

Time, Space, and Marker Types: James A. Ford's 1936 Chronology for the Lower Mississippi Valley

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James A. Ford's name is often linked historically with frequency seriation through his 1936 chronological ordering of sites in western Mississippi and eastern Louisiana. This linkage is understandable given the manner in which frequency seriation typically is conceived, but it is incorrect. In fact, Ford sorted 103 sites based on the frequencies of their included marker types into seven spatial-temporal units he termed decoration complexes. Ford's marker types as analytical units were unlike those used in the frequency seriations of A. L. Kroeber and the ceramic stratigraphy of Nels Nelson in the Southwest. Ford's types were index fossils that encompassed relatively large spatial areas and small spans of time – they were horizon styles – whereas Kroeber's and Nelson's units encompassed relatively small areas and long spans of time. Frequency seriations of Ford's marker types show that not all of them meet the requirements of the frequency-seriation model and hence do not display battleship-shaped frequency distributions. Nevertheless, the seriations indicate more continuity among some decorative complexes than Ford's original analysis suggests.

In his 1936 publication entitled "Analysis of Indian Village Site Collections from Louisiana and Mississippi," James A. Ford used a series of pottery types to order 103 sites that he and Moreau Chambers had surface collected in the late 1920s and early 1930s while employed by the Mississippi Department of Archives and History. Received wisdom has it that Ford used seriation to create the chronological ordering (e.g., Trigger 1989:200-202; Watson 1990:43). Probably because of the famous "thumbs-and-paper-clips" diagram that Ford (1962) late in life used to illustrate one way to perform frequency seriation, that technique in particular has forever been linked to his name. But Ford never used frequency seriation in any of his own work (O'Brien and Lyman 1998), despite his later claims to the contrary (Ford 1962). Only in the most general, and thus obscure, sense did Ford "seriate" his and Chambers' pottery collections in 1936.

Standard dictionary definitions of seriation generally read, "arrangement in a series." Such definitions, however, cloud the history of Americanist archaeology, and we have relied instead on John Rowe's (1961:326) definition of seriation as "the arrangement of archaeo-

logical materials in a presumed chronological order on the basis of some logical principle other than superposition." The logical principle is that formally similar materials are close together in the arrangement, whereas formally dissimilar materials are far apart (Cowgill 1972). Similarity can be measured in several ways (O'Brien and Lyman 1999a), but the one of relevance here concerns relative frequencies of artifact types, or what is termed frequency seriation (Dunnell 1970). Attending standard dictionary definitions, seriation as practiced by archaeologists has two tasks: (1) ordering artifact collections based on their similarities, and (2) determining whether the ordering measures the passage of time (Cowgill 1968). The first task might entail, for example, creating a series of types and computing their relative frequencies per collection, and the second might involve examining the stratigraphic positions of the types created – what we elsewhere term percentage stratigraphy (Lyman et al. 1997, 1998; O'Brien and Lyman 1999a).

In our view Ford's 1936 effort is well characterized as "artifact (bio)stratigraphy for purposes of cross dating" (O'Brien and Lyman 1999a:209). As we note elsewhere, Ford "determined the most abundant marker type in each collection, then noted which decoration complex was most frequently represented by the marker types, and finally placed each collection in its appropriate decoration complex" (O'Brien and Lyman 1999a:209). This is one way a biostratigrapher uses index fossils to correlate strata and assign them to geological periods (Lyman and O'Brien 2000). It is only in this biostratigraphic sense that Ford's 1936 effort resulted in an "arrangement in a series" and thus that Ford performed a "seriation."

Ford's 1936 analysis is significant in that it produced the first archaeological chronology for the lower Mississippi Valley, a chronology that Ford would revise over the next several years as a result of the large Works Progress Administration project he directed in Louisiana (O'Brien and Lyman 1998, 1999b). Select aspects of Ford's work have been considered in detail elsewhere (Lyman et al. 1997, 1998; O'Brien and Lyman 1998, 1999a, 1999b), but those treatments merely summarize what might have been his most innovative contribution to southeastern archaeology, the development of a workable regional chronology. Our considerations here are twofold. First, we examine in detail how Ford produced his chronology of 1936, particularly the rationale that dictated his choice of analytical units (artifact types) with which to measure the passage of

time across a complex cultural landscape. The kinds of units he used, generally referred to as historical types, were not unique in Americanist archaeology; one version had made an appearance in the Southwest during the second decade of the twentieth century. Ford employed a different version and in a manner different from the way the units were used in the Southwest. Second, because Ford's historical types were different from those developed in the Southwest, we examine the kind of results his units would produce if they were used in a frequency seriation, which was one way they were used in the Southwest. That is, we want to know if they meet the requirements of the frequency seriation model and also if they reveal details of southeastern prehistory not apparent in Ford's original analysis. To address this second interest we describe several frequency seriations we performed with some of Ford's assemblages. We show that whereas Ford's original sorting of the assemblages resulted in an ordering that he could interpret in terms he found satisfying, some of the assemblages are difficult to arrange in a series because the units they comprise do not meet the requirements of the frequency seriation model. This is largely because some of Ford's pottery types were designed to be index fossils, or horizon styles. They encompass large spatial areas but have relatively brief temporal spans, whereas seriable types must be more like a cultural tradition and encompass small spatial areas and have relatively long temporal durations.

Time, Culture Change, and Units

Throughout the twentieth century archaeologists have employed a multitude of units to keep track of time (Dunnell 1986; O'Brien and Lyman 1999a), with the choice of unit depending in large part on how time is viewed analytically. One perspective views time as a seamless continuum; any units used to subdivide it are nonreal in an empirical sense but certainly real in a theoretical sense. A second perspective, although it too views time as a continuum, holds that it is possible to segment time by identifying natural disjunctions, thus imparting a degree of reality to the divisions (O'Brien and Lyman 1999a). How one conceives of culture change influences how one measures the passage of time (Lyman and O'Brien 1997). Is change more like a series of stair steps, with natural breaks, or is it more like a ramp, with no natural breaks in the continuum? Different units measure time, and therefore culture change, differently.

The units Ford used in his ordering were similar to those used by A. L. Kroeber, Nels Nelson, A. V. Kidder, and Leslie Spier in the Southwest almost 20 years previously, though Ford had little or no knowledge of what his forebears had done (O'Brien and Lyman 1998,

1999b). All five men used historical types, that is, analytical units that marked time's passage. But Ford's historical types were of a kind different from those of his predecessors, and, because of this, the manner in which Ford used these units to carve time and culture change into segments differed significantly from what had been done in the Southwest. Ford's views on culture change and how to measure it shifted continuously, making them difficult to summarize (O'Brien and Lyman 1998, 1999b). One element present from the start, however, was that the entity called culture metaphorically flows along in unbroken fashion, always changing, always becoming something else. The Ford of the 1940s and early 1950s was adamant that although the cultural flow could be segmented for analytical purposes, those segments were in no sense real (e.g., Ford 1951). The Ford of the mid-1930s, however, was much less adamant and in fact attached considerable reality to the segments into which he subdivided culture's flow. This view accounts in part for why he used what he called "marker types" in the first place and how he used them in 1936.

Ford's Use of Marker Types

Ford (1936:26) stated that the 103 ceramic assemblages used in his analysis came from sites located in an area "roughly three hundred miles from east to west and two hundred miles from north to south, that lies in the northern part of the state of Louisiana and in central and southern Mississippi. This area extends across the wide alluvial valley of the Mississippi River and includes the hill country on either side" (Figure 1). Many of the sites were located along the Mississippi, Red, Ouachita, Tensas, Yazoo, Big Black, and Pearl rivers. For the most part Ford's sample was drawn from village sites. When compiling his data he specifically ignored assemblages from burial sites, stating that "burial collections are subject to selection, peculiar mortuary styles, and possible lag due to ceremonial conservatism" (Ford 1936:9). He concluded that assemblages from village sites were not susceptible to these problems, primarily because he believed that domestic wares found on such sites were more likely not to have stylistic constraints imposed on them. Village sites also offered an advantage because many were plowed and thus had good surface exposure, and, as Ford (1936:8) noted, "no midden deposits have been found in the local area that lacked decorated potsherds."

Collection procedures entailed gathering as many decorated sherds as possible from the surfaces of village sites. As land conditions changed from season to season, many sites were revisited and additional sherds collected. When collecting the material, Ford and Chambers carefully examined the spatial distribution of

sherd types in a "number of sites" (Ford 1936:11) to determine whether there was segregation of pottery styles. Although Ford expected some clustering of sherd types, no such occurrence was observed, a result he attributed to long-term plowing of sites. Only sherds that "promised to yield information concerning vessel decoration, shape, tempering material, or appendages" were collected (Ford 1936:11). To ensure that assemblages from his sites were randomly collected, Ford calculated an average variation in type frequencies for multiple collections at 13 localities. Most of the average variation in type frequencies fell below 5.0%, with a maximum of 7.3%.

To build a chronology of ceramic art in the region, Ford (1936:12) believed it was necessary to "evaluate correctly the relative popularity of different decoration types." In his view this procedure was important for three reasons:

- (1) It may be expected that two sites occupied through the same period of time, under the sway of the same school of ceramic art, will yield nearly identical decorations in about the same proportions.
- (2) The assumption is usually possible that, while decorations characteristic of a school of art will form a major proportion of the material at their native sites, on contemporaneous sites of different modes to which they might have been traded or were the results of imitation, they will be in the minority.
- (3) Provided the factor of population [size] had remained nearly constant, a village inhabited through two style periods could be expected to show a majority of the material characteristic of the period in which it existed ... longer (Ford 1936:12).

The Classification System. To observe patterns associated with these assumptions Ford needed a classification system able to track change in pottery decoration over time. The system he devised was an experiment, and he used it only once. His concern was to develop a system that could both measure the flow of time accurately and be replicated by anyone. His 1936 system met both demands (O'Brien and Lyman 1998). This contrasted with one of his earlier attempts – a system based on a mixture of pottery attributes such as decoration type, temper, paste, thickness, hardness, and vessel shape – that failed to "detect significant correlations" (Ford 1936:18). In other words, the types didn't measure the passage of time. In moving to a system in which the types were built primarily around stylistic dimensions, Ford minimized the effects of functional characteristics, which are susceptible to recurrence through time (Dunnell 1978; O'Brien and Holland 1990).

Ford's (1936:19-22) system was based on three dimensions of variation in the sense of a paradigmatic classification (Dunnell 1971; O'Brien and Lyman 2000). Two of the three dimensions – motif and element – were used in the creation of each class. As Ford (1936:19) explained, "Motif is the plan of the decoration: scroll, parallel features, herringbone, etc. Elements are the means used to express the motif, i.e., incised lines, rows of punctat[ion]s, rouletting, etc." The third dimension, which he labeled "adaptation and arrangement of motifs," was used inconsistently. For each dimension Ford listed a series of different attributes, or modes, which in the case of motif were characteristics such as chains of triangles, scrolling, and bands of elements.

