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SMUDGE PITS AND HIDE SMOKING: THE USE OF ANALOGY
IN ARCHAEOLOGICAL REASONING

LEWIS R. BINFORD

ABSTRACT

It is argued that as a scientist one does not justifiably employ analogies to ethnographic observations for the "interpretation" of archaeological data. Instead, analogies should be documented and used as the basis for offering a postulate as to the relationship between archaeological forms and their behavioral context in the past. Such a postulate should then serve as the foundation of a series of deductively drawn hypotheses which, on testing, can refute or tend to confirm the postulate offered. Analogy should serve to provoke new questions about order in the archaeological record and should serve to prompt more searching investigations rather than being viewed as a means for offering "interpretations" which then serve as the "data" for synthesis. This argument is made demonstratively through the presentation of formal data on a class of archaeological features, "smudge pits," and the documentation of their positive analogy with pits as facilities used in smoking hides.

THE PURPOSE of this paper is two-fold:

(1) to present a discussion of analogy and provide an example of the use of analogy in archaeological reasoning, and (2) to present a functional argument regarding a particular formal class of archaeological feature. The justification for this type of presentation is a conviction that (a) archaeologists have generally employed analogy to ethnographic data as a means of "interpreting" archaeologically observed phenomena, rather than as a means for provoking new types of investigation into the order observable in archaeological data. It is the latter role for analogy which is hopefully exemplified; (b) archaeologists have neglected the formal analysis and investigation of relationships between classes of archaeological features. That this situation should be corrected can best be defended by the demonstration of provocative results obtained through the analysis of features.

Analogy is the term used to designate a particular type of inferential argument. Thus, in discussing analogy we may profitably consider the criteria employed in judging the relative strength of such an argument regardless of sub-

ject matter. Having explored the general characteristics of such arguments, we may turn to a consideration of *anthropological* arguments from analogy, attempting to isolate more general characteristics. Finally, using the conclusions from these two kinds of discussions, we shall offer certain programmatic suggestions which we believe could be profitably followed.

The term *analogy* is defined in Webster's Unabridged Dictionary with the following discussion:

A relation of likeness, between two things or of one thing to or with another, consisting in the resemblance not of the things themselves, but of two or more attributes, circumstances or effects . . .

Analogy is frequently used to denote similarity or essential resemblance but its specific meaning is a similarity of relations and in this consists the difference between the argument from example and that from analogy. In the former we argue from the mere similarity of two things, in the latter we argue from the similarity of their relations . . .

Biology—correspondence in function between organs of parts of different structures with different origins—distinguishing from homology . . .

Logic—form of inference in which it is reasoned that if two or more things agree with one another in one or more respects they will probably agree in yet other respects. The degree of probability will depend upon the number and importance of their known agreements (Neilson 1956: 94).

The crucial or distinctive characteristic common to all the definitions is that an analogy is not strictly a demonstration of formal similarities between entities; rather it is an inferential argument based on implied relationships between demonstrably similar entities. All those arguments which exhibit this form can be studied, and we can ask what characteristics are shared by those arguments which on investigation were verified. Three such characteristics have often been found to characterize successful arguments by analogy (these are paraphrased from Stebbing 1961: 243–56):

(1) *If the initial resemblances are such that the inferred property would account for the resemblances, then the conclusion is more likely to be true.* A good example might be the following argument: (1) A distinctive pattern of wear is observable on the unmodified end of an end scraper recovered from a Magdalenian site in western Europe. (2) The same pattern of wear is observable on the unmodified end of an end scraper hafted in a wooden haft collected from the Plains Indians of North America. (3) One infers the presence of a functionally similar haft during the period when the archaeologically recovered (Magdalenian) end scraper was in use. The inferred property, the haft, would account for the resemblances in wear observed on both end scrapers. In this case, where it can be said that the inferred relationship or property accounts for the known positive analogy, the positive analogy is said to consist of "important" properties. The term "important" refers to properties which, on the basis of other knowledge or conviction (in this case knowledge regarding the properties resulting from mechanical friction under certain conditions), the posited relationship is said to be justified.

The obvious corollary of the above generalization is that *if the initial resemblances are not such that the inferred property would account for the resemblances, then the conclusion is more likely to be false.* For example, almost any case of attempting to infer specific meaning from an abstract design on an artifact by analogy to a design of known context when there is no demonstrable continuity between the symbolic contexts of the two designs in question would be more likely to be false.

