A Critique of Some Recent North American Mortuary Studies

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A CRITIQUE OF SOME RECENT NORTH AMERICAN MORTUARY STUDIES

David P. Braun

Interpretations of prehistoric social organization based on multivariate statistical analyses of burial practices are becoming increasingly common in the North American archaeological literature. Unfortunately, these analyses and interpretations can incorporate weaknesses ranging from faulty data coding and the misapplication of statistical procedures to biases in the statistical and logical procedures employed. These problems are discussed in light of recent analyses (Tainter 1975a, 1975b, 1977a, 1977b, 1978) which use burial data from six Woodland sites in the riverine midwestern United States to develop a model of social change for the period A.D. 200–800. The results of these particular analyses are shown to be, at best, highly ambiguous and, at worst, contradictory to the proposed interpretations. This paper summarizes the weaknesses in these analyses, both to show the absence of support for the particular proposed interpretations and to illustrate how inappropriate methods can negate potentially useful mortuary research.

Sociological studies based on cluster and factor analyses of burial practices have become increasingly common in North American archaeology (e.g., Peebles 1971, 1974; Hatch 1974, 1976; Goldstein 1976; Rothschild 1975, 1979; Jeffries 1976, 1979; King 1976, 1978; Mainfort 1977; O’Shea 1978; Braun 1977, 1979; Orser 1980). Tainter (1975a, 1975b, 1977a, 1977b, 1978), for example, has used an analysis of six Woodland mortuary sites in the riverine midwestern United States as the basis of an interpretation of social change during the Middle and Late Woodland periods, between ca. A.D. 200 and 800. Overall social complexity, and the complexity of authority structures in particular, are interpreted to have decreased during the Middle Woodland–Late Woodland transition, but to have increased again during the later Late Woodland period in a manner foreshadowing subsequent Mississippian developments.

While the anthropological goals of such studies are laudable, failure to recognize a variety of methodological pitfalls can produce highly misleading results. This paper examines the above interpretation for midwestern Woodland mortuary sites to show that it rests on faulty analytical procedures and questionable theoretical assumptions. My purpose, however, is not simply to catalogue errors, for in this respect we all could find fault with each other (e.g., Thomas 1978). Rather, the purpose is to illustrate how a lack of compatibility between interpretive goals and analytical methods can negate potentially useful mortuary research.

SUMMARY OF THE WOODLAND MORTUARY STUDIES

Most North American studies of social organization using archaeological mortuary site data have focused on the form and extent of hierarchical differentiation or ranking (see also Buikstra 1976; Greber 1976, 1979; Trubowitz 1977). The necessary bridging assumptions concerning the relationship between social rank and burial ritual treatment have been drawn from more general considerations of the relationships between social organization and burial ritual practice presented by Binford (1971), Saxe (1970), and others.

Tainter (e.g., 1978) has proposed methods for more precisely determining properties of prehistoric social hierarchies, using mortuary remains, and applied these to the question of social change during the Middle to Late Woodland transition in the riverine Midwest. The methods derive from the idea that members of a society are ranked relative to each other in terms of their involvement in decisions affecting larger and larger segments of society. This follows the

David P. Braun, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901

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sociological use of the term "rank" to denote a managerial level within a decision-making hierarchy and does not presuppose any particular mechanism of authority acquisition. Tainter suggests, following Blau (1970), that decision-making organizations are differentiated along two basic dimensions of variability. The "vertical" dimension is that of the differential ranking of managerial positions; the "horizontal" dimension is that of differential segmentation and specialization of positions within hierarchic levels. The concept of "differentiation" as applied here, is congruent with such others as Durkheim’s concept of "division of labor" (1933) and von Bertalanffy’s concept of systemic "segregation" (1968:68–69).

This model is developed primarily from the results of Blau’s (1970; cf. Blau and Schoenherr 1971) study of variability in the organization of state employment security agencies in the United States. Blau indicates that the number of distinct decision-making levels in such organizations covaries with both the overall size (number of personnel) and the overall differentiation (number of differentiated task-specific offices) of such organizations. This follows a general systems principle, suggested by Miller (1978:92) and others (e.g., Berelson and Steiner 1964:366–369), that "in general, the more numbers or components a system has, the more echelons [i.e., distinct decision-making levels] it has" (Miller 1978:92). Tainter argues on this basis that monitoring of differentiation along the vertical dimension in a society will simultaneously monitor overall differentiation in the society as well (Tainter 1975b:82–86, 1977a:72–73, 1978:132).

The vertical dimension of differentiation, it is further argued, will be indicated in burial programs by variations in the amount of energy expended in mortuary ritual (Tainter 1975b:83, 1977a:72, 1978:131). By ordering burial types according to the inferred relative amounts of energy represented, one simultaneously will be ordering the represented social personalities along the vertical dimension of differentiation. Information on the number and relative sizes of the vertical rank levels thereby detected will provide information on the complexity of organization and overall differentiation of the society in question.

The basis of this bridging argument is summarized as follows (see also Tainter 1975b:48–51, 1977a:71–72):

An alternative approach to isolating rank distinctions is derived from Binford’s (1971:17, 21) observation that the form of a mortuary ritual will be determined by, among other factors, the size and composition of the social aggregate recognizing obligatory status responsibilities to the deceased. Binford proposes that such a larger array of duty-status relationships (which is characteristic of persons of high rank) will entitle the deceased to a larger amount of corporate involvement in the act of interment, and to a larger degree of disruption of normal community activities for the mortuary ritual. . . . Directionally, higher social rank of a deceased individual will correspond to greater amounts of corporate involvement and activity disruption, and this should result in the expenditure of greater amounts of energy in the interment ritual. Energy expenditure should in turn be reflected in such features of burial as size and elaborateness of the interment facility, method of handling and disposal of the corpse, and the nature of grave associations. Reversing this reasoning, when sets of mortuary data cluster into distinctive levels of energy expenditure, this occurrence will signify distinctive levels of social involvement in the mortuary act, and will reflexively indicate distinctive grades or levels of ranking (Tainter 1978:125).

This argument was evaluated for an ethnographic sample of 103 societies in which descriptions of the social importance of individuals could be compared with descriptions of their treatment at death. No ethnographic case disconfirmed the proposition that when individuals differed in social importance they also would differ correspondingly in the energy expended for their burial (Tainter 1975b:52–61). The converse proposition, that differences in energy expenditures will always indicate differences in social importance, was not evaluated (see also Tainter 1977a:72, 1978:126–128).

The use of the assumption concerning social rank and burial ritual energy expenditure requires that a society’s burials be examined for the presence of distinct levels of energy expenditure among the treatments represented. To this end, Tainter (1975a:3) sought a technique, capable of partitioning the data set into aggregates of burials which can be interpreted as socially distinctive. That is, the data base must be segregated into clusters of burials accorded equivalent forms of inter-
ment. At the minimum, such aggregates of burials must be defined by attributes reflecting equivalent amounts of energy expenditure in mortuary ceremonialism.

