PART IV: REGIONAL ANALYSIS

6

Introductory Remarks on Regional Analysis

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The five chapters in this section discuss relevant structures of archaeological data on human settlement and subsistence at the regional scale. They also evaluate various analytic techniques (old and new) for their concordance with those structures.

The first three chapters, by Limp and Carr, Parker, and Kvamme, stand as a logically consistent unit. They present or employ a decision-making, theoretical framework for analyzing and explaining settlement or subsistence patterns. The authors assess several economic and statistical techniques (e.g., cost function analysis, statistical decision methods, kriging), which have previously been used in such analyses, for their congruence with the nature of the cognitive choice processes involved in settlement and subsistence behavior. They then present new methods (hierarchical choice analysis, multivariate logistic regression) that are often more concordant than the previous ones. The fourth chapter, by Keene, extends and qualifies these discussions by taking a partially Marxist viewpoint that stresses dialectics and the social domain. From this perspective, Keene critiques linear programming and other fine-grained analyses of subsistence that employ either a cognitive or evolutionary ecological framework. The final chapter, by Williams et al., is reprinted here in part to introduce the concept of the polythetic organization of behavior and archaeological entities, and one approach to the concept's methodological application. As a regional study, the work complements the use of the concept by Carr at the intrasite level (chapter 13).

THEORETICAL FOUNDATION

The chapter by Limp and Carr provides the primitive, conceptual foundation for this section. The authors present a highly generalized theory of rational choice. The alteration of several parameters in the theory allows the formulation of a continuum of more specific theories that range from a classical marginalist stance to set theoretic approaches that are useful in nonwestern situations. These theories vary in the particular assumptions that they make about three cognitive aspects of choice processes: 1) the level of detail of information that is assumed to be perceivable by or available to the decider (e.g., nominal or continuous scale distinctions), 2) the amount of information that is assumed to be processable by the decider, and 3) whether information is assumed to be processed sequentially or simultaneously.

The synthetic nature of the general theory of choice offers at least two benefits. First, by clarifying the three kinds of assumptions about choice processes that any specific economic theory or methodological application implicitly involves, it provides *dimensions* for evaluating the degree of logical concordance between theory, method, and phenomenon of interest/data. The authors summarize the relative restrictiveness of the assumptions of various theory-method pairings using these dimensions and discuss the approximate behavioral contexts in which such theory-method pairings are appropriate. Second, by defining the logical relationships among specific theories of rational choice, the general theory helps to resolve the apparent conflicts that are involved in the formalist-substantivist debate and the maximizer-satisficer debate. Through their explication of the general theory of choice, Limp and Carr show that in the first debate, marginalism (a specific form of choice process) has been confused with choice in general. In regard to the latter debate, the authors show that the concept of satisficing and its history of application have been misunderstood.

Two additional aspects of the chapter by Limp and Carr deserve to be highlighted. First, in considering how to evaluate an economic analysis, the authors distinguish between the logically concordant relationship that should exist between theory and method (what they term *etic coherence*) and that which should exist between a theory-method pairing and the phenomenon of interest (what they term *emic symmetry*). This distinction reiterates the two requirements for meaningful analysis that are discussed in the introduction of the volume. A second matter of importance that is discussed by the authors is the distinction between *physical properties* and *conditional preference aspects*. This distinction is critical to both developing a data base with a relevant subset structure and interpreting analytic results. When the variables that are used to describe observations are their physical properties, rather than their conditional preference aspects which were employed in the decision process, regularities in the decision process can be obscured. Moreover, it is inappropriate to conclude—solely on the basis of the predictability of a derived model of a decision process—that the variables that were chosen to describe observations capture their conditional preference aspects as envisioned by the deciders. The emic meaning of a set of variables requires rigorous validation with independent data, such as informant interviews. Finally, we may note that the distinction between physical properties and conditional preference aspects parallels Rappaport's (1979) distinction between *operational* and *cognized environments*, providing a natural bridge between economic and ecological theory.

METHODOLOGICAL ADVANCES

The chapters by Parker and Kvamme, in combination, present a new set of statistical procedures that allow the formulation of predictive models of settlement decision processes. Their approach offers three broad advantages over previous methods.

