PATTERN RECOGNITION IN HISTORICAL ARCHAEOLOGY

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The process of pattern recognition using data from historic sites is illustrated with data from the British colonial system. The Brunswick Pattern of Refuse Disposal monitors eighteenth century refuse disposal behavior patterns. The Carolina Pattern monitors artifact relationships from domestic occupation. The Frontier Pattern is seen on frontier sites as well as the area inside domestic ruins, and is characterized by a high architecture to kitchen artifact relationship. The formula concept of pattern recognition demonstrated by the Mean Ceramic Date Formula is a tool based on the recognition of highly regular patterns of variation in the popularity of ceramics through time. Such pattern recognition is foundational for historic site data to contribute to the explanation of culture processes. Historical archaeology has an as yet unrealized potential for contributing to method-refinement and theory building in archaeology generally. This is the exciting promise historical archaeology holds for the future.

TRADITIONALLY, HISTORICAL ARCHAEOLOGY in America has been oriented to site-specific goals focused on filling in historical documentation, locating architectural features, recovering and describing artifacts associated with architecture, and correlating archaeological with historical data. Most of this involvement can be termed "heritage studies" from sponsorship by agencies concerned with research founded on a priori beliefs about the past. Under this traditional format historical archaeology has come to have a particularistic image.

In spite of the fact that data from historic sites lend themselves admirably to the study of high energy cultural systems, few archaeologists have concerned themselves with a search for pattern on an intra- and intersite level to explore site function, chronology, structure, as well as status, trade routes, ethnicity, settlement patterns, frontier phenomena, and environmental variables. Once replicated patterns are demonstrated, the accompanying variability in the archaeological record can be understood with reference to the basic regularity. This strategy can be carried out as an integral part of a research program whose sponsor may well be concerned primarily with heritage goals, provided the archaeologist maintains as the primary responsibility an allegiance to the data base with which he is testing his ideas about the past.

To use such an approach the archaeologist must make use of quantitative analysis so that comparison can be made between sets of data in addition to those based on presence and absence alone. This quantification strategy can also be applied to historical documentation and ethnographic data sets to abstract generalized systemic pattern rather than the biased perspective afforded by a more particularistic orientation.

Some historians have long emphasized the broader, more generalized perspective, and the failure of historical archaeologists to do likewise accounts for the general lack of communication between archaeological particularists and the historical generalists. Historical archaeologists looking beyond their particular site can begin to delineate regularity and variability reflective of cultural systems in the form of patterned relationships from sites with similar temporal and cultural associations. Historical documentation is most effectively used to derive some degree of independent control of function, status, ethnic background, time, etc., against which archaeological patterns can be projected for exploring the relationship between past behavioral processes and the archaeological record. In order to identify behavior and process reflected in the archaeological record the archaeologist must concern himself with pattern recognition using all data sets at his disposal.

With the delineation of archaeological pattern that says to the archaeologist "this was a tavern," "this was a domestic dwelling," "this was a slave quarters," "this was a planter's mansion," the heavy dependence now placed on historical documentation can be replaced with a reliance on, and a confidence in, the archaeological record. The archaeologist who depends on documentation exclusively to interpret the ruin being excavated must always live in fear that a new document will turn up to refute the interpretation, since that interpretation was anchored in a particular document to begin with. Once functional and other behavioral processes have been delineated in the form of archaeological pattern the archaeologist will be in a position to take issue with particularistic historical
documentation not in keeping with the general archaeological pattern. For example, once the pattern is known for the by-products associated with eighteenth century tavern activity in the British colonial system, the documentation of the site as that of a tavern will carry less weight than that the archaeological record demonstrates this fact. With such control via the archaeological record the archaeologist can come to rely more on the primary archaeological record and less on the secondary historically documented sources.

As the variables are isolated the archaeologist may express the pattern as reflecting a law predictive of past human behavior. Postulates can be tested as new sites are examined and by this means the pattern can be verified from which hypotheses directed at the cultural system can be formulated and tested. In some cases empirical data may be contrary to expectations and in such cases both the historical and archaeological, and other data bases must again be examined for isolating other variables. This process of data manipulation, this free exploration of the regularity and variation in the archaeological record is a major part of pattern recognition aimed at understanding the dynamics of past cultural systems.

The process of pattern recognition using data from historic sites will be illustrated here using artifact distribution frequencies and quantitative relationships between artifact types, classes and groups. Several patterns have been delineated by use of data from the British colonial system. Four of these will be summarized here (from South 1977a): the Brunswick Pattern of refuse disposal, the Carolina Pattern of artifact relationships, the high architecture group ratio I have termed the Frontier Pattern, and the Mean Ceramic Date Formula.