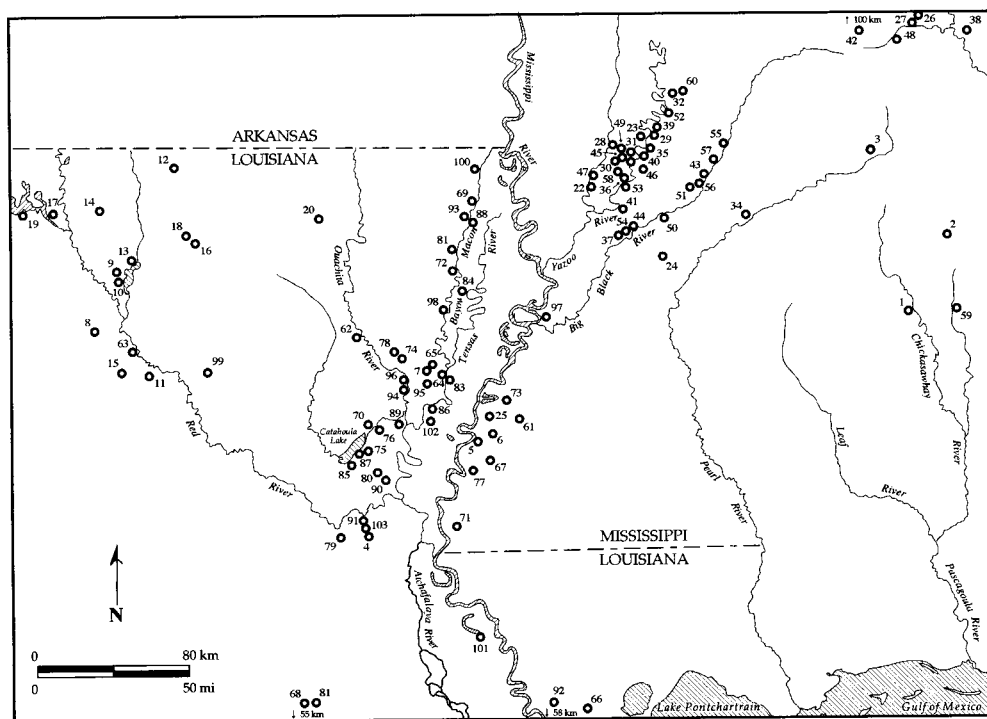


Figure 1. Locations of the 103 sites in Mississippi and Louisiana surface collected by James A. Ford and Moreau Chambers in the late 1920s and early 1930s. Numbers are those used by Ford (after Ford 1936).

Each attribute received a unique numeric code, and types were created by stringing together specific attributes in the order of motif, element, and (if used) adaptation. As an example, one of his types was designated 61;24;7. By definition, every specimen that he placed in that type had to have the following characteristics:

61. Motif – Arranged parallel to the vessel lip.
24. Element – Overhanging lines, [i]ncised with a flat, pointed instrument, held at such an angle that the tops of the lines are deeply incised, while the bottoms rise flush with the surface of the vessel wall.
7. Arrangement – Elements placed over three-eight[h]s of an inch apart (Ford 1936:20, 22).

The only aspects of the system that kept it from being a true paradigmatic classification were that some of the attributes were not mutually exclusive within each dimension and some of the definitions contained “and/or” statements (O’Brien and Lyman 1998:85).

Using this system, Ford (1936) identified 84 pottery types. Although the system was successful in its measure of variation – Gibson (1982:265) claimed that it was the most exacting system ever used in the lower Mississippi Valley – its success was probably its downfall. Ford abandoned the system after publication because, as O’Brien and Lyman (1998:86) speculate, he “probably came to the conclusion that the system was far too detailed even for his own purposes.” The amount of variation it measured was unwieldy and unnecessary, with over 20,000 types possible, and as a result Ford turned to marker types to order his sites.

Marker Types and Decoration Complexes. Ford created marker types based on his excavation of Peck Village in Catahoula Parish, Louisiana (Ford 1935a), and on his first-hand knowledge of the pottery from excavations at Marksville in Avoyelles Parish, Louisiana (Setzler 1933a, 1933b), and at Deasonville in Yazoo County, Mississippi (Collins 1932a). He included those types found in large proportions at sites and hence “more likely to be found in small site collections” (Ford 1936:26). Ford designated 19 of the 84 pottery types as marker types, each of which was placed into one of seven “decoration complexes,” which he defined as “a group of pottery decorations characteristic of an area at a definite period of time” (Ford 1936:74). Importantly, it was one or more marker types that became the definitive criteria for each decoration complex. Each decoration complex was placed in one of three periods (Figure 2). Complexes included in Period III were determined by the presence of pottery types found in sites known to have been inhabited by one of the four historical-period groups in the region: the Caddo, Choctaw, Natchez, and Tunica. The order of the three prehistoric complexes – Marksville, Deasonville, and Coles Creek – was determined

by superposition of marker types at excavated sites, especially Peck Village.

The manner in which Ford presented his complexes (also see Ford 1935b) suggests that he considered the Marksville complex ancestral to the later complexes. Following Marksville (Period I) there was a division into two complexes: Deasonville in the northern and western parts of the region, and Coles Creek in the southern and eastern parts (Period II). Each of these complexes in turn was viewed as ancestral to other (in this case, historical-period) decoration complexes: Deasonville was ancestral to Caddo and Tunica, and Coles Creek was ancestral to Choctaw and Natchez. But this ancestor-descendant relationship was, in Ford’s view, illusory; for example, Coles Creek was ancestral to Choctaw and Natchez only in a *temporal* sense, not in any genetic sense. Ford (1935a:10) was clear on this: “Although the Caddo had occupied the territory where they were first described longer than had the Natchez, both cultures at comparatively recent times had displaced others which had entirely different pottery designs and which very likely represented an entirely different people.”

Although Ford stated that it was important to determine the relative abundance of marker types in an assemblage to ascertain its chronological position, he did not use this reasoning to *order* his sites. Rather, sites were correlated and grouped within a decoration complex on the basis of their most abundantly represented marker type(s); no attempt was made to order them within a complex. Indeed, Ford (1936:10) stated explicitly, “In this study the desired results are not the ages of individual sites, but the relative ages of the different schools of ceramic art,” or what he termed decoration complexes. His failure to order site-specific assemblages within each complex underpins our view

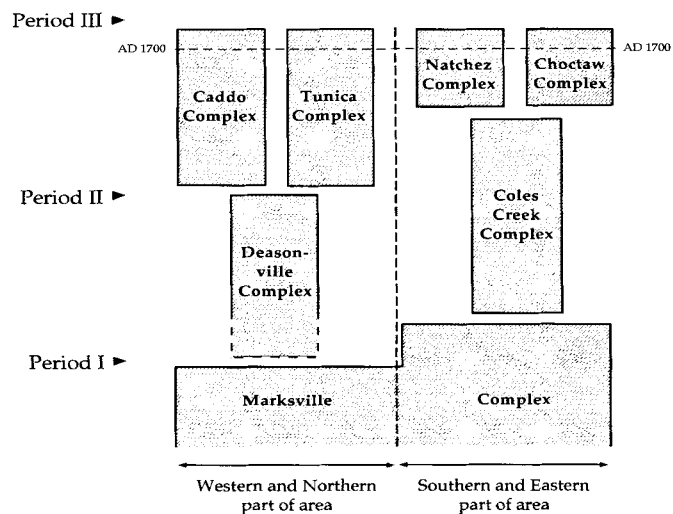


Figure 2. Diagram produced by Ford showing the chronological positioning of seven ceramic decoration complexes from north-eastern Louisiana and southwestern Mississippi (after Ford 1935b).

that Ford did not at that time use frequency seriation. It also indicates that Ford was interested in isolating large chunks of time – his decoration complexes – and not in ordering the sites except at the coarse scale of period. Importantly, always in the background was the equivalence of decoration complexes with ethnic groups, be they ethnohistorically known groups or prehistoric groups. In Ford's mind there was little or no heritable continuity between chronologically adjacent complexes, meaning that one complex had not produced another. Rather, one complex had *replaced* another.

Ford's Interpretations. Several of the 103 sites Ford examined, especially those that had been occupied during the historical period, contained sherds of only one decoration complex. But many of them in the southern part of the region contained sherds of both the Marksville and Coles Creek complexes, and many of those along the Yazoo and Big Black rivers in western Mississippi (Figure 1) contained sherds of both the Marksville and Deasonville complexes. Ford illustrated this overlap in his master sequence for the region (Figure 2, Period I to Period II). A few sites that were known locations of the historical-period Caddo and Tunica contained rare Coles Creek-complex sherds, but no Choctaw or Natchez sites contained Coles Creek sherds, nor did any historical-period sites contain Deasonville-complex sherds. This pattern led Ford to suspect that the Coles Creek complex might have been in part contemporaneous with the Caddo and Tunica complexes and that it outlasted the Deasonville complex, as shown in Figure 2 (Period II to Period III):

In searching for connections between the historic and prehistoric horizons, it will be noted that the sites of the Tunica and Caddo have a conspicuous amount of types that are characteristic of the Coles Creek complex. Also, several of the Coles Creek sites show small amounts of Caddo and Tunica marker types. As typical Coles Creek sites are not found in the region of either of the two historic complexes, it is easily possible that at one time Coles Creek may have existed in its geographical area [temporally] alongside the Caddo and Tunica. The evidence of interinfluence points to this condition. Neither the Choctaw nor the Natchez complexes show any relation to the Coles Creek or any other of the prehistoric complexes. Evidently the Tunica and Caddo were established in their regions before the Choctaw or the Natchez appeared in the area.

None of the historic complexes show any direct relation to Deasonville. Although at one time it was contemporaneous with Coles Creek, it seems to have disappeared before the advent of either of the two earlier historic complexes, Caddo and Tunica. Tunica took over part of the area that Deasonville had occupied (Ford 1936:254).

As the quote makes clear, Ford realized that "mixing" of sherds of different decoration complexes could result

from several factors. Earlier he had commented that there is "system to this mixing of complexes. It can usually be attributed to one or two causes. Mixture often results from trade or borrowing of ideas having occurred between neighboring, contemporaneous complex areas [e.g., the presence of Deasonville sherds on sites containing primarily Coles Creek sherds], so that foreign designs become incorporated in the village refuse dumps" (Ford 1935b:34–35). Reoccupation – that is, occupation after a preceding abandonment – was possible, but "it would be unlikely that a succeeding people should select the exact [previously occupied] habitation spot for their use. If the old locality had been intentionally reoccupied, the odds are that the dumps of the succeeding group would be located near but not precisely on those of the original inhabitants" (Ford 1936:255). Thus, mixing of complexes was more likely the result of continuous occupation. "It seems more reasonable to suppose that sites on which apparently subsequent complexes are mixed were either settled in the time of the older and were occupied on into the time of the following complex; or that the villages were inhabited during a period of transition from one complex to the other" (Ford 1936:255–256).

