## SPATIAL RELATIVISM AND PERCEPTION:

## THE SITE DISTRIBUTION OF WESTERN NEW YORK

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*ABSTRACT*

The spatial context of archaeological sites and artifacts is fundamental to all archaeology. This paper considers the methodological problems inherent in archaeological maps and their interpretation. It shows that different archaeological interpretations can be legitimately drawn from the same set of spatial data depending upon the observer's location as exemplified by the spatial distribution of some 1500 prehistoric sites in western New York.

*INTRODUCTION*

This paper examines the distribution of prehistoric populations and sites in western New York. More generally, it considers the nature of spatial context and the issues created by spatial perception and spatial relativism. There are eight sections—an introduction to the issues, a brief history of archaeological work in western New York, a description of the data, a report on field work undertaken to ensure the quality of the data, an examination of the methodology of interpolation, a discussion of theoretical questions which impinge upon the analysis, an enumeration of results and finally, a summary of the conclusions.

The role of spatial control in excavation and survey has always been fundamental to archaeology for space is closely tied to cultural behavior. Most archaeologists believe that the distribution of sites and artifacts reflect rational purposes and are characteristic of particular groups or activities. Underlying this belief is the assumption that the spatial grid is absolute and limited to Euclid's three dimensions. Thus, they believe there are only a few obvious ways to map artifacts or sites. In short, given spatial location, the recognition of spatial pattern is a necessary prerequisite for archaeological interpretation.

What is not so obvious is that what is chosen to map, how the spatial grid is defined, what is called a pattern, and how it is interpreted, will make a difference. This paper demonstrates that the location of the observer, the observer's perceptions, and the particular configuration or distortion of the spatial relationships among artifacts and sites will have an effect upon the types of patterns archaeologists perceive. This will, in turn, have an effect upon the interpretations they make.

An example will be instructive. Consider briefly, the construction of topographic contour maps on which sites and artifacts are located. They begin as a series of elevations, usually located at irregular intervals. At first examination, these numerical data have no relationship to the clearly perceived landscape the archaeologist remembers. The map maker takes this information and extrapolates the data into an equally-spaced grid. Then, with the landscape in mind he searches for patterns in the data—in this case, locations with equal elevations. He connects these locations with a contour line. When he cannot find exactly equal elevations, but knows that somewhere in between two locations the elevation exists, he interpolates.

Several aspects of this process are important. First, the map maker chooses the types of spatial grid on which the information will be plotted. One does not need to represent the irregularly located data on an equally spaced grid. Indeed, one may choose to locate it on a spatial grid in which the north/south axis and the east/west axis are not equal. The former may be twice or three times the size of the latter. This process of transposition from one spatial grid to another is known as projection. Everyone is familiar with examples of the changing spatial relationships which this creates. A Mercator projection and a Lambert projection of the world appear very differently on one's wall. If one examines the shortest actual path between two cities such as Vancouver and Cape Town on a simple cylindrical map of the world, it is not a straight line, but a curve. The type of projection will make a difference. Sites which may appear closest to the water actually need not be. This may make a significant difference in economic reconstructions.

Second, the map maker chooses the perspective from which the map is drawn. It may be drawn from the viewpoint of a person in the north or in the south. This matter of perspective is important for it may make differences in apparent relationships. One remembers with fondness the surprise felt when one first saw the world on a polar map. The spatial relationship among countries are different when the world map is seen from a polar or equatorial perspective. Similarly, for archaeological maps, whether the observer is conceived as being directly overhead of one location or of another will make a significant difference in the map.

Third, the archaeological map maker decides what data are used. It is a conscious decision to use elevations for data which result in a topographic contour map. One could just as easily use density of artifacts or number of sites or the ratio of density of artifacts to density of bones.

Fourth, the map maker also decides what is a pattern both *a priori* and sometimes *a posteriori*. There is no reason why the pattern for which one looks has to be equal values as in the case of a topographic map. One could examine the data for numbers which are increasing linearly, logarithmically or any other replicable pattern. If one draws contours between points in which the elevation is increasing linearly, and other contours between points in which elevation is increasing logarithmically, an important but non-obvious topographic phenomena is mapped. By changing the pattern from equal values to increasing values, one creates a map of isoslope curves—a map of land grades. Each contour will show locations at which the rates of change of the land grades are similar. The importance of such a map for the interpretation of modern or prehistoric irrigation and for the location of historic or prehistoric check dams or canals is self-evident.

After the map is constructed, there is the problem of what constitutes an appropriate spatial relationship to study. What is appropriate from one person's perspective is insufficient from another's. There is also the question of defining a pattern. Whether or not one is interested in one or two dimensional patterns, in logarithmic or linear patterns, in continuous or point patterns, is all a matter for decision. All four of the above implications will influence the eventual interpretation.

Consider a regional archaeological map. The sites will suddenly take on an interpretive importance if they are compared to the topographic features of the area. For example, Early Woodland sites are located only in depressions near rivers, Middle Woodland sites only on plateaus, and Late Woodland sites only on steeper slopes. As the reader has seen, these simple interpretations require a considerable number of assumptions and decisions about the nature of the spatial relationships to be analyzed. This paper will take such a simple notion as what are the spatial relationships among sites in western New York and show how complex a problem it really is.

Why use data from western New York? There are several reasons. First, it is readily available since it has been systematically collected by Marian White and her students over a 25-year period. Second, it has neither been published nor presented in a public forum before now,

and it represents over *25* years of Marian White's fieldwork. Third, the collection techniques, although not totally systematic, have the advantage of a systematic reporting technique both in Marian White's explicit attempt to be consistent and by the implicit fact that she oversaw the project from its origin until her death in 1976. Fourth, the author has done further field testing to determine explicitly the quality of previous field data.

## HISTORY

New York has provided an environment for human activity since the retreat of the last glaciation more than 10,000 years ago. Viewing the development of culture in this area from the wider context of North American archaeology, one is struck by the slow, but persistently stable rates of cultural evolution, as well as by the large amount of natural resources which are available for exploitation. They never seemed to be taxed by the relatively small populations.

The history of archaeological work in western New York may be divided into three time periods. The earliest work might be called the collection phase and is the result of such scholars as Houghton (1909), Silver (1923), and Parker (1922). Beginning with the 1880's and continuing into the 1930's, these archaeologists collected, non-systematically surveyed, and occasionally excavated a large number of prehistoric sites. By the early 1930's, a style of western New York archaeology had been refined with large numbers of amateurs collecting, professionals excavating, and museums supporting work and holding collections.

