related activities. Another conditioning factor is the average dimensions of the human body. While there is great variation in human body dimensions, anthropometric data provide baseline ranges for adult males and females that allow archaeologists to tailor their methodologies to better accommodate the smallest behavioral denominator—the individual.

NASA's Body Dimension Data

Anthropometry and body mechanics are reported on by the *Habitability and Environmental Factors Division* of NASA, at the Johnson Space Center in Houston, Texas. The personal space taken up by the human body and all its range of motions is referred to by these researchers as the *body envelope*. Nowhere is the “body envelope” more scrutinized than in the production of spacecraft and space stations—so I assumed that their data would be adequate for determining minimum analytic unit size for mapping humans in their life space. To best accommodate crew members and visiting personnel of both sexes of varied ethnic backgrounds in the design of the seats and workstations, data were collected for human body size, posture, and movement. While the data were not meant to be representative of the world’s population, they cover the range of human body dimensions by sampling adult males from the United States at the upper end of the distribution and adult females from Japan at the other. My goal was to establish a range at the high end of the modern reach boundary for adult males so as to provide complete coverage of human statures throughout prehistory in a formational model depicting a seated individual and the potential range of fallout for debris-producing activities.

The data for “grasp reach limits” can be used as a baseline for matching archaeological units with human-scale activities (<http://msis.jsc.nasa.gov/sections/section03.htm>). Grasp reach limits vary according to the height above the seat reference point, but all fall within the span of one meter. I chose the measurements taken at +46 cm to estimate average arm positioning while working on stone tools. At this height, it is evident that the average grasp ranges for adult American females and males span 65.2 to 88.2 cm directly in front of the body and 64 to 90 cm laterally.

Reach Envelope Model

I created a spatial model, Figure 1, by plotting NASA’s data for right hand reach envelope from the 95th percentile of American males using SURFER mapping software; mirroring the range on the left side, to delimit the largest possible drop zone for a seated individual. The model defines the space across which primary refuse can be distributed and the appropriate scale to capture formational data.

We can infer that the fallout created during debris producing activities will fall well within the defined grasp reach limits outlined in the NASA report. Seated individuals engaged in debris-producing activities like flintknapping or bone processing do not work with their arms stretched to the limits of their grasp reach envelope; rather, they work with their arms bent close to their torsos for stability, creating a concentrated primary drop zone that fans out between their legs approximately half the diameter of their grasp limits.

Behavioral models by Binford (1983) and Stevenson (1991) stress the importance of human body size and positioning around outdoor hearths. From behavioral observations of the use of space from three Aché camps, Jones (1993) reports that the mean distance from a fire for adult debris producing activities was 57.0 ± 24 cm. The arm’s-length scale at which ethnoarchaeological observations are made is blurred within the analytic space of one-square meter. In other words, due to the physical size range of humans, archaeological collection units measuring 50 cm x 50 cm (0.25 m²) capture potentially meaningful traces of human behavior that are lost at the 1 m² level of spatial resolution. Given these insights, why should most

archaeologists interested in behavioral interpretation still use one-square-meter as their smallest provenience unit?

Archaeological Site Structure

Archaeological investigations at rockshelters are necessarily linked to site structure set by our collection units. *Site structure* is defined as, "...the patterned distribution of artifacts, features, and other materials in site space" (Wandsnider 1996:319). How to best capture, describe, and interpret the site structure of hunter-gatherer occupations is unresolved. Enloe *et al.* state with regard to site structure, "[t]he variety of patterns observable depends on the methods of display and the scale of the units of observation" (1994:122). They noted different patterns when they changed the scale of the units from 1 m to 50 cm for their density contour plots, and hint that these "different patterns" may represent a loss of behavioral information. In addition to showing more accurately the distributions of items at a more appropriate scale for capturing contextual evidence, 50 cm units allow better partitioning of the concentrations when analyzing artifact distributions. Despite the straightforward goal of linking their spatial data to past activities, processual archaeologists have spent the past two decades attempting to reconcile archaeological spatial signatures with behavioral interpretation.

Archaeological Units

One-meter and 5-foot square excavation units have been the dominant scale of recovery for most work in rockshelters in Pennsylvania and the Middle Atlantic Region. Following the norm for standard archaeological procedure, researchers never give much thought to what they might be missing at this level of recovery resolution. Until recently, Pennsylvania rockshelter excavations have been generally carried out at coarse scales of resolution. Regarding the challenges of archaeological interpretation, Johnson notes:

"The underlying problem is simply that the resolution of conventional grid-squares is insufficient to explore the full information potential of the majority of excavated sites. Increased resolution of collection units (i.e. smaller units), together with more limited and explicitly controlled use of coordinates or mapping for larger finds, is seen as the solution to these problems" (1984:93).

More attention should be given to Johnson's words dating back to 1984: since conventional 1 m² grid-squares have proven to be insufficient to make behavioral interpretations, we must adjust our methodologies.