Ford identified two transitional periods or complexes: Coles Creek-with-Marksville and Deasonville-with-Marksville. To demonstrate the existence of such transitional periods, Ford (1936:262–263) discussed "certain decoration types which suggest that they are the results of an evolutionary trend which runs through two or more of the subsequent complexes." But he was careful to point out that such continuation "does not imply that this evolutionary process occurred in the local geographical area. In most cases it is more likely that the evidence is a reflection of the process taking place *in some nearby territory*" (emphasis added). In other words, Ford was suggesting that particular attribute states of decoration types originated in and diffused from one area ("territory") to another, where they subsequently became incorporated into the local decoration complex. He noted, for example, how one type was found throughout the sequence of complexes, but it "also took on, in each complex, the features [read *attributes*] peculiar to that complex" (Ford 1936:263). Such "lines of development" (Ford 1936:263) provided historical linkage between complexes, but only in a chronological sense. In other words, the linkage created a sequence, in the sense that A came before B, which came before C; but it was not an evolutionary sequence, in the sense that A contributed to the rise of B, which contributed to the rise of C.

Ford's conception was that design change rested almost entirely on the effects of outside influences. This was the metaphysic popular in Americanist archaeology at the time. Metaphorically, a culture is a flowing (evolving) stream of ideas, but because cultures are not

autonomous – they interact – the appropriate model for culture change is a braided stream, with each intersection of two trickles representing “cultural influences” (Stirling 1932:22). These influences are the result of ethnographically visible processes such as diffusion, trade, or even immigration, all of which provide a new source of variation for the local pottery tradition. New decoration complexes, which are aggregates of types, thus represent the *replacement* of one culture by another. In other words, breaks in the flow between complexes signify cultural (and temporal) discontinuity. By 1936 the braided-stream model was how Ford viewed culture change (O’Brien and Lyman 1998). Thus he ended his monograph on the surface collections by noting that “Even with this modest beginning there is quite a temptation to see a story of ancient movements of people and cultural forces in the local region with ramifications spread over much of the eastern United States” (Ford 1936:270).

Types and Measuring Time

When it came to his selection of a general method to measure the passage of time, it is not surprising that Ford chose the one he did. By the early 1930s the use of historical types (sometimes termed “styles”) was commonplace in Americanist archaeology (Lyman et al. 1997), and even as rudimentary as Ford’s formal knowledge of archaeological method was (O’Brien and Lyman 1998), he would have been exposed to it. For example, many of the presentations at the Conference on Southern Pre-History in 1932 (e.g., Collins 1932b; Stirling 1932) contained references to a method that is, as Willey and Sabloff (1993:126) note, “almost as old as archaeology.” The use of temporally overlapping cultural traits became the basis for what later was termed the direct historical approach (Steward 1942; Strong 1935; Wedel 1938; see Lyman and O’Brien [2000] and O’Brien and Lyman [1999c, 2001] for detailed discussions). It “involves the elementary logic of working from the known to the unknown. First, sites of the historic period are located.... Second, the cultural complexes of the [historical-period] sites are determined. Third, sequences are carried backward in time to protohistoric and prehistoric periods and cultures. [The approach allows one to] carry sequences backward beyond the point where the traits of the known, historic peoples faded out” (Steward 1942:338). A “cultural complex” comprised a set of cultural traits more or less unique to a particular culture (e.g., Wedel 1938). Knowing that specific traits occurred in different complexes allowed one to trace those cultural traits backward through time across temporally successive cultural complexes.

It is these shared, or overlapping, traits that serve as the basis for placing complexes or assemblages adjacent to one another in an ordering thought to comprise a

sequence. Thus overlapping is a form of “linkage” between archaeological phenomena (Ford 1938b:262; Strong 1935:68). It has two significant aspects (see below), both of which are found in Nels Nelson’s (1916:163) statement that when he excavated Pueblo San Cristobal, New Mexico, he was explicitly seeking data indicating that one type of pottery “gradually replac[ed]” another rather than seeking mere “time relations” of the types; he already knew the sequential arrangement from the relative stratigraphic positions of the types, just as Ford knew the relative stratigraphic positions of some of his marker types. Nelson (1916) excavated the way he did, and plotted ceramic type frequencies the way he did, because only in those ways could the gradual *replacement* of one or more types by one or more others – the overlapping of types across multiple assemblages – be found. Each type would appear, persist for a while, and finally disappear. But the various types would do so in piecemeal fashion and thus partially overlap in their temporal occurrences. The principle of overlapping is therefore critical to the direct historical approach precisely because an overlapping trait, one shared by multiple assemblages or complexes of different ages, connects the assemblages.

The two significant aspects of the principle of overlapping are that (1) it helps ensure that time’s passage is being measured, and (2) it does so because it implies a particular *kind* of continuity. With respect to the first aspect, the implicit assumption allowing application of the direct historical approach is that prehistoric materials most similar to historically documented materials are the more recent. Prehistoric materials less similar to historically documented materials date to more remote times. This allows sequences to be built. With respect to the second aspect, the connections of cultural complexes denoted by overlapping traits – traits shared by complexes adjacent to one another in an ordering – have a particular but implicit meaning that not only warrants the temporal inference but provides an explanation for that inference. The principle of overlapping assumes a direct *phylogenetic* connection between culture complexes that share traits, an evolutionary, or genetic-like, continuity founded on transmission and inheritance (Lipo et al. 1997; O’Brien and Lyman 1999a, 2000). Although implicit, this is why traits overlap from complex to complex and why the complexes are viewed as being linked. It was exactly such linkages that were explicitly sought by Nelson and referred to by Kidder, Spier, and others. But, and this is an important exception, the units they used were decidedly different from those usually employed in the direct historical approach. Instead of using traits, they used trait *variants* (Lyman and O’Brien 1999, 2000; O’Brien and Lyman 1999a), a strategy Ford would employ two decades later. The differences were in the kind of variants and in how he used them.

Whereas Kroeber, Nelson, and their colleagues used variants of the culture trait "pottery," soon to become known as "styles" (e.g., Rouse 1939), to measure time continuously, Ford used them to measure it discontinuously. In short, his concern with decoration complexes forced his hand; he *had* to use marker types, similar to the manner in which a biostratigrapher uses index fossils to correlate strata and assign them to periods. Thus there was no way to determine whether there were phylogenetic connections across the boundaries of the complexes. Of course, Ford did not believe such continuity existed to any great degree, which is why decoration complexes and marker types could be identified in the first place. In Ford's view, complexes represented ethnic groups, and it was the cultural processes associated with those groups, especially group movement, that caused a new suite of pottery decorations to appear in a region.

Even in the few instances where Ford (e.g., 1936:262) saw "an evolutionary trend which runs through two or more of the subsequent complexes," he chalked it up to outside influence that caused design motifs to "evolve." In only a single instance did he explore the epistemological underpinnings of design continuity, though not in one of his many publications. Rather, it was in his master's thesis (Ford 1938a), completed two years after the surface collection monograph was published. In it Ford attempted to demonstrate that if artifact types were created properly, it should be possible to show, on the basis of homologous similarity, that certain types could be grouped into what he referred to as "significant idea groups." If so, then one could conclude that the types within the group were derived from a common ancestor (Ford 1938a:30). Groups of types could be linked together at successively higher levels of inclusivity such as series and wares, groups that had but a single purpose: "the translation of ceramic history into the history of cultural spread and development" (Ford 1938a:86). An uncritical reading of Ford's writings might suggest that by 1938 he had changed his mind on design evolution being influenced solely by outside forces, but this is not true. He simply was mimicking what Harold Colton and Lyndon Hargrave (1937), among others, had proposed with their hierarchical system of nomenclature for pottery classification (see Ford 1940). For Ford, pottery decoration evolved, but it did so only with the help of outside influence. If a "common ancestor" for a series of pottery types could be identified, it would be in a locality far removed geographically from where its descendants were found.

Ford (1938a:5) believed it was possible to discover "general principles which may be expected to underlie" the creation of idea groups, but he did not pursue the matter. Kroeber (1931), in fact, had outlined the basis for such a principle a few years earlier, and ironically that

basis was homology, which Ford (1938a:30) stated was the basis for creating "significant idea groups." But whereas Ford was thinking of homology only in vague ancestor-descendant terms, Kroeber thought homology denoted true "genetic unity" (Kroeber 1931:151), what we referred to above as a direct *phylogenetic* connection. It was this principle that in 1915 yielded a shift both in how time was measured and in the archaeological units used to measure it (Lyman and O'Brien 1999). That was the year Kroeber (1916) used variants of a trait, pottery, to order surface collections of sherds from sites in the countryside around Zuñi Pueblo, New Mexico, by means of frequency seriation. Several features of those collections allowed them to be ordered, one of which was ambiguous in Ford's collections. Whereas Ford's assemblages came from a 6000-square-mile region, Kroeber's came from a very small region. We examine the implications of this important difference below.

Units, Time, and Space

To be useful for tracking time as a continuous variable, measurement units rendered as historical types must occupy a single span of time. But such units can have varied geographical distributions and occupy spans of time of varied duration. To illustrate this, we offer Figure 3, in which artifact form is modeled as varying continuously through time and across space.

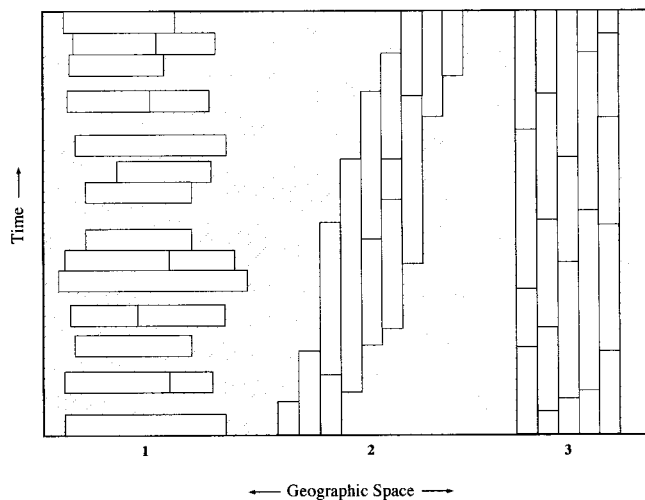


Figure 3. A model of units used by archaeologists to measure time. Artifact form varies continuously along both axes, but there is no absolute scale on either axis. Each rectangle represents a unit used during analysis to measure variation; shaded areas represent formal variation not measured by those units. Each column of rectangles (1-3) denotes a set of units comprising a typology: 1, analytical units include relatively large geographic areas but brief time spans, and they do not overlap in time; 2, analytical units overlap through time but include spatial variation as well, and thus change over time as well as variation over space is included; and 3, analytical units overlap through time but do not include a change in spatial variation, and thus only time is measured (after Lyman and O'Brien 2000).