The second period begins in the late 1930's and continues with few exceptions into the present and is termed the period of time-space systematics or spatial chronology. Many important regional, topical, and cultural syntheses should be noted including Ritchie's *Archaeology of New York State* (1980), MacNeish's "Iroquois Pottery Types" (1952), and White's ***Iroquois Cultural History*** (1961). Today, studies, have been completed by Tuck (1971), Granger *(1978),* and Funk (1977) as well as by their Canadian contemporaries.

Recently, the third period or processual period has begun. Under the direction of Bill Engelbrecht (1972) and other scholars from the area, students are beginning to ask questions of why and how cultural change and stability took place, rather than the more traditional questions of what, where, and when did an event take place.

The general outlines of the western New York archaeological sequence have been stated and restated by Ritchie and others including Ritchie and Funk (1973) and in Granger (1978). Rather than reiterate them in the text, I have provided a chart (Table 1) which outlines the western sequence. The trend, as one moves from the Laurentian through the Iroquois, is a sequence of continual development without very much innovation. After the contested hiatus which separates the Paleo-Indian from the Archaic, the economic development is summarized as the addition of more varied resources within the hunting, gathering, and fishing sectors, a more sophisticated toolkit, and at approximately AD 1000, the addition of agriculture on a small scale. The sites increase in size and eventually there is differentiation of longhouses, fortifications, and activity centers. Socially, there appears to be a gradual development from the band to the confederacy. In short, it has been remarkably stable growth.

## DATA BASE DESCRIPTION

The University of Buffalo site file was created by Marian White to systematize what was known about western New York sites. At the present time, there are slightly over 1500 sites entered. Information about these sites comes from throughout the state, but tends to emphasize western sources. The data are derived from historical sources, unpublished notes, published reports, occasional finds, site surveys, excavations, and cultural resource studies. Professional archaeologists, historians, amateurs and the general public have all contributed.

**TABLE 1**

**A WESTERN NEW YORK CULTURAL SEQUENCE**

| Stage | Culture or Tradition | Phase | Component & Economics * | | Tools | Sites | Organization | CIA Dates |
|---|---|---|---|---|---|---|---|---|
| | | | ---------- Western Subarea ---------- | | | | | |
| | | | Newton-Hopper | | | | Confederacy | |
| Late (WOODLAND) | | Eaton | Buffam St. Eaton | | | | | |
| | | Shelby | Shelby Fort Hill | | | | | |
| | Iroquois | Long | Nursery Long | | | | | |
| | | Oakfield | Oakfield | | | Longhouses fortifications | | |
| | | Ganshaw | | h/g/f agric. | Agric. tools | | | 1000 AD |
| Middle | Point Peninsula | Hunter's home | Portage | h/g/f | | | | 400 AD |
| | Hopewellian | Squawke Hill | Poland Ctr. Caneadea Killbuck Vandalia Lewiston | h/g/f ? | mounds burials few habitations | | | 500 BC |
| Early | Meadowood | | Meadowood Riverhaven | seasonal h/g/f | ceramics | creamation burials small houses | | 1000 BC |
| TRANSITIONAL | | | | | | | | 800 BC 1200 BC |
| | | | | | | | | 1200 BC |
| ARCHAIC | Laurentian | Brewerton | | h/g | Working wood tools large # and variety of flint tools | | Tribes (?) | |
| | | Lamoka | | h/g/f | copper tools | houses | | 3000 BC |
| HIATUS | | | | | | | | |
| PALEO INDIAN | Clovis | | | bgh/g | fluted pts. | kill sites dwelling sites | Bands | 8000 BC 10,000 BC |

h = hunting; bgh= big game hunting; g = gathering;        f= fishing.

When a site is found, it is located on a topographic quadrangle map in the United States Geological Survey 7.5 Minute Quadrangle Series. A standardized site form is filled out which includes such information as site latitude, site longitude, size of site, ownership of land, period of occupation, types of structures, cultural affiliation, type of excavation, historical or published records, as well as suggested mitigation. In addition to the site form, all other records which Marian White gathered are kept with the site file.

### FIELD TEST

I did a field study in order to test the quality of the data in the site file. Twenty-five or 10% of some 250 quadrangles were chosen randomly (Fig. 1). Data were confirmed from each quadrangle. For each of the randomly selected quadrangles where archaeological sites were specified, I went to the location of the sites as recorded in the file. I attempted to find surface and/or subsurface indications of the site or physical evidence of the site at each potential site location.

If one considers the data from the site file as predictors of where sites should be found, and my actual rediscovery of the site in the field as confirmation of the expectations, disconfirmations are then defined as sites which I could not find at the predicted locations. Eighty-four per cent
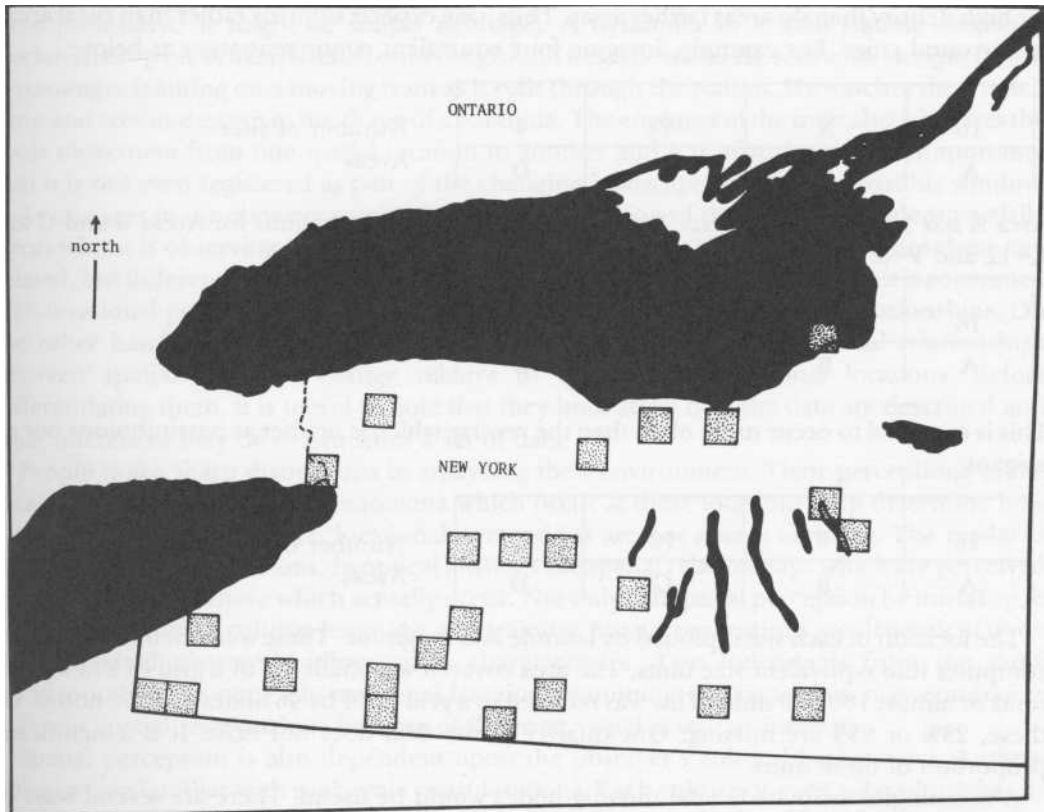