(2) *The more comprehensive the positive analogy and the less comprehensive the inferred properties, the more likely the conclusion is true.*

This criterion simply recognizes a major distinction between an argument from example and one from simple enumeration, where a large number of cases sharing limited numbers of attributes are cited, as opposed to an argument from analogy in which a large number of common attributes are cited and the number of cases may be quite small. The more numerous the similarities between analogs, the greater the probability that inferred properties are similar. The corollary of this is: *the more comprehensive the inferred properties, the less likely is the*

conclusion to be true. This guide to judging the strength of an argument from analogy rests with the common-sense notion that the more detailed the inference, the more specific must be one's ability to cite the determinants of the positive analogy.

These criteria are derived as arguments from example, since they can be viewed as generalizations from a large sample of arguments by analogy. The incidences of confirmation, as opposed to the incidences of disproof, are tabulated and studied for common properties. In short, these "criteria" are simply a statement of probable outcome generalized from a large sample of cases of reasoning by analogy. They are believed to be independent of the content of particular arguments.

In the examination of anthropological arguments from analogy, we are not concerned with the criteria which will allow us to judge the *form* of a particular argument from analogy as in the previous discussion. Instead, we are concerned with the *content* of the argument. The only guide which I can discover for aiding in this evaluation rests with our previous mention of the citation in an argument of "important" properties. We mean by this properties which, on the basis of other knowledge or conviction, are posited as relevant to the relationship argued. A common situation in which argument from analogy is offered by archaeologists is that in which similarities in form of artifacts are cited between archaeologically and ethnographically observed data, with the proposition that behavior observed in the ethnographic situation (unobserved in the archaeological situation) was also present in the past when the artifacts were in use.

Several persons have addressed themselves to a consideration of the problem of citing "important" properties in argument from analogy and have offered the following suggestions for establishing the conditions of relevance for archaeological arguments from analogy.

- (1) Relevance can be established by demonstrating, or accepting as demonstrated, that there is a historical continuity between the archaeologically observed unit and the ethnographically cited society or social unit.
- (2) In the absence of the above demonstrated justification, relevance could be justified by seeking analogies in cultures

which manipulate similar environments in similar ways (Ascher 1961).

While certainly not subject to question as such, one wonders at the utility of attempting to specify in the form of suggestions for the "new analogy" all those conditions under which one would expect to find functional linkages between cultural elements. For only with such an exhaustive listing of contemporary anthropological theory and knowledge could one hope to enumerate all of the conditions of relevance which might arise in various anthropological arguments from analogy. Stating this point another way, the only means open to anthropologists attempting to evaluate by inspection any given argument by analogy is in terms of the degree to which the inferred property could be expected to vary concomitantly with the cited features in the positive analogy. Such an evaluation must therefore be made on the basis of our current understanding of the form, structure, and functioning of cultural systems. It is my hope that contemporary understanding goes far beyond the "canon for the selection of analogs" recently advanced (Ascher 1961).

We now turn to the crucial question of the function of arguments from analogy in the broader field of archaeological reasoning. I have chosen to offer one example of such an argument and to attempt an analysis of its form and structural position in a broader logical system of analytical method. Hopefully by such a procedure the formal, functional, and structural characteristics of arguments from analogy in archaeological analytical method will be made explicit.

Previous archaeological reports have occasionally cited the occurrence of small "caches" of carbonized corncobs (Cole 1951: 34, 40); yet the specific functions of these small pits have not been previously considered analytically nor has there been any formal analysis of the characteristics common to a number of samples of these "corn cob caches." Recent archaeological investigations in the Carlyle Reservoir of south-central Illinois resulted in the excavation of a number of these caches (Binford, Schoenwetter, and Fowler 1964). The recognized formal homogeneity of these features prompted their analysis and systematic description and justification as a distinctive class of feature which, in all probability, had a single function in the activities of the extinct societies represented.

Our procedure here will be: (1) provide a summary of the formal characteristics of this class of cultural feature; (2) document and evaluate the analogy which is demonstrable between this class of feature and certain facilities described ethnographically; (3) offer a postulate as to the function of the archaeological features; (4) develop certain deductively drawn hypotheses that could be investigated to test the probability of the postulates; and (5) cite the procedure employed as an example of a role for analogy in archaeological reasoning which is not believed to be commonly employed among practicing archaeologists.

FORM OF THE FEATURES

The particular cultural features under discussion are best known from the Toothsome site, Clinton County, Illinois, where a total of 15 such features were excavated and detailed observations were made (Binford, Schoenwetter, and Fowler 1964). Since this sample constitutes the best available data, I will duplicate here the original description of this sample of 15 features.

