Gateson took a deep breath. "God, I love the smell of sagebrush." Then he started the truck.

"Hate to just leave you like this, but what other way is there?" He ground the shifter into reverse. Yellowman quickly stuck his hand in the window and took Gateson's. "Thanks, sir," was all he said.

"You'll do fine." Gateson smiled. Yellowman wiped his eyes and watched as the truck disappeared in the dust. Soon the air was still, broken only by the sound of trowels scraping across rocks.

"Well," Yellowman said to the sagebrush as he turned to walk back up the hill, "there's work to be done."

An earlier version of this essay was originally presented at the 2002 Great Basin Anthropological Conference in Ogden, Utah. I thank Steve Summs for inviting me to "do something different" for the plenary session.

The Goals of Processual Archaeology

AMBER L. JOHNSON

IN THE PRELIMIUE TO this volume, the character of Leonard Yellowman is, as Kelly indicates by the title, "Searching for Home in the Modern Landscape of Archaeology." His frustration with the confusing array of competing opinions regarding what is appropriate for an archaeologist to think and do is understandable. Anyone who has thought about what they are doing in archaeology must at some point recognize that—given that there are so many different goals for studying the archaeological record and so many different ways of making knowledge claims about the past—the question isn't which one is the right one, it is, what are we trying to accomplish and what is the most productive way of going about it?

GOALS OF PROCESSUAL ARCHAEOLOGY

From the beginning, processual archaeology has been distinguished from traditional archaeology on the basis of its goals and the methods used to obtain them. Binford's publication of "Archaeology as Anthropology" in 1962 is commonly cited as the first explicit statement of the goals of processual archaeology. Rejecting against the general dismissal of archaeological knowledge by anthropologists pursuing explanations for cultural processes (see Binford 1972b:10), he argues that archaeologists can and should participate in furthering the aims of anthropology. While it is difficult to
imagine most anthropologists agreeing on one set of goals were we to ask
the question today, Binford (1962) references Kroeber’s discussion in the
introduction to the 1973 edition of Archaeology Today when he writes,
“Most will agree that the integrated field is striving to explicit and explain
the total range of physical and cultural similarities and differences char-
acteristic of the entire spatial-temporal span of man’s existence” (217;
emphasis in the original). Since the subject matter of archaeology covers
“the total range of physical and cultural” changes across “the entire spatial-
temporal span of man’s existence,” it seems we should have something to
say that is relevant to the general goals of anthropology.

Given that traditional archaeology had already made “major contrib-
utions as far as explanation [was concerned],” the goal of processual ar-
chaeology was and is focused upon explanation (Binford 1962:217). A
scientific definition of the term explanation is offered as “simply the dem-
omatation of a constant articulation of variables within a system and the
measurement of the concomitant variability among the variables within the
system” (Binford 1962:217; emphasis in the original).

Much of the criticism of processual archaeology over the years results
from the different goals of explanation and explanation and the methods
used to achieve them, referred to by Kroeber as historical and scientific
approaches, respectively (Kroeber 1936/1952:69–71). In Kroeber’s terms:

The essential qualities of the genuine scientific approach are, first, that it seeks
understanding as an end in itself; second, that in seeking this understanding it
insists on starting from and with phenomena; and third, that, as it achieves suc-
cess, it destroys the phenomena as phenomena by reassigning them into abstract
concepts—laws, constants, mathematical relations, and the like. Hence the sty-
ing that science converts qualities into quantities [Kroeber 1936/1952:69].

By contrast, he suggests, “The essential characteristic of the historic ap-
proach appears to be the endeavor to achieve a conceptual integration of
phenomena while preserving the quality of the phenomena” (Kroeber 1936/
1952:70). The tension between these two approaches lies in what you do
with data. Kroeber’s essential characteristics of the scientific approach pro-
vide a useful framework around which to elaborate on the goals of processual
archaeology.

Understanding as an End In Itsel

Kroeber distinguishes between pure and applied sciences on the basis of goals
and the use of knowledge. The relationship between biology and medicine, phy-
ics and engineering are the primary examples of pure sciences and their
associated applied fields. There is no strictly applied discipline associated
with archaeology. The most likely candidate, cultural resource manage-

(CRM), has as its mandate to assess the significance of archaeological
materials, not to put archaeological knowledge to some practical purpose.
There are, however, several examples of approaches to archaeology that
have specific social or political agendas (e.g., Marxist, feminist, nationalist
archaeologies). Here the focus is on interpreting the archaeological record
to make a social statement about modern society and culture (e.g., Levine and
Porter 1988:20; Conkey and Gero 1994; Gelchrist 1999; and discussions of
nationalist archaeology in Trigger 1989). Further, in traditional archaeology
there is built in a bias toward the collection of only certain kinds of data such
as artifacts and structures to the exclusion of recording features and saving
fire-cracked rock. In contrast to these approaches to archaeology, processual
archaeology sets out to learn about the archaeological record in the terms in
which it can be observed, for purposes of understanding and explaining the
variability in that record of what we can observe. One of the founding
assumptions of processual archaeology is that there is no useless data (see
the description of methodological battles fought with Griffin over what to
save from archaeological sites in Binford [1972:125–133]), and the discus-
sion of the disillusionment that comes because, even with a lot of data, the
facts don’t speak for themselves, in Binford [1983:98–106]). Further, pro-
cessual archaeology focuses on identifying dimensions of variability in
the archaeological record and building explanatory arguments regarding this
variability, not on interpreting this variability or making use of it to comment
on contemporary social or political problems. In Kroeber’s terms, this
makes processual archaeology a pure rather than an applied science.

For our purposes, it is relevant to point out that processual archaeology
does not propose that there is a single correct theoretical construction that
should be used in any and every archaeological context. In fact, it has been
forcefully argued from the beginning that:

It is no more justifiable for archaeologists to attempt explanation of certain
forms of spatial and temporal similarities and differences within a single frame
of reference than it would be for an ethnographer to attempt explanation of
differences in cause and effect causality, the rhythm of social, and the physics
of transportation. All such are variables within the same frame of reference.
These variables are articulated differently within

an integrated cultural system, hence the pertinent variables with which each is
articulated, and exhibit concomitant variation are different. This fact obviates
the single explanatory frame of reference. The processes of change pertinent
to each are different because of the different ways in which they function in
contribution to the total adaptive system [Binford 1962:219].

Processual archaeology does not offer a single set of ideas about how the
world works or why it works that way; rather it seeks to evaluate our ideas—
whatever they may be—about what conditions variability in the archaeo-
logical record. There are many dimensions of variability in the archaeological
Starting from and with Phenomena

The phenomena we start with, as archaeologists, are observations on the archaeological record. As Binford has pointed out repeatedly, "The archaeological record is here with us in the present" (Binford 1983:19; emphasis included in original). Therefore, the most productive questions for an archaeologist to ask do not address the dynamics of the past directly. To work productively, we must take our problems from the patterning we observe in the archaeological record (for a recent statement, see Binford 2001a).

From the beginning of processual archaeology, there has been a focus on using the patterned remains in the archaeological record to learn about the operation of the cultural systems that produced them. White's definition of culture as the extraneous means of adaptation for the human organism (1959:8) forms the foundation for this approach. If the material in the archaeological record has been organized and distributed through the operation of a cultural system, the patterns of distribution and association of artifacts, features, and sites should contain information about the organization of the system that produced them. Thus, in "Archaeology as Anthropology," Binford proposed an explanation for the Old Copper complex that integrated knowledge relevant to discussing technological, social, and ideological dimensions of the sociocultural system (Binford 1962:220-224). Studies of the differential distribution of stylistic attributes on pottery in Southwestern pueblos by Longacre (1963, 1964a, 1964b, 1964c, 1966, 1968; for a historical review of related studies see Longacre 1970:1-10) and Hill (1956, 1967, 1968, 1970a, 1970b) further sought to use observation of archaeological patterning to learn about the organization of past social systems.

However, these early attempts to move directly from the patterning in the archaeological record to models of past cultural systems focused on technological, social, and ideological dimensions of variability met with only limited success and much criticism. It was quickly realized that observations on the archaeological record are still ambiguous—there is no easy way to assign meaning to what we see. Therefore, efforts were directed at the central epistemological question of how we know we are making accurate inferences from archaeological observations.

Recognizing that one cannot think with knowledge one does not have, a central focus of processual archaeology has been to learn as much as possible about how differently organized dynamic cultural systems produce a static organization of remains that becomes the archaeological record. In chapter 5 of In Pursuit of the Past, Binford writes of his disillusionment when rigorous analysis of data on Mousterian sties still did not lead to clear inferences about the past:

What I had found, of course, was many new facts that nobody had seen before. But some of these new facts spoke for themselves, just as the initial facts had not. By generating more and more facts and by detecting more and more patterns, I had simply increased the scope of the problem without reaching any solutions. None of the correlations carried sufficient information to tell us why they were that way; they simply stood as increasingly complex patterns of static association in the archaeological record (Binford 1983:101).

What was missing was a way to link the dynamics of the past to the static archaeological record they produced. Binford continues,

In short, I was led to the inescapable conclusion that there existed no way to develop archaeological methods of inference, except via the study of contemporary living people, or by controlled experiments under laboratory conditions, or by doing archaeology in situations whose dynamic components is historically documented. "Ethnoarchaeology," "experimental archaeology," and "historic sites archaeology" seemed to me to be the only chances we have for the development and perfection of methods of inference dealing with historically generated archival material (1983:104).

Thus some of the participants in processual archaeology moved in those directions. Others developed new fields of study to pursue what has become known as middle-range research as the next layer of ambiguity became apparent.

Since the archaeological record has been created by numerous cultural and natural processes (see Schiffer 1976, 1987) operating at different spatial and temporal scales, archaeologists who start from and with observations on the archaeological record inevitably find they must learn how to diagnose the contributions of various processes in the accumulation of the archaeological record. Cultural dynamics are not the only dynamic forces structuring what we observe. Thus much of the work that has served to define processual archaeology has focused on site formation processes, including the operation of physical, chemical, and organic processes that modify the arrangement and structure of archaeological assemblages. Since stones and bones are the most commonly recovered archaeological materials, processes that contribute to their modification and redistribution have received the greatest attention (see Schiffer 1983) for a thorough review of the then-current state of research on formation processes.

The archaeological pursuit of knowledge of formation processes, especially taphonomic processes acting on bones in archaeological sites, grew in tandem with research in geology and paleontology, fields where researchers faced similar problems about how to make inferences about the past
given what was left to observe in the present. Taphonomy has developed into one of the most productive of the research pathways pioneered by Binford (1978), processual archaeologists. Building on the analytical work of Binford (1978), processual archaeologists have learned how to recognize the difference between natural death assemblages and those modified by human or non-human activities. We have learned how to identify and quantify the impact of factors such as bone size, shape, and density on modification from various movement patterns (e.g., Voight 1969; Bellemere 1975; Boaz 1982), and how trampling (e.g., Gifford-Gonzalez et al. 1983) and the presence of carnivores (e.g., Binford and Bertram 1977) impact bone assemblages. Similar studies of the impact of non-human activities on the archaeological record (e.g., McHenry et al. 1998).

Taphonomy has made significant contributions to archaeological knowledge because researchers in this field have fostered the development of indices that measure the utility of different bones along different dimensions (e.g., size, shape, density). Such robust intellectual tools contribute significantly to Kroeger's third characteristic of the scientific approach—transforming the transformation of observed phenomena into abstract concepts.

Transmuting Phenomena into Abstract Concepts

Kroeger's third characteristic of a scientific approach is that as it achieves success it destroys the phenomena as phenomena by transmuting them into abstract concepts—laws, constants, mathematical relations, and the like.
archaeological record is patterned with respect to other things we might expect to be general. These tools are not designed to be used simply to interpret archaeological materials, rather they are designed to be used strategically to determine the extent to which our knowledge is sufficient to make claims about the patterning in the archaeological record. There is no limit to the number of intellectual tools that could be developed to aid pattern recognition.

DOMAINS OF KNOWLEDGE GROWTH

In discussing the goals of processual archaeology above, some of the results of this approach to explaining variability in the archaeological record have been introduced. Here, let’s explore some of what has been learned over the years of working this way. This discussion is intended to illustrate only a few examples of knowledge that grew out of processual approaches to archaeological research; it is in no way intended to be a comprehensive review of what we have learned.

Traditional interpretations of change in cultural elements invoked the “processes” of innovation, migration, and diffusion. It was assumed, for example, that (1) the archaeological record was a record of events—of migration, technological innovation, abandonment; (2) knowledge was the limiting factor for the major changes in human society such as the adoption of agriculture, the use of wheeled vehicles, the construction of cities; and (3) traits were bundled into complexes that were always associated as people migrated or knowledge diffused from the point of innovation to that some of these traits could be inferred from the evidence—of the association of agriculture, villages, and pottery is a good example. By challenging these assumptions and rigorously evaluating ideas based upon observations of the both the archaeological and the ethnographic records, we have learned that (1) the grain of archaeological information is rarely fine enough to identify discrete events and thus more suited to learning about processual change; (2) mobile hunter-gatherers have many advantages (health, workload) over agriculturists and often do not choose to adopt agriculture even when they know about it, and (3) agriculture is not necessarily associated with either sedentary villages or pottery; in fact, these can and do appear independently in every possible combination of pattern in documented archaeological sequences. In addition to challenging the conventional wisdom that formed the basis of interpretation in traditional archaeology, this growth of knowledge has led to the development of new avenues for research. The dynamics of the past, as documented archaeologically, are much more variable and more fascinating than we had imagined. This realization challenges us to learn enough that we can explain this variability.

CURRENT RESEARCH IN PROCESSUAL ARCHAEOLOGY

The research included in this volume is representative of the current state of research in processual archaeology, although it is certainly not comprehensive. Despite the range of variability of archaeological contexts in which this strategy is being pursued. Most of the contributors are former Ph.D. students of Lew Binford (ranging from Bill Longacre, his first Ph.D. student, who graduated from the University of Chicago in 1963, to Amber Johnson, his sixty-sixth Ph.D. student, who graduated from Southern Methodist University in 1997). Only Fred Wendel and Rosamund Schild are not former students. Chapters are arranged in two parts, continuing the organizational theme developed for this introduction around Kroeger’s characteristics of the scientific approach to learning.

Part I: Starting from and with Phenomena

Part I includes seven chapters that “start from and with phenomena,” that is, they are written to cope with problems arising directly from observation of archaeological (or ethnarchaeological) observations. Contributions by Steve Kuhn (chapter 2) and Jim Enloe (chapter 3) focus on questions relating to the comparability of the basic units of analysis used in most archaeological research. Two more chapters, contributed by Bill Longacre (chapter 4) and Bob Hitchcock (chapter 5), present new information from ethnarchaeological studies with which we can build on what we know about division of labor and intensification, respectively. Alan Osborn (chapter 6) as well as Fred Wendel and Rosamund Schild (chapter 7) use organized frames of reference to explore archaeological patterning related to the technology associated with the use of poison hunting strategies in the arctic and Mesolithic tool assemblages in the eastern Sahara of Egypt. Finally, Mary Stiner’s contribution (chapter 8) draws upon an analytical foundation established previously to build a series of inferences from the observations in the archaeological record. Here is an ambitious, synthetic paper working at a large scale of pattern recognition and building middle-range theory that should set the stage for research in this domain for years to come.

Steve Kuhn’s discussion, “Middle Palolithic Assemblage Formation at Riparo Mochi” (chapter 2), uses the unusual style of excavation at the Italian site of Riparo Mochi as a challenge to learn about assemblage formation in a situation where it is difficult to define and compare assemblages in the traditional way. He focuses on changes and contrasts in rates of artifact deposition at the site through time. Comparing fluctuating rates of accumulation across artifact classes provides novel perspectives on how assemblages were formed at this particular site, and about what variation among geologically bounded segments of the total sequence might mean. Kuhn contends that while conventional approaches to the study of archaeological
The goals of Processual Archaeology

The data on ground slate tools in the Arctic and uses ethnohistoric data on poison hunting strategies to warrant an argument linking ground slate tools to these strategies. This argument is used to explain variability in the distribution of ground slate tools in terms of the distribution of sea mammals that could most productively be hunted using this strategy. The author derives explicit expectations from his argument and tests them against the empirical evidence, demonstrating both support for a number of his hypotheses and complexity in interassemblage variability that demands further attention.

Weisdorf and Schild in chapter 7 present a study titled "The Functional Hypothesis Revisited: An Evaluation of Cumulative Graphs Using the Moisterans in the Eastern Sahara of Egypt and in Southwest France." The authors analyze assemblage variability among 23 Moisteran sites excavated in the two adjacent basins of Bir Tafawli and Bir Sahurz East and dated between 230 and 70 kya. Two different varieties of Moisteran assemblages are represented. Secondary Levallois workshops with Denticulate Moisteran tool assemblages associated with lacustrine sediments represent one variety. The second variety occurs with deposits of drying or dry lake bottoms and is usually associated with abundant faunal remains. The lithic assemblages in this second group are dominated by Mousterian points and sidescrapers, and often occur with fauna; these are classified as Typical Mousterian. These two varieties of Mousterian occur repeatedly and almost unchanged throughout the more than 100 kya represented in the sequence. In this instance the kind of Mousterian appears to reflect the settings in which the sites occur. Comparisons of cumulative graphs show a close resemblance in broad tool categories between the Egyptian and French Mousterian. This chapter offers an elegant illustration of the utility of Bordes typology for pattern recognition, though the conclusions challenge Bordes's own interpretation of the meaning of typological variability in archaeological assemblages by demonstrating a regular association of certain tool types with specific environmental contexts.

Stiner's contribution in chapter 8 is an ambitious synthesis of population ecology, migration, warfare, and sedentary society that is sure to be controversial because of the number of specific linkages between archaeological observation and domains of ecological inference. This broad-scale argument spans the transition from Middle Paleolithic to Upper Paleolithic and the Broad Spectrum Revolution exploiting shifts in eight ecological dimensions. This is a chapter with substantial intellectual content that is sure to spawn numerous research projects attempting to dispute the arguments made.

Part II: Transmuting Phenomena into Abstract Concepts

Part II includes three chapters that focus more upon the issues relating to "transmuting phenomena into abstract concepts" than with observations of
the archaeological record itself. Contributions by Johnson (chapter 9) and Binford (chapter 10) both deal with strategies for controlling variability and present the limits of archaeological inference. Wandishin (chapter 11) explores the limits of archaeological inference that lie at the very heart of the methodological challenges of archaeological inference. These challenges are as apparent in the conclusion as in the epistemological issues addressed in the first section of this chapter. The conclusion meets the challenge of explaining variability in its pace and pattern of culture change documented in archaeological sequences in the Southwestern United States and around the world. While the generalization that, other things being equal, systems that have greater niche breadth are more stable than those that are more specialized works nicely to anticipate variability in the timing of the adoption of agricultural systems in a particular region, it remains that these generalizations fail to anticipate variability at the level of the specific case. This suggests that there is a caveat to the use of variability as a broad generalization. The problem of controlling variability in analyses performed at different scales is discussed and illustrated using partial correlation coefficients. Johnson’s conclusions further emphasize the difference between historic and scientific approaches to explanation.

Binford’s contribution (chapter 10), “Niche: A Productive Guide for Use in the Analysis of Cultural Complexity” considers some of the interdependent implications of the failure to consider potential sources of variability among cultural systems. Emphasizing the importance of recognizing boundary conditions for scientific argument, Binford uses the niche concept to compare and contrast the organization of ecosystems and cultural systems. With any other species, it is impossible to study the species in its natural environment and understand the niche it occupies in an ecosystem, environmental setting, and ecosystem, ecological setting, and environment. This is not possible with human societies, however. Binford’s conclusion to a consideration of boundary conditions is ambiguous. This discussion leads to a consideration of the relative importance of our species in the context of the ecological and environmental settings in which they exist. The focus throughout the chapter is on how to control information to learn from it productively. This chapter is on how to control information to learn from it productively. The conclusion to this chapter is that the goal of processual archaeology is to use the knowledge that we have about the world to learn about the past. This is the goal of processual archaeology.