In a comparison among five analytical techniques applied to presence/absence data on 18 attributes of burial treatment at the Klunk-Gibson mound group (Perino 1968, 1970; Buikstra 1976), Tainter found monothetic-divisive cluster analysis, using the information statistic, the most compatible technique. Polythetic-agglomerative cluster analysis using either average or complete linkage and principal factor analysis with varimax rotation, all three using Kulczynski's Matching Coefficient 2, failed to generate burial clusters which differed on attributes reflecting different amounts of energy expenditure. Monothetic-divisive analysis using the chi-square statistic was rejected on empirical grounds for generating clusters which frequently differed only in the presence or absence of "idiosyncratic" attributes of burial treatment. Tainter also preferred the information statistic over the chi-square statistic for use with the monothetic-divisive procedure because the former excludes negative matches from the computation of the coefficients of association (Tainter 1975a, 1975b:61-82, 1978:119).

Having established a suitable analytical technique, Tainter employed three steps to obtain the desired measures of organizational complexity for each burial program: (1) cluster analysis of the burials; (2) regrouping of the taxonomic clusters into larger classes representing equivalent levels of expenditure; and (3) assessment of four measures of burial program complexity based on the number and relative sizes of the regrouped burial classes.

The cluster analyses employed as variables the presence versus absence for each burial of several attributes of burial treatment, placement, and grave accompaniment (Table 1). Some of the resulting clusters were subdivided further manually, because they "seem[ed] to isolate small numbers of burials which, on the basis of energy expenditure distinctions, should more appropriately fall into separate clusters" (Tainter 1975b:151, see also 1975a, 1975b:166, 178, 190, 202, 212, 217).

The regrouping of the resulting taxonomic clusters into larger classes entailed the identification of those attribute distinctions characterizing each cluster and an assessment of the significance of these distinctions in terms of energy expenditures. The regrouped classes were then ordered from highest to lowest levels of energy expenditure represented, and thereafter referred to as rank levels (Tainter 1975b:151-153, 166-171, 183-184, 190-195, 202-217, 1977a, 1977b).

Four measures are proposed for evaluating the form and extent of vertical differentiation in a society based on the organization of its burial program: (1) the number of structurally differentiated rank levels; (2) the "amount of organization"; (3) the "degree of organization"; and (4) the "degree of rank differentiation." Calculations of the latter three measures require the prior evaluation of the first, along with an evaluation of the relative number of individuals participating in each identified rank level. The first of these measures is established from the output of the cluster analysis, as described above.

The second two measures are based on the Shannon-Weaver Information Measure (Shannon and Weaver 1949). Given a set of objects or cases divided among K subsets, the information statistic provides a measure of the extent to which the cases are distributed equally among the K subsets, in contrast to being highly aggregated in only one or a few of these subsets. The statistic achieves a maximum value, determined by the value of K, in situations of completely equal distributions of cases among the K subsets; a minimum value of 0.0 is achieved when all cases are aggregated within only one of the K available subsets. Any deviation from an equal distribution of cases will indicate the operation of some form of organizing constraint. Adapting arguments from information theory, therefore, Tainter proposes that the extent to which burial cases are non-equally distributed among the rank levels of a given society, will reflect the relative organizational complexity of that society (Tainter 1975b:86-100, 1977a:73-75, 1978:132-133; cf. Shannon and Weaver 1949; Gatlin 1972).

The second measure employed by Tainter is defined as:

\[ D_1 = H_{\text{max}} - H \]
Table 1. Illinois Woodland Mortuary Variables (1/0), after Tainter (1975a, 1975b).

<table>
<thead>
<tr>
<th>Klunk-Gibson Site</th>
<th>Joe Gay Site</th>
<th>Koster Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Earth walls/log walls</td>
<td>4. On side/not on side</td>
<td>4. On side/not on side</td>
</tr>
<tr>
<td>10. Central location/peripheral location</td>
<td>10. Stone crypt/none</td>
<td>10. Technomic items/none</td>
</tr>
<tr>
<td>11. Supine/not supine</td>
<td></td>
<td>11. Locally produced sociotechnic items/none</td>
</tr>
<tr>
<td>14. Hematite/no hematite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Miscellaneous animal bone/none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Imported sociotechnic items/none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Locally produced sociotechnic items/none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Technomic items/none</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Klunk Late Woodland</th>
<th>Homer Adams Site</th>
<th>Schild Late Woodland</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. On side/not on side</td>
<td>4. On side/not on side</td>
<td>4. On side/not on side</td>
</tr>
</tbody>
</table>
(Tainter 1975b:105–107, 1977a:75, 1978:133), where $D_1$ measures the “amount of organization”—that is, the deviation of a society from a condition of evenness in the distribution of burial cases among the several detected rank level categories. It calculates the difference between the observed information statistic value, $H$, and the theoretical maximum value possible for $H$ given the number of rank levels present.

The third measure employed by Tainter is defined as:

$$RD_1 = \frac{D_1}{D_{1 \text{ max.}}} = \frac{(H_{\text{max.}} - H)}{H_{\text{max.}}} = 1 - \left( \frac{H}{H_{\text{max.}}} \right)$$

(Tainter 1975b:106–107, 1977a:76, 1978:133), where $RD_1$ measures the “degree of organization”—that is, the deviation of a society from a condition of evenness in the distribution of burial cases among detected rank level categories independent of the actual number of such categories detected. It calculates, in other words, the ratio of the observed $D_1$ value to the theoretical maximum value possible for $D_1$, given the number of rank levels present. The value of the second measure, $D_1$, thus is determined by both the number of rank levels present and the relative distribution of burial cases among them. The value of the third measure, $RD_1$, is determined only by the relative distribution of burial cases.

The fourth measure derives from a graph theory technique for calculating a person’s status in a hierarchical organization, based on the number of the individual’s subordinates in successive descending rank levels (Harary 1959). For burial cases arranged by inferred rank level, one can calculate the number of burials represented in the paramount rank level, and the number of burials represented in successive descending levels relative to the number in the first. Tainter presents a formula for calculating the maximum number of subordinate links of hierarchical command possible for an individual based on the number of subordinate rank levels present and on the relative number of individuals contained in those rank levels. This formula, calculated for a hypothetical individual of paramount status, is proposed as a measure of the degree of rank differentiation in a society. The calculated value, labeled $s(1)$, achieves a maximum value when as many individuals as possible are contained exclusively in the lowest rank level and also is positively affected by the number of rank levels present in total (Tainter 1975b:110–118, 1977a:76–78, 1978:133–134).