The features exhibited so little internal formal variability that there is little doubt that they represent a single type of feature and a single activity. The contents of the pit are always primary and are unaltered by subsequent cultural activity. In addition, the size, shape, and contents of each feature are almost identical to all others included in this category.

Size. These pits are slightly oval, having a mean length of 30.27 cm. and a mean width of 27.40 cm. They extend below the present surface to a mean depth of 33.53 cm.

Shape. All are slightly oval and are generally straight-sided, with essentially flat bottoms.

ELEMENTS OF THE FEATURE

- (a) Grayish loam soil.
- (b) Charred and carbonized corncobs.
- (c) Charred and carbonized twigs (possibly corn stalks).
- (d) Charred and carbonized bark of an as yet unidentified tree.
- (e) Charred vegetable material, possibly from other as yet unidentified plants.
- (f) Occasionally a minor oxidation of soil near the mouth of the pit.

DISTRIBUTION OF THE ELEMENTS

The very bottom of the pit is filled with the charred material for a variable depth of from 7 cm. to within 8 cm. of the mouth of the feature. The charred twigs are generally curled around in the bottom of the pit with the cobs nested in the center. The upper part may be partially filled with the grayish loam soil which was the characteristic soil on the surface of the site. The latter would have no included charred material.

GENERAL OBSERVATIONS

The invariable presence of the grayish loam soil in the upper fill demonstrates intentional covering of the pit contents, rather than an accumulative filling with midden and surface debris.

Distribution of these features on the site. The pits are distributed peripherally around a small Mississippian farmstead composed of two house structures and one storage structure. In addition to these buildings, the site is internally differentiated into several activity areas, which include outdoor cooking areas and a dump. There is no obvious tendency for these features to cluster; they appear rather well dispersed in a peripheral fashion around the boundary of the site.

Discussion. In the original report on these features it was suggested that they were probably small "smudge pits," since the conditions of combustion which would have resulted in the carbonization of the recovered plant materials would certainly have produced vast quantities of smoke. It was further speculated whether these obvious sources of smoke might have been employed in the control of mosquitoes, which in the experience of the excavators, had constituted a real pest during the summer months.

Possible occurrence at other locations. In addition to the occurrence of these features at the Toothsome site, pits of identical form were observed at a slightly earlier Mississippian farmstead site at the Sandy Tip site in the Carlyle Reservoir (Binford 1964). Later investigations at the Texas #1 site, also in the Carlyle Reservoir, exposed nine additional features of this type (Morrell 1965). The small size of the feature led the investigator to interpret eight of them as postmolds.

Features 22, 23, 26, and 27; small pits or postmolds filled with charred corncobs. Average diameter .21

meters. A total of nine cob concentrations were located within Unit No. 3, 8 of which appear to have been postmolds. The cobs are arranged generally in a crescent on the outer edges of the molds, possibly indicating the use of cobs for post tamping and support (Morrell 1965: 24-7).

Cutler (1963) suggests that the cobs were broken before they were deposited and probably before they were carbonized. Cutler further suggests that the cobs do not represent a cache of cobs discarded after shelling. Radiocarbon dates were obtained from Features 22 and 23; these are A.D. 1030 \pm 85 (GX-0364) and A.D. 1090 \pm 100 (GX-0365) respectively (Morrell 1965: 24-7).

Small features characterized by the clustering of carbonized corncobs were recently reported from the Lloyd Village site in the American Bottoms near East Saint Louis, Illinois (Hall and Vogel 1963: 25-6), and similar features were noted on the nearby Cahokia site (Cutler 1963: 16).

The Kincaid site on the Ohio River in southern Illinois, extensively investigated during the 1930's, yielded features which appear to be identical to those described from the Toothsome site. It is interesting that, although they were observed at three different locations on the site (Mx¹D Section I and East Section; Mx¹c), all were in the village area, while none was reported from the mounds so intensively investigated on the site (Cole and others 1951: 34, 40, 53, Fig. 3).

Quimby (1957: 105) noted the occurrence of "a deposit of fragmentary corncobs that had been burned" in the village deposits under Mounds 1 and 2 at the Bayou Goula site, which is interpreted by Quimby as the remains of a historically known group, closely related to the Natchez, occupying the location between 1700 and 1739.