1) The approach takes the *land parcel* as the unit of analysis rather than the *site*, which has previously been used in settlement distributional studies (e.g., Struever, 1968) and catchment analysis (Vita-Finzi & Higgs, 1970). By considering all possible *alternative* locations of settlement—sites and nonsites—rather than simply settled locations, the method allows one to apply decision-making, theoretical frameworks and techniques in evaluating settlement patterns. These techniques make it possible to (a) determine the relative importance of various biophysical attributes (and potential conditional preference aspects) of the landscape in determining settlement choice in a known area, (b) model the choice process, and thus (c) *generate* or predict settlement patterns in new landscapes rather than simply describe and *generalize* on the pattern of a known settlement distribution (Limp, 1981, p. 4). It allows the building of processual models and theory rather than redescriptive ones.

2) The approach introduces the use of a statistical technique—*multivariate logistic regression (MLR)*—that concords reasonably well with settlement decision-making processes. (a) The familiar multivariate regression model involves a continuous dependent variable that ranges from $-\infty$ to $+\infty$. It thus is inappropriate for predicting the choice or nonchoice of a land parcel for settlement (site presence or absence), given the parcel's biophysical attributes as predictor variables. In contrast, a MLR model involves a dependent variable that is restricted in range from 0 to 1, and is therefore capable of representing the probability of choice or nonchoice of a land parcel. (b) The predictor variables in a MLR model can be nominal, ordinal, n-cotomized continuous, or continuous in nature. Thus, the *measurability* (Limp & Carr, chapter 7) of the biophysical attributes and potential conditional preference aspects of land parcels (predictor variables) can be controlled. This allows the formulation of a model that assumes a specified level of detail of the information available to and processable by the decider. (c) Also, in MLR, when working with nominal, ordinal, or n-cotomized continuous predictor variables, the number of distinct probability levels that is taken by the dependent variable can be controlled to some extent. This is achieved by specifying the number of predictor variables and number of states taken by each variable. In settlement analysis, the number of distinct probability levels represents the number of subsets of land parcels into which the global landscape set is divided and to which the decider is not

indifferent—the *k-fold partitioning parameter* (Limp & Carr, chapter 7) that represents the level of information accessible to and processable by the decider. Thus, the technique allows the formulation of a settlement selection model that assumes a choice structure and selection process that can range considerably in its degree of detail and determinism—from a set structure with a small number of partitions, which defines a highly stochastic selection process, to a continuously divisible structure, which defines a highly deterministic process in line with a marginalist stance. This flexibility is concordant with the general theory of choice that is presented in chapter 7 by Limp and Carr. (d) Unlike kriging and trend surface analysis, MLR makes no assumption about the *spatial continuity* (autocorrelation) of settlement. The predictor variables are landscape biophysical attributes, which may have patchy spatial distributions, rather than spatial coordinates which are autocorrelated. (e) One aspect of MLR that often may not be concordant with settlement decision processes—particularly in nonwestern contexts—is its *simultaneous* rather than *sequential hierarchical* consideration of multiple decision criteria (predictor variables). A hierarchical decision rule approach (Limp & Carr, chapter 7) may be more appropriate in this regard. However, this approach implies such a large calculation burden that it may not be feasible in most nontrivial archaeological applications (e.g., CRM projects). As a compromise between the conflicting needs for concordance and efficiency, a two-stage methodology can be used. This involves first using stepwise MLR to determine the approximate relative importance of various landscape attributes to the settlement choice process, and then incorporating only the more important attributes in alternative hierarchical decision tree models, which can be tested against each other in the manner illustrated by Limp and Carr (chapter 7).

3) The theoretical and methodological framework that is used by Parker and Kvamme allows a broad range of potential constraints on human settlement decisions to be evaluated for their importance: subsistence, constructional, psychological, social, and other factors (e.g., distance to plant food resources, soil drainage, locational exposure to natural hazards such as flooding or social hazards such as attack). In contrast, most previous decision-making analyses of prehistoric settlement choice (e.g., Jochim, 1976; Binford, 1980; Keene, 1981) have been limited to the investigation of potential causal factors in the subsistence domain. This limitation results from the fact that the settlement analyses have been *derived* from analyses and models of subsistence systems and their implications on the use of the environment and mobility.