Each rectangle represents an ideational unit that includes a particular amount of formal variation; shaded areas represent formal variation not measured by those units. Each column of rectangles (1–3) denotes a set of analytical units termed historical types. Those types vary within and between sets with respect to how much time or space they include. In column 1 analytical units include relatively large geographical areas but brief time spans. Furthermore, there is no temporal overlap between types. These kinds of historical types later became known as *horizon styles* (e.g., Kroeber 1944:104; Willey 1945). In column 2 analytical units overlap in time but also include significant spatial variation. In column 3 analytical units overlap in time but do not include much spatial variation. Thus, relative to the two other kinds of types, only time is measured. Culture traits – those used in, say, the direct historical approach – often had distributions such as that modeled in columns 2 and 3; when they were like those in column 2, debate ensued over what the historical significance of the units might consist (e.g., Steward 1929).

The types constructed by Kroeber, Nelson, Spier, and Kidder approximated the rectangles shown in column 3. For the most part they monitored the passage of time rather than differences in geographic location. This kind of analytical unit had to be built by trial and error. Given such a mode of construction, the utility of a type for measuring the passage of time had to be tested, a point made explicit by Krieger (1944) when he indicated that archaeologically useful types must pass the historical-significance test. In other words, did a type track time and *only* time?

It seems that a few of Ford's marker types had distributions like those in column 3, but more of them had distributions like those in column 2 (see below). This was due in part to Ford's inconsistent application of his three dimensions when he defined his types. Recall that many of the types were created using only two dimensions, motif and element, a strategy that resulted in more formal variation in some types than in others. The former types would tend to be found over larger geographic areas than the latter. Still other types had distributions that resembled those in column 1, because Ford lumped various types together (Marksville type 31:23//101/102:1/2, for example), in essence creating types that included considerable variation. All of them measured time, but they also had large spatial distributions. The net result of that action was a conflation of time and space, brought about in large part because Ford did not have access to the actual sherds when he switched from his earlier classification system to the one used in the 1936 monograph.

To seriate a group of archaeological assemblages successfully, those assemblages must meet three conditions: (1) they must be of similar temporal duration; (2) they must come from the same local area; and (3)

they must belong to the same cultural tradition (Dunnell 1970, 1981). The first two requirements are more difficult to fulfill, but if they *are* fulfilled, then the third criterion is also likely to be satisfied (O'Brien and Lyman 1999a). Although Ford did not specifically set out to satisfy the first two requirements, he explicitly stated that he chose his pottery samples from village sites because they were more likely to have been occupied for a similar duration (Ford 1936:8). He also was attuned to the necessity of controlling for space and thus defined two areas, a northern and western area and a southern and eastern area. As we discuss in the next section, this was insufficient control of geographic space to permit totally successful frequency seriations. It was, however, sufficient for the correlation of a site's ceramic assemblage with a particular decoration complex based on the frequencies of the marker types included in the assemblage.

As Ford's model of regional prehistory (depicted in Figure 2) indicates, he believed he was dealing with a cultural tradition that branched at least three times prehistorically. We suspect this is why he had to structure his marker types to include considerable spatial variation and relatively little time. Such types allowed him to correlate roughly in time what were spatially remote sites. For example, sites assigned to the Deasonville complex were approximately the same age as sites assigned to the Coles Creek complex. Thus Ford's marker types worked much like horizon styles. Two years after his 1936 monograph appeared, Ford (1938b: 262) anticipated this archaeological concept when he stated that a decoration complex comprising marker types represents a "distinct time horizon." Ford's marker types were, we believe, built by him to represent relatively brief spans of time and rather large geographic areas – precisely the distributions they should have if they are to serve the same function as a biostratigrapher's index fossils.

In sum, Ford's types were similar to Kroeber's, Nelson's, Spier's, and Kidder's historical types. But Ford built his types in a different way and for a different purpose than did those individuals. The latter were interested in constructing geographically limited local chronologies based on a single site or several sites spatially close to one another. They were also interested in measuring time as a continuous variable. Thus their types entailed relatively limited geographic space and relatively long time spans, and the types overlapped across multiple assemblages. Ford, however, wanted to construct a regional history and to explain that history in the anthropological terms of diffusion, migration, and the like. To do so, his units had to encompass rather extensive spatial areas but limited time spans. Ford (e.g., 1949) would later construct historical types that had relatively smaller geographical and larger temporal distributions and then use their relative frequencies to

order them via percentage stratigraphy. Those working in the Southwest eventually constructed units that encompassed larger geographic areas and smaller time spans (e.g., Colton 1939; Kidder 1924).

Frequency Seriations of Ford's Data

Whether termed marker types, index fossils, or horizon styles, the typological units Ford used in 1936 were variants of a cultural trait (pottery) that served their purpose well. This begs the questions that underpin our second interest in his 1936 monograph: Do his units produce good solutions when submitted to frequency seriation, and do those solutions reveal different aspects of regional prehistory than what is revealed in Figure 2? To answer these questions, we performed several seriations using Ford's data. The first, incorporating all of his sites, was not particularly

informative. There were countless violations of unimodal frequency distributions among the types, many more than would be predicted if sampling error were the only factor driving the distributions. This was not unexpected given the size of the region from which the assemblages were derived. We then seriated sites by geographic area, reflecting Ford's alignment of complexes (Figure 2). Caddo, Tunica, and Deasonville assemblages were placed in the northern and western area, and Natchez, Choctaw, and Coles Creek assemblages were placed in the southern and eastern area. Marksville assemblages, being the earliest complex for both areas (Figure 2), were placed in both. Once again, the results were not particularly useful, especially with respect to Coles Creek-complex and Deasonville-complex types, which had multimodal frequency distributions. We suspect part of the problem is again the sizes of the two sampling areas, but sampling error and tabulation error evidently also contribute.

Table 1. The thirty-two sites and nineteen marker types remaining after screening Ford's (1936) data.

			Choctaw	Natchez	Caddo				Tunica	Deasonville	Coles Creek				Marksville								
			40:31/4	41:21/5	11/21:61	34:27/25:1	61/64	60:41/21	63:42	82:20	82:52	82:52/20	11:11:14	11:81:14	34:24/104:1	61:24:6	61:24:7	61:24/21:8	63:101	31:73:2	31:101/102:1/2	45:23:6	
Site	Total																						
Number	Name	Sherds																					
Choctaw	2 Coosa	119	95																				
	3 Nanih Waiya	53	32																				
Natchez	5 Fatherland Pl.	83	1	48						6			1										
Caddo	10 Ed Pease Pl.	141			4	9	38	13															
	18 Colbert Pl.	103			7	6	9	6				2											
	19 Harrison Bayou	171			10	3	26																
Deasonville	32 Gamewood Pl.	105																					
	37 Lee Pl.	65										5	93										
	39 Quafalorna Pl.	48										3	95										
	42 Ky. Q. Smith Pl.	126										13	81										
	50 Gross Pl.	102											99										
	51 Deasonville	176										1	86			5							1
	53 Clark Pl.	85										4	51										1
	54 Coody Pl.	72										10	58										1
Coles Creek	61 Coles Creek	175																					
	67 Mazique Pl.	173																					
	70 Old Rhinehart	142																					
	71 Smith Creek	457																					
	74 White Oak Ldg.	63																					
	75 Chevalier Md.	124																					
	83 Alphaenia Ldg.	66																					
	89 Jonesville	398																					
Marksville	93 Neal Plant	200																					
	94 Prichard Ldg.	207																					
	95 Peck Pl.	515																					
	96 King Pl.	75																					
	101 Smithfield Pl.	107																					
	102 Churupa Pl.	286																					
Marksville	97 Yokena Site	86		2																			
	103 Marksville Site	135																					

Note: The order of rows and columns mimics Ford's (1936) arrangement.

With respect to tabulation error, we found that Ford's type percentages for each site do not all add up to one hundred. In fact, the range – from 49% to 116% – is much greater than can be accounted for by rounding or mathematical error. One might suspect that Ford included undecorated sherds in his initial calculations and then removed them from his table. However, he explicitly stated that no undecorated sherds were included in the analysis. Another possibility is that somehow during the transfer of sherds from his 1935 classification system to his 1936 system there was a loss of resolution that Ford failed to address. Whatever the reason, we cannot correct the percentages because Ford did not include absolute sherd frequencies for each type for each site in his monograph. We therefore screened Ford's data on the basis of several criteria.

Data Screening and Methods. We first considered deleting all sites for which type frequencies did not sum to 100%, but this would have left only 29 of the original 103 sites. We therefore accepted some error and initially retained sites whose cumulative type percentages ranged from 94% to 105%, leaving two-thirds of the sample, or 68 sites, in the data base. Second, we con-

sidered how adequately an assemblage represents the true population of ceramic types at a site. Ford (1936:38) dealt with this problem by limiting his analysis primarily to those sites with 50 or more sherds. In later works Ford (1949, 1952; Phillips et al. 1951) suggested that although 50 sherds was often adequate, he preferred 100 sherds per assemblage based on several experiments he performed with samples of different sizes. Using the modern technology of computers, Lipo et al. (1997:312-316) endorse bootstrapping, a method by which assemblages are resampled repeatedly to determine the minimum sample size at which the frequencies of sherd types found in complete assemblages are represented. Although this method provides an excellent statistical basis for establishing the minimum size of an adequate sample, Lipo et al.'s results indicate that most of the samples from the Mississippi Valley deemed acceptable for inclusion in their seriations have well over 100 sherds. Applying that standard to Ford's 68 assemblages that we initially retained would have left only 25 assemblages. Because of the severity of this reduction, we returned to Ford's rough indicator as to what constituted an adequate sample size. For purposes of this study we used assemblages with more than 45 sherds, with one last proviso. As Ford must have experienced, we found using all 84 types at one time cumbersome. To alleviate this problem we concentrated on Ford's 19 marker types, which comprise a majority of sherds in the assemblages. Because the marker types are of key interest in this study, and thus need proper representation, we removed all sites that did not include 45 marker sherds, irrespective of type. At the end of this process, 32 sites were left in the sample. These sites and the relative frequencies of marker types in each are arranged in Table 1 in the same fashion and order in which Ford presented the total 103 sites and 84 types he considered. Although we are interested more in Ford's methods than we are in his substantive results, which have been subjected to 65 years of additional research, we illustrate examples of the 19 marker types in Figure 4. Representative examples are much easier to present than Ford's complicated definitions of each marker type.