These four measures were applied to six mortuary sites in west-central Illinois: the Klunk-Gibson Middle Woodland mound complex, ca. A.D. 150–250 (Perino 1968, 1970; Buikstra 1976); the Joe Gay mound group, ca. A.D. 600–700 (Perino 1970); the Koster mound group, ca. A.D. 650 (Perino 1973c); the Late Woodland portion of the Pete Klunk mound group, ca. A.D. 600–800 (Perino 1968, 1973a); the Late Woodland portions of the Homer Adams mound group, ca. A.D. 600–800 (Perino 1970); and the Late Woodland portions of the Schild mound group, ca. A.D. 800 (Perino 1973b). The variables coded for the burials from each of these sites are listed in Table 1. The number of burials analyzed from each site ranged between 61 from the Pete Klunk Late Woodland complex and 443 from the Klunk-Gibson Middle Woodland complex (see Table 3, below).

It must be noted at this point, as a necessary digression, that several of the coded variables used in the Woodland site analyses misclassify grave goods according to their geographic source (local versus imported) and hence their presumed meaning in terms of energy expenditure. Bear canines were classified as “imported sociotechnic items” for the Middle Woodland samples, but as “locally produced sociotechnic items” for the Late Woodland samples (Tainter 1975b:128, 129). Among the seven matched pairs or sets of bear canine burial accompaniments recorded in the Middle Woodland sample, distributed among four individuals, only two pairs of imported Grizzly canines ($Ursus horribilis$) have been tentatively identified as accompanying one individual. A single case of a bear canine accompaniment is recorded in the Late Woodland samples, and this specimen cannot be identified to a nonlocal species (Perino 1968, 1970, 1973a). All the specimens not identified as Grizzly canines conform in size and form to canines of the Black Bear ($Ursus americanus$), a locally available species (Cory 1912:396–404; cf. Parmalee et al. 1972:39–40). Worked Black Bear canines of the same form and manufacture as those included in Tainter’s mortuary samples are a consistent, minor inclusion in Woodland habitation and mortuary sites throughout the region (e.g., Griffin et al. 1970; Parmalee et al. 1972:39; Braun 1979:Table 3).
Anculosa shell beads (Anculosa praerosa) also were classified as imported sociotechnic items for the Middle Woodland sample and as locally produced sociotechnic items for the Late Woodland samples (Tainter 1975b:128, 129). No evidence exists for a change in the productivity of the Illinois or upper Mississippi River systems for this species between the Middle and Late Woodland periods; it has not yet been resolved whether the species ever was locally available in these drainages (Griffin et al. 1970:36; cf. Baker 1930; Parmalee 1973:207). Two individuals in the Middle Woodland sample had associated Anculosa beads; nine individuals among the Late Woodland samples had associated Anculosa beads, including five individuals in the Koster sample (Perino 1968, 1970, 1973a, 1973b, 1973c).

Similarly, all smoking pipes were classified as imported for the Middle Woodland sample, but as locally produced for the Late Woodland sample. No studies exist justifying this absolute distinction.

Finally, galena cubes have been reported to occur naturally in the local surface deposits (Worthen 1870; Rubey 1952). The classification of all Middle Woodland galena as imported (there were no Late Woodland galena specimens) thus also may be unwarranted.

The presence versus absence of imported and/or locally produced sociotechnic items figures significantly in all six cluster analyses (see below, and details in Tainter 1975b:119–220). The shifts in the classification of similar items between the Middle and Late Woodland samples thus have had a direct impact on the size and attribute characteristics of the output clusters and inferred rank levels. It also should be noted that in all the cases cited, the Middle Woodland items were assumed to be imported while the Late Woodland counterparts were assumed to be locally produced. Given the meaning assigned to the distinction between imported and locally produced grave goods, these assumptions predisposed the analysis toward identifying parts of the Late Woodland burial programs as less complex than their Middle Woodland counterparts.

Monothetic/divisive cluster analyses yielded between 12 and 22 terminal clusters for each site. These clusters were then reordered and regrouped to permit calculation of the four proposed measures. The reordering was achieved for each site by scaling the dominant or definitive attributes of each terminal cluster relative to each other in terms of inferred differences in the energy expenditure they represented. Burial treatments were scaled according to the extent (e.g., number of steps) of corpse manipulation and processing, the degree of access to specialized processing facilities, and the size and architectural complexity of the interment facility (Tainter 1975b:123–127, cf. 1977a:80–82). Artifact inclinations were scaled according to their probable local versus nonlocal manufacture and “technomic” versus “sociotechnic” function (terminology sensu Binford 1962) (Tainter 1975b:127–130). The artifact scaling runs from all technomic items to all locally produced sociotechnic items to all imported sociotechnic items, in order of presumed increasing inferred energy (labor) content.

The reordered clusters were grouped into either five or six rank level classes, and the remaining three measures were calculated. The attribute characteristics of each rank level are presented in Tainter (1977a:91). Table 2 summarizes the calculated measurement values for the six sites, following a summary table in Tainter (1977a:93, also 1975b:222).

Tainter (1975b:221–231, 1977a, 1977b, 1978) offers the following interpretations of the results:

1) The number of rank levels present generally decreased between the Middle and Late Woodland samples. The Koster site is interpreted as an aberrant case for this measure, as well as for the other three measures.

2) The “amount of organization” (D1) generally decreased between the Middle Woodland and earlier Late Woodland samples, but increased rapidly between the earlier and later Late Woodland samples.

3) The “degree of organization” (RD1) also generally decreased between the Middle Woodland and earlier Late Woodland samples and increased between the earlier and later Late Woodland samples.

4) The “degree of rank differentiation” (s(1)) decreased slightly between the Middle Woodland and earlier Late Woodland samples, and increased sharply between the earlier and later Late Woodland samples.

<table>
<thead>
<tr>
<th>Site</th>
<th>Date</th>
<th>Rank Levels</th>
<th>D₁</th>
<th>RD₁</th>
<th>s(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klunk-Gibson</td>
<td>A.D. 150-250</td>
<td>6</td>
<td>0.7496</td>
<td>0.2900</td>
<td>13.671</td>
</tr>
<tr>
<td>Joe Gay</td>
<td>A.D. 600-700</td>
<td>5</td>
<td>0.6125</td>
<td>0.2638</td>
<td>20.446</td>
</tr>
<tr>
<td>Koster</td>
<td>A.D. 650</td>
<td>6</td>
<td>0.9710</td>
<td>0.3756</td>
<td>171.600</td>
</tr>
<tr>
<td>Klunk L. W.</td>
<td>A.D. 600-800</td>
<td>5</td>
<td>0.4546</td>
<td>0.1958</td>
<td>3.413</td>
</tr>
<tr>
<td>Homer Adams</td>
<td>A.D. 600-800</td>
<td>5</td>
<td>0.4125</td>
<td>0.1777</td>
<td>7.756</td>
</tr>
<tr>
<td>Schild L. W.</td>
<td>A.D. 800</td>
<td>5</td>
<td>1.4260</td>
<td>0.6141</td>
<td>26.998</td>
</tr>
</tbody>
</table>

Tainter (1975b:186, 1977a:83-84) suggests that the anomalously high values on the last three measures obtained for the Koster sample result from an underrepresentation of individuals of paramount status, rank level 1, in the excavation collection. Tainter supports this suggestion with the following observations: that individuals of paramount status at all five Late Woodland sites occasionally are cremated; that only one cremation was found in the Koster sample and no crematory was located; that Late Woodland crematories may occur at some distance from their associated burial mounds and may also contain some cremated interments (cf. Buikstra and Goldstein 1973). He suggests, therefore, that the anomalous measurements indicate only excavation sampling problems in the Koster Mounds vicinity.

