

Besprechungen

David L. Clarke, *Analytical Archaeology*. Methuen & Co. Ltd. London, 1968. 684 Seiten und 170 Abbildungen.

This book is not easy to read. Not even for the reader whose native language is English and who is to some extent familiar with the jargon used by the author. Nonetheless, it would be very much a mistake to dismiss the author's ideas simply because of the way in which he has chosen to express them. David Clarke has taken upon himself nothing less than the monumental task of attempting to provide a theoretical basis for empirical archaeology – that is, archaeology based on the observation and recording of the material remains of the past. There is little dependence on anthropologically or historically based social theories which, whether acknowledged or not, underly the interpretation of the past by those archaeologists who rise above mere classification and recording.

Clarke's main line of thought will appear, at first, to be more of interest for those who deal with periods or areas where no additional information from written history is available. In fact, many of the ideas presented are quite general and could be invoked when considering real data from any culture.

In some respects the archaeologist reader will find the construction of the book puzzling, although the author takes considerable trouble to explain what he is trying to do from the very beginning. He is following precedents evolved in New World geography, stiffened by a strong dose of modern theories of complex systems of physical character. As such, in an attempt at an almost mathematical rigor, the mode of expression often hinders rather than aids in outlining a remarkable analysis. A word of advice to readers: at the end of each chapter the author has provided a summary of the contents of that chapter. Read this first! Better still, read all the summaries before reading the book. Even though these are very compressed, when one knows what the author has planned, the text is easier to follow.

The aim of this review is not to repeat or criticize the vast content of the book in detail. The question which will be raised here is, is Clarke's analytical model applicable as a theoretical basis for archaeology and, if it is, will it work in archaeological practice given present techniques?

First, it is important to note that the author devotes the whole first part of the book, over four hundred pages, to the detailed definition of language and method used, as well as to the working details of what is probably the most complex theoretical model for cultural systems, their interaction with each other and their variation in time ever attempted. The second part of the book is devoted to examples which provide some flesh and blood for the theoretical skeleton of the first part. Since the approach is new, examples are of necessity not numerous, and this section is inevitably weaker than the first.

The model, as a 'set of structured hypotheses' has a long and respectable history in archaeology which the author briefly traces. He proposes three different though similarly constructed models, one for archaeological procedure – the discipline –, one for the archaeological entities themselves – the static model –, and one for the change of those entities with time – the dynamic model. Having proposed this analytical scheme, the author then goes on to assume that the real world and its data corresponds closely enough to the model so that the two can be treated as if they are identical. All further analysis is carried out on the intellectual construct, the model, with only occasional reference to real data. Although this may be a completely acceptable approach in physics, acceptability having been gained through practical success, it seems doubtful that archaeologists will accept it for the analysis of the complicated system of human relationships which are conditioned by interaction with natural surroundings. In order to examine the whole work, book, one must tentatively admit the main hypothesis, the usefulness of the method of models.

The model for archaeological procedure – i. e. the activity of the archaeologist – is a modification and adaptation of that due to R. J. Chorley for geography¹. The average reader will find it acceptable and

¹ R. J. Chorley, *Geography and analogue theory*. *Annals of the Association of American Geographers*, 54, 1964, 127–137.

applicable to almost any observational science. This least controversial section occupies little space in Clarke's work.

The model for the archaeological entity is derived from that which is becoming modish in biology, as exemplified in the numerical taxonomy of Sokal and Sneath². The entity is said to be made up of logically irreducible characters or attributes which are described in terms of simple presence or absence. The attributes are two state variables and multistate variables can be reduced to larger sets of two state variables by setting various limits. An aggregate of entities connected with each other forms a complex whole or system. Changes in the system with time, seen as a series of arrested states, is defined as process. Although the time change is known to be continuous, the sampled nature of the data makes the foregoing formulation more convenient. The distinction is made, following the taxonomists, between monothetic systems in which the possession of a unique set of attributes is necessary for membership in the system and polythetic systems in which membership is achieved through possession of a reasonably large number of attributes. No single attribute is sufficient for membership in itself. It is self-evident that the complexes of interest to archaeologists are polythetic, and that in the normal mode of archaeological reasoning, this convention is unconsciously adhered to.