The temporally late complexes were particularly hard hit by the data-screening procedure. All five Tunica assemblages were removed, as were two of the three Natchez assemblages, 10 of the 13 Caddo assemblages, and two of the four Choctaw assemblages. These historical-period complexes already had fewer representatives than did the earlier complexes, and our removal of small collections seriously impacted an already poor resolution for Period III. For Period II, the Deasonville complex and one of Ford's hybrid complexes, Coles Creek-with-Marksville, approximately half the sites were eliminated. Less than half the Marksville (Period I) sites were removed.

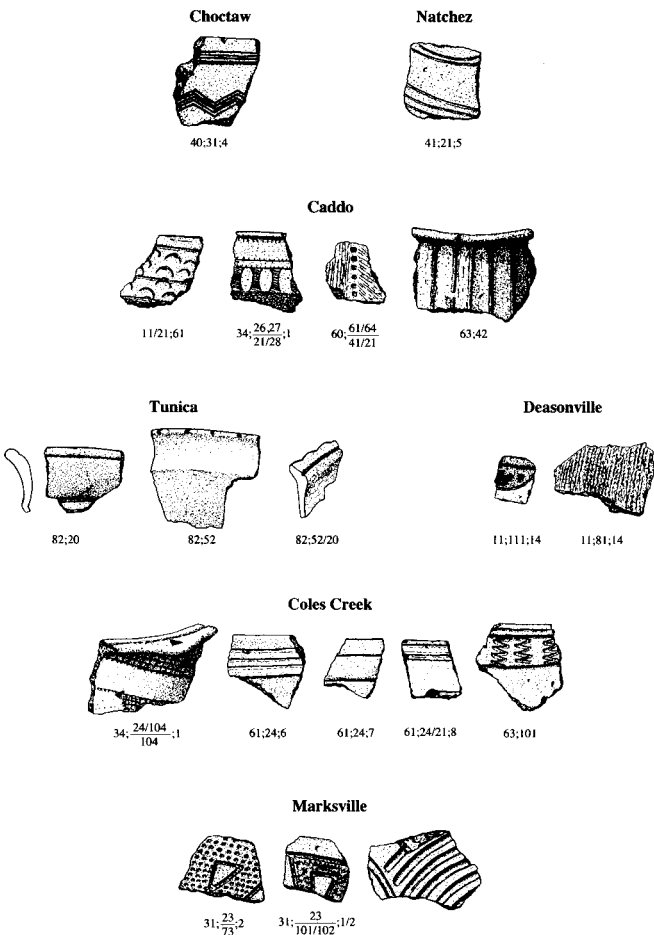


Figure 4. Index markers used by Ford to place the sites in Mississippi and Louisiana into decoration complexes (after Ford 1936).

Although there is an abundance of computer software available for seriating assemblages, we chose Ford's (1962: Figure 8) time-honored technique of arranging paper strips. For each site that remained in the sample, we generated a strip that displayed the percentage of each pottery type. When arranging the strips, we sought orders that had pottery-type sequences with the least number of violations to a unimodal frequency distribution. Orienting the direction of the seriation was simple, as it was for Ford when he arranged his decoration complexes according to the stratigraphic order of marker types and based on ethnographic information (Ford 1935a). Beyond using this information as an indicator of seriation polarity, however, we did not let it dictate assemblage order.

The first set of seriations used all sites remaining in each of the two areas defined by Ford, but for the second set we narrowed the geographic range considerably by defining two site clusters, one in each area. A cluster in this instance is defined as a group of sites in which all members are within 30 kilometers of at least one other member, a distance over which transmission might reasonably occur on a regular basis. This approach represents our attempt to satisfy the local-area requirement of seriation, which is

necessary to ensure that inheritance is actually being measured (O'Brien and Lyman 1999a). A local area does not have a precise definition and can vary through time and space, but we do not perceive any geographic barrier in the lower Mississippi Valley that would make 30 kilometers an unreasonable distance over which community interaction could occur. The areas, then, are imposed on the study area, an approach that differs

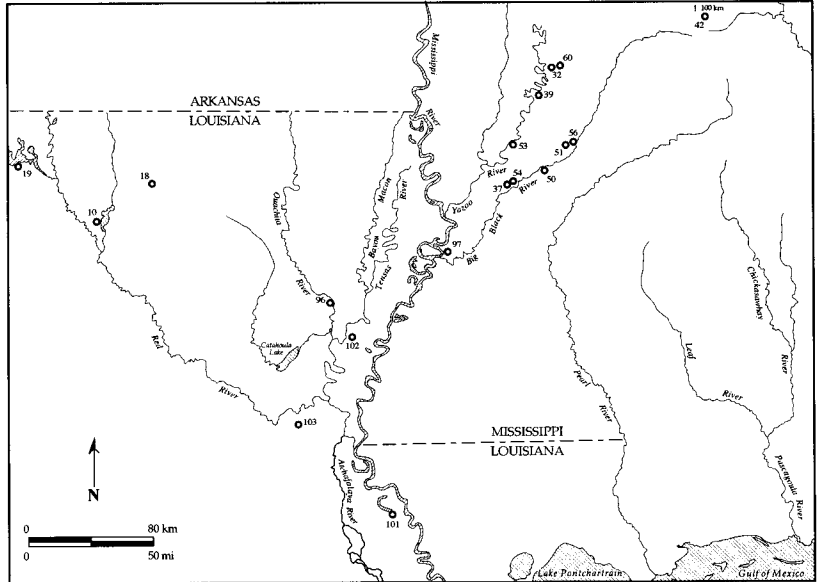


Figure 5. Sites remaining in Ford's northern and western area after data screening. Names of sites are listed in Table 1.

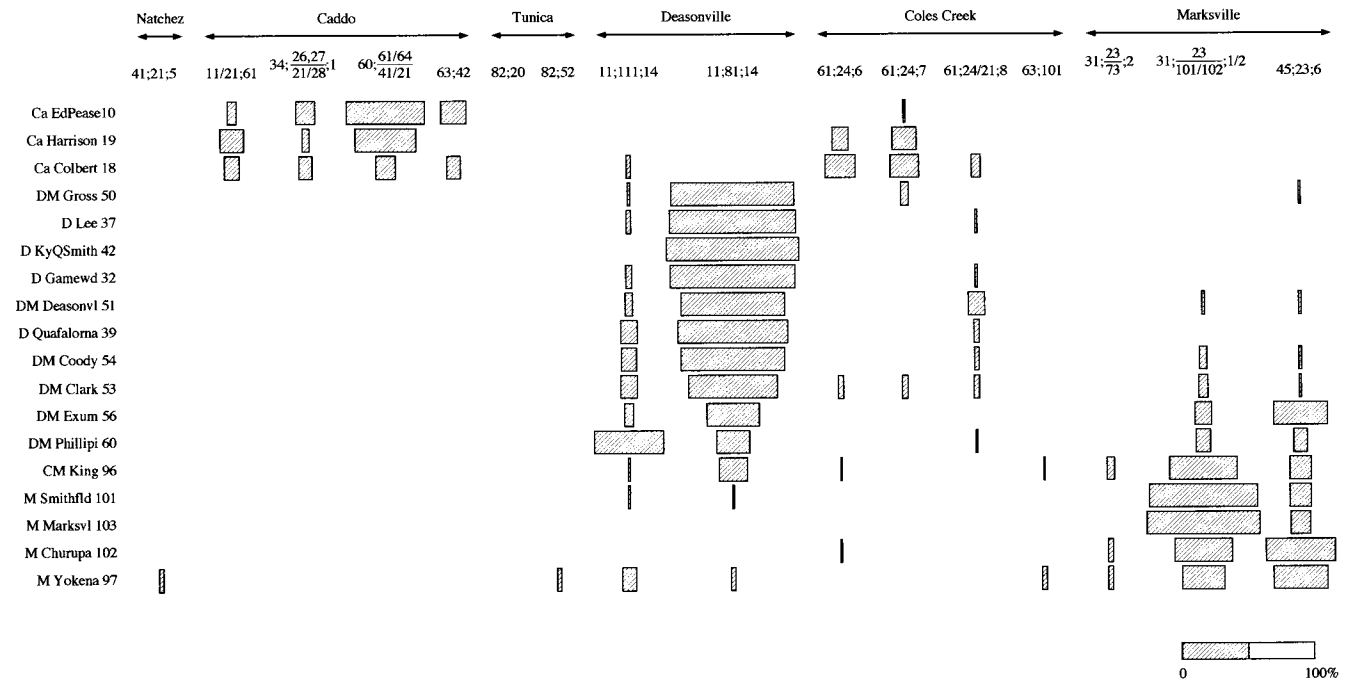


Figure 6. Frequency seriation of assemblages in Ford's northern and western area after data screening. Ford's numerical code for each marker type is at the top of each column, and marker types are placed under their respective decoration complex. Site names and numbers (left column) are preceded by a letter or letters indicating the decoration complex to which Ford assigned the site: Ca, Caddo; DM, Deasonville-Marksville; D, Deasonville; M, Marksville.

from that used by Lipo et al. (1997), who define local areas empirically on the basis of similarity in pottery-type frequencies among sites. Ultimately the approach used by Lipo et al. better measures local areas – it is empirical and takes into account both geographic and social barriers to interaction – but was impossible to implement with our screened set of Ford’s data because of sample size.

When considering the following discussion, recall that types useful for frequency seriation must occur continuously and display unimodal frequency distributions over the time span of their occurrence. Ford (1952:344) later referred to the latter as “battleship’ frequency curves.” If a type does not display a continuous, unimodal frequency distribution, then one or more of the three requisite conditions of seriation mentioned above have not been met (Dunnell 1970). Alternatively, the conditions may be met but the types used in the seriation may not be historical types. Finally, types useful in a frequency seriation should occur over a span of time that is “neither exceptionally short nor excessively long.... That is, they should not be so limited in time that they occur in only one assemblage but no others; were such the case, then no overlap between assemblages could be detected and continuity would be precluded. But the types also should not occur over so long a time span that ... every type is found in every assemblage. In such a case no sorting and thus no ordering of the assemblage [may be possible]” (O’Brien and Lyman 1999a:131). Given the requisite characteristics of types useful in frequency seriation, we were curious to see how well Ford’s types worked.