This explanation for the anomalous Koster site measurements may be challenged on empirical grounds. First, the excavation strategy employed for the Koster site was the same as that employed for both the Middle and Late Woodland portions of the Klunk and Gibson sites (Perino 1968, 1970, 1973a; Buikstra 1976) and for the Late Woodland portions of the Schild site (Perino 1973b). Second, evidence indicating the existence of undetected off-mound crematories also is reported for the Joe Gay site (Perino 1970; Tainter 1975b:163–164) and for the Klunk Late Woodland burial areas (Perino 1968, 1973a). Buikstra (1977:74) suggests from these indications that “burial procedures other than mound interment formed a regular part of the burial program” for Late Woodland groups between A.D. 600 and 800. Third, off-mound areas of the Koster site were explored extensively with a probe rod; numerous off-mound burials and other features were detected in this manner (Perino 1973c:142–144). The off-mound areas of the Gibson site were systematically explored in the same manner (Buikstra 1976:16). On this basis, the reasons for viewing the Koster results with caution should apply equally to all results obtained in the analysis of all six sites. As Buikstra has noted (1977:74), underrepresentation of a particular segment of the population can be demonstrated biologically only for the Klunk Late Woodland sample, in which adult male individuals are significantly underrepresented (Tainter 1975b:198).

Tainter (1977a:84–85) offers the following interpretation of his findings:

The Middle to Late Woodland transition seems, then, to have involved a number of distinct changes. The most constant of these was a decrease in the structural complexity of social units. Correspondingly, during the early Late Woodland period, there were decreases in both the amount and degree of organization characterizing Woodland social groups. The degree of rank differentiation also generally decreased during this time. . . . This trend appears to have altered after 700 A.D. Between 700 and perhaps 800 A.D. the Late Woodland social system underwent changes to a higher amount and degree of organization, and to a higher degree of rank differentiation. Such a pattern of change suggests that later Late Woodland cultural systems were formulating an adaptive social posture which led to the highly organized and highly differentiated social systems characterizing the succeeding Mississippian period.

CLUSTERING PROCEDURES

The selection of a burial attribute coding procedure and of a statistical procedure are among the most critical steps in any mortuary site analysis. The latter step has received some abstract consideration (e.g., Peebles 1972, 1974; Hatch 1974; Tainter 1975a, 1978; Braun 1979; Rothschild 1979); the former only rarely receives such consideration (e.g., Tainter 1975b; Rothschild 1979).
As noted above, Tainter has argued for a monothetic-divisive clustering procedure using the information statistic as the most appropriate means for identifying differences in terminal rank among a set of burials. It is argued here, however, that this conclusion may not be generally valid. Further, the use of the suggested monothetic-divisive procedure places severe constraints on the construction of input variables, and if these constraints are ignored (e.g., Tainter 1975a, 1975b; King 1976, 1978) the results will be invalidated. An additional problem is that the procedures suggested by Tainter for ordering output clusters along a scale of energy expenditures appear to be irreproducible, at least in the Woodland examples.

Monothetic-divisive cluster analysis successively segregates a set of input cases into subsets such that the attributes characterizing the cases in each subset have a higher level of statistical association within the subset than within the total data set. The method considers all attributes individually; at each successive step a subset is subdivided into two daughter subsets based on the presence or absence of a single attribute. The particular subset and dividing criterion used in each step are selected to maximize both the within-subset homogeneity and the between-subset variability among the total resulting subsets. Details of the method may be found in Whallon (1971, 1972), Peebles (1972, 1974:104–112), and Sneath and Sokal (1973).

Tainter argues for a theoretical advantage to such a method, as follows (1975a:13):

For any set of mortuary data coded on a binary scale, the suitability of polythetic-classification procedures will be dictated by the amount of redundancy in attribute combinations. Perfectly redundant attributes states represent situations in which clusters of burials are defined by the values of variables which are not present in any other cluster (cf. Clarke 1968:90–92). When such an ideal pattern is present, polythetic measures of co-variation will produce sets of burials which are clearly distinct. ... In theory both factor and polythetic cluster-analyses could potentially be used for mortuary data. But in practice few or no sets of burials will ever display perfectly redundant attribute combinations (cf. Saxe 1970:102–109, 230–231). As a consequence, polythetic classification of mortuary data cannot be expected consistently to yield satisfactory and distinct burial clusters.

Monothetic-divisive methods, however, by definition, generate output clusters that always differ from each other on the basis of the presence or absence of discrete attributes. As long as such differences are assumed to symbolize discrete social distinctions, any burial program analyzed by a monothetic-divisive method will appear to recognize only qualitative, categorical social distinctions among terminal social personae.

Further, Saxe's work in fact suggests not only that burial programs in general are highly, if not always perfectly, redundant (1970:102–110, 230), but that qualitative distinctions in social rank are particularly redundantly recognized when present (e.g., Saxe 1970:116–118, 227–228, 232–233). This appears to follow both from a strong tendency for qualitative distinctions in social position to entail qualitative distinctions in burial treatment (see also Saxe 1970:15–16; Binford 1971:21–23) and from a tendency for more significant social positions to be more redundantly significant in burial ritual programs.

The observation (above) that the success of performance of polythetic methods depends on the extent of redundancy in burial attribute combinations, therefore, suggests rather that such methods are more appropriate for evaluating the presence of "distinctive levels of ranking." That is, where distinctive, redundantly symbolized rank levels are present, a polythetic clustering procedure should produce sets of clusters characterized by redundant attribute combinations, signifying qualitative social distinctions assignable to a dimension of ascriptive ranking (Peebles 1974; cf. Peebles and Kus 1977; Braun 1979). Peebles (1974) and Hatch (1974), for example, have presented cases in which polythetic and monothetic methods jointly confirm the existence of symbolically distinct levels of social ranking in two separate Mississippian societies (see also Hatch 1976; Peebles and Kus 1977; Steponaitis 1978).