The archaeological feature of this type believed to be the earliest thus far known is reported from the Williams site, Gordon County, Georgia. This find is described as follows:

The most important find... was Feature 7. This was a group of 30 to 40 burnt corn cobs in an area about eight inches in diameter and four inches in depth... Also included mixed in with the cobs was ash, wood, cane and one half of a shelled acorn. No pit was discernible since the group was in the dark brown sand. The cobs were oriented in every conceivable direction and it appears as if the whole unit was thrown into a pit... At 9-Wd-L... a group of cobs were found which exhibited evidence of being deposited during a corn

planting ceremony. These differed from the Williams Site specimens in being placed in four orderly rows in a specially prepared pit . . . The Williams Site cache does not give evidence for or against a corn ceremony. However, the cobs were not badly broken up and some sort of a ceremony would be expected, whether at planting, harvesting, or in between, in a culture concerned with the success of a corn crop. There are many instances of corn ceremonialism in the eastern United States, but they are mainly found in a Mississippian or historical context (Morse and Morse 1960: 88).

The Williams site find has been radiocarbon dated at A.D. 470 ± 75 (M-1107, Crane and Griffin 1963: 239).

Carbonized corncobs were recovered in two general contexts at the George C. Davis site, Cherokee County, Texas (Newell and Krieger 1949: 248-9). Five cases of recovered corncobs are reported from "postmolds" of Structures 31, 8, and 6 respectively, all of which are buildings not constructed on mounds. Three finds were of "caches" of quantities of carbonized cobs similar to those features described from the Toothsome site. Recent radiocarbon dating suggests that these features date at A.D. 1307 ± 150 (M-1186), a period somewhat later than originally proposed (Griffin and Yarnell 1963).

Summarizing our findings, one point is strikingly clear: the geographical distribution of these features is spotty. On sites from the same general geographical provinces, where they are documented, and where one would expect them to have been reported had they been present, there is no suggestion that they were observed. For example, they are absent from sites in the Chickamauga Lake section of the Tennessee River (Lewis and Kneberg 1946); similarly they are unreported from the Norris Basin and the Pickwick Basins of the Tennessee drainage (Webb and DeJarnette 1942; Webb 1938). Moreover, they are not present at the Bessemer site in north-central Alabama (DeJarnette and Wimberly 1941), nor at the Rood's Landing site in Stewart County, Georgia (Caldwell 1955), nor at the Macon Group (Kelly 1938) at Macon Georgia. The Gordon site also appears to lack these features (Myre 1928). This list of eastern sites apparently lacking the "corn cob" features could be greatly expanded. On the other hand, a search of the literature for the Upper Illinois valley and prairie fringe areas as well as for the Great Plains, the Eastern coastal region, the Upper Ohio valley, and the Great Lakes regions failed to yield a single incidence of the "corn cob pit." This latter finding

is based on my investigation of the context of all the reported incidences of corn which were recently inventoried by Yarnell (1964). In all cases where the context of finds of corn could be determined, it was generally as charred kernels, and, when cobs were reported, they were generally single or in small numbers occurring in the midden fill of recognizable cooking or storage pits.

These investigations suggest that the smudge pits are a feature characteristic of the societies of the Middle and Lower Mississippi River area, with extensions into the Georgia-Creek area to the east and the Texas-Caddo area to the west. The spotty distribution and the lack of data from numbers of sites in this area, however, further suggest that this feature is probably restricted in use to certain limited kinds of activities. This inference is further supported by the documented cases being limited to associations with village house-remains and never with public buildings. Although the functional specificity of the feature may be a major contributor to the spotty distribution of documented examples, my search of the literature made it painfully obvious that archaeologists have neglected the analysis and systematic description of cultural features, which makes it impossible to assess the degree to which the spotty distribution is a function of events in the past or of the data-collecting techniques and analytical methods employed by archaeologists.

The earliest documented example is from the Williams site in northwest Georgia, A.D. 470 ± 75 (M-1107) where such an early date stands as a unique case. All of the other known examples (if one accepts the revised dating of the George C. Davis site corn) are relatively late, post-dating A.D. 1000. These data suggest that we could reasonably expect the activity in the context of which these features were used to have been practiced by the historically documented groups in the "agricultural east."

There is a variety of functional interpretation offered by investigators who observed these features. At Kincaid they were interpreted as "caches" (Cole and others 1951: 156) in spite of the fact that none of the corncobs had kernels attached. Morse and Morse (1960: 88) entertain the probability of a "ceremonial" function for the feature. At both the George C. Davis site (Newell and Krieger 1949: 248-9) and the Texas site (Morrell 1965) they were interpreted as postmolds, presumably because of

their small size. The author (Binford, Schoenwetter, and Fowler 1964) offered the interpretation of a smudge pit, but at that time he could only suggest that the smudge was produced as a means of controlling mosquitoes!