The Brunswick Pattern of refuse disposal results from the practice on British colonial sites of discarding refuse at the entranceways to houses, shops and forts. It is a refuse density dispersion phenomenon identified by simply measuring the relative density of secondary refuse around a structure. The Carolina Pattern of artifact relationships is a statement of the relative frequency of the artifact groups recovered in the secondary refuse around a structure, a high percentage of Kitchen Group artifacts in relation to Architecture Group artifacts being the characteristic pattern.

The Frontier or architecture pattern has a high Architecture to Kitchen Group artifact ratio. This pattern has been seen in eighteenth century frontier military and trading post sites, but also characterizes the artifact group relationship seen inside ruins of domestic function not located on the frontier. Nondomestic structures also reveal this high Architecture to Kitchen Artifact ratio.

The Mean Ceramic Date Formula is a tool based on the recognition of highly regular patterns of variation in the popularity of ceramics through time. This tool monitors site chronology via ceramics. The Brunswick Pattern monitors refuse disposal behavior via dispersion of all artifact classes and groups, while the Carolina and Frontier patterns monitor function via the frequency relationship between artifact groups. The Kitchen Artifact Pattern monitors specific function through variability in patterns based on artifact class relationships within the kitchen artifact group, but this pattern is not dealt with in this paper (South 1977a).

THE FORMULA CONCEPT OF PATTERN RECOGNITION

Artifact patterning reflecting the occupation period during which the archaeological sample accumulated is being examined by means of the formula concept of pattern recognition. This concept is focused on determining a mean manufacture date of artifacts for use in deriving an interpreted median occupation date represented by the artifact sample. Artifacts such as ceramics, wine bottles and other types and classes of objects for which the manufacture period is known can be used with the formula concept.

An assumption on which the formula concept is based is that artifact fragments can be used to determine an archaeologically relevant comparison of surviving material remains of culture. A second assumption is that artifacts surviving in the archaeological record reflect the use of the artifacts in time as a unimodal curve having a beginning, a rise in use to a peak, and a decrease to extinction. For the purpose of illustration of the formula concept we will use British ceramic types, a frequently recovered class of artifacts on American historic sites.
The mean manufacture date for the group of British ceramic types from an eighteenth-century historic site taking into consideration the frequency of occurrence of fragments of the types, can be determined by a mean ceramic date-frequency formula as follows:

The mean ceramic date, \( Y \), is expressed:

\[
Y = \frac{\sum_{i=1}^{n} X_i \cdot f_i}{\sum_{i=1}^{n} f_i} - 1.1
\]

Where \( X_i \) = the median date for the manufacture of each ceramic type

\( f_i \) = the frequency of each ceramic type (fragments)

\( n \) = the number of ceramic types in the sample

The median manufacture date for each ceramic type in the sample is determined from the documents (Noël Hume 1970, and personal communication). This information has been compiled into a list of 78 ceramic types. In order to use the formula the archaeologist places the sherd count for each type in a column beside the median date and these are multiplied, producing a third column, which is a product of the median date times the frequency of occurrence. The sum of the frequency column is divided into the sum of the product column, producing the mean ceramic date for the sample. Although this frequency-adjusted manufacture date might be assumed to have nothing to do with the occupation date for an historic site, it has been found that there is a remarkable degree of similarity between the mean ceramic date derived from the use of the formula and the historically known median occupation date of the eighteenth century historic sites on which it has been used.

The application of the formula concept to ceramics is illustrated with data from the Hepburn-Reonalds ruin (S7) in the town of Brunswick, North Carolina. This ruin was a stone-lined cellar located on lot 71 in Brunswick, and was excavated in 1959. The records reveal that the structure was probably standing by 1734, and was burned in 1776, with a median historic date of 1755. The collection of ceramic fragments from the entire ruin was used as the sample.

A total of 13 ceramic types for which the median manufacture dates were known was recovered from the ruin, for a total of 1,960 ceramic fragments. When the number of fragments for each type was multiplied by the assigned median manufacture date for each type and these products totalled, the sum was 3,446,567, which, when divided by the total number of sherds, 1,960, produced a mean ceramic date of 1758.4, a date only 3.4 years from the median historic date of 1755 for the ruin.

Since its first introduction in 1972 (South 1972a) the Mean Ceramic Date Formula has proven highly predictive of the median occupation dates for sites, demonstrating the great redundancy of the pattern on which it was based. For example, 16 sites from the Carolinas, Virginia, Tennessee, Michigan, and Newfoundland were found, on the average, to overestimate the median historic occupation date by only 1.025 years. These sites had an \( R^2 \) value of .980 for the relationship between the known median occupation dates and the mean ceramic dates derived from the formula (South 1977a:236). The formula, therefore, appears to be a valid tool for helping the archaeologist to infer the occupation period represented by archaeological samples from British colonial sites.