Since change is the essence of history, the static model proposed in the first chapter must be extended to a dynamic one, with the introduction of the elements of system theory and changes within systems. The system theory technique is a product of the last twenty years and is now being widely applied to explain dynamic behavior in large interrelated complexes in economics, industry and production. In the chapters which follow, the relationships between the social system and the environment is laid out, and the conditions for equilibrium and its disturbance are defined. Culture and environment are seen as a system with many complex subsystems. It is said to be an 'information' system in the sense that 'messages' as 'ordered selections from an agreed set of selected variety' are distinct from 'noise' defined as 'disturbances which do not represent any part of the essential message from the source'. Stated more simply, the message or information which we are looking for is what we want to know, the noise is usually of no interest. The vocabulary of information theory finds a sympathetic response in this reviewer, but he is probably letting his personal preference prejudice his judgement of the applicability of this theory to archaeological practice. If the atomistic model based on two state variables is initially granted, there seems to be no basic reason why one ought to object to information theory terminology. The great attraction of system and information theory lies in their rational explanation of why and how wholes can be rather more than simple sums of their parts and how irrelevant evidence can be safely ignored. The author points out that 'partially preserved material culture subsystems' are the primary concern of archaeologists, and that the generalities of system theory do allow deductions to be made, in a rational though not necessarily unique way, concerning the missing chunks of data. These missing pieces are, above all, those concerning the structure of society, the relationships with the environment, the ideology of the epoch and the change of all of these with time.

The heart of the book and, in the reviewer's opinion, the best thought out, is contained in the fourth through the seventh chapters. In a long and difficult text, the author explains the ideas presented in the introductory chapters. Perhaps because most practical work has been done with artefacts and the attributes which describe them, the fourth chapter is the best in the book. Two types of regularities of attributes within artefact populations are defined: patterns based on 'phases', the thinnest 'recognizable slice' of the development of an artefact with time, patterns in time – the variation leading to rise and decline in the numbers of different attributes per artifact. These, with their various distributions, are explained with a number of interesting concrete examples.

Following the treatment of the single artefact and its attributes, the study is generalized in the fifth chapter to the vexing question of type. Type is defined as 'a homogeneous population of artefacts which share a consistently recurrent range of attribute states within a given polythetic set'. This means a group of artefacts which share a reasonably large number of attributes in common define a type. Subtypes are also distinguished and phase and time variations at this and type level are discussed. Since the number of variables rise drastically, the more complex the objects and the more detailed the analysis, the problem of time variation is necessarily more complex. At this level, the system concept is introduced in order to deal with sudden changes in time, rapid and slow fluctuations in type and sequence in the development of types. These are defined as having threshold, formative, coherent, and post-coherent phases.

The culture or cultural assemblage is treated as a system of assemblages and artefact types. They are divided into three broad sets which the author labels the subculture, 'a restricted segment of cultural assemblage populations', the culture, 'a specific cultural assemblage population', and the culture group, 'a family of allied cultural assemblage populations'. When dealing with the culture, even the static model taken at a sole instant of time, the problem becomes very complex. The terminology is rather confusing,

² R. R. Sokal, P. H. A. Sneath, *Principles of Numerical Taxonomy*. W. H. Freeman, San Francisco, 1963.

but the argument may be restated briefly as being one in which many groups of variables have to be considered simultaneously. Phase and time variations within cultural assemblage make the matter more difficult still. The model is, by analogy, extended dynamically to allow for the 'birth, growth, and death' of the system. Given the horrid number of possibilities in a practical situation, the whole becomes rather difficult to grasp in detail, though the broad stages called threshold, formative, coherent and post-coherent can be recognized. Of course, rather like M. Jourdan who discovers much to his delight that he has been speaking prose all his life, most archaeologists will be pleased to find that they have been carrying out this complex analysis quite innocently and often quite competently. At this level, the reviewer is of the opinion that the associative memory characteristic of the archaeological mind begins to surpass the capabilities of the largest computer.