The failure of the polythetic methods to isolate distinct burial clusters differing in represented levels of energy expenditure in the Klunk-Gibson data set, therefore, may indicate only the lack of distinct levels of social ranking in that particular case, rather than the unsuitability of these methods in general (cf. Braun 1979; Brown 1979). The output of Q-mode clustering procedures always will be affected by the choice of algorithm and coefficient (see, for example, Matson and
True 1974; Doran and Hodson 1975). R-mode procedures also may serve as means for identifying patterns of attribute redundancy in burial treatments and as bases for a subsequent Q-mode analysis (e.g., Braun 1979; cf. Whallon et al. 1974; Christenson and Read 1977), with the choice of algorithm and coefficient again affecting output structure (e.g., Carroll 1961; Speth and Johnson 1976). In most cases, then, comparisons across a set of different known methods, applied to the same data, are necessary to verify that the suggested clusters are truly prehistoric social artifacts and not artifacts of a particular statistical procedure.

Whallon (1971, 1972) and Peebles (1972, 1974) also emphasize that monothetic-divisive procedures require binary variables which are not logically auto-associated or redundant. That is, the presence or absence of a given attribute cannot logically determine the presence or absence of any other. Such redundancy would arise when two or more attributes are alternative members of the same attribute class; for example, flexed posture, extended posture, and disarrangement would be alternative attribute states in the class of skeletal postures. Mathematically, redundant variables will be perfectly disassociated. Their comparison at any step in the monothetic-divisive procedure would exaggerate the apparent range of variability in attribute associations within the total data set and inappropriately increase the likelihood that one of the redundant variables becomes the dividing criterion at that step. In the analysis of pottery decoration (e.g., Whallon 1971, 1972) or burial artifact inclusions (e.g., Peebles 1974), alternative states in single attribute classes have been easily identified and coding redundancies avoided. In many mortuary programs, however, attributes can interact at least partially in a hierarchical manner with the occurrence of one attribute presupposing the occurrence of another, but not vice versa (cf. Saxe 1970). As a result, it is possible to construct binary, presence/absence variables which are asymmetrically redundant. Asymmetrical redundancies are equally as damaging to the validity of an analysis as are symmetrical redundancies.

Although Tainter (1975a:4, 1975b:67) sought to generate truly nonredundant variables (Table 1), for example, the collapsing of entire attribute classes into single binary variables produced several logical but asymmetrical redundancies. The site reports on which the coding of the Middle Woodland sample was based (Perino 1968, 1970) define all Middle Woodland ramped mortuary structures as “central features,” although not all identified central features had ramps. As a result, variable 5 for the Klunk-Gibson data set (ramps present/absent) is logically redundant in its positive state with the positive state of variable 10 (central feature placement/noncentral feature placement) (see Tainter 1975a:5, 1975b:74). Variable 2 (articulated/disarticulated) for the Klunk-Gibson data set collapses the three conditions of unmodified disarticulation, bundling, and rearticulation (Perino 1968, 1970) under the single state of “disarticulation” (Tainter 1975a:5, 1975b:74). As a result, unless the interment was rearticulated (only two cases) variable 2 is redundant in its negative state with the negative states of both variable 3 (extended/not extended) and variable 11 (supine/not supine). Similar problems occur among the variables employed with the Late Woodland samples (Table 1).

Analytical programs capable of handling redundant variables in a monothetic-divisive procedure have been developed (e.g., Whallon 1971, 1972), in which both symmetrical and asymmetrical redundancies can be handled. Such a program, however, was not employed for the six Woodland site analyses (Tainter 1975a:9–11, 1975b:73), and their formal validity therefore is questionable.

An alternative method employed to avoid redundant variables is the collapsing of entire attribute classes into single binary variables. That is, alternative attribute states are defined as if they represent positive and negative (presence and absence) states of a single attribute. For example, the condition “not supine” in variable 11 for the Klunk-Gibson data set signifies not only the absence of supineness, but the presence of some other state of postcranial position such as facing left, facing right, or facing downward. All three alternative states occurred at the Klunk-Gibson site (Perino 1968, 1970). For other examples, see Table 1 or King (1976, 1978).

Two problems result from the collapsing of multistate variables beyond a simple loss of information:

First, where more than two opposing attribute states are involved, the collapsing will entail ig-
noring the possibility that the alternative modes of burial treatment symbolized an array of mutually exclusive social identities. The identification of patterns of mutual exclusion, as well as of combinations among burial attributes, requires that all attributes be allowed analytically to vary freely against all others (cf. Braun 1979).

Second, the use of clustering coefficients that exclude negative matches from their computation will effectively give less weight in the analysis to those attributes collapsed into the negative side of a variable than to their “positive” counterparts. Examples of coefficients with this effect are the Jacquard coefficient for polythetic procedures and the information statistic for monothetic procedures. In any comparison between two variables using any such coefficient, the frequency with which the variables occur jointly in their negative states will be ignored. The use of collapsed variables under these circumstances will entail a pre-selection of those attribute states in each attribute class to be considered important in the definition of burial clusters (cf. Williams and Lambert 1959, 1960; Lance and Williams 1965; Whallon 1971, 1972). Such pre-selection may be desirable under some circumstances, but then it must be explicitly recognized and justified (Sneath and Sokal 1973). In the case of the six Woodland analyses, the pre-selection is not recognized (see Table 1); the use of cremation, for example, is treated as a negative attribute state for the Middle Woodland sample, but as a positive attribute state for the Late Woodland samples. Such problems again affect the formal validity of the analyses.

The manual subdividing and regrouping of monothetic-divisive output clusters into sets representing distinctive levels of energy expenditure further presupposes detailed external criteria for scaling the evidences of differential expenditure. Except in situations with highly redundant attribute combinations, the terminal output clusters will share several attributes in common. The scaling criteria, therefore, must be sufficiently precise so that any differences in attributes between clusters can be consistently interpreted as indicating either differences or equivalences in energy expenditure.

The criteria employed by Tainter (see above) proved insufficiently precise, for example, resulting in considerable ambiguity in burial ranking. In the manual subdivision of the output clusters for the Klunk-Gibson sample, two clusters were subdivided because they contained a minority of individuals exhibiting central feature interment (variable 10); two clusters were subdivided because they contained a minority of log-covered interments (variable 7); one cluster was subdivided because it contained a minority of slab-covered interments (variable 8); and one cluster was subdivided because it contained a minority of interments with limestone slab inclusions (variable 9) (Tainter 1975b:151). Three clusters also containing a small minority of interments with slab inclusions received no attention (Tainter 1975b:76–79); no reason is given for treating slab inclusions as significant in one case and not in others. A similar confusion exists for variable 8 in this same instance.