Recent archaeological investigations at the Sandrocks Shelter (36GR68) in western Pennsylvania were conducted using 1 m² analytic units. Montag writes, "...one-by-one meter excavation units were used as a basic element of spatial analysis because they were the smallest unit excavated across the site" (2001:115). In a self-fulfilling methodological prophecy, researchers are invariably stuck with 1 m resolution during analyses simply because they do not question the analytic utility of this scale at the onset of excavation.

In her spatial analysis of the Monongahela levels at the Sandrocks Shelter (36GR68), Montag claims to see no evidence for size sorting of the ceramic assemblage when divided into

three weight classes (≥ 1 g, < 1 g, < 1.9 g); writing, “[t]he contour maps do not show any significant spatial differences between the weight classes plotted” (2001:123). Despite Montag’s objective of defining activity sets from spatial data, the Sandrocks Shelter was excavated using meter units to provenience small artifacts. She did not see any variation in her plots because her data collection methodology failed to capture informative spatial variation of artifacts within the analytic space of a square meter provenience unit.

At Mykut Rockshelter, 1,052 pieces of pottery weighing 780 g occurred in levels 1 through 7 and were classified into 10 sherd lots. Although most sherds were too small and worn to allow detailed classification, some 450 could be assigned to a recognized types representing the Clemson Island and Monongahela cultures in the earlier part of the Late Woodland period and later Shenks Ferry and McFate-Quiggle groups. An important first step is to consider the distribution of the total ceramic assemblage across the site. More informative patterning, however, can be observed by breaking the entire assemblage down into 5 cm levels.

50 cm² Units

Individual level plots show much more detail and spatial variation due to their smaller provenience lots. And although the 5 cm arbitrary levels do not represent discrete occupations, they provide a valuable means of spatial comparison. Artifact assemblages may be examined by class for repetitive spatial patterning and co-occurrence both within the levels of a single rockshelter and among other sites.

Combined overlays can be made for different classes and/or sizes of artifacts, allowing patterning to be seen simply through visual inspection of multiple combinations of lot distributions and piece-plotted items. For example, Figure 2 shows the Mykut Rockshelter pottery distributions by weight represented by blue contour lines, and fine lithic debitage counts represented by purple contour lines. Piece-plotted tools are plotted in black with various symbols. Note that the distributions peak at different locations, suggesting differential use of space during debris-producing activities. Also note that these distributions would mostly blur together had the provenience units been larger than 5 cm thick and 0.25 m² in horizontal extent.

Since lithics, pottery, and bone are the most abundant classes of artifacts found in rockshelters, we need to be able to reliably compare these distributions both on an inter- and intra-site basis. Viewing the lithics, evidence for late-stage flint knapping and re-tooling behavior is widespread throughout the block; while bone occurs mostly past the dripline and down the talus slope. The larger piece-plotted bones, represented by weighted yellow symbols, provide convincing evidence of size-sorting.

Modeling Human Behavior

The act of “making camp” implies the structuring or ordering of space as a temporary home away from home. Different activity zones result as the camp space is compartmentalized to make it comfortable and amenable to accomplishing specific tasks. The campsites of mobile peoples include space to work, cook, eat, socialize, and sleep. As noted earlier, fire hearths are central features that serve as foci for various activities. The physical features of rockshelters also

structure the activity zones. Frequently used camps tend to include secondary trash dumps, site furniture, and caches.

Rockshelter occupations differ from those of open-air settings in that prime real estate is limited. In addition to the natural depositional and transportation processes operating at rockshelters, cultural activities are influenced by the dripline, backwall, and talus slope. We should expect to find specific activities in different zones of the rockshelter during any given occupational episode. I modeled my expectations for behavioral zones at rockshelters from the ethnoarchaeological insights listed earlier to gauge their fit with actual spatial patterning. For example, we know from ethnoarchaeology that sleeping and socializing should tend to be conducted towards the back wall of a rockshelter, while cooking and other debris-producing activities will likely be conducted at or beyond the dripline. The dripline area affords better light and ventilation while still offering some shelter. I argue that spatial models like this one are more useful than simple site typologies because they facilitate behaviorally informative comparisons among archaeological sites.

CONCLUSIONS

The data sets from the Mykut and Camelback Rockshelters are important contributions to Middle Atlantic archaeology in that they provide comparable detailed examples of repeated human occupation of these special landscape features throughout Pennsylvania's prehistoric past. The excavations were conducted at a scale sensitive to the physical size of the human body and formational clues that are encoded in the distributions of refuse produced and preserved within the constrained spaces of these rockshelters. I have suggested the utility of smaller analytic units during excavation in an effort to facilitate behavioral interpretations of rockshelter occupations that will help us to break free of the limitations of site typologies based on assemblage trait lists rather than spatial data.

There is no short-cut to getting the kind of spatial data required to make sound comparisons of site structure and activity sets produced by human behavior at short-term camps. No high-tech laboratory techniques or GIS modeling can replace detailed spatial data as the core of archaeological interpretation. In conclusion, and remembering William Gardner's legacy, we must evaluate our excavation methods to ensure a match between our data and our archaeological expectations. It is clear that our behavioral interpretation of hunter-gatherer campsites is limited using conventional excavation strategies and methodology. By discounting small artifacts and small-scale spatial distributions, one misses the most crucial aspect of the material evidence of human behavior at short-term camps.