The Multivariate Logistic Regression Approach in Total

The two chapters by Parker and Kvamme report or stress different aspects of the MLR approach in order to avoid redundancy. In total, the approach encompasses at least the following technical operations.

1) The sample of surveyed locations (sites and non-sites combined) is checked for its representativeness of the total range of environmental variation in the study area (or ecozone of interest; see below). This is done using *K-S* tests for continuous or ordinal variables and X^2 tests for discrete variables.
2) The significance of biophysical variables in determining settlement location is assessed. This is done in a stepwise manner, first with univariate (*K-S* and X^2) tests, then multivariate MPRR procedures, and finally MLR procedures.
3) Stepwise rather than simply static approaches to MLR procedures can be used.
4) The logistic regression model is validated statistically and tested in the field.
5) Probability surface maps of potential settlement locations can be generated with the MLR model.

Either random point location data or quadrat data on site presence/absence and environmental variation can be used to generate a MLR model. The model can be used simply as an aid for understanding settlement decision processes in an archaeologically known area, or it can be applied to biophysical data about an archaeologically unknown area for predictive purposes.

Comparison to Other Inductive Approaches to Predictive Modeling of Settlement Location

The framework for predictive modeling of settlement patterns that is used by Parker and Kvamme differs markedly from a variety of approaches that have been employed recently in CRM contexts in the western United States and have raised some controversy. These latter projects have used at least four methodologies (W. James Judge, personal communication, 1983).

1) *The density transfer method.* This approach involves the simple proportional transfer of site densities within an archaeologically known area to an unknown area of similar environment (e.g., Drager & Rice, 1983; Ebert & Gutierrez, 1979; Larralde & Nickens, 1980; Read & Nickens, 1980).

2) *The density regression method.* Here, site densities within *large* land units in an unknown area are predicted on the basis of a multiple regression between site density and biophysical features within large land units in a known area (e.g., Green, 1973; Kemrer, 1982; Nance et al., 1983). Large land parcels are defined here as those with dimensions greater than the minimum distance between sites and possibly including more than one site. Small land parcels are those of less area, not likely to include more than one site, as in Parker's and Kvamme's studies (chapters 8, 9, respectively). Either small quadrats or point locations fall in the latter class.

3) *The significance prediction method.* In this approach, an interval scale measure of the significance (CRM sense) of sites that are present within small land parcels in an unknown area is predicted. Zero significance is defined as site

absence. The prediction is made on the basis of a regression model that relates significance to biophysical predictors in small land parcels in a known area (James et al., 1983).

4) *Linear discriminant function analysis:* In this approach, site presence or absence in small or large land parcels in an unknown area is predicted. The prediction is based on a linear discriminant function analysis of the distribution of sites, nonsites, and biophysical attributes among land parcels in a known area (Holmer, 1979; Burgess et al., 1980; Larralde & Chandler, 1980; Peebles, 1981, 1983; Zier & Peebles, 1982).

Each of these approaches has one or more disadvantages that can be circumvented by using multivariate logistic regression in the manner of Parker and Kvamme.

The density transfer method allows the use of only categorical biophysical variables in predicting settlement location. It also does not allow one to determine which of the suite of biophysical attribute states that are shared in common by the known and unknown areas is responsible for site presence in a location; thus, it bring little understanding of the settlement decision *process*.

Neither the density transfer method nor the density regression method, in using large land parcels as the units of analysis, are concordant with settlement decision processes. Settlement decision processes involve locations of *restricted* area as logical alternatives as well as large ecotones. The importance of the idiosyncratic characteristics (e.g., shelter quality, view quality, slope) of small land parcels to the positioning of more permanent settlements is emphasized by Kvamme in his hierarchical spatial model of site selection. Also, in using large land parcels, neither method allows the prediction of *specific* locations that are likely to have or not have archaeological sites, which causes a problem for CRM planning. The use of large land parcels also poses operational problems in characterizing them for their biophysical attributes when they are internally heterogeneous (Lafferty et al., 1982, p. 66).