The manual subdivision of the output clusters for the Joe Gay sample separated two clusters on the basis of the presence or absence of cremated interments, two on the basis of the presence or absence of articulated interments, and two on the basis of the presence or absence of stone crypts (variables 1, 2, and 10, respectively). The presence of a minority of burials with multiple interments (variable 5) in two other clusters, however, was ignored without an explanation as to why this latter distinction should carry no significance (Tainter 1975b:166–170). Similar instances may be cited in the treatment of the other four Late Woodland samples (Tainter 1975b:178–183, 190–194, 202–206, 212–217).

The regrouping decisions are equally ambiguous. For example, the regrouping of clusters for the Klunk-Gibson sample involved distinguishing between rank level 3 (of six) and subordinate rank level 4 on the basis of the inclusion of limestone slabs in the graves of the former and the inclusion of locally produced sociotechnic items with the latter (Tainter 1975b:76–77, 151–153, 1977a:81, 91, 1978:134). Arguments supporting the “energy expenditure” significance of this distinction or the appropriateness of the ordering are not presented. Similarly, Schöld rank levels 3 and 4 differ only in the placement of limestone slabs over the graves of the former and the inclusion of locally produced and/or imported sociotechnic items with the latter (1975b:217, 1977a:92, 91). Koster rank levels 4 and 5 differ only in the exclusive presence of extended burials lacking a
limestone slab covering in the former and the presence in the latter of both extended and flexed burials lacking a slab covering but containing locally produced and/or imported sociotechnic items (1975b:178–184, 1977a:91). (It should be noted, for this last example, that the listing of rank level characteristics in Tainter [1977a:91] fails to record the presence of slab covering in level 4 or the nearly 50% presence of extended interments in level 5 [cf. Tainter 1975b:178–184].) Other examples may be cited in the regroupings for all six data sets. The gross contrasts between highest and lowest rank levels follow Tainter’s general model in each of the six cases, but justifications are not provided for either the number or the relative ordering of the intervening levels.

ORGANIZATIONAL MEASURES

The difficulties identified above in the data base and clustering procedures employed by Tainter call into question the veracity of the numbers, sizes, and relative orders of the rank levels identified at the six Woodland sites studied. As the four proposed organizational measures are calculated entirely from these three rank level parameters, the measurement values obtained in these particular instances must be considered logically irreproducible. More importantly, however, organizational measures based on the Shannon-Weaver information statistic are mathematically inappropriate in general for the purposes Tainter proposes. Further, the size and demographic structure of mortuary sample populations, even if biologically representative, can affect the appearance of complexity in burial programs in ways which, if ignored (e.g., Tainter 1975b, 1977a), can invalidate inferences concerning social organizational complexity.

As Tainter has argued (see above), the information statistic measures organizational constraint in terms of the randomness or evenness in the distribution of cases among a set of possible subcategories. It is necessary, however, that the categories involved be assumed to exist in parallel, representing alternative states on a single level of information content (Shannon and Weaver 1949; see also Brillouin 1962). In the present instance, they are instead assumed to exist in hierarchical series, representing different levels of information content. Several problems result from this latter assumption (if the replicability of the rank levels is granted for heuristic purposes).

The minimum value for $H$, and the maximum values for $D_1$ and $RD_1$, in any instance, will occur when virtually (but not absolutely) all cases are contained in a single subcategory, regardless of the category. $D_1$ and $RD_1$, therefore, cannot distinguish between a rigidly egalitarian society containing a very few social outcasts (an inverted pyramid with most individuals assigned to the “paramount” rank) and a grossly overcentralized society containing a very few rulers and their agents (a pyramid with virtually all individuals assigned to the most subordinate rank).

If one assumes an upward-pointing pyramid to exist in all cases, $D_1$ and $RD_1$ will measure the degree of centralization in prestige and authority rather than the degree of vertical differentiation in decision-making. The degree of centralization in a system depends on what, and how many, functions of the system are centralized. That is, centralization increases as the number and diversity of regulatory functions performed by the central positions increase, relative to the number and diversity of regulatory links in the system as a whole (von Bertalanffy 1968:71; cf. Flannery 1972:409). In the sociological study of organizations, for example, centralization is indirectly measured in terms of the ratios of management personnel between successive levels in the managerial hierarchy, the supervisor-to-staff ratios within successive levels, and the degree of autonomy (number of fields of independent responsibility) of components within each successive level (Blau 1970; Blau and Schoenherr 1971:111 et seq.; cf. Pugh et al. 1968). The degree of vertical or hierarchical differentiation, on the other hand, depends on the numerical and functional diversification of system parts overall. The degree of vertical or hierarchical differentiation increases as the number of hierarchic levels and the diversity of functions performed at each level increase relative to the diversity of functions performed at adjacent hierarchic levels (Blau 1970; cf. Pugh et al. 1968; Blau and Schoenherr 1971; Miller 1978).

$D_1$ and $RD_1$ vary only with the relative sizes of successive levels in a hierarchy and increase as the number of individuals in successively higher hierarchic levels decreases. In a situation where the number of individuals in each hierarchic level decreases monotonically from lowest level to
highest, therefore, $D_1$ and $RD_1$ will duplicate the information provided by $s(1)$. In all other nominally hierarchical situations, $D_1$ and $RD_1$ will provide only an indication of the average degree of centralization in the system as a whole.

The basis of Tainter's proposed organizational measures, and of mortuary site analyses in general, is the treatment of a burial population as if it represents a cross-section of the vertical dimension of social differentiation in the organization of a living community. Burials representing several decades of mortality are combined to model a single functioning system of social differentiation and mortuary ritual. The size of a burial population, however, will depend on both the length of time over which the burial site was used and the size of the living population using the site. Both variables demand control. The former, of course, affects not only the biological completeness of the burial population, but also the ability of the analyst to separate evidence of idiosyncratic or short-term variations in burial ritual from evidence of the more stable, replicative properties of the ritual program. The longer the span of use of a burial site, on the other hand, the greater will be the probability that significant changes in the organization of social relations and of the ritual program could have occurred. In the absence of means for accurately estimating spans of use of the six Woodland burial sites, approximate equivalency necessarily was implicitly assumed (see also Buikstra 1976; Asch 1976; Braun 1979).

The size of the living community using each burial site becomes critical in light of the general propositions upon which Tainter's four organizational measures are based: Blau's (1970) tested propositions that the number and complexity of decision-making levels in a set of organizations will strongly covary with overall organizational size even in the absence of variation in overall organizational form (Tainter 1975b:82–86, 1977a:72–78, 1978:130–134). Differences in burial population size, for example, appear superficially to explain a moderate portion of the variability in the four proposed measures of organizational complexity among the six Woodland sites analyzed. The number of rank levels detected for a mortuary sample varies directly with burial population size (Pearson's $r = .7293$). Both the $D_1$ and $RD_1$ measures are moderately positively correlated with burial population size as well ($r = .5066$ and .4358, respectively). Rank-order correlations of $D_1$ and $RD_1$ with $N$ (burial population size) give identically high positive values, for Spearman's rho, 0.7714. The rank-order correlation of $s(1)$ with $N$ is .6000 (Spearman's rho). A rank-order correlation of rank level number with $N$ cannot be computed properly due to the overwhelming number of ties present among rank level values (cf. Siegel 1956). Such analytical results, if their replicability is granted, would support a suggestion that there was no change in organizational complexity during the period bracketed by the six Woodland burial samples. That is, within the limits of sampling variability, the results might be interpreted as indicating that differences in apparent organizational complexity among the six samples result simply from differences in the sizes of the six simulated communities. The statistical representativeness of the mortuary samples cannot be assumed, of course, and the correlation values are used here descriptively rather than as inferential estimates.