In summary, smudge pits are a class of archaeological features sharing (a) small size, (b) contents composed diagnostically of carbonized corncoobs, lacking kernels, and (c) contents exhibiting a primary depositional context. These features are documented from a number of Mississippian sites in the southern Illinois area as well as from sites in the lower reaches of the Mississippi Valley, northern Georgia, and eastern Texas. The context in which the features occur at these sites is invariably that of house areas, as opposed to areas of public buildings, and, in the case of the known farmstead, they are distributed peripherally around the centers of activity within the site. These features are dated as early as A.D. 470; however, the majority are referable to a post-A.D. 1000 time period.

Previous attempts at "interpretation" have shown considerable originality, but all must be considered as conjecture.

RELEVANT ETHNOGRAPHIC OBSERVATIONS

The distinctive form of these features, together with their necessarily limited possible range of uses (all of which must have involved the production of quantities of smoke), made an optimistic search for relevant ethnographic descriptions and references realistic and potentially profitable. The following descriptions from ethnographic accounts were located.

I. *Descriptions of the process of smoking hides as observed among the Southeastern Indians.*

A. *The Natchez, 1700-1750*

According to Swanton (1911: 64), Dumont in 1753 said:

They first dig a hole in the earth about 2 feet deep, with a diameter of six inches at the top and a little less toward the bottom. They fill this hole with cow dung, rotted wood, and maize ears and place it over two rods in the shape of a cross, the four ends of which are slanted in the earth so as to form a kind of cradle on which they stretch the skin they wish to tan. They then set fire to the combustible substance in the hole and fasten the skin down all around by means of many little pegs driven into the ground. Then they cover it with earth over and along the edges, so as to keep in the smoke. The materials in the hole becoming consumed without throwing out the flame, the thick smoke that comes out of it, especially owing to the lack of any exit

...fastens itself to the skin which it smoke-dries and dyes a yellow color.

B. *The Creek, 1900-1950*

...next, they scooped a hole in the ground, built a fire in it, and put corncoobs upon this so that a thick smoke was produced with little flame. The hide was fastened down over this pit with the other surface down and left until it was smoked yellow (Swanton 1946: 445).

C. *The Choctaw, 1900-1950*

If the skins are to be smoked, a process that renders them more durable, a hole a foot or more in depth is dug in which a fire is kept until a bed of hot ashes accumulates. On this are put pieces of rotten oak, no other wood being used for this purpose, these are not permitted to blaze, as the more smoke that arises the better is it for the skins. These already tanned soft and white and perfectly dry, are stretched over the hole and allowed to remain in the smoke an hour or more (Bushnell 1909: 11-12).

D. *The Seminole, 1900-1950*

Usually, however, the leather is finished by smoking. The skin is sewed up in a bag-like form and suspended, bottom up from an inclined stick. The edges are pegged down about a small hole in which a smouldering fire burns. The smoke and fumes are allowed to impregnate the hide thoroughly, and then the tanning is completed... (Skinner 1913: 72-3).

II. *Description of the process of smoking hides as observed among the Plains Tribes.*

A. *The Omaha, 1850-1900*

Skins to be used in making moccasins were browned by smoke (Fletcher and La Flesche 1911: 345).

B. *The Dacotah (Sioux), 1800-1850*

If after all this working, the skin is hairy or stiff, it is drawn over a cord as large as a finger, for some time, as hard as they can pull, which softens it much: sometimes this is the last process, except smoking. This is done by digging a hole in the ground about a foot deep, putting in a little fire and some rotten wood, when the skin is sewed into a bag and hung over the smoke: in ten minutes the skin is ready for use (Schoolcraft 1856: 61).

C. *The Blackfoot, 1850-1900*

The color and finish were imparted by smoking. The skins were spread over a frame similar to that of a sweat house, a hole was dug underneath and a smouldering fire maintained with sage or rotten wood (Wissler 1910: 65).

D. *The Crow, 1800-1850*

The greater part of these skins, however, go through still another operation afterwards, which gives them a greater value and renders them much more serviceable—that is, the process of smoking. For this, a small hole

is dug in the ground and a fire is built in it with rotten wood, which will produce a great quantity of smoke without much blaze; and several small poles of the proper length stuck in the ground around it and drawn and fastened together at the top, around which the skin is wrapped in form of a tent, and generally sewed together at the edges to secure the smoke within it, within this the skins to be smoked are placed, and in this condition the tent will stand a day or so, enclosing the heated smoke (Catlin 1880: 52).