In using the formula concept it has been found that eighteenth century British American sites of varied functions, from port town ruins, to townhouse mansions, to frontier forts and Indian villages have similar groups of ceramic types present at similar periods of time. This has been interpreted in terms of the horizon concept outlined by Gordon R. Willey and Philip Phillips (1958). The time required for the spread of the cultural material representing the horizon is a factor to be considered. Therefore, an approximate contemporaneity is involved for a group of ceramic types leaving the source of manufacture and being distributed throughout the British empire.

In demonstrating the regularity of the pattern, and expressing this as an empirical generalization in terms of the horizon concept, we still have not explained the phenomenon in terms of the processes of
culture. This can be done by stating hypotheses relating the horizon concept to processes at work in the British colonial cultural system, postulating the mechanism whereby these are related, and presenting arguments of relevance within a research design directed at the collection of new data.

Hypotheses for explaining the horizon phenomenon described by the Mean Ceramic Date Formula could be focused on a specified set of variables expected to provide explanatory power. These range from broad phenomenon such as the distribution system of colonial empires to refuse disposal practices in domestic households. Historical documentation and archaeological inference permit us to control the following regular variables which, in turn, should provide some degree of explanation for the success of the formula concept: the distribution of goods from the mother country to the colony and the subsequent dispersal mechanisms in the colony; the procurement, preparation, serving and consumption of food; the cleaning, display, and storage of ceramics; and the modes of discard of broken ceramics and other refuse.

If these variables are archaeologically monitored we can hypothesize that a highly regular patterned relationship would exist between ceramic types from domestic refuse deposits of various occupation periods. Disruption of the regularity would occur with variation in any of the major causal variables just mentioned having an effect on the ceramic relationships in the archaeological record, such as non-domestic occupation, change in the distributive system, etc.

If the above variables are highly regular, and we know the manufacture period for the various ceramic types involved, then it should come as no surprise that a formula designed to monitor the regularity between ceramic types from domestic refuse deposits within a cultural system is found to be predictable as a dating tool. Hopefully future investigations directed at testing this and other explanatory hypotheses will elucidate the specific cultural processes at work that led to this useful regularity.

THE BRUNSWICK PATTERN OF REFUSE DISPOSAL

For over a decade the pattern of refuse disposal at the ruins of the town of Brunswick, North Carolina has been used as a guide for predicting the location of refuse deposits reflecting eighteenth century behavior on British colonial sites. Excavations at Brunswick Town State Historic Site were carried out from 1958 to 1968, through the North Carolina Department of Archives and History. This archaeology revealed that the occupants of these structures, from about 1725 to about 1776, discarded their refuse adjacent to their homes, primarily at the back door, but also adjacent to the front doorway. Nearby depressions were also used, as well as the public street. So firmly established was this pattern of refuse disposal that entrance areas to structures could be identified by the increased quantity of midden at the doorways, even if no architectural data had been present. This practice of discarding secondary refuse adjacent to the dwellings is the basis for what I call the Brunswick Pattern of Refuse Disposal (South 1977a), expressed as a generalization as follows: On British American sites of the eighteenth century a concentrated refuse deposit will be found at the points of entrance and exit in dwellings, shops, and military fortifications.

The Brunswick Pattern of Refuse Disposal is seen specifically in the distribution of ceramic fragments around the Public House-Tailor Shop ruin (Fig. 1). The concentration of ceramic fragments in two areas to the rear of the structure reveals the location of a doorway as well as a major refuse disposal area at the rear corner of the building. These midden deposits resulted from occupants throwing refuse outside a rear door, and behind the buildings from the direction of the front yard. The contrast between the slight amount of refuse around the front entrance and the concentration at the rear is a characteristic of the Brunswick Pattern.

Most secondary refuse artifacts will reveal this same Brunswick Pattern whereas any primary refuse classes will vary from this dispersion. The importance of frequency variability in the distribution of different classes of artifacts is seen when pins and beads are examined (Fig. 2). The high concentration of these inside the structure as "loss refuse," with few in the secondary refuse behind the ruin reflects the fact that these artifacts were not discarded, but were lost accidentally inside five of the six rooms, having fallen through the cracks in the floorboards. The virtual absence of these artifacts in the sixth room reveals that a different function was involved here, probably that of an office or merchandizing
Fig. 1. Plan of the Public House-Tailor Shop (S25), at Brunswick Town, North Carolina. Ca. 1732-1776. Dispersion of ceramics.

room. These pins and beads, plus a similar concentration of other tailoring objects inside the rooms, suggests this ruin functioned as a tailor shop. This, plus documentation that the owner of this lot once operated a public house, plus the architectural plan revealing a number of small rooms in a row, resulted in a public house-tailor shop interpretation for this structure.