Differences in the organizational complexity of burial practices as measured by Tainter, independent of the effects of burial population size, may also be evaluated superficially by calculating the ratios of $D_1$, $RD_1$, and $s(1)$ relative to burial population size ($N$) for each mortuary sample. The values of these ratios are presented in Table 3, along with the estimated sample dates (assuming measurement replicability for heuristic purposes). At a minimum, the ratios presented in Table 3 indicate that burial practices at the single Middle Woodland site were organized at a lower level of complexity per unit of burial population size than those at any of the five Late Woodland sites. For both $D_1$ and $RD_1$, the Klunk Late Woodland sample presents the only exception to an apparently consistent trend of increasing complexity per unit of burial population size throughout the period of study. It should be noted that, with the effects of burial population size held constant, the Koster results no longer appear anomalous for either $D_1$ or $RD_1$. For $s(1)$, the Koster Late Woodland sample presents the only exception to an otherwise moderate trend of increasing complexity over time. With a single, mid-Late Woodland exception in all instances, the three ratios appear to indicate a consistent trend of increasing organizational complexity in burial practices per unit of burial population size, in contradiction to the original interpretations.
Table 3. Additional Measurements of Organizational Complexity for Woodland Mortuary Sites.

<table>
<thead>
<tr>
<th>Site</th>
<th>Date</th>
<th>N Burials</th>
<th>D₁/N (10⁻³)</th>
<th>RD₁/N (10⁻⁴)</th>
<th>s(1)/N (10⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klunk-Gibson</td>
<td>A.D. 150-250</td>
<td>443</td>
<td>1.6921</td>
<td>6.546</td>
<td>0.3086</td>
</tr>
<tr>
<td>Joe Gay</td>
<td>A.D. 600-700</td>
<td>185</td>
<td>3.3108</td>
<td>14.259</td>
<td>1.1052</td>
</tr>
<tr>
<td>Koster</td>
<td>A.D. 650</td>
<td>263</td>
<td>3.6920</td>
<td>14.281</td>
<td>6.5247</td>
</tr>
<tr>
<td>Klunk L. W.</td>
<td>A.D. 600-800</td>
<td>61</td>
<td>7.4525</td>
<td>32.098</td>
<td>0.5595</td>
</tr>
<tr>
<td>Homer Adams</td>
<td>A.D. 600-800</td>
<td>138</td>
<td>2.9891</td>
<td>12.877</td>
<td>0.5620</td>
</tr>
<tr>
<td>Schild L. W.</td>
<td>A.D. 800</td>
<td>279</td>
<td>5.1111</td>
<td>22.011</td>
<td>0.9677</td>
</tr>
</tbody>
</table>

The demographic structure of a burial population, however, differs from that of a living population. This difference has theoretical bearing not only on the calculation of the $D_1$, $RD_1$, and $s(1)$ measures in the present Woodland analytical examples, but on the interpretation of authority structures from burial remains in general.

The age profile of a burial population is the product of a mortality schedule imposed on a living census profile, rather than of the living census profile per se. The proportion of individuals in a living population over time who die at a particular age will not be the same as the proportion of individuals of that same age who are alive at any particular time. In general, for age cohorts below the median age of the population, the proportion of individuals in each cohort of a living population will be greater than the proportion in that cohort of a burial population. Conversely, for age cohorts generally above the population median, the proportion of individuals in any cohort of the burial population will exceed the proportion in that cohort of the living population (cf. Weiss 1973). Burial populations thus contain a far greater proportion of individuals above the median age range than do living populations. Buikstra, for example, presents data indicating that individuals over the age of 30 in the Klunk-Gibson Middle Woodland sample comprise approximately 52% of the burial population, but would have comprised only 26% of the associated living population (Buikstra 1976:21-26).

To the extent that burial age cohorts distribute unevenly along the primary dimension of ranking, therefore, the relationship between burial and living rank level sizes will not be consistent between rank levels. In societies where authority covaried positively to a significant degree with adult age so that a subset of increasingly mature adults dominated the social hierarchy, for example, the ratio of adult apparent leaders to followers in the burial population would be exaggerated. Age cohorts distributed unevenly among rank levels for all six sets of results obtained by Tainter (1975b:154, 172, 185, 196, 208, 218; see also Buikstra 1976; Braun 1979).

Correcting burial age cohort sizes along a ranking dimension by using the calculated mortality and living census profiles for the population is feasible, but it requires an assumption that all rank levels followed the same mortality schedule. Since nutrition, hygiene, and physical tasks conceivably can vary systematically with rank (cf. Segraves 1977), particularly in situations of ascriptive ranking, such an assumption would require independent justification. Further, the age cohort and mortality structures along the primary dimension of ranking could vary among different societies, requiring separate corrections. This latter situation would also hold for the six sets of results obtained by Tainter (1975b:154, 172, 185, 196, 208, 218).

THEORETICAL ASSUMPTIONS

Tainter (e.g., 1978) suggests basing studies of social complexity, which would use mortuary remains to examine extinct authority structures, on two key assumptions. The first of these is that "structural differentiation along the vertical dimension can serve as an index of the total structural complexity of past social systems" (Tainter 1978:132). The second is that differences among individuals in energy expenditure in mortuary ritual will indicate differences in the social importance of the deceased. These assumptions, however, may not be as generally applicable as proposed.
The first assumption rests on findings (e.g., Blau 1970) that, in general, the sizes of organizations and measurements of different aspects of their overall integration and differentiation tend to covary. It also is commonly recognized, however, in anthropological, sociological, and systems-theoretical studies of organizational processes (e.g., Flannery 1972; Friedman 1975; Sahlins 1958, 1961; Strathern 1969; Miller 1978; Beer 1972; Litterer 1969; Lawrence and Lorsch 1967a, 1967b), that different variables or dimensions of organization, such as the degree of centralization of control, horizontal segmentation, or hierarchical differentiation in decision-making, respond to different kinds of adaptive constraints. That is, different variables of organization vary relatively independently of each other, according to the specific adaptive constraints operating in particular situations. Consequently, the use of some variables of hierarchical differentiation alone as indices of overall organizational complexity amounts to treating social adaptation as a nearly unidimensional phenomenon, ignoring the multitude of other specific processes potentially involved. The possibility, for example, that horizontal differentiation could increase in some circumstances, despite a steady state or reduction in vertical differentiation (e.g., Friedman 1975), is denied a priori by the proposed theoretical perspective.