Fig. 1. The location of the randomly selected quadrangles for field testing in the 10% quality control study.

of the expectations were confirmed. This is a primitive attempt at quality control. However, it is sufficient to lend credence to the reality of the data and the file's value. The reason certain (16%) of the sites could not be relocated can be summarized in order of their importance: (1) the major problem was lack of locational accuracy or areal specificity in the records, *(2)* site destruction, *(3)* erroneous records, and ***(4)*** mistaken identity.

## *METHODOLOGY OF INTERPOLATION*

In order to examine the prehistoric distribution of sites in the western part of New York, one makes several assumptions. First, on the basis of the field survey, I assume that the data available are generally correct and reliable.

Second, I assume that my data are complete. Not all the sites have been preserved; if preserved, not all have been found; if found, not all have been reported.

Third, the data in the site file are a partial representation of reality, albeit an imperfect one. In general, I believe that if a large number of sites are reported in one area, and a few in another, it actually does reflect reality. There really is a higher probability for sites to be more numerous in the former area than the latter.

Fourth, I assume that the principle "like is near like" is operating even if the evidence does not exist. Namely, if one has a high density area, then the areas near it have a higher probability for high density than do areas farther away. Thus, one expects suburbs rather than rural areas to surround cities. For example, imagine four equivalent contingent areas as below:

| 16 | *X* | *Y* | 4 | Number of sites |
|---|---|---|---|---|
| A | B | C | D | Areas |

Area A has 16 sites. Area D has 4 sites. The reasonable expectations for Areas B and C are X=12 and *Y=8:*

| *16* | 12 | *8* | **4** | Number of sites |
|---|---|---|---|---|
| A | **B** | C | D | Areas |

This is expected to occur more often than the reverse which is neither as parsimonious nor as elegant:

| 16 | *8* | 12 | **4** | Number of sites |
|---|---|---|---|---|
| A | B | C | D | Areas |

The location of each site is plotted by latitude and longitude. These were then grouped by a computer into equivalent size units. The area covered was made up of a grid of 215 by 445 units or almost 100,000 units. This was reduced to a grid of *44* by *96* nodes or *4356* nodes. Of these, *23%* or *989* are missing. One-quarter of the data does not exist. It is a significant proportion of these units.

A meaningful estimate for the missing nodes would be useful. There are several ways of estimating the missing values. One method is to calculate a grid using any of a variety of distance-related functions. These functions are defined in such a manner as to weight the sample data points so that their influence declines as their distance from the point being estimated increases.

Another method is to do a trend analysis. This method extrapolates the general trends and using the trend equations, missing data points are interpolated. These points are found by using the trend equations and weighting distance in a variety of distance functions.

A third method is to combine the two previous ones. In any case, after interpolation, the "real" data points and the interpolated points are plotted as a surface. A small number of lines, (approximately 100) are used to plot out this surface as it would appear in three dimensional space. This resulting surface may be rotated, reproportioned, and observed from differing distances and elevations. Thus, one may examine the distribution of sites as if one were individual observers located at different locations at the same time. One may be a Southerner looking north, a Northerner looking south, an Easterner viewing the west, or a Westerner examining the east.

## THEORETICAL QUESTIONS

As the reader is aware, it is not always clear what is meant by spatial location. The problem is deep and has fascinated a plethora of scholars—physicists from Newton to Einstein, philosophers from Kant to Russell, as well as whole schools of geographers and psychologists. Consider an example through ethnographic analogy: the location of a single tool—not a major piece of material culture such a Mayan Stelae, but just an ordinary discarded tool. (If it were prehistoric, it might be simply debitage). A bystander in a train station watches a workman drop his broken wrench onto the ground near the track. He sees it fall straight down. A passenger is sitting on a moving train as it rolls through the station. He watches the wrench drop and sees its descent in the shape of a parabola. The engineer of the train also witnesses the tools movement from one spatial location to another and it is of such minimal importance that it is not even registered as part of the changing landscape which flows past his window.

As one sees in the above example, the changing location of the tool is dependent partially upon whom is observing and where the observer is located. This study combines these two related, but different, issues in the description of spatial data. On the one hand, it is concerned with locational perceptions, the problem of how observers perceive spatial relationships. On the other hand, it deals with spatial relativism which states that the actual relationships between spatial locations change relative to different observational locations. Before differentiating them, it is useful to note that they both affect how the data are described and what inferences may be drawn from a set of data.

People make sharp distinctions in analyzing their environment. Their perceptions of the locations and the events or phenomena which occur at these locations help determine how they classify them. However, locational perceptions are not always accurate. The reader is familiar with optical illusions. In optical illusions the spatial relationships which are perceived are not the same as those which actually occur. Not only can spatial perception be mistaken, it varies by individual, culture, language, and training. Spatial perceptions are dependent upon the individual observer's idiosyncratic characteristics. Two individuals from the same background at the same observational location examining the same data may emphasize different spatial relationships because of differing visual acuity or interests.

Spatial perception is also dependent upon the observer's cultural background. Anthropologists are familiar with such emic considerations. Each culture or even sub-culture has its own sets of spatial relationships and differentiations they emphasize. There have been many serious reviews and analyses of this phenomena under various rubrics in anthropology and geography. All of us maintain psychological maps. Perhaps they are most humorously portrayed in the famous Steinberg *New Yorker* cover of Manhattan and the California coast. Examples abound.

Even language effects one's spatial perception. The linguistic categorization of domains of phenomena limits as well as defines which spatial relationships can be communicated.