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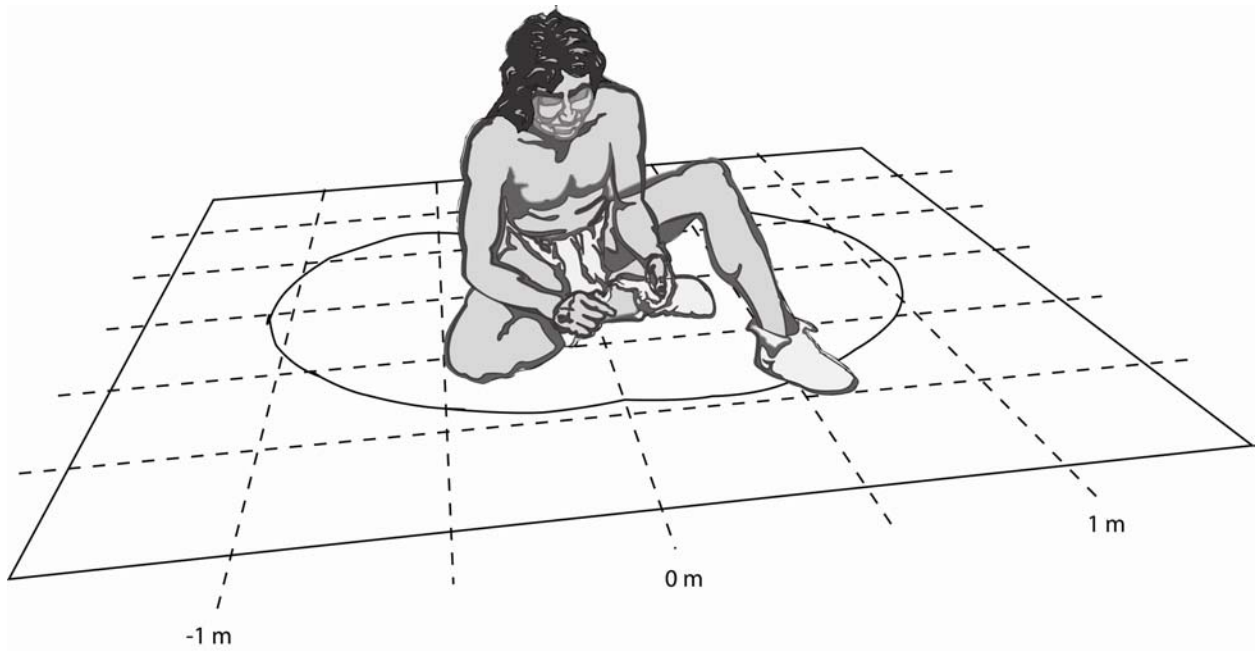


Figure 1: Seated Figure Model

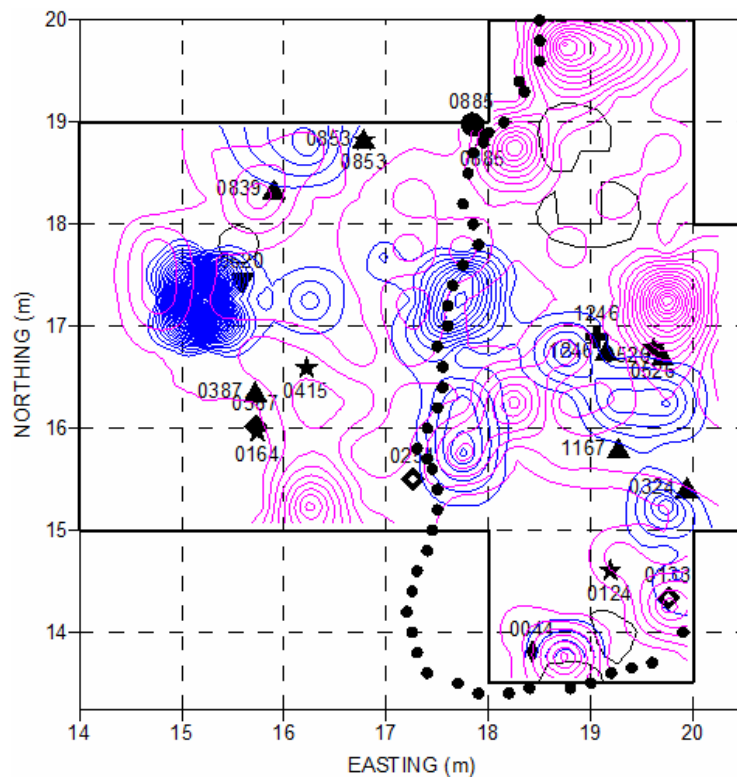


Figure 2: Combined density plots