When the author passes to the next level, that of the culture group or system of interlinked cultural assemblages, and especially when their variations with time are considered, he is dealing with what has, up to now been called history. At this stage, the analytical model, because of its complexity begins to get pretty vague. It also becomes nearly impossible to apply numerically in practice. Historical or anthropological terminology with its verbal models seems better suited to deal with the problem. As Robinson states, 'There are verbal models, mathematical models and physical models . . . a scientific model represents the embodiment of theory and observation. Of necessity, it must be a compromise between simplicity and reality. There will never be one all encompassing model: there must be many kinds of models to fit different situations. Above all, a model must incorporate practical information because the final interpretation will be based on practical needs'. But the problem is more than one of terminology. Since the complex systems involved are, at the highest level, acting like very much more than the sums of their elements, it is the reviewer's opinion that it is incorrect to affect the purely empirical mode of thought, especially when the data is fragmentary. General and subtle theoretical ideas are required.

At the highest level, the author examines what he calls the technocomplex system. This is a set of loosely related cultural groups sharing a similar level of technological development at a given phase in time. This reviewer is inclined to see things so directed that developments at this level provide the moving force for all the developments which we have witnessed at lower levels-even if this reverses the way in which we observe and sort the evidence. That is, the mode of analysis in which one starts with the smallest elements of the system should not blind us to the fact that these smallest elements have, in themselves, no element of human will and hence are directed, not directing. As De Vore stated 'In the past we were presented with lithic industries which, to judge by their descriptions, were copulating, hybridizing, evolving, adapting and producing offspring'. The absurdity of the vocabulary often used in analysis is thus made clear. Hence the reviewer's wish to attach priority to the highest phase not the lowest, in the ultimate analysis, even though for convenience we may start the other way around.

It follows from the pure analytical approach that the technocomplex (a not very happy term) emerges as the result rather than the cause of all of the developments, right down to the two state variable at the attribute level. This is philosophically acceptable to pragmatists but not to many others, including this reviewer.

In the ninth chapter of the book, the author compares the results obtained through examination of the complex model and the evidence obtained from contemporary and historical ethnographic data. The evidence can be illuminating for an analytical model in quite a number of instances where material culture alone is involved. With language added, things are messier, but some success seems possible.

This reviewer thinks that the analytical model is most useful as a means of organizing very fragmentary evidence in some cases, rather than as a means of accounting for developments taking place among real peoples.

The tenth chapter which summarizes the entire theory and attempts to examine the ideas lying behind process shows the difficulty with the whole construct. Empirical concepts of acculturation, assimilation, intrusion, substitution, diffusion, invention, and loss are used. All concepts are verbal at this level, but given the complexity of the underlying assumptions, even these seem difficult to apply in all but the most elementary instances. Traditional historical theory with its ideas of interaction, moving force, direction and change would appear to be better suited to the task, if sufficient quantities of well ordered information are at hand to serve as controls. Historical theory does not relieve one of the necessity for studying detail, but is in some respects more tolerant of fragmentary data than is the analytical approach. It would be capricious, as some reviewers have done, to ignore the great merits of the first part of this book. The approach recommended will undoubtedly be taken up strongly by the younger Anglo-American school of anthropology and prehistory, in which Clarke's work has already caused something of a

³ E. A. Robinson, *Multichannel Time Series Analysis with Digital Computer Programs*. Holden-Day, San Francisco 1967, p. x.

⁴ I. De Vore in S. R. & L. R. Binford, *New Perspectives in Archeology*. Aldine, Chicago, 1968, p. 346.

sensation. The second part of the book on method is, however, less impressive. Further examples will surely be available for later editions, and they are needed. But let us examine the second part of the book.

First, the author gives a good explanation of time trends in models, based on similarity matrices and seriation techniques. This is illustrated with results taken from Robinson⁵, Hole and Shaw⁶. Later editions will be able to incorporate the very important paper by Kendall⁷ which appeared a year after the book. Geographic trends are very well treated, though archaeological examples, with the exception of the author's own work on British beakers were not available at the time of writing. In a later edition, Hodson's summary paper⁸ ought to be cited to provide further illustrations, especially the retreatment of the data of bronze analysis as carried out at Stuttgart. The examples from modern geography which Clarke has chosen are convincing but less relevant, since the data here is very much less fragmentary than is that in an archaeological problem.