The assumption that differences in the expenditures of energy in the burial treatments accorded individuals will indicate differences in the social importance of the deceased rests on general considerations and the results of an ethnographic test. The ethnographic test, in particular, evaluates the proposition that when individuals differ in social importance, they also will differ correspondingly in the energy expended for their burial. To conclude that differences in ritual energy expenditure will reflexively indicate difference in the social importance of the deceased, however, without testing this converse proposition, is to commit the logical fallacy of affirming the consequent (Salmon 1973:27–28). The ethnographic test does not consider, let alone dismiss, the possibility that differences in burial ritual energy expenditure could occur among individuals who do not differ in social importance.

Even if the proposed analytical procedures were fully replicable (cf. Tainter 1975b:59–61), the researcher cannot logically rule out the possibility that individuals of equivalent social importance could have received different expenditures of energy in their burial treatments. This problem goes beyond the well-known uncertainties in all mortuary site studies. The latter concern the nonrecoverability of funeral behaviors, noncultural formation processes (sensu Schiffer 1975), and culture-specific conceptions of expenditures. The problem rather is whether the social messages of different attributes of burial treatment, as components (sensu Saxe 1970) of a mortuary ritual, necessarily increase in significance directly with their mechanical energy costs.

The seminal studies by Binford (1971) and Saxe (1970) did not demonstrate that mortuary ritual contents are linked mechanically to the size and composition of the group responding to obligations of the deceased. Rather, they showed that the mortuary ritual program of a society constitutes a system of symbolic communication, serving as a cultural mechanism for affirming and reinforcing the continuity of social orderliness. That is, mortuary rituals reduce social uncertainty occasioned by the loss of participants in the social order (cf. Van Gennep 1960; Rappaport 1971a). The rituals inform the observers (who generally are also participants) not only about the size and composition of the group recognizing and responding to social obligations to the deceased, but also about the positions of the deceased in society and thereby about the overall organization of society. The vocabulary of this system of symbolic communication consists of a set of ritual acts, some of which may involve the remains of the deceased, objects, or specialized facilities.

The relationship between a symbol and its referent is, by definition, abstract rather than directly representational. Therefore, as Tainter has argued (1975b:48–52, 1978), our ability to interpret the social messages in the remains of an extinct mortuary program depends on the existence of cross-cultural or mechanical constraints on the selection of symbols. The cost of a ritual act, in terms of effort expended in the act or in the production of objects disposed of during the act, is proposed as such a constraint on the communication of the social significance of the deceased.

Viewed as parts of a system of symbolic communication, however, mortuary ritual acts should
exhibit additional properties of constraint—abstract formal properties common to communication systems in general (e.g., Cherry 1966; cf. Saxe 1970; Rappaport 1971a). Shannon and Weaver (1949) note, in particular, that the amount of information conveyable by a message in a particular context is inversely related to the likelihood of its occurrence in that context. Following Peebles (1974:46–47; cf. Peebles and Kus 1977), then, we would expect that mortuary symbols of social significance would increase not only in mechanical energy cost, with increasing social significance of the deceased, but also would be increasingly rare and/or increasingly associated with ritually sanctified or highly exclusive contexts of use (see also Rappaport 1971a, 1971b; Schiffer 1972). The interpretation of the social significance of attributes of burial treatment, therefore, requires the analysis not only of the relative mechanical costs of alternative attribute states, but also of their overall availability, accessibility, exclusivity of contexts of use, and exclusivity of contexts of disposal, where logically applicable, for the particular culture of concern (cf. Braun 1979). Differences in social significance among the deceased, then, should be expected to entail differences in the amount of information communicated and energy expended in their mortuary rituals, and conversely.

CONCLUSIONS

The criticisms and arguments presented in this paper indicate the extent to which errors and ambiguities in procedures and assumptions can affect the credibility of mortuary analyses and their interpretation. Problems exist for the particular examples of mortuary analyses examined in the content and construction of the input data matrixes, in the procedures used to cluster and order the input data, in the proposed mathematical measures of burial program complexity, and in certain theoretical assumptions underlying the entire set of analyses. The problems at each of these four levels of concern, in conjunction with those of all preceding levels, have increasingly global effects on the credibility of the analytical results. These effects can be so comprehensive as to render the results, at best, completely ambiguous and irreproducible or, at worst, contradictory to their proposed interpretations.

Nevertheless, the present criticisms should not be taken as a condemnation of the multivariate statistical analysis of burial practices, nor of the broader goal of quantitatively modeling of social change (cf. Tainter 1978). Rather, the criticisms illustrate simply that every decision taken during an analysis constitutes a premise in an interpretive argument. And the credibility of an interpretation depends not only on the argument’s formal validity, but on the credibility of its individual premises. Archaeologists conducting analyses of burial practices must do so with the awareness that they are studying the end result of not one, but several interrelated processes—demographic, social, ritual, and symbolic-communicative, as well as geological, excavatory, and importantly, statistical-analytical. All of these processes are within our conceptual control, at least in theory if not always in practice.

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REPLY TO
“A CRITIQUE OF SOME RECENT NORTH AMERICAN MORTUARY STUDIES”

Joseph A. Tainter

Braun’s critique is characterized by misleading statements, by misrepresentations of my work, and by repetition of cautions that I have already voiced.

As one who has called repeatedly for the development of objective, quantitative methods for measuring characteristics of past societies, I am heartened to see that others share this concern. Theoretical and methodological refinements in this area are certainly to be desired. Unfortunately, through flaws in logic, lack of understanding, and poor scholarship, Braun’s critique offers little in this regard.

I will not discuss in detail the coding of the data used in my studies, for I do not believe that the pages of American Antiquity are the proper place to discuss such local concerns as the significance of limestone slabs in Woodland graves, or whether an obscure mound group in the Midwest does or does not have a crematory. I would, however, like to mention two points. First, the criteria used to classify Middle Woodland grave associations are fully described elsewhere (Tainter 1973:49–50), and second, there is not, as Braun believes, any auto-association in the coded data. Thus, not all facilities classified as central features had ramps, while at least two disarticulated Middle Woodland burials were rearticulated as part of the mortuary ritual. Parenthetically, I find Braun’s criticisms concerning auto-association in the Klunk-Gibson data puzzling in light of the fact that Braun’s own study of the same data contains variables which he admits suffer from this problem (Braun 1979:72). I will also mention that, if Braun had contacted me concerning those aspects of my coding criteria which he found unclear, I would have been happy to explain my rationale.

Joseph A. Tainter, Cibola National Forest, Albuquerque, NM 87112

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