Finally, training will make a difference. A trained architect, engineer or archaeologist will each observe the facets of spatial relationships which are most relevant to their concerns. Each will perceive subtleties which might not be apparent or even extant to the non-trained eye.

The question is not whether these differences are real or not. The fact is that changing the observer means that reality is perceived differently. These perceptions are the basis of inferences are not part and parcel of scientific analysis. Thus, perceptual reality affects analytical reality.

What do I mean by spatial relativity? Spatial relativism states that the spatial location of the observer will have an effect upon the analysis. It is inaccurate to state that everything is relative. If it were, to what would it be relative? By the term "relative" is meant: dependent upon external phenomena. Relativity is generally considered the relating of phenomena to external forms of reference.

What one sees is dependent upon the location at which the observer is positioned and in which direction the observer looks. Consider an observer who examines a set of data from a particular location. He sees a specific spatial relationship from which he draws inferences. If this observer moves to another location, the actual spatial relationships change according to the laws of geometry. The observer may see new relationships. These changes are not emic or culturally specific. A second observer who makes the identical locational shift will see similar foreshortening and elongating of relationships. The same data from different locational positions will be observed as more or less similar according to the degree of symmetry. It will appear isomorphic from a multiplicity of directions and observational locations if it is symmetrical; more variable if it is not symmetrical.

There is a concern here for genuine physical and relational differences which are legitimately observed. Each is a correct record of a certain event from that vantage point. There is a difficult line that distinguishes between what belongs to the observer and what belongs to the occurrence being observed. It is this difference which distinguishes spatial relativism from locational perception.

## RESULTS

Fig. 2 is a map of New York showing the limits of the data in the shaded area. The density of shading represents the approximate density of site coverage. Fig. 3 shows the density of archaeological sites in this area. It is a machine-generated contour map in which three intermediate points are calculated between every two sample points in order to smooth the contours. The hatchured marks are depressions. The contours show site densities ranging from 0 to over 50 per 7.5 minute quadrangle. These data have had a variety of interpolating analyses applied to them. These include distance weighted function estimates, trend analyses, and representations in two or three dimensions.

In order to study the perceptual reality and spatial relativism, those surfaces which represent the distribution of sites in western New York will be examined from the perspective of different observers. Fig. **4** is the view from the south to the north. More accurately, our observer is due south (0 degrees corrected 7 degrees for magnetic declination). He is looking towards the north and down at the presentation of the distributional surface from an angle of 45 degrees and at a distance of 400 matrix units. The peaks are the location of high density areas. The higher the peak, the higher the density of sites at the particular location. This map of the site distribution was calculated using a constrained distance square weighting function combined with a linear trend analysis.
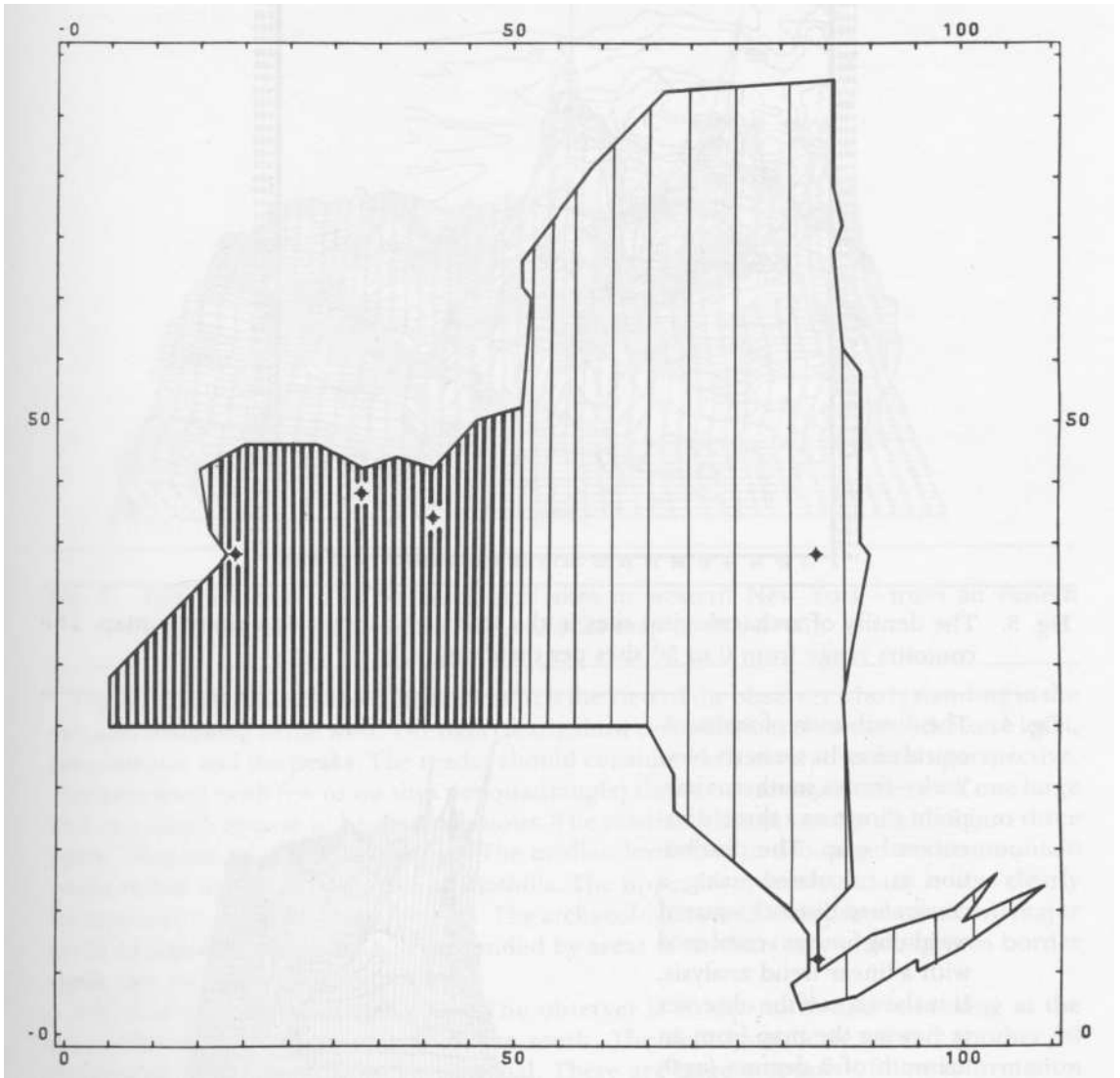
Fig. 2 New York State showing the approximate density of data coverage.