Results of Seriation for Ford’s Geographic Areas. Using sites in Ford’s northern and western area (Figure 5), it was possible to create a relatively good seriation order for the early part of the sequence (Figure 6). With one major exception, the unimodal curves for Marksville types 31;23//101/102;1/2 and 45;23;6 are excellent. Similarly, both Deasonville marker types – 11;111;14 and 11;81;14 – have relatively good order until a point between the Gross (50) and Colbert (18) sites. Here a truncation of the unimodal curve is associated with type 11;81;4 and a replacement by two Coles Creek and four Caddo marker types. This truncation and abrupt replacement suggests no heritable continuity between Ford’s Deasonville and Caddo marker types. The lack of continuity between the two Deasonville types and the four Caddo types is breached only by Deasonville type 11;111;14 in Colbert (18), but it is very rare at that site, and its presence could be fortuitous. The break in continuity, or lack of overlap, suggests a break in cultural tradition. The appearance of discontinuity might be related to a loss of temporal resolution because of sample-size requirements. But it is more likely attributable to the fact that the three Caddo sites – Ed Pease (10), Harrison (19), and Colbert (18) – are geographically removed from other sites in the sample by over 130 kilometers (Figure 5). A similar spatial effect is not apparent at the Marksville-Deasonville boundary. Between King (96) and Phillipi (60), type 31;23//101/102;1/2 (what Ford identified as a Marksville marker type) decreases but does not disappear, despite the fact that the distance between those sites is over 200 kilometers.

We wonder if the lack of overlap between Deasonville and Caddo markers might be a result of increasingly localized stylistic traditions (e.g., Braun and Plog 1982). In other words, transmission networks became progressively smaller and, therefore, types useful for seriation progressively encompassed smaller geographic areas (e.g., Davis 1981). Ford’s marker types for Period III were explicitly designed to detect this because he intended them to reflect the geographic position of distinct, ethnohistorically documented ethnic groups.

For sites in Ford’s southern and eastern area (Figure 7) the transition between the Marksville and Coles Creek complexes is much smoother than it is between the Marksville and Deasonville complexes (Figure 8). Marksville type 31;23//101/102;1/2 gradually decreases, whereas Coles Creek types 61;24;6 and 61;24;7 gradually increase. Exceptions to this pattern are Coles Creek types 61;24;21;8

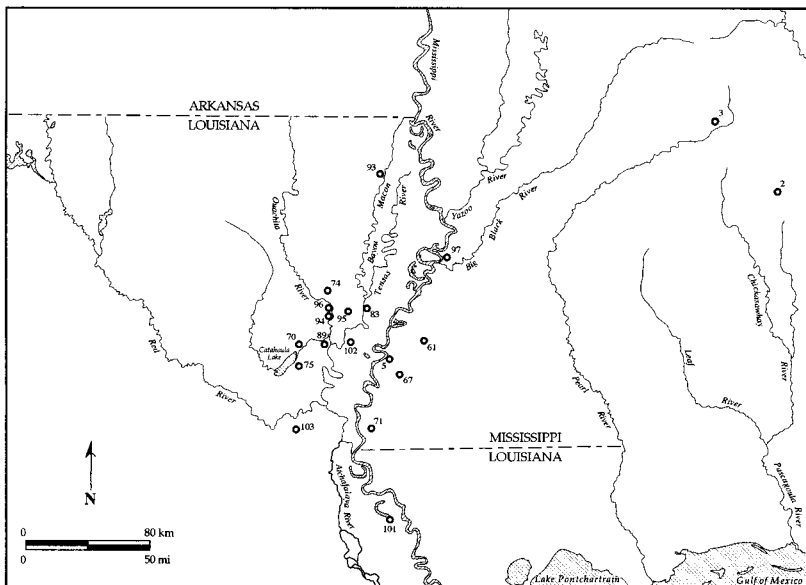


Figure 7. Sites remaining in Ford’s southern and eastern area after data screening. Names of sites are listed in Table 1.

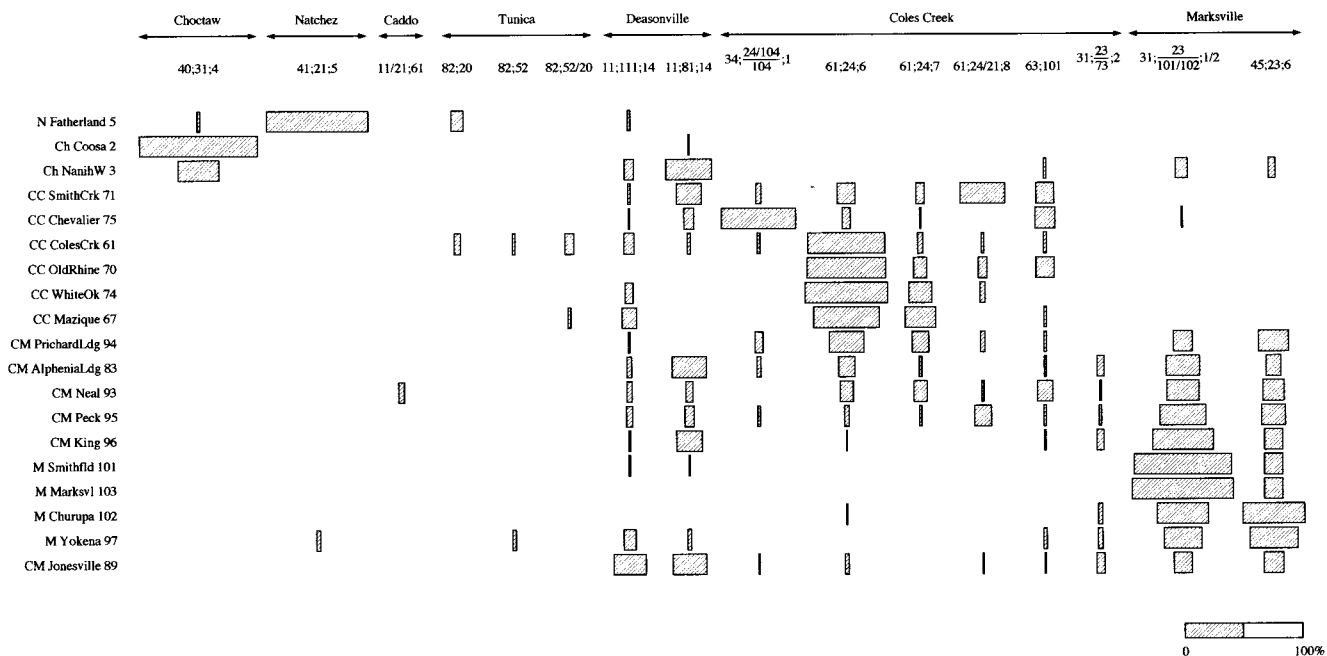


Figure 8. Frequency seriation of assemblages in Ford's southern and eastern area after data screening. Ford's numerical code for each marker type is at the top of each column, and marker types are placed under their respective decoration complex. Site names and numbers (left column) are preceded by a letter or letters indicating the decoration complex to which Ford assigned the site: N, Natchez; Ch, Choctaw; CC, Coles Creek; CM, Coles Creek-Marksville; M, Marksville.

and 63;101. Our guess is that these disparities result from sampling error, as both types are relatively rare in the assemblages. The apparent smoothness of the transition from Marksville to Coles Creek can probably be explained by the geographic proximity of sites Ford assigned to the Coles Creek complex to those he assigned to the Marksville complex. With few exceptions, such as Neal (93) and Smithfield (101), most assemblages in these complexes occur in a cluster in the center of Ford's (1936) study area (Figure 7). We suspect that major portions of the same stylistic tradition are found in both complexes.

Ford's two Deasonville types included in Figure 8 – types 11;81;14 and 11;111;14 – are so rare that their frequency distributions are multimodal and uninformative. Geographic distance does not appear responsible for either type's distribution, and it may well be the case that these types are simply not useful in a frequency seriation. That is, whereas they serve well as marker types (horizon styles), they do not produce unimodal frequency distributions over time.

As with the seriation of sites in the northern and western area (Figure 6), there appears to be no continuity in the southern and eastern area between prehistoric sites and those from the historical period. Both Choctaw sites, Coosa (2) and Nanih Waiya (3), are considerably distant from other sites in the sample and thus probably do not comply with the same local-area or same cultural-tradition requirements. Fatherland (5), a Natchez-complex site, is close to many of the other sites but does

not fit well onto the end of the sequence, perhaps because of the number of sites that were removed by our data screening.

Results of Seriation for Thirty-Kilometer Clusters. Two clusters of sites are present in the sample using 30 kilometers as a maximum distance that a site could be spaced apart from any other site (Figure 9). Assemblages included in Cluster 1 derive from sites attributed to the Deasonville complex (three sites) and the Deasonville-with-Marksville complex (six sites). No pure Marksville-complex sites are included, nor are any sites attributed to complexes in Period III. Assemblages included in Cluster 2 are from sites attributed to the Coles Creek complex (five sites), the Marksville complex (two sites), the Coles Creek-with-Marksville complex (four sites), and the Natchez complex (one site).

The seriation order derived for Cluster 1 has few violations (Figure 10). Similar to the order derived for Ford's northern and western area (Figure 6, which has but one minor violation), type 11;81;14 exhibits unimodality, and there are no violations. Other marker types have minor variations in their orders, all of which appear to result from sampling error. This seriation order, if it is correct, has several implications. First, there is historical continuity among the assemblages in the cluster, which implies heritable continuity (O'Brien and Lyman 1999a). Second, marker type 11;111;14 is relatively more abundant during the Deasonville-with-Marksville complex than are the two Marksville types

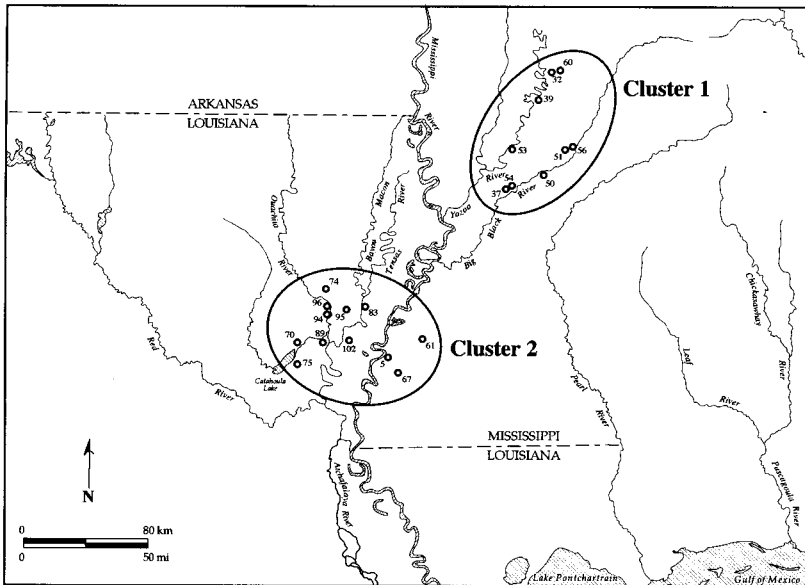


Figure 9. Two clusters of sites in Ford's sample in which each site in a cluster is within 30 kilometers of every other site in the cluster.