Fig. 2. Plan of the Public House-Tailor Shop (S25), at Brunswick Town, North Carolina. Ca. 1732-1776. Dispersion of pins and beads.
The *Brunswick Pattern* is mainly applicable, it is thought (in the absence of comparative data from other cultural systems), to sites of British American, or British colonial origin. There is some evidence to suggest that German American settlements will reveal far different refuse disposal patterns than that of the *Brunswick Pattern* due to the different behavioral variables involved (South 1972b).

**THE CAROLINA ARTIFACT PATTERN**

By examining the frequency variations in artifacts from five ruins of British colonial origin in the Carolinas a *Carolina Artifact Pattern* was delineated. This pattern has been tested against sites outside the Carolina area and a similar pattern was found (South 1977a, 1977b).

The patterned regularity in the by-products of human behavior seen in the *Carolina Pattern* reflect a degree of uniformity in behavior on the sites studied. The expression of the regularities seen in the *Carolina Pattern* can be seen as an empirical generalization in the form of "A Law of Behavioral By-product Regularity," which constitutes a basic assumption on which the *Carolina Pattern* was delineated: The by-product of a specified activity has a consistent frequency relationship to the by-products of all other activities in direct proportion to the organized integration of the various activities. Stated another way, the broken ceramics discarded from a domestic kitchen will have a consistent frequency relationship to all other associated artifact classes in direct proportion to their organized integration within kitchen activity.

The question remains as to what types of sites will fall into the predicted range of the *Carolina Pattern*. The pattern was derived from sites both domestic and military in nature, and they have in common the fact that they are in the mainstream of a colonial cultural system. That system was British colonial in origin, even though two ruins contained materials dating to 1830. The application of the pattern to data outside the Carolinas suggests that the phenomena we are dealing with is certainly not limited to the Carolina area from which the pattern was derived. This data suggest applicability extends at least as late as about 1860 (South 1977a, 1977b).

Patterns contained within data from historic sites can be compared with what is known about such sites historically. Therefore, the archaeologist working with documented as well as archaeological data sets has an advantage in that some of the information sought for variable control is available as a given. A group of known domestic house ruins from varying areas and known cultures can be selected, such as those from British American communities, German American communities, French American communities, and Spanish American communities, for abstracting patterns from each group for comparative analysis. Frontier fort sites, manufacturing sites, high and low status sites, etc., can also be used to determine the covariation of patterns resulting from such occupation.

In delineating the *Carolina Pattern*, the concern has been to examine the ratios between artifact groups with the view of establishing certain broad regularities or pulsations against which any deviation from such regularity can be contrasted. Such deviation is seen as reflecting behavior somewhat different from expected margins.

The basic assumption here is that there was a patterned casting off of behavioral by-products around an occupation site that might be viewed as a per-capita-per-year contribution to the archaeological record. Since a middle-class laborer in Charleston would contribute his per-capita-per-year procurement-use-breakage-discard record in a similar ratio to his counterpart in Savannah or Philadelphia, some uniformity in the record would certainly be expected.

Patterned regularity in the archaeological record does indeed exist, and steps must be taken to define it before much progress can be made toward elevating historical archaeology from a study of the unique and particular to a study of lawful regularities of culture. The postulates involved in the delineation of the *Carolina Pattern* might be expressed as follows:

1. British colonial behavior should reveal regularities in patterning in the archaeological record from British colonial sites.
2. Specialized behavioral activities should reveal contrasting patterns on such sites.
3. These patterns will be recognized through quantification of the fragmented by-products from such behavior comprising the archaeological record.
The sites used in the Carolina Pattern are the Public House-Tailor Shop ruin (S7) at Brunswick, North Carolina, occupied about 1732 to 1776; Nath Moore's Front ruin (S10), at Brunswick, occupied about 1728 to 1776; the American occupation at Fort Moultrie, South Carolina, from 1775 to about 1794; the British occupation at Fort Moultrie from 1780 to 1782; and a Cambridge cellar midden deposit at Ninety Six, South Carolina, representing an occupation about 1783 to about 1800. All of these sites were excavated under the direction of the author through the North Carolina Department of Archives and History, and the Institute of Archeology and Anthropology, University of South Carolina.