   Examining the data for the first time, our observer perceives numerous patterns. First, the density of sites appears to be directly related to the distance from the observer. The further the location is from where the observer is standing the larger the number of sites. In addition, the observer is clearly aware that there is a pattern of increasing number of sites as one moves east to west. The large densities and numbers of sites are aggregated in the upper left hand corner of the diagram which is indicated by the peaking being focussed on the northwest corner. Based on this map, an archaeologist might conclude that this area of western New York was transitional vis-a-vis settlement pattern with higher site density further to the north and west in Ontario and lower in central and southern New York.
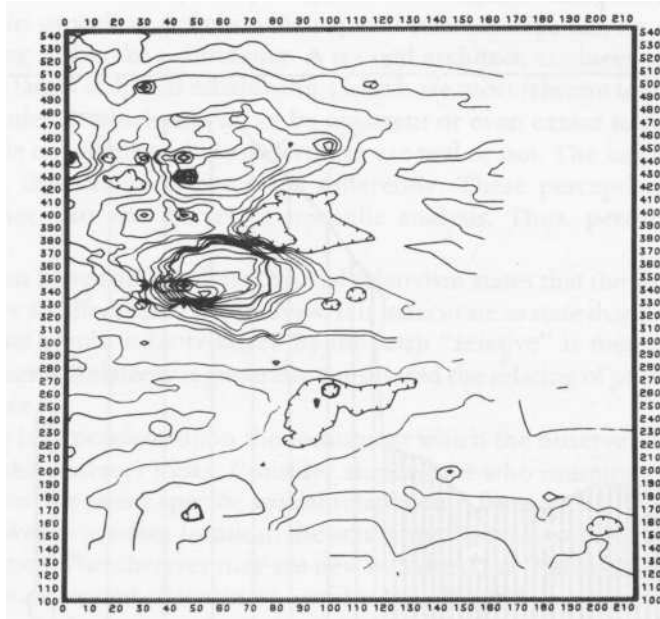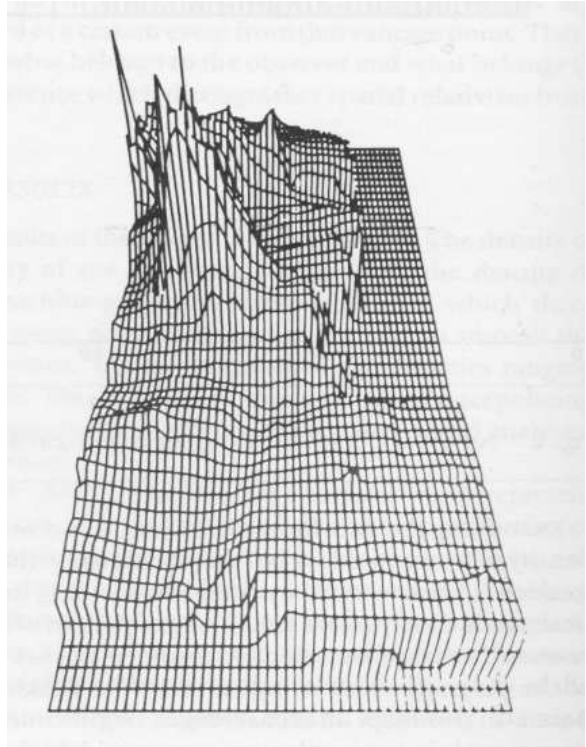
Fig. 3. The density of archaeological sites in the study area shown as a contour map. The contours
       range from 0 to 50 sites per quadrangle.

Fig. 4.    The distribution of archaeol-
           ogical sites in western New
           York—from a southern view-
           point shown as a three-dim-
           ensional map. The distribu-
           tion is calculated using a
           constrained distance squared
           weighting function combined
           with a linear trend analysis. It
           is shown as if the observer is
           viewing the map from an
           azimuth of 0 degrees (a=0)
           and an elevation of 45 degrees
           (e=45). In other words, the
           observer is in the south
           looking north. The X and
           Y coordinates represent actual
           map locations and the ele-
           vation represents the density
           of sites per quadrangle rang-
           ing from 0 to 50 sites per quad
           rangle. The following figures
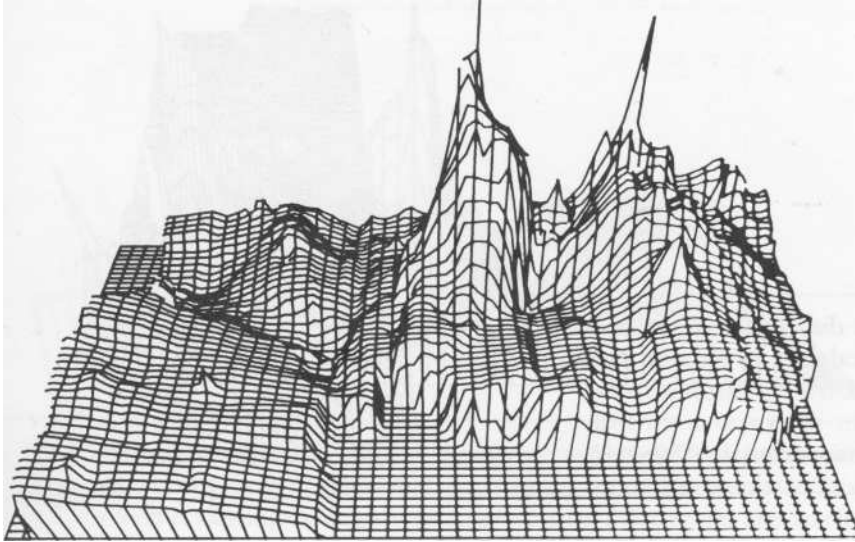           are similar unless otherwise
           noted.

Fig. 5. The distribution of archaeological sites in western New York—from an eastern viewpoint, shown as a three-dimensional map (a=90, e=45).

Fig. 5 has the results rotated 90 degrees. It is the view of the observer who is standing in the east and is looking to the west. The data clearly show three distinct elements—the zero level, the plateaus, and the peaks. The reader should consider each in turn from this perspective. The zero level (with few or no sites per quadrangle) shows two areas. These areas, one large and one small, appear to be discontinuous. The median plateau level is divided into three parts. They are relatively contiguous. The median level rises in two ridges to the mountain peaks rather than row upon row of foothills. The upper level or mountains is now clearly divided into two relatively sharp peaks. The archaeologist could interpret them as two major areas of active prehistoric use, surrounded by areas of median use, which in turn border upon two areas which were not used.