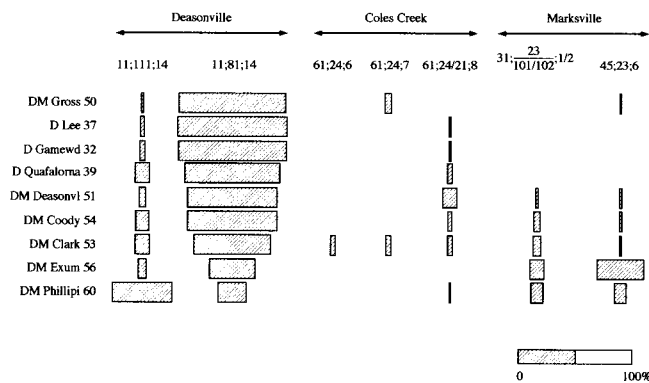


Figure 10. Frequency seriation of assemblages in Cluster 1. Ford's numerical code for each marker type is at the top of each column, and marker types are placed under their respective decoration complex. Site names and numbers (left column) are preceded by a letter or letters indicating the decoration complex to which Ford assigned the site: DM, Deasonville-Marksville; D, Deasonville.

31;23//101/102;1/2 and 45;23;6. This suggests that type 11;111;14 is not a good marker type for the Deasonville complex.

The seriation of assemblages in Cluster 1 shows another deviation from that expected based on the complexes to which Ford assigned the sites. The Gross site (50), which Ford attributed to the Deasonville-with-Marksville complex, should fall in the bottom half of the seriation rather than at the top. However, there is little Marksville-complex material at this site (e.g., type 45;23;6 comprises only 1% of the total). Thus its position at the top seems reasonable, and the type could be present at the Gross site fortuitously.

Although there are more abnormalities in the order constructed for Cluster 2, overall most of the types that

span long sequences also have relatively unimodal frequency distributions (Figure 11). This includes both Marksville types and one of the Deasonville types (11;81;14). Despite the fact that Ford attributed many of the assemblages in the cluster to the Coles Creek complex, only three of the six Coles Creek marker types (34;24/104/104;1, 61;24;6, and 61;24;7) have unimodal or nearly unimodal patterns. In the case of the other three Coles Creek marker types, it is likely that small sample sizes are driving the inconsistencies. We note that three of the Coles Creek marker types are virtually identical except for the "adaptation and arrangement" dimension. Types 61;24;6, 61;24;7, and 61;24/21;8 all contain sherds with motifs (first dimension) arranged parallel to the vessel lip and their elements (second dimension) comprising overhanging lines incised with a pointed instrument. Lumping these

three together into one type by omitting the third dimension would prompt us to reverse the order of Peck (95) and King (96) in Figure 11. It would also eliminate numerous gaps in the continuity of the Coles Creek materials, and the frequency distribution of the resultant type (61;24/21) would be more unimodal than any of the three separate types that it comprises.

The remaining marker types in Figure 11 – those attributed to the Choctaw, Natchez, and Tunica complexes – are largely present only in the two most recent assemblages, Fatherland (5) and Coles Creek (61). Consequently, as in the seriation for Ford's northern and western area, there is a resolution problem. Only two types, 82;20 and 11;111;14, are shared between the Fatherland and Coles Creek sites, and all of the Coles Creek marker types terminate with the latter site. This discontinuity is especially pronounced with respect to type 61;24;6. As might be predicted, given the way in which the Period III types were constructed, virtually no continuity or linkage exists between the Coles Creek and Natchez complexes, nor between the Coles Creek and Choctaw complexes.

The order derived for assemblages from sites in Cluster 2 departs somewhat from Ford's original sequence. Most of this deviation comes from shuffling assemblages on the basis of their proportions of Marksville marker types. This results in sites such as Prichard Landing (94), supposedly a Coles Creek-with-Marksville assemblage, moving up slightly in the sequence, and Peck (95), supposedly a Coles Creek-with-Marksville assemblage, moving down between two Marksville-complex assemblages. Insofar as Ford did not truly order assemblages within complexes, these differences are not unexpected. We suspect they result from two

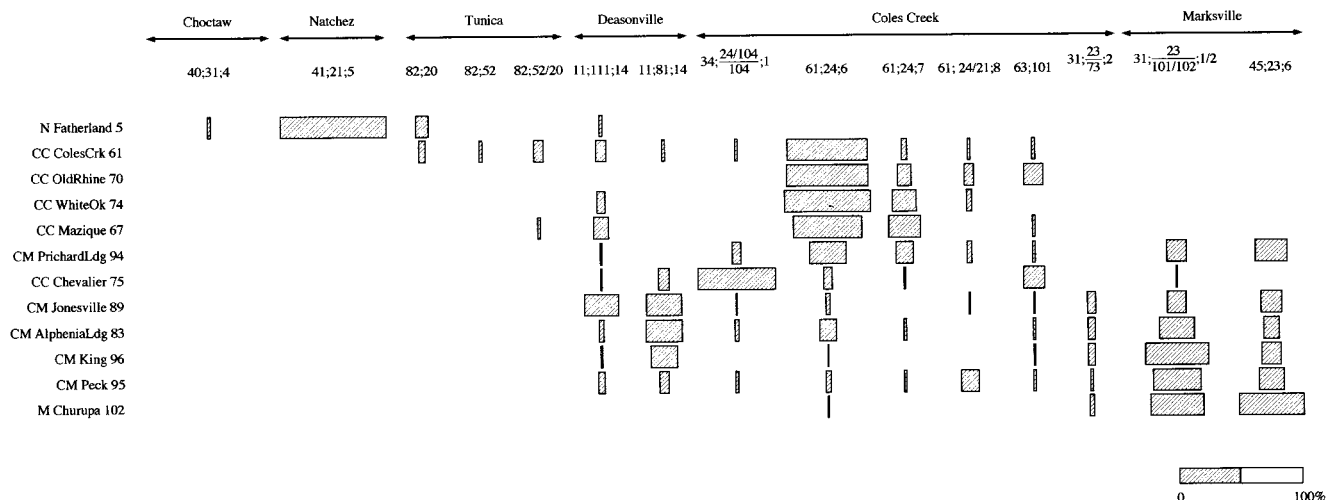


Figure 11. Frequency seriation of assemblages in Cluster 2. Ford's numerical code for each marker type is at the top of each column, and marker types are placed under their respective decoration complex. Site names and numbers (left column) are preceded by a letter or letters indicating the decoration complex to which Ford assigned the site: N, Natchez; CC, Coles Creek; CM, Coles Creek-Marksville; M, Marksville.

major causes, apart from sampling deficiencies. First, some sites no doubt were occupied over varied durations or were occupied during two periods. Prichard Landing (94), an apparent example of the latter, contains nearly equal amounts of Coles Creek and Marksville marker types. Ford dealt with this problem by creating the transitional complex Coles Creek-with-Marksville. This was reasonable given that he was not interested in ordering sites within complexes, but it also suggests that at least some of his marker types measure time continuously and denote a linkage between certain complexes. The second cause is that Cluster 2 is sufficiently large geographically to include more than one cultural tradition defined by Ford (for example, both Coles Creek and Deasonville) and thus fails to meet the third requirement of frequency seriation.

Discussion

Because we were able to build two fairly good seriation orders (Figures 10 and 11), it appears that at least some of Ford's marker types measure time in a continuous manner. That is, they seem to have spatio-temporal distributions like those modeled in Figure 3, columns 2 and 3. If this were not the case, the seriation orders would have fewer types with more or less unimodal frequency distributions. There would be more regular evidence of discontinuity between the Marksville and Deasonville complexes in the northern and western area (Figure 6) and between the Marksville and Coles Creek complexes in the southern and eastern area (Figure 8). Such disconnectedness is clearly evident between the marker types attributed to Period II and Period III, probably because of two factors. First (though of lesser importance), we suspect there was a

loss of resolution due to the data screening requirements that sites had to pass before they were allowed into our analysis. Second, because the types used are marker types (i.e., they have spatio-temporal distributions like those modeled in Figure 3, column 1), there is no *a priori* reason to expect them to overlap complexes, particularly those assigned to Periods II and III, given the way in which the historical-period complexes were built. That some of them overlap merely indicates that Ford's types were not always the best horizon styles (e.g., Deasonville type 11;111;14). This aside, because the assemblages can be arranged in a rather clean order in which some types display unimodal frequency distributions, they likely form a heritable sequence (O'Brien and Lyman 1999a:116-117). Keep in mind, however, that the heritable sequence includes only those assemblages in the two 30-kilometer clusters.

One implication of this heritability is that types attributed to the Coles Creek complex probably *did* arise out of Marksville types. As depicted in the seriation for Cluster 2 (Figure 11), Coles Creek marker types became popular at the same time that Marksville types were waning. That Coles Creek types *are* the direct descendants of Marksville types is supported by the close proximity in space of the assemblages that contributed to both complexes. Whether or not Deasonville marker types are directly related to Marksville is another question. But rather than delve more deeply into this substantive issue, we think it more important here to briefly outline why Ford's marker types serve fairly well to place a site's pottery assemblage into a decoration complex but serve less well as units for a frequency seriation.

Nearly 20 years after Ford's 1936 monograph was published, the paradigm in Americanist archaeology

that would later be termed “culture history” by the “new archaeologists” of the 1960s and 1970s had grown to major stature. Various synopses of how the paradigm was implemented appeared in the 1950s, perhaps the best known being that of Gordon Willey and Philip Phillips (1958), who in fact dedicated their book to Ford. In another consideration of some of the basics of the paradigm, Irving Rouse (1954:222) used a simile of a rectangular piece of cloth, the “side edges of which represent the geographical limits ... and the bottom and top edges, the limits ... in time.” Rouse (1954:222) wrote:

The warp threads of the cloth consist of a series of regional traditions running from the bottom towards the top of the cloth, while the weft is composed of a number of horizon styles which extend from one side of the cloth towards the other. The cloth is decorated with a series of irregularly arranged rectangles, each representing a single culture, and these are so colored that they appear to form a series of horizontal bands.

Changing Rouse’s wording a bit, we think it is easy to see what Ford might have been thinking when he performed the analysis that forms the heart of his 1936 monograph:

The side edges of the cloth comprise the edges of the map in Figure 1. The bottom edge of the cloth is marked by the Marksville complex and the top edge by the ethnohistoric period and the Caddo, Tunica, Natchez, and Choctaw complexes (Figure 2). The warp threads of the cloth consist of a series of decoration complexes running from the bottom toward the top of the cloth that should be marked by types with long time spans yet found over small areas, while the weft is composed of a number of marker types which extend from one side of the cloth towards the other and thus encompass large spatial areas but brief time spans. The cloth is decorated with a series of irregularly arranged rectangles, each representing a single decoration complex, and these are so colored that they appear to form a series of more or less horizontal bands (Figure 2).