The significance prediction method represents an inappropriate application of multiple regression procedures. The model combines a dependent variable and independent variables that do not relate to each other as variables that define a single process. Biophysical attributes of a land parcel determine the preferability of the location for use in some manner and the presence or absence of a site type—not archaeological significance as an ad hoc polythetic composite index of site characteristics.

The linear discriminant function approach with small land parcels is closely related to the logistic regression method of Parker and Kvamme. It has the limiting assumptions, however, that the populations to be discriminated (e.g., sites and nonsites) are multivariate normal and have equal covariance matrices for the variables being investigated. It also does not allow the use of both continuous and discrete predictor variables in the same model (although discrete variables can be employed by themselves in kernel discriminant analysis).

Finally—and of greatest controversy in the use of predictive modeling—some studies of the above varieties (see Chandler & Nickens, 1983 for a summary of projects) have not taken into consideration the need to both statistically *validate* a predictive settlement model and to field *test* it prior to applying it to an unknown area for management purposes. This point is stressed by Parker. Also, some CRM studies, (e.g., Peebles, 1983, p. 9; Chandler & Nickens, 1983, p. 6-7) have suggested that predictive settlement models, alone—without field checks—be used to *determine* whether specific, archaeologically unknown locations can be cleared for development without significant impact on archaeological resources. This use is inappropriate, given the statistical rather than deterministic nature of both human settlement decision processes and the methods of analysis. A more appropriate role of predictive modeling in CRM would be as an aid, during the planning stages of compliance procedures, for *projecting* those areas of potential development that are less likely to include many significant sites. Berry (1984) and Ambler (1983) detail the abuses of predictive modeling of site location in CRM work.

Global vs. Local Analysis of Settlement Decision Process

The chapters by Parker and Kvamme differ in the geographic scales of the decision processes that the authors wish to consider and, thus, in certain aspects of the list of variables and the sample of location observations that they use. As Kvamme notes, a settlement process can be modeled as a hierarchy of decisions, with different levels pertaining to land units of different scales and to different kinds of preference aspects. The uppermost levels focus on broad alternative areas for settlement (e.g., ecozones) and the food and social advantages that they offer. The lowest levels are concerned with small alternative areas of actual occupation and their idiosyncratic characteristics that immediately affect occupation (e.g., slope, soil drainage, exposure). When a study area is moderately to strongly structured into geological and biophysical communities, such as the lifezones in Kvamme's study area or the various upland, terrace, and valley bottom ecozones in Parker's study area, it is possible to investigate at least two different levels of the settlement decision hierarchy for the area. One can ask, "What *ecozones* were more or less preferred for settlement for the food resources and social advantages that they offered?" Additionally, one can ask, "What specific locations *within* a given ecozone were more or less preferred for their characteristics that immediately affect occupation?"

The variables and observations (relevant subset structure) that are appropriate for a settlement decision analysis using MLR will vary, depending on whether one is interested in global, upper-level decision processes or local, lower-level decision processes. For a local analysis, variables that are concerned with local idiosyncratic characteristics that immediately affect occupation should be used. Only observations (locations) in the *same* ecozone should be included in the analyzed sample because only these represent logical *alternatives* to each other for exploitation or settlement. If local decision processes in multiple ecozones are of interest, a separate model should be built for each ecozone. In contrast, for a global analysis, variables that pertain to resource availability in broader catchments or to regional social advantages should be used. Locations from *multiple* ecozones, which are exploitation/settlement alternatives, should be included in the analyzed sample of observations, and one model that pertains to all ecozones should be built.

Kvamme is clearly interested in decision processes at the local level. The variables that he uses all pertain to local, idiosyncratic characteristics that immediately affect occupation (e.g., shelter, exposure, view, distance to water). Additionally, he discusses the preferability of formulating a separate model for each ecozone. In contrast, Parker is apparently interested primarily in global settlement decision processees. Most of the variables that she uses monitor biophysical community attributes (e.g., several soil characteristics, elevation, distance to upland/lowland ecotone, order of nearest stream). The positive or negative significance of these attributes in her model can be interpreted as the preferable or less preferable nature of various biophysical communities for use or settlement. Also, Parker builds one model pertaining to locations in all ecozones within her study area.