Fig. 6 is the Canadian viewpoint. The observer is in the north and is looking at the interpolated distribution of sites to the south. The data have been rotated another 90 degrees or 180 degrees from the original. There are large amounts of new information which are available from this perspective. First, the two peaks are not linearly related in a north/south line as was originally perceived. Rather, the northern peak is offset to the west. Second, the northern median plateau demonstrated a large degree of linearity on the eastern side. Third, the northern-most peak is sharper and rises more rapidly from the plateau. Finally, two of the three median plateaus are merged as one.

A reconstruction might equate the northern peak, offset to the west, with its sharper slopes as a more self-contained prehistoric region. While the southern center of archaeological activity would be expected to have more inter-relationships with the populations of the immediate hinterlands or represented by the foothills and median plateau. The linearity of the eastern edge of the northern median plateau may be related to an economic, ecological or political border. What is particularly interesting is the border's homogeneous impermeability. There are no islands of archaeological density beyond the border.

Fig. 6 The distribution of archaeol-
ogical sites in western New
York from a northern view-
point shown as a three-di-
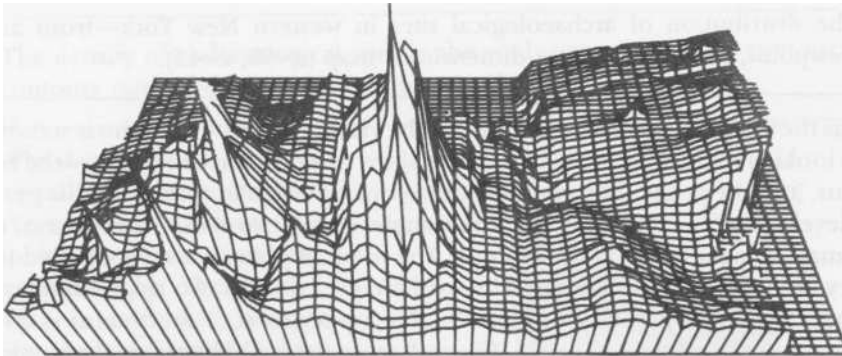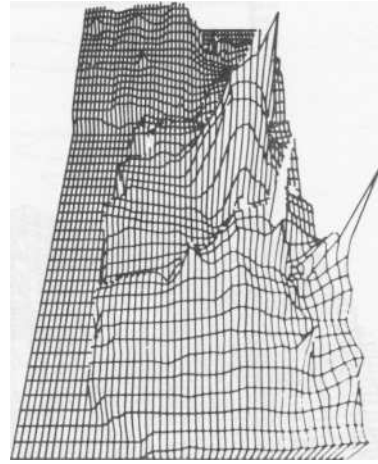mensional map (a=180, e=45).



Fig. 7. The distribution of archaeological sites in western New York from a western view-point shown as
a three-dimensional map (a=270, e=45).

Fig. 7 shows the data from the west looking toward the east. In other words the azimuth is 270 degrees.
The area in which the high peaks are contained was once thought to be unimodal, then bimodal. It now
appears to be trimodal with a relatively large number of subsidiary peaks. They are suggestive of
secondary areas of high site density. The descending slope towards the north of the southeastern plateau
is very apparent in this figure as is the rising slope of the southwestern plateau. Finally, any western
observer seeing this pattern would be very reluctant to describe the density of sites either as a direct or
inverse distance function. The archaeologist interpreting a now multimodal center of activity might consider
a core area model or a central place model to explain these high density areas. The converging slopes
indicate a geographic hiatus in prehistoric population which might reflect the geographic distribution of
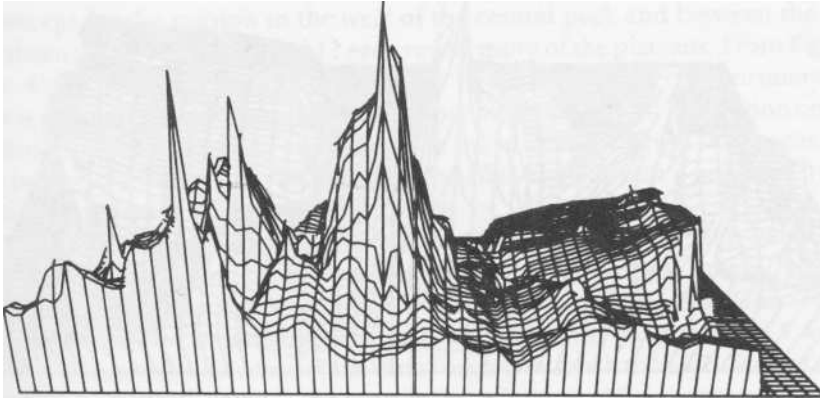resources or a cultural boundary phenomenon.

Fig. 8. The distribution of archaeological sites in western New York from a western view-point shown as a three-dimensional map viewed almost horizontally. It is shown as if the observer is viewing the map from an azimuth of 270 degrees and an elevation of 15 degrees (a=270, e=15).
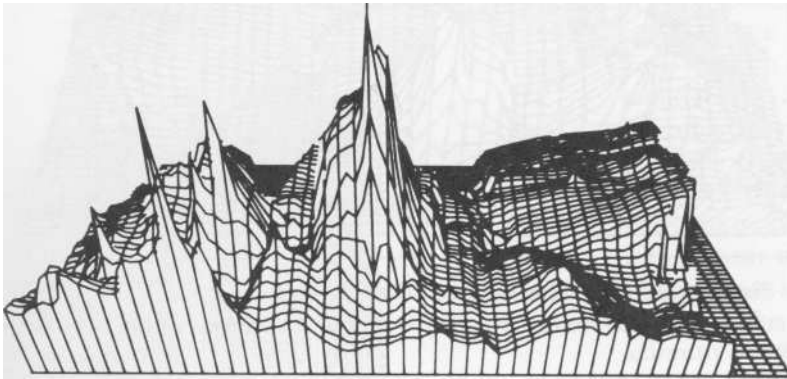


Fig. 9. The distribution of archaeological sites in western New York from a western view-point shown as a three-dimensional map viewed obliquely (a=270, e=30).