E. *The Arapaho, 1900–1939*

...After it was as soft as she wanted it she dug a hole, about 20 inches deep and about 15 inches in diameter, and built a smudge in it, using either fine chips of wood or bark of cottonwood. She then sewed up the hide to make a sack of it with one end open. She placed this sack over a tipi-shaped framework made of saplings and set this over the smudge. She watched the smudge carefully so there would be no blaze, but only smoke. At the closed end of the sack she had sewed a strip of buckskin with which she tied the sack to the top of the saplings. This held the hide in place. When one side of the hide was sufficiently smoked, the sack was turned inside out and again smoked, thus giving both sides a tan (Hilger 1952: 184).

III. *Descriptions of the process of smoking hides as observed among the Indians of the Great Lakes region.*

A. *Iroquois — General, 1850–1860*

...a smoke is made, and the skin placed over it in such a manner as to inclose it entirely. Each side is smoked in this manner until the pores are closed, and the skin has become thoroughly toughened with its color changed from white to a kind of brown (Morgan 1901: 13).

B. *Iroquois — Specifically the Seneca, 1800–1890*

A hole 18 inches in diameter was then made in the ground and the skin suspended above it on upright sticks and smoked until the desired color is produced, by burning rotten wood beneath. The skin was then ready for use (Mason 1891: 573).

C. *Ojibwa, 1930–1940*

After the hide was dry the informant removed it from the stretcher, laid it on the ground folding it on head-to-tail line, turned both edges together, and beginning with head end fastened them together by means of clothespins. This made a nearly airtight compartment. In former days edges were sewed together tightly with basswood fiber. The head end of the hide was next fastened to the branch of a tree; the tail end placed so it encircled the rim of a pail of smudge. Two granddaughters...prepared the smudge by placing bits of birchbark on burning embers fetched from the kitchen stove and packing the remainder of the pail with white pine and Norway cones. Punk was sometimes used in place of cones since it was less inflammable. Jack pine cones were not used. They give an unsatisfactory color.

The worker swung the pail back and forth several times to enhance the smudge and then placed it under the hide, holding it there carefully as to permit the hide to fill with smoke.... When it was sufficiently tanned, she loosened the clothespins, turned and folded the edges and again pinned them, she then tanned the reverse side. Smoking not only gave color to hides but preserved them from moths (Hilger 1951: 131–2).

D. *Menomini, 1900–1920*

A hole about a foot wide and six inches deep is dug in the earth in a locality sheltered from the wind, and a slow glowing, smoky fire is made in the bottom of the pit with dead branches, punk, or even dry corn cobs. Over this the inverted bag is suspended and pegged down about the base (Skinner 1921: 228).

It is readily observable that two of the documented incidences of the use of corncobs as fuel for smoking hides fall within the distribution as known archaeologically for corncob-filled smudge pits. The single exception, the Menominee, are described as making use of corncobs in the 1920's. It seems reasonable to suggest this might be a relatively recent practice, related to the reservation period rather than to the period of aboriginal adjustment to the northwestern Great Lakes region. This suggestion is further credited by the fact that in all the cases of ethnographic documentation which fall outside of the area of archaeologically known smudge pit distribution, with a single exception, the Choctaw, fuels other than corncobs are cited as being used. This supports the archaeological observations of the absence of corncob-filled smudge pits in the Plains, Great Lakes, and northern Ohio valley. In short, the ethnographic and archaeological distributions of the use of corncobs as fuel in smudge pits are strikingly similar, in spite of obvious lacks in the coverage from both sources.

The correspondence in *form* of smudge pits as known archaeologically and of hide-smoking smudge pits as described ethnographically is essentially perfect. Table 1 presents in summary the comparative information regarding the form of the facilities as known from archaeological and ethnographic sources.

On the basis of (a) the convincing correspondence between the formal attributes of smudge pits as known archaeologically and smudge pits used in smoking hides as known ethnographically, (b) the strong positive analogy between the distribution of smudge pits in which corncobs were used as fuel and the use of corncobs as fuel for smoking hides as docu-