Both Kvamme's and Parker's analyses involve some incongruities between the variables or observations (subset data structure) that are used to model the decision processes of interest and the nature of the processes themselves. In each case, the problems arise from the small sample of site locations that is available for study and the necessity of lumping heterogeneous populations to proceed with analysis. In Kvamme's study, despite his interest in local decision processes within ecozones, and despite his use of a set of variables that monitor such processes, site and nonsite data from *multiple ecozones* were used to build a single MLR model. To keep this incongruence to a minimum, however, two steps were taken. 1) Analysis was restricted essentially to the more similar, lowland ecozones rather than allowed to include both lowland and mountain ecozones. This was done by weighting the sample of site and nonsite locations that were analyzed heavily toward the lowland ecozones, rather than proportional to the areas of each ecozone. 2) The relative proportion of sites and nonsites that were selected from each ecozone was held constant over zones (see Kvamme's chapter for a justification). In Parker's study, despite her interest in global decision processes that pertain to individual subsistence-settlement systems, site and nonsite data from *multiple systems* that reflect *different ecological adaptations* over time (hunter-gatherers and agriculturalists) were combined to build a single MLR model. In addition, a few of the variables that Parker used (e.g., soil depth to water, several measures of distance to water) pertain more to local decision processes than global ones.

In sum, Parker's and Kvamme's studies differ in whether the variables chosen for analysis pertain to global or local decision processes, whether observations from all portions of the environment or only some portions were selected for analysis, and whether environmental variation was sampled proportionally or disproportionally for those strata that were considered. These differences in the subset data structures that are assumed relevant by the authors reflect the different settlement decision processes of interest to them and the different analytic compromises that they had to make to study such processes.

The Future of Logistic Regression in Settlement Analysis

The chapters by Parker and Kvamme suggest several areas of concordance between method and data structure that need to be investigated more throughly and improved.

1) The method assumes that population density in the study area was great enough, or the study area was occupied long enough by peoples of a single settlement adaptation, that a high proportion of the locations in the most preferred attainable set were occupied. The method also assumes that the number of preferred but unsettled locations is small compared to the number of unpreferred, unsettled locations. These circumstances are necessary if the physical properties or potential conditional preference aspects that distinguish preferred from unpreferred settlement locations are to be determinable statistically. The robusticity of the approach in regard to these requirements needs investigation.

2) Related to the first point, it should not be expected that two environmentally similar areas, which are occupied by groups that had similar settlement decision frameworks, will be found in a MLR analysis to be characterized by a similar set of preference criteria. The results that are obtained will depend not only on the common decision framework that was used by the peoples in the two areas, but also on the relative population densities of the two areas and the degree to which less preferable locations of settlement had to be occupied in one area relative to the other. Different levels of the common decision tree hierarchy will possibly be evaluated if population densities differed much. This relationship between population density and decision analytic results needs to be investigated.

3) Both Parker's and Kvamme's studies use two kinds of variables: (a) *quadrat* characteristics that describe the nature of a particular land parcel or the immediate surroundings of a randomly chosen point (e.g., soil drainage within a unit), and (b) *absolute distance* characteristics that describe how far the land parcel lies from some desirable feature (e.g., distance to nearest permanent water). Settlement decisions among mobile and semimobile groups, however, often involve a third kind of variable, as well: *proportional distance* characteristics that describe the distance of a land parcel from one critical resource compared to its distance from another. Binford (1980) has documented the importance of this settlement characteristic among hunter-gatherers (collectors) in patchy to coarse-grained

environments in the mid to high latitudes. In these circumstances, settlements are often chosen so as to *equalize* the distances to critical resources relative to each other, rather than to minimize the absolute distance to any one resource. This aspect of settlement decision-making processes can be incorporated in a MLR analysis by including ratios of distances to critical resources among the list of variables that are analyzed. The ratios should be of the form:

$$\frac{\overline{XA} - \overline{XB}}{\overline{XA} + \overline{XB}}$$

where $\overline{XA}$ is the distance between location X and resource A and $\overline{XB}$ is the distance between location X and resource B. This form, rather than a simple ratio between absolute distances, is necessary for the variable to be definable in most cases (no division by zero, except when the two resources coincide at the site location) and a *linear* function of the absolute distance from either resource. In addition, the variable has a convenient restricted range, from -1 to $+1$.