Fig. 8, 9, 10 and 11 show the effects of changing the elevation of the observer. In the previous figures, the elevation was kept constant and the azimuth was rotated. Now the azimuth is kept constant and the elevation is rotated. Fig. 8 is observed from the west from an altitude of 15 degrees, Fig. 9 from 30 degrees, Fig. 10 from 45 degrees (the same as Fig. 7), and Fig. 11 from 60 degrees. Some generalities may be drawn. For example, as the elevation is decreased the observer's eye is drawn to the peaks and subpeaks.

Fig. 8 emphasizes all of the peaks at the expense of the plateaus. In addition, the centrality of the central peak is very clear. The two highest peaks are approximately equal in value. As one increases the elevation, there appears to be a great disparity in size. If one examines the central
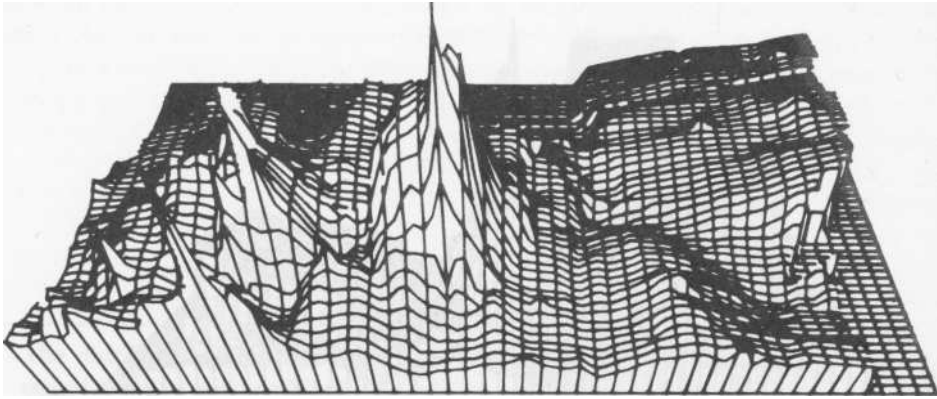
Fig. 10. The distribution of archaeological sites in western New York from a western view-point shown as a three-dimensional map. It is shown as if the observer is viewing the map from an azimuth of 270 degrees and an elevation of 45 degrees. (a=270, e=45).
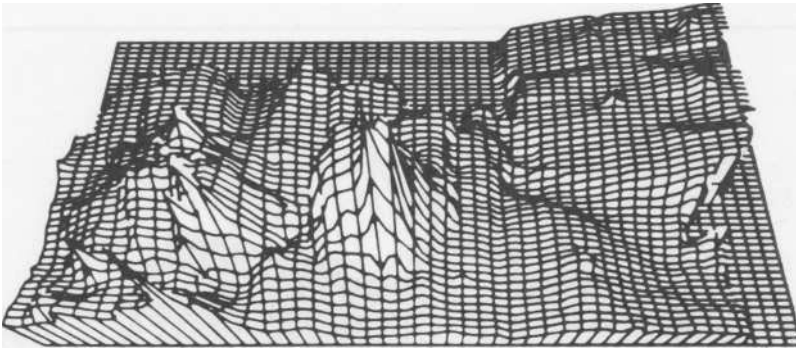


Fig. 11. The distribution of archaeological sites in western New York shown as a three-dimensional map as viewed from the west and from an elevation of 60 degrees (a=270, e=60).

peak in more detail on the north side, there is a sharp face leading three-quarters up the side of the mountain. It creates a plateau ridge and then rises almost vertically to the peak. On the south side, the steep incline rises seven-eighths of the way to the top of the peak and then creates a very small ridge which then becomes a shear face which reaches the summit. This latter pattern maintains its coherence until one reaches Fig. 11 where the south face is shown to be differentiated into two peaks.

Indeed, not only are the mountains emphasized by the lower observational elevations, but so are the depressions. For example, consider the small valley in the south and the west of the central peak. Examine it right at the western edge of the figure. By Fig. 10 it has flattened out and by Fig. 11, unless one knew where to look, it is barely perceptible. In general, as elevation increases, horizontal distances and relationships are emphasized at the expense of the vertical.

Other relationships may be drawn from these figures. As one increases the elevation, the amount of masking of information is decreased. This is most apparent if one examines the

plateaus behind the northern mountains. In Fig. 8 one can hardly see any of the northern plateaus except for the portion to the west of the central peak and between the central and more northern peaks. Figs. 9, 10 and 11 each reveal more of the plateaus. From Figs. 8 to 11, as from Figs. 4 to 8, archaeological inferences may be made. However, the primary purpose of this paper is to demonstrate the importance of spatial relativism and perception on the types of spatial relationships from which archaeologists make archaeological inferences. It is not to make the inferences themselves. Thus, a detailed analysis will await a paper addressed to this subject alone and it will not be continued here.

One is not limited to spatial relationships based upon a one-to-one unit size. For example, Fig. 12 shows the same data once again. It is essentially similar to Fig. 5 in that the azimuth is 90 degrees. The elevation is slightly higher—50 rather than 45 degrees. However, the large difference in the surface is caused by making the X axis one-quarter of the Y axis. In other words, every unit east to west counts four times each unit north to south. One of the effects of this is to make the data appear to fit the geography differently. The east/west axis is now longer than the north/south axis. In addition, the southern plateaus are more clearly corrugated emphasizing gradual and small north/south discrepancies. One may also note that the importance of the rise of elevation for the southern mountain is more clearly shown to be connected with the southern ridge.
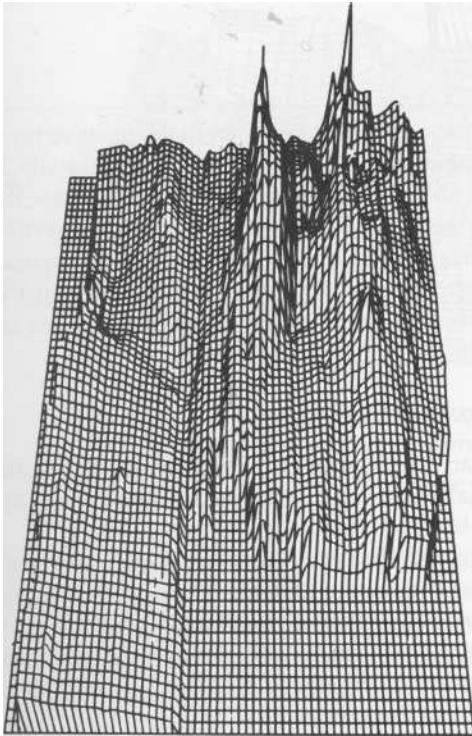