TABLE 1. SMUDGE PIT ATTRIBUTES

<i>Class of attributes</i>	<i>Archaeologically observed attributes</i>		<i>Ethnographically described attributes</i>
1. <i>Size</i> : Relatively small, shallow excavations in the ground when the facility is a pit.			
	Mean	Range	
Length	30.27 cm.	23.0–42.0 cm.	The cited sizes range from 15.24–30.48 cm. (6"–12") in diameter and 15.24–60.96 cm. in depth.
Width	27.40 cm.	20.2–31.0 cm.	
Depth	33.53 cm.	25.0–37.1 cm.	
2. <i>Contents</i> : Soft, porous, poorly combustible organic materials. Corncobs, bark, twigs, and possibly cornstalks.			Corncobs, bark, twigs, (dead branches), rotten wood, dung, pine cones, and sage.
3. <i>Treatment of contents</i> Contents burned in a reducing atmosphere resulting in the carbonization of the fuels.			Contents burned in a reducing atmosphere resulting in the production of quantities of smoke.
4. <i>Final condition of the facility</i> The facility was abandoned with no disturbance of the carbonized fuels; nothing was removed from the pit, showing that it did not contain the fuels and the items being processed as in the case of roasting pits, fire pits, etc. The archaeological remains of the pit exhibit a primary fill, and secondary fill if present is superimposed.			All the descriptions cite the suspension of the hides over the smudge pit. The items being processed are not contained in the facility with the fuels. Completion of the smoking process and the removal of the hides for use does not result in a disturbance of the contents of the smudge pit.

mented ethnographically, and (c) the relatively late archaeological documentation for the use of smudge pits, which would make continuity between the archaeological and ethnographic periods reasonable, we postulate that the archaeologically-known features described were in fact facilities employed in the task of smoking hides by the former occupants of the archaeological sites on which they were found.

The procedure which should be followed in refuting or increasing the probability of the validity of the proposition would be as follows:

(1) Determine if there are any spatial correlates of the activity of smoking hides; in other words, determine if the activity was regularly conducted in any particular location. If so, determine whether or not the smudge pits exhibit such a distribution.

(2) Determine if there are any temporal correlates of the activity of smoking hides; was the activity regularly conducted at any particular period of the annual cycle? If so, determine whether or not the smudge pits exhibit such an association with respect to relevant seasonally variable phenomena.

(3) Determine if there are any formal correlates of the activity with respect to other imple-

ments or facilities which were employed as parts of a set which also included hide-smoking pits. Was hide smoking normally conducted at the same place and at approximately the same time as the manufacture of clothing from the hides? If so, then there should be demonstrable concomitant variation between the incidence of smudge pits and implements used in clothing manufacture, such as needles.

(4) Determine if there are any other activities which employed facilities which shared the same formal attributes as observed in hide-smoking pits. If so, then the specific postulate could be refuted, but a more general one could be stated which could then be tested along the dimensions of time, space, and form.

The following observations are made in the hope that they are pertinent to the formulation of systematic hypotheses:

(a) In all the ethnographic cases cited the smoking of hides was women's work; therefore, we would expect stylistic variation in smudge pits to vary directly with stylistic variation in other female-produced items such as ceramics.

(b) In all the ethnographic cases cited, when temporal data were given, hide smoking was a spring and summer activity conducted in the

"base camp" after the major hunting season was concluded and before the winter hunts were begun. We therefore offer the following hypothesis: Smudge pits should occur almost exclusively in "base camps" occupied during the period of the year when hunting activity was at a minimum.

(c) In many cases there were indications in the ethnographic literature that hide smoking and the related manufacture of clothing from smoked hides were activities which would be more frequently performed by individuals possessing recognized skills in these tasks. Therefore, the incidence of smudge pits might be expected to vary independently of the number of persons occupying the appropriate site for any given unit of time. In short, they would be expected to vary independently of such direct measures of the number and duration of occupants as cooking-fires and sleeping facilities.

Aside from these interesting and potentially informative avenues for future research, I think it is necessary to point out another and as yet unmentioned potential source of additional understanding; namely, that the survey of ethnographic literature demonstrated that the practice of smoking hides, particularly deer hides, for use in the manufacture of moccasins, shirts, and leggings, was a practice common to most, if not all, of North America. The major characteristic which appeared to vary from region to region was the fuel used in the smudge pits, as well as the idiosyncracies of construction for suspension of hides over the smudge pit. Our investigations have been limited to the citation of archaeological remains in which corncobs were the fuel. An acquaintance with the general range of size of the feature and with the depth of it can be extremely beneficial. The size appears to be limited by the circumference of a deer skin when sewn into a "bag"; the depth seems to be limited by two general considerations: (a) deep enough to provide an oxygen-starved environment; (b) shallow enough to contain only a limited amount of fuel. This knowledge, along with an acquaintance with the generic class of fuel, and the probability that the contents would not be disturbed (resulting in the archaeological recovery of fairly complete carbonized fragments of soft spongy fuels), enables the recall of numerous examples of features observed on sites from the east coast, the Great Lakes, and the pre-Mississippian occupa-

tions in central Illinois which were almost certainly smudge pits in which fuels other than corncobs had been burned.