The critical part of this is that in his 1936 monograph Ford did not pay any attention to the details of the warp threads, the types that would mark the slow flow of a cultural tradition and be seriable. Instead he was concerned only with the weft threads, his own marker types, or what Rouse referred to as “horizon styles.” Because of Ford’s narrowly focused concern, we are not at all surprised that some of his marker types do not perform well in a frequency seriation and thus do not consistently signify historical and heritable continuity. This does *not* mean that the temporal relations of the marker types indicated in Ford’s master chronology are incorrect; at least some of them seem correct based on excavations at Peck Village (Ford 1935a) and other sites.

What it does mean is that there are historical aspects of Ford’s chronology that require further testing.

Conclusion

James A. Ford’s 1936 monograph is often held up as the seminal “seriation” of archaeological materials from the Southeast. Only in reference to the standard dictionary definition of seriation as an “arrangement in a series” is this an accurate characterization. Although Ford’s units were in one respect like those used by others 20 years earlier to chronologically order collections (i.e., they were historical types), his units were constructed for a purpose different than frequency seriation or percentage stratigraphy. Units used in either of the latter must encompass relatively small areas of geographic space and large spans of time, whereas units used as marker types or index fossils must encompass relatively large areas of geographic space and brief spans of time. Based on our attempts to seriate Ford’s marker types, we conclude that some of his units have properties of marker types, whereas others have properties of seriable units. We find this result unremarkable given the history of the development of Americanist archaeological methods (Lyman et al. 1997, 1998; O’Brien and Lyman 1999a), but we also consider it a critically important episode in that history. To date, that episode has not been fully explored.

Notes

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References Cited

- Braun, David P., and Stephen Plog
1982 Evolution of “Tribal” Social Networks: Theory and Prehistoric North American Evidence. *American Antiquity* 47:504–525.
- Collins, Henry B.
1932a Excavations at a Prehistoric Indian Village Site in Mississippi. *United States National Museum, Proceedings* 79(32):1–22.
1932b Archaeology of Mississippi. In *Conference on Southern Pre-History*, pp. 37–42. National Research Council, Washington, DC.
- Colton, Harold S.
1939 Prehistoric Culture Units and Their Relationships in Northern Arizona. *Museum of Northern Arizona, Bulletin* 17.
- Colton, Harold S., and Lyndon L. Hargrave
1937 Handbook of Northern Arizona Pottery Wares. *Museum of Northern Arizona, Bulletin* 11.
- Cowgill, George L.
1968 Review of “Computer Analysis of Chronological Seriation” by F. Hole and M. Shaw. *American Antiquity* 33:517–519.
- 1972 Models, Methods and Techniques for Seriation. In *Models in Archaeology*, edited by D.L. Clarke, pp. 381–424. Methuen, London.
- Davis, Dave D.
1981 Ceramic Classification and Temporal Discrimination: A Consideration of Later Prehistoric Stylistic Change in the

- Mississippi River Delta. *Midcontinental Journal of Archaeology* 6:55–89.
- Dunnell, Robert C.
1970 Seriation Method and Its Evaluation. *American Antiquity* 35: 305–319.
1971 *Systematics in Prehistory*. Free Press, New York.
1978 Style and Function: A Fundamental Dichotomy. *American Antiquity* 43:192–202.
1981 Seriation, Groups, and Measurements. In *Manejo de Datos y Metodos Matematicos de Arqueologia*, edited by G. L. Cowgill, R. Whallon, and B. S. Ottaway, pp. 67–90. Union Internacional de Ciencias Prehistoricas y Protohistoricas, Mexico City.
1986 Methodological Issues in Americanist Artifact Classification. *Advances in Archaeological Method and Theory* 9:149–207.
- Ford, James A.
1935a Ceramic Decoration Sequence at an Old Indian Village Site near Sicily Island. *Louisiana Department of Conservation, Anthropological Study* No. 1.
1935b Outline of Louisiana and Mississippi Pottery Horizons. *Louisiana Conservation Review* 4(6):33–38.
1936 Analysis of Indian Village Site Collections from Louisiana and Mississippi. *Louisiana Department of Conservation, Anthropological Study* No. 2.
1938a *An Examination of Some Theories and Methods of Ceramic Analysis*. M.A. thesis, Department of Anthropology, University of Michigan.
1938b A Chronological Method Applicable to the Southeast. *American Antiquity* 3:260–264.
1940 Review of "Handbook of Northern Arizona Pottery Wares" by H. S. Colton and L. L. Hargrave. *American Antiquity* 5:263–266.
1949 Cultural Dating of Prehistoric Sites in Viru Valley, Peru. *American Museum of Natural History, Anthropological Papers* 43(1):29–89.
1951 Greenhouse: A Troyville–Coles Creek Period Site in Avoyelles Parish, Louisiana. *American Museum of Natural History, Anthropological Papers* 44(1):1–132.
1952 Measurements of Some Prehistoric Design Developments in the Southeastern States. *American Museum of Natural History, Anthropological Papers* 44(3):313–384.
1962 *A Quantitative Method for Deriving Cultural Chronology*. Pan American Union, Technical Manual No. 1.
- Gibson, Jon L.
1982 *Archeology and Ethnology on the Edges of the Atchafalaya Basin, South Central Louisiana*. Report Submitted to the U.S. Army Corps of Engineers, New Orleans.
- Kidder, Alfred V.
1924 An Introduction to the Study of Southwestern Archaeology, with a Preliminary Account of the Excavations at Pecos. *Papers of the Southwestern Expedition, Phillips Academy*, No. 1.
- Krieger, Alex D.
1944 The Typological Concept. *American Antiquity* 9:271–288.
- Kroeber, Alfred L.
1916 Zuñi Potsherds. *American Museum of Natural History, Anthropological Papers* 18:1–37.
1931 Historical Reconstruction of Culture Growths and Organic Evolution. *American Anthropologist* 33:149–156.
1944 *Peruvian Archaeology in 1942*. Viking Fund Publications in Anthropology No. 4.
- Lipo, C. P., M. E. Madsen, R. C. Dunnell, and T. Hunt
1997 Population Structure, Cultural Transmission, and Frequency Seriation. *Journal of Anthropological Archaeology* 16:301–333.
- Lyman, R. Lee, and Michael J. O'Brien
1997 The Concept of Evolution in Early Twentieth-Century Americanist Archeology. In *Rediscovering Darwin: Evolutionary Theory in Archeological Explanation*, edited by C. M. Barton and G. A. Clark, pp. 21–48. *American Anthropological Association, Archeological Papers* No. 7.
1999 Americanist Stratigraphic Excavation and the Measurement of Culture Change. *Journal of Archaeological Method and Theory* 6:55–108.
2000 Chronometers and Units in Early Archaeology and Paleontology. *American Antiquity* (in press).
- Lyman, R. Lee, Michael J. O'Brien, and Robert C. Dunnell
1997 *The Rise and Fall of Culture History*. Plenum Press, New York.
- Lyman, R. Lee, Steve Wolverton, and Michael J. O'Brien
1998 Seriation, Superposition, and Interdigitation: A History of Americanist Graphic Depictions of Culture Change. *American Antiquity* 63:239–261.
- Nelson, Nels C.
1916 Chronology of the Tano Ruins, New Mexico. *American Anthropologist* 18:159–180.
- O'Brien, Michael J., and Thomas D. Holland
1990 Variation, Selection, and the Archaeological Record. *Archaeological Method and Theory* 2:31–79.
- O'Brien, Michael J., and R. Lee Lyman
1998 *James A. Ford and the Growth of Americanist Archaeology*. University of Missouri Press, Columbia.
1999a *Seriation, Stratigraphy, and Index Fossils: The Backbone of Archaeological Dating*. Kluwer Academic/Plenum, New York.
1999b *Measuring the Flow of Time: The Works of James A. Ford, 1935–1941*. University of Alabama Press, Tuscaloosa.
1999c The Bureau of American Ethnology and Its Legacy to Southeastern Archaeology. *Journal of the Southwest* 41:407–440.
2000 *Applying Evolutionary Archaeology: A Systematic Approach*. Kluwer Academic/Plenum, New York.
2001 *Setting the Agenda: The National Research Council Archaeological Conferences of 1929, 1932, and 1935*. University of Alabama Press, Tuscaloosa (in press).
- Phillips, Philip, James A. Ford, and James B. Griffin
1951 Archaeological Survey in the Lower Mississippi Valley, 1940–1947. *Peabody Museum of American Archaeology and Ethnology, Papers* 25.
- Rouse, Irving B.
1939 Prehistory in Haiti: A Study in Method. *Yale University Publications in Anthropology* No. 21.
1954 On the Use of the Concept of Area Co-Tradition. *American Antiquity* 19:221–225.
- Rowe, John H.
1961 Stratigraphy and Seriation. *American Antiquity* 26:324–330.
- Setzler, Frank M.
1933a Hopewell Type Pottery from Louisiana. *Washington Academy of Sciences, Journal* 23:149–53.
1933b Pottery of the Hopewell Type from Louisiana. *United States National Museum, Proceedings* 82(22):1–21.
- Steward, Julian H.
1929 Diffusion and Independent Invention: A Critique of Logic. *American Anthropologist* 31:491–495.
1942 The Direct Historical Approach to Archaeology. *American Antiquity* 7:337–343.
- Stirling, Matthew W.
1932 The Pre-Historic Southern Indians. In *Conference on Southern Pre-History*, pp. 20–31. National Research Council, Washington, DC.
- Strong, W. Duncan
1935 An Introduction to Nebraska Archeology. *Smithsonian Miscellaneous Collections* 93(10).
- Trigger, Bruce G.
1989 *A History of Archaeological Thought*. Cambridge University Press, Cambridge, England.
- Watson, Patty Jo
1990 Trend and Tradition in Southeastern Archaeology. *Southeastern Archaeology* 9:43–54.
- Wedel, Waldo R.
1938 The Direct-Historical Approach in Pawnee Archaeology. *Smithsonian Miscellaneous Collections* 97(7).
- Willey, Gordon R.
1945 Horizon Styles and Pottery Traditions in Peruvian Archaeology. *American Antiquity* 10:49–56.
- Willey, Gordon R., and Philip Phillips
1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago.
- Willey, Gordon R., and Jeremy A. Sabloff
1993 *A History of American Archaeology*, 3rd edition. Freeman, New York.