Fig. 12. The distribution of archaeological sites in western New York from an eastern view-point shown as a three-dimensional map. The distribution is calculated using a constrained distance squared weighting function combined with a linear trend analysis. It is shown as if the observer is viewing the map from an azimuth of 90 degrees and an elevation of 50 degrees. The X and Y coordinates represent actual map locations and the elevation represents the density of sites per quadrangle ranging from 0 to 50 sites per quadrangle. The X and Y axes have been manipulated. One unit on the X axis in one-quarter of a unit on the Y axis. In other words, each east-west unit counts four times each north-south unit.
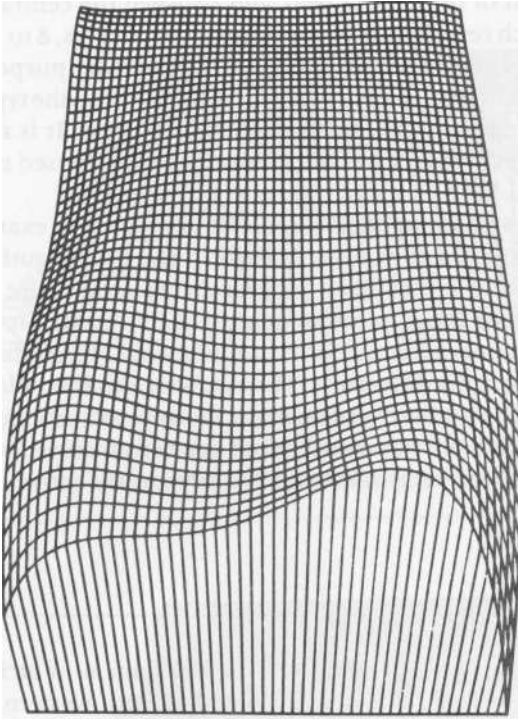
Fig. 13. The distribution of archaeological sites in western New York from an eastern view-point shown as a three-dimensional map. The distribution is calculated using a sixth dimensional trend analysis of the residuals. It is shown as if the Observer is viewing the map from an azimuth of 40 degrees and an elevation of 45 degree. The X and Y coordinates represent actual map locations and the elevation represents the density of sites per quadrangle ranging from 0 to 50 sites per quadrangle.

Nor does one need to be limited to two dimensional trend analysis or to the positive forms of the data. For example, Fig. 13 shows a sixth dimensional trend analysis of the residuals. First, one immediately notices large amounts of smoothing and averaging. Second, because it is an analysis of the residuals, it shows the trends in what is left after the general global patterns have been removed. After having removed the important pattern of east to west increasing density, one rediscovers the bimodal north to south pattern which is skewed towards the north and skewed toward the edges. In addition the reverse pattern of increasing density of sites as one moves east in the plateaus is pointed out again.

### GENERAL CONCLUSIONS

There are two phenomena at work in every archaeological map. One is emic, the other is etic. This paper describes the difference as spatial perspective and spatial relativism, although this is a very idiosyncratic use of the terms.

It has been clearly shown that the changing spatial perspective and the changing location of the observer makes a significant difference in the spatial relationships one discovers in the archaeological data. All archaeological data are reducible to questions of what the material culture is, when it was, and where it is located. One notes that the third question is somewhat malleable by pointing out that the spatial framework is flexible. Archaeology is built upon spatial analysis and spatial analysis has very sandy foundations.

Secondly, this study suggests a new methodology for improving the discovery procedures which analyze the contextual relationships. One should use differing interpolating procedures and plot one's maps as if viewed from a variety of perspectives.

Doing this, one recognizes several different types of spatial patterns. Some maintain their coherence through numerous perspectives. In western New York these appear to be:

a) global patterns of increasing density from south to north and east to west as well as a bimodal residual pattern along the north to south axis,

b) discontinuous small areas of exceptionally high density (peaks), continuous large areas of medium density (plateaus) and discontinuous small areas of low density (zero areas),

c) three areas of high density which are not linearly related and which have numerous subsidiary peaks surrounding them,

d) two plateaus with increasing densities of sites in opposite directions,

e) clear linear boundaries between each low density and each plateau area, and

f) two low density areas with the smallest variation of any area within western New York.

These patterns suggest differing cultural interpretations which should be explored further. The peaks may correspond to specific culture areas. The changing densities of the plateaus might be the result of economic patterning following an ecological gradient. Clearly, the entire pattern has a temporal constituent which needs to be analyzed in a separate paper.
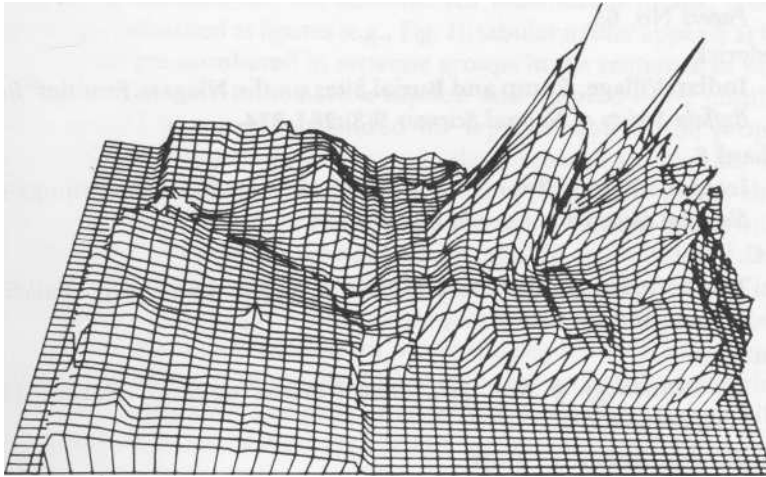


Fig. 14. The distribution of archaeological sites in western New York from a southeastern viewpoint shown as a three dimensional map (a=60, e=45).

One question is the problem of optimal observational position. Is there a single observational position which is better than any other? Is it Fig. 14? There are really several inter-related problems. First, is it possible to determine criteria to show that one observational position is better than another? Second, is it possible to show, given these criteria, that there is one which is better than all others which have been examined? Third, is it possible to show that that observation is better than any other which might ever be examined?

Finally, this paper should be examined in the long historical tradition of archaeology. In some areas this paper continues a trend toward greater explicitness. First, archaeologists argued that to dig and