A good review is provided of the methods of numerical taxonomy and statistics derived largely from the work of Sokal and Sneath. The archaeological examples are taken from the author's own studies and from the important papers of Hodson, Sneath and Doran⁸. The technique of cluster analysis is explained at a level which archaeologists ought to understand if they have gotten this far in the book. The examples, taken from the author's Beaker studies are quite clear. The method used is essentially that of Shepard and Kruskal⁹ which seems to be emerging as the best of the available numerical techniques. Unfortunately linear graph theory is neglected, though it stands behind many of the ideas of Sokal and Sneath. The older and less spectacular statistical methods of correlation, regression analysis and variance analysis are briefly mentioned as is the less frequently employed factor analysis. For the latter, the later papers of the Binford's will supply some additional illustrations¹⁰. References to the statistical literature would probably go beyond the intention of the author, but a few might have been included for those readers not content with secondary sources.

The penultimate chapter deals with computer methods and examples. Paleolithic flint tools, eneolithic Beakers, Amerindian pottery motifs, Iron Age and Medieval finds, and English rural house types are but a few of the diverse assemblages chosen. Practically all of those published up to the date of writing seem to have been included.

Information retrieval techniques for archaeological inventories and a magnetic map taken from the reviewer's paper¹¹ are also included as examples of computer application though their relevance to the main text is not immediately evident.

The final chapter is a plea for the analytical method at all levels including the socio-cultural, a generalized restatement of the theoretical background, the procedure and the 'grammar' of archaeology. A list of definitions of many of the terms used in the text is appended, a few pages which the reader will often want to refer to when working his way through the book.

In the opinion of this reviewer, the place which should be occupied by analytical methods is similar to that to be accorded statistical theories in physics. They explain behavior at very small scales quite well. On a large scale, general theories are required. Somewhere in the middle, classical theories are adequate. Underlying each region is a quite different model. All may be considered universal in application, though in practice they are too cumbersome or inaccurate when working outside their domain. Similarly analytical techniques in archaeology will probably be applied at the artefact, type and assemblage level.

⁵ W. S. Robinson, A method for chronological ordering archaeological deposits. *American Antiquity* 16, 1951, 293-301.

⁶ F. Hole, M. Shaw, *Computer Analysis of Chronological Seriation*. Rice University Studies, 53, 1967, vol. 3.

⁷ D. G. Kendall, Some problems and methods in statistical archaeology. *World Archaeology*, 1, 1969, 68-76.

⁸ F. R. Hodson, Searching for structure within multivariate archaeological data. *World Archaeology* 1, 1969, 90-105.

⁹ R. N. Shepard, The Analysis of Proximities: Multidimensional Scaling with an Unknown Distance Function. *Psychometrika*, 27, 1962, 125-139, 219-246. - J. B. Kruskal, Multidimensional Scaling by Optimising Goodness of Fit to a Nonmetric Hypothesis. *Psychometrika* 29, 1964, 1-27.

¹⁰ S. R. Binford, Variability & Change in the Near Eastern Mousterian of Levallois Facies, in 'New Perspectives in Archeology' (note 4) p. 49-58.

¹¹ I. Scollar & F. Krückeberg, Computer Treatment of Magnetic Measurements from Archaeological Sites. *Archaeometry* 9, 1966, 61-71.

Better examples can now be found in the excellent survey papers of Nagy or Levine which appeared after Clarke's book:

G. Nagy, State of the Art in Pattern Recognition. - *Proceedings of the IEEE*, 56, 1968, 836-862. - M. D. Levine, Feature Extraction; a Survey. *Proceedings of the IEEE* 57, 1969, 1391-1407.

Given large enough computers, perhaps even the subculture and culture may be attempted in static models. Dynamically, or at higher levels, it seems unlikely that machines large enough to handle the incredible number of variables and combinations in a reasonable time will be available in the immediate future. Associative human reasoning, with all its defects, will probably remain pre-eminent at high levels, using data processed by machine. The macroscopic language of historical research with all of its richness of association and subtle connection of complex ideas describes, even if somewhat vaguely and imperfectly, a still more complex reality. It will probably not suffer from technological unemployment in the near future.

Despite these reservations, the reviewer thinks that David Clarke's book makes a remarkable attempt at a unified theory and a considerable contribution to archaeological thought, the significance of which will probably be appreciated only by the younger generation of archaeologists. Fortunately, the future belongs to them.

B o u n

I. S c o l l a r