Inasmuch as most environments have some resources with patchy or coarse grained distributions (e.g., lithic resources, animal migration routes, trade routes), the need for proportional distance characteristics of land parcels will have to be considered in most MLR applications.

4) Hunter-gatherer subsistence systems are characterized by reliance on diverse resources that are procured by multiple strategies in order to reduce the risk of not obtaining the food and raw material requirements of life at any one time (e.g., Lee, 1968, 1979; many citations in Jochim, 1976). Measures of food resource diversity within a one-day trip distance, two-day trip distance, etc., from a land parcel should therefore be considered for use in future MLR applications. The use of multiple measures of diversity, which consider multiple radii, is necessary to avoid the improbable assumption that hunter-gatherers exploit a catchment basin of one size for all resources (see next point).

5) As MLR applications become more sophisticated, involving measures of productivity of specific food resources as predictor variables (e.g., density of nut resources), care will have to be taken to avoid using a single size quadrat for measuring all resource potentials. Doing so would imply the erroneous assumption of a constant size catchment and constant production and transportation costs for all resources—a point stressed in chapter 7 by Limp and Carr. Other quadrat variables that do not involve a cost-production function (e.g., local drainage, susceptibility to attack) are not limited in this manner.

6) Future analysis will need to consider whether the prehistoric decision process that is to be modeled involved the *individual* natural characteristics of land parcels (e.g., nut productivity, soil drainage) or *constellations* of them that are regionally correlated (biophysical communities). Was settlement choice made in regard to individual landscape attributes or intercorrelating landscape attributes that define *dimensions* of variability? The answer to this issue will determine whether primary descriptions of the environment or their summary

dimensions (e.g., as obtained from a factor analysis; see Parker, 1981) should be used to build the decision model. Thus, the researcher is forced to consider how environmental variability was cognized at a *general* level.

As a means for solving this problem, it may be useful to consider ethnographic analogs that are selected on the basis of at least two criteria. These are: (a) whether the environment in the analogous circumstance has a *structure* similar to that of the landscape of interest (e.g., strong or weak dimensions of variability; many or few dimensions) and (b) whether the environment in the analog is similar in *content* to the landscape of interest (e.g., involves game animals and plant resources of similar sizes; behaviors; and habitats such as terrestrial, marine, or riverine).

7) Paralleling comments by Keene (chapter 10) on the limitations of linear programming models in subsistence analysis, we may note that the analysis of settlement decision processes using MLR makes it difficult to include social and political factors in the modeling process. In particular, it is difficult to relate site location choice to conditional preference aspects that pertain to the locations of other sites—as opposed to biophysical variables—unless the study area at large is well known archaeologically (W. James Judge, personal communication, 1983). Site clustering that results from dependence on central places (e.g., Cahokia, Pueblo Bonito), or voids in site distribution that result from the nucleation policies of central places (e.g., Teotihuacan) or border maintenance processes (e.g., Spencer, 1982) are some relevant factors that remain difficult to model.

This problem can be addressed to some minimal degree for complex societies by incorporating measures such as distances (absolute and proportional) to sites of various size classes and functions. It may be more difficult for simpler societies where the focal sites are less obvious, perhaps undiscovered, and possibly changed frequently over time with alliance structure. The problem can possibly be corrected to some degree in MLR applications that are concerned with modeling settlement decision processes in *known* study areas, but it does not seem solvable for CRM applications that are concerned with prediction in *unknown* areas. It is important that these two kinds of applications be distinguished in reference to this problem.

A more extensive discussion on some potential directions of development of MLR approaches to settlement decision modeling, and a critique of Parker's work, are provided by Carr (1981).