The artifacts from these ruins were classified by type, class, and group, with the eight groups being used for delineating the Carolina Pattern. The percentage range and mean for all five sites were determined, and this constitutes the Carolina Pattern (Table 1).

Table 1. The Carolina Artifact Pattern.

<table>
<thead>
<tr>
<th>Artifact Group</th>
<th>Mean</th>
<th>% Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen</td>
<td>63.1</td>
<td>51.8–69.2</td>
</tr>
<tr>
<td>Architecture</td>
<td>25.5</td>
<td>19.7–31.4</td>
</tr>
<tr>
<td>Furniture</td>
<td>.2</td>
<td>.1–.6</td>
</tr>
<tr>
<td>Arms</td>
<td>.5</td>
<td>.1–1.2</td>
</tr>
<tr>
<td>Clothing</td>
<td>3.0</td>
<td>.6–5.4</td>
</tr>
<tr>
<td>Personal</td>
<td>.2</td>
<td>.1–.5</td>
</tr>
<tr>
<td>Tobacco Pipes</td>
<td>5.8</td>
<td>1.8–13.9</td>
</tr>
<tr>
<td>Activities</td>
<td>1.7</td>
<td>.9–2.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

Other British colonial sites within and outside the Carolina area have been found to fall within the predictive ranges of the Carolina Pattern. It is obvious that in order to compare new data with the Carolina Pattern the archaeologist must recover and quantify all artifacts in the collection in order to have a comparable data set.

An explanation of why the Carolina Pattern exists on British colonial sites is to be found in the examination of hypotheses directed at cultural processes in the British colonial system. These hypotheses would focus on questions such as the logistics of the British distributive system, the production system, discouragement or encouragement of colonial manufacture and self sufficiency by the British power structure, British expansionist and empire-building policies, status-enforcing rituals, and role-regulating mechanisms. The archaeological patterning resulting from such processes would be expected to vary between British American, German American, French American, and Spanish American occupations, reflecting variability in these cultural systems. Patterning would also vary with the functional role of the site in the social system.

THE FRONTIER PATTERN

The same procedure used to delineate the Carolina Pattern was used to define a Frontier Pattern using sites of the eighteenth century British colonial frontier. This pattern contrasts with the Carolina Pattern in the reversal of the frequencies for Kitchen and Architecture Group artifacts (South 1977a). This pattern was delineated using data from Spalding's Lower Store, Florida, a British trading post site; Fort Ligonier, Pennsylvania, a British anti-Indian fort site; and Fort Prince George, South Carolina, a British anti-French and Cherokee Indian trading post site (South 1977a). All three sites date from the period of the French and Indian War.

By deriving the mean for each artifact group for these three sites the Frontier Artifact Pattern mean and range can be determined (Table 2).

The most apparent contrast between the Carolina Pattern and the Frontier Pattern is the inverse ratio between the Architecture and Kitchen Groups. When we question the cause of this reversal, an increase in by-products associated with architecture in frontier situations can be suggested. This might result from a shorter occupation period per architectural unit on the frontier than in the settlements.
not on the frontier, thus increasing the Architecture Group artifacts in relation to secondary midden deposits of Kitchen Group artifacts. This might also be the result of sampling error in that from the forts very little secondary refuse from the moat ditches (where refuse is most often thrown) was recovered, whereas more architectural objects were recovered from inside the fort where the major excavation was concentrated. The Frontier Pattern could perhaps best be termed an Architectural Artifact Pattern to reflect the variable distinguishing it from the Carolina Pattern since a similar high architectural ratio is often found inside the area of a ruined structure compared with the Carolina Pattern usually seen to prevail in the yard around the structure.

The delineation of patterns for comparing archaeological data from historic sites toward understanding more about the archaeological record and the processes that produced it is a necessary step that must be taken if historic site data are to contribute to explanation of culture processes. The role of historical documentation in controlling some variables while archaeological pattern is defined and compared is the major role of the historical record in the future of historical archaeology. By controlling for variability relating to national origin, distributive systems, status and function through documents providing the basis for classification of historic sites, and then delineating the patterns from such sites through archaeology, we will eventually develop the ability to interpret cultural processes from historic site patterns without dependence on historical control. When we achieve this level of archaeological sophistication we can apply this knowledge to sites for which there is no historical control: prehistoric sites, for instance. This potential for contributing to method-refinement and theory building in archaeology generally is the exciting premise historical archaeology holds for the future.

Noll Hume, Ivor
South, Stanley
1972b Discovery in Wachovia. Manuscript on file with the Institute of Archeology and Anthropology, University of South Carolina, Columbia.
Willey, Gordon R., and Philip Phillips