Our investigations have resulted in the recognition of a generic class of facility which can be expected to vary regionally with respect to the specifics of its contents. This recognition could aid in the documentation of seasonally variable activities in the areas of less aboriginal sedentism, such as the Great Lakes.

The final consideration to be taken up is the degree to which this study can be cited as an example of the use of analogy in archaeological argument and its pertinence to general statements regarding the role of analogy in archaeological reasoning.

The logical steps followed in this argument were as follows:

A. The Analogy

(1) The recognition and demonstration of a positive formal analogy between a class of archaeologically observed phenomena and a class of ethnographically observed phenomena.

(2) A consideration of the positive analogy between the spatial distribution of the facility as documented archaeologically and ethnographically, and the observation that, although poorly documented, the known distributions show a strong positive analogy.

(3) A consideration of the degree to which it would be reasonable to expect a continuity between the archaeologically and ethnographically known cases; for example, the dating of the archaeologically known materials as reasonably viewed as cases of historical priority to the ethnographic data.

B. The Postulate

(1) The behavioral context of the use of the archaeologically known features was the same as that described ethnographically for the analogous facilities.

C. The development of testable hypotheses in a deductive framework given the postulate offered

(1) An examination of the ethnographic "context" of the activity for correlated formal characteristics which could be directly observed or studied archaeologically.

(2) Given the postulate set forth in B (1) above and the knowledge of the formal, spatial, and temporal correlates of the activity designated in the postulate, the specification of a number of hypotheses as to the predicted mode of variation expected between the archaeologically observed analog and other archaeologically observable phenomena as specified by the studies of C (1) above.

(3) The testing of the stated hypotheses and the refutation, refinement, or verification in probabilistic terms of the truth of the stated postulate.

- D. Finally this particular procedure should lead the investigator into the recognition of previously unrecognized relationships as suggested in C (1): the explanation of previously unexplained variation in archaeological data as the outcome of (C) and, as in the case of this particular example, the recognition of a generic class of phenomena definable by certain general formal characteristics where previously only a restricted class was recognized, isolated by the common occurrence of specific formal similarities (for example, charred corncobs).

CONCLUSIONS

The procedure discussed here is appropriate in the context of a positivistic philosophy of anthropology and archaeology. It denies categorically the assertion of antipositivists that the final judgment of archaeological reconstruction must be based on an appraisal of the professional competence of the archaeologist (Thompson 1956: 331). The final judgment of the archaeological reconstruction presented here must rest with testing through subsidiary hypotheses drawn deductively. Questions were also raised concerning the argument made by Robert Ascher (1961) that by following certain of his suggestions for "placing analogy on a firmer foundation" we could in any way directly increase our knowledge of archaeologically documented societies. The arguments presented by Ascher (1961), if followed, could at best serve to increase our understanding of archaeological observations in terms of ethnographically described situations. The archaeologist would be performing a role analogous to that of a historical critic who attempts to translate data of

the past into the context of relatively contemporary or culturally prescribed experience. It is maintained here that as anthropologists we have a task quite different; we seek to explain cultural differences and similarities. We approach our task by developing methods and procedures that will permit us to demonstrate order in our data. It is assumed that the demonstration of order implies a set of systematic relationships among cultural phenomena that existed in the past. The understanding of the operation of systems rests in the measurement of concomitant variation between various classes of ordered phenomena and the eventual statement of general laws of cultural variability.

The role of analogy in this process has hopefully been demonstrated in this particular example. Analogy serves to provoke certain types of questions which can, on investigation, lead to the recognition of more comprehensive ranges of order in the archaeological data. In short, we ask questions about the relationships between types of archaeologically observable phenomena that had possibly not been placed in juxtaposition or viewed as orderly. In doing so we can develop a common "explanation" for observed variability in a number of formally independent classes of archaeological data, and thereby we can approach more closely the isolation of systematic variables which operated in the past. It should be pointed out that these gains may obtain regardless of whether the original analogy led to a correct postulate. In short, I do not view interpretations, or syntheses of interpretations as an end product of our investigations; on the contrary, we should be seeking generalizations regarding the operation of cultural systems and their evolution—something which has not been described ethnographically nor thus far achieved through the observation and analysis of contemporary events.

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ANNOUNCEMENT

The Seventh Annual Conference on Historic Site Archaeology was held at Avery Island, Louisiana, on November 3, 1966. Papers from the conference will be published in the Spring and are available by sending \$3.00 membership dues to the Chairman, Conference on Historic Site Archaeology, 225 Pine Grove Drive, Wilmington, North Carolina.