IN HISTORICAL PERSPECTIVE

The final chapter in this section, by Williams, Thomas, and Bettinger—though written ten years ago—is reprinted as a precocious effort to utilize several key concepts or methods that are discussed or qualified in other studies in the volume. 1) Williams et al. stress the *cyclical* nature of the scientific process, which Carr (chapter 2) discusses as a means for bringing concordance between theory, method, and data. This understanding of the scientific process stands in contrast to the more limited perspective—emphasizing the testing of hypotheses and explanation, through deduction—that preoccupied many archaeologists (e.g., Watson et al., 1971; Fritz & Plog, 1970) at the time that Williams et al. wrote their article. It should be noted, however, that the logical framework of Williams et al. oversimplifies the "deductive," hypothesis-testing phase of scientific logic, as have many other presentations. It does not acknowledge that the testing of a hypothesis through the analysis of complex data almost always requires inductive logic in addition to deductive logic, in order to successfully select relevant variables and cases and an appropriate analytic technique (see Carr, chapter 2).

2) The authors almost discover the appropriateness and the necessity of using the *land parcel*, rather than the site, as the unit of analysis in settlement pattern studies, as discussed by Parker and Kvamme. Williams et al. envision a fourfold contingency table that summarizes the environmental features of both site and nonsite locations. However, they are unable to realize an analysis in this format because they incompletely conceptualized the land parcel as a unit of analysis: they define preferable loci of settlement (locations that have more favorable biophysical characteristics) but not unpreferable loci. This mental framework, which is transitional between one that uses the site as the unit of analysis and one that uses the land parcel, clarifies how the former restricts one from applying a decision-making framework to the study of settlement patterns.

3) The chapter introduces the notion of *polythetic* organization—as opposed to monothetic organization—of entities. Following Clarke (1968, p. 35-38), the authors argue that envisioning and analyzing archaeological entities (e.g., archaeological cultures, settlement systems) as polythetic constructs has utility in two ways. (a) The real world—in this case, past human behavior—often operates in a polythetic rather than monothetic mode (chapter 11, p. 278). When such a condition holds, the analytic technique that is used should assume the polythetic organization of entities if it is to be concordant with the nature of the phenomenon of interest. This point is also made and emphasized by Carr in chapter 13, for intrasite analysis. (b) Regardless of whether a phenomenon of interest is organized polythetically or monothetically, envisioning it as polythetic can be helpful during early stages of analysis. It can allow the researcher to make explicit and operationalize intuitive impressions about the phenomenon until it becomes better known through analysis and perhaps becomes understandable in a monothetic framework (chapter 11, p. 279).

The approach to the study of archaeological entities as polythetic entities that is offered by Williams et al. differs in three ways from that presented by Carr in chapter 13. First, Carr stresses that polythetic or monothetic organization is a *natural aspect* of certain kinds of data, which results from the operation of specified *processes* under specifiable contexts. He explicitly seeks to enumerate the processes and contexts that determine those organizations for some kinds of artifact distributions within sites. In contrast, Williams et al. stress the utility of the polythetic concept as a *device* for operationalizing intuitions. They do not address the issue of whether settlement patterns and the behaviors and processes that generate them are polythetic in nature.

Second, Williams et al. employ the polythetic concept in its *fully* polythetic form (i.e., no attribute is necessary and sufficient for membership in a set), whereas Carr employs it as pertaining to any of a range of organizations that vary from fully polythetic through partially polythetic (some attributes may characterize all members of the set) to nearly monothetic. This difference stems from the different uses that the authors make of the concept, as previously mentioned. A fully polythetic organization can be used to define intuitive categories for which exceptions are anticipated across any attributes (Williams et al., chapter 11, p. 279), and thus is appropriate to Williams et al.'s concern for operationalizing intuitive classes. The definition of polythetic organization as any of a range of possible forms, on the other hand, allows the investigation of organizational variation as a function of variation in the kind and intensity of the processes that are responsible for organization—the intent of Carr's chapter.

Finally, Carr employs the concept of asymmetry as a fundamental organizational parameter that partially underlies the polythetic-monothetic continuum. This reflects Carr's interest in a continuum of organizational forms between the monothetic and fully polythetic extremes. In contrast, Williams et al., who have other purposes, do not use the concept of asymmetry.

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