Strategies of processual archaeology

In the Preface to the current volume, Kelly’s 'Ladders of Modernity' is presented. The conclusion to the current volume is that 'Archaeology has to be everything or nothing.' I fear it is logically impossible for any field to simultaneously pursue goals as fundamentally different as those of feminist, Marxist, or postmodern approaches and those of processual archaeology. There is a fundamental difference of opinion regarding the value of the past. This is true of the use of archaeological knowledge. On the one hand, there are those who value it for its value as a resource, to be used to make life more meaningful for those who live in the present. On the other hand, there are those who value it for its value as a resource, to be used to make life more meaningful for those who live in the present. Science studies classes of phenomena. It proceeds by restricting observation to certain boundary conditions, working out relational arguments about the world.
interaction of variables in conditioning the production of observable patterns, then testing the limits of these arguments by exploring their implications across class boundaries.

Processual archaeology offers a scientific learning strategy that systematizes and builds on prior knowledge to inform our ignorance about variability in the archaeological record, and by extension the natural and cultural processes that contribute to its formation. There are no realms of cultural variability that have an impact on the structure of the archaeological record that are off-limits. So long as there is an organizational pattern in the archaeological record, we can learn how to learn about the dynamics that stand behind it. However, there is strategic priority for using prior knowledge. Binford's prior knowledge of environmental variability and ecological dynamics led him to develop this information into frames of reference for use in archaeological analysis. Because technology and subsistence patterns relate more directly to environmental variability than do some other aspects of cultural systems, and because these relationships are easier to describe in small-scale societies than in complex ones, much of the work in processual archaeology thus far has focused on exploring relationships between technology, subsistence, mobility, and environment for relatively small-scale hunting-gathering groups. This is certainly not the limit of processual archaeology.

In 1970, Paul S. Martin reviewed papers in Reconstructing Prehistoric Pueblo Societies (Longacre, ed.) by noting, "They represent a singular departure from traditional approaches to archaeology... Many may not realize the changes that these essays illustrate. They mark a metamorphosis, a reversal, a vision" (p. 194). Martin's subsequent comments highlighted the change in goals ushered in with processual archaeology.

In the 42 years since the publication of "Archaeology as Anthropology" (Binford 1962), it has become popular to interpret archaeological materials with reference to prehistoric social organization. However, few archaeologists have sought understanding of the archaeological record as an end in itself, fewer have designed research starting from and with the phenomena we observe in the archaeological record, and only a very few have overcome the impulse to offer historic explication of an archaeological record rather than transmitting the phenomena to abstract concepts that can be generalized and used in exploration. The contributors to this volume are among the few who are working in the tradition of processual archaeology as laid out by Binford in 1962.

As Binford (2001b:243) states in the first paragraph of chapter 8 in Constructing Frames of Reference, "Theory building is not for sissies. It is a rigorous, time consuming process, and there is no guarantee that a comprehensive, defensible theory will result from the effort that has been invested in its development." Although processual archaeology is more than 40 years old, it is still in its infancy. We have just begun to put in place the bodies of reference knowledge that will drive the process of learning about the past. This is an exciting time to be an archaeologist. As the chapters in this volume demonstrate, we have learned a lot over the past 40 years; most important, we have developed strategies for learning how to learn from the archaeological record.

REFERENCES CITED

Beauregard, A. K.

Binford, L. R.

Binford, L. R., and J. B. Bertram

Buzo, D. D.
1982 Modern Riororos Taphonomy: In Reference To The Interpretation of Plio-Pleistocene Fossil Paleoecology in the Omo Basin. Doctoral Dissertation, University of California.

Buzin, C. K.

Conkway, M. W., and J. M. Prep


Martin, P. S.

McBryar, S. L., Bishop, T. Plummer, R. Dewey, and N. Conan

Schiffer, M. B.


Trigger, B. G.

Voolstra, M. R.

White, L. A.

Wylie, M. A.
PROCESSUAL ARCHAEOLOGY

Exploring Analytical Strategies,
Frames of Reference,
and Culture Process

Edited by
AMBER L. JOHNSON
This volume is dedicated to
Lewis Roberts Binford
in honor of his vision, dedication, and enthusiasm
for learning how to learn about the past.