A Brief Introduction to Systematics

by Michael J. O'Brien

Systematics can be defined as procedures used to create units derived logically for a specific analytical purpose. The units are used (1) to characterize and measure similarities and differences between phenomena and (2) to sort them into sets such that like goes with like. This is as true in archaeology (Dunnell 1986; O’Brien and Lyman 1999, 2000; Ramenofsky and Steffen 1998) as it is in biology (Mayr 1942) and paleontology (Simpson 1961). Each set should be internally homogeneous such that within-group variation is analytically meaningless and between-group variation meaningful. Importantly, this does not mean that every item in a set is a clone of every other item in that set. It does mean, however, that in terms of certain characters, or attributes—those assumed to be important for a particular analytical purpose—the items in a set are redundant.

Typically, things that are alike are thought to have a particular affinity. The kind of relation specified when one states that every specimen of kind A has an affinity with every other specimen of that kind, and that specimens of kind A have a different affinity with those of kind B, often is of a particular sort. Multiple kinds of things may be affines because they are close in time, in function, in symbolism, in ancestry, or in terms of something else. Specifying and measuring a particular kind of affinity is the ultimate goal of systematics, irrespective of discipline (O’Brien and Lyman 2002). This point is critical. If we are interested in ancestral–descendant affinity, this is quite different than functional affinity. We cannot assume that the kinds used to identify the latter will
automatically tell us something about the former. In fact, there is every reason to suspect they will not (Allen 1996; Beck 1995, 1998; Meltzer 1981).

The goal of systematics is realized by classification, which is the creation of new units and the modification and revision of old units by stipulating the necessary and sufficient conditions for membership within a unit. A unit is a conceptual entity that serves as a standard of measurement. An inch is a unit constructed explicitly to measure linear distance; the degrees found on a compass are conceptual units constructed explicitly for the measurement of orientation. As conceptual entities, units must be defined explicitly. Units can be specified at any scale. They can comprise one or multiple attributes of characteristics of a discrete object, of discrete objects, or of sets of discrete objects of various kinds. All sciences require that units for describing the phenomena under study be specified, but this requirement is not always readily met. Biologist Richard Lewontin (1974:8) put it this way: “[T]he problem of theory building is a constant interaction between constructing laws and finding an appropriate set of descriptive [units] such that laws can be constructed. We cannot go out and describe the world any old way we please and then sit back and demand that an explanatory and predictive theory be built on that description.” Philosopher David Hull (1970:32) used similar wording when he noted that the “two processes of constructing classifications and of discovering scientific laws and formulating scientific theories must be carried on together.”

Systematics, therefore, is basic to everything an archaeologist does, but rarely do we step back and examine the underpinnings of the classificatory systems that we use. Failure to do so, we might expect—and we would be correct—seriously weakens any claim that archaeology is scientific. If the units we are employing to measure similarities and differences are not logically derived—and by “logical” I mean that they are appropriate for the analytical problem at hand—then how in the world can we expect our conclusions to be anything more than interpretive stories about the past? Our conclusions might be more than that, but how will we know? How do we know that our conclusions are better than someone else’s?
Science is only one of several ways of looking at the natural world—one sense-making system—and it has its own set of rules and expectations. One expectation is replicability—that is, will we get the same conclusion if we repeat a certain experiment? Replicability underlies another expectation: that we can predict future phenomena based on replicable experiments. In the scientific arena conclusions are based on these expectations being met. One can quickly determine whether the conclusions are logical—that is, whether they follow from the data. The veracity of conclusions is based on empirical—real—phenomena and how well the distribution of the real phenomena is explained by the theory one is using.

Theories are nothing but explanations of why the phenomena behave the way they do. Importantly, they are not interpretations of the behavior but rather concise, logical statements of cause and effect. In archaeology, one of the things in which there is considerable interest is change. We ask questions regarding why things change, how they change, when did they change, and, perhaps most important, why they change. To provide more than little stories—interpretations—about change requires systematics. That is, explanations of change demand the logical use of units designed specifically to measure change. This has, in many respects, been archaeology’s downfall; the use of units that are not up to the task at hand or the use of units that although they are appropriate for measuring one kind of change are inappropriate for measuring other kinds of change. In short, there are no universal units in archaeology any more than there are in any other brand of science. This is the take-home message of the papers included here: inappropriate use of units has led to serious problems in archaeology. The papers were presented during the 2000 Missouri Archaeological Society fall symposium on systematics in archaeology, and they were so well received that we thought we would make them available in published form.

In “Units in Archaeology and Paleontology: Identifying Unknowns,” Lee Lyman points out that the methods used by paleontologists to identify fossil species are identical to those used by archaeologists to identify point and pottery types. Not surprisingly, similar weaknesses attend efforts to establish definitive criteria of both biological units and archaeological types.
The paper by Judith Harpole and Lyman, "Seriating Change in the Fashion of Women's Bonnets," concerns the analysis of archaeological change and one strategy available to archaeologists to order phenomena chronologically. Most people—professionals as well as nonprofessional archaeologists—are familiar with various radiometric techniques for keeping track of time—radio-carbon dating is one such method—but there are other methods that have deeper roots in Americanist archaeology. One of these is seriation, which is a method of ordering phenomena according to their similarities. Within that broad method is frequency seriation, which uses similarities in the relative frequencies of classes of phenomena as the basis of ordering. Frequency seriation can be used to measure the passage of time, but only when appropriate units are constructed.

In "The Use of Cladistics in Archaeology," I discuss a paleobiological method for reconstructing lineages of organisms both living and extinct. I point out that the method, cladistics, also is applicable to cultural phenomena because culture and biological organisms evolve in a similar manner. Using a case study focusing on Paleoindian projectile points from the southeastern United States, I outline how cladistic analysis works and demonstrate why it is useful to archaeologists.

In "Social Interaction and Pottery Lineages in the Southeastern United States," Karen Smith and I point out that although in American archaeology pottery types are a familiar result of systematics—that is, they are the final products of classifying pottery sherds—not all pottery types are subjected to purposeful classification and as a result are not useful for delineating time and space relations. The case we use as an example is the pottery type Swift Creek complicated stamped, which has a temporal span of some 700 years and a spatial distribution across several southeastern states.

Raymond Wood, in "The Realities of Ethnogenesis," notes that tracing the "genealogies" of historic Native Americans into the prehistoric past, however popular it may once have been, is subject to grievous problems. Tracing such genealogies involves the direct-historical approach and the subdiscipline of ethnohistory as points of departure. However, disease and ensuing cultural discontinuities, the lack of ethnic isomorphism, and the unreality of systemat-
ics as they have been used in the past make extending any tribal genealogy very far into the past an exercise based on untenable assumptions.

In “Difficulties with Archaeological Units in the Missouri Ozarks,” James Wettstaed points out that archaeologists routinely mask considerable variation through the use of terms such as the Late Archaic period. This, of course, is acceptable when archaeologists are painting with a broad brush, but as Wettstaed notes, what often happens is units defined for one region are applied to areas where considerably less work has taken place. Such applications enter the literature and soon become gospel. He demonstrates the effect this has had on our (mis)understanding of the archaeological record in the northeastern Ozarks.

I know that what is presented in these papers will be new to some of our readers, but I urge you to not to be discouraged. Archaeology, as with any science, contains a certain amount of jargon, but the authors went to great lengths to explain the terms they employ, and with a small amount of patience you’ll understand precisely what they are trying to get across. I’ve said this before in numerous venues, but it bears repeating again: For anyone to be as deeply involved in archaeology as some of us want to be, there are several fundamental issues that must be addressed. One of these is systematics—a topic that as I said at the outset is absolutely fundamental to serious archaeological inquiry. These papers hit on only a few of the myriad topics involved in archaeological systematics, and perhaps sometime we can follow up with another session. Take heart in the fact that if after reading the papers you retain as little as, say, 20% of what was discussed, you’ll know more than a lot of professionals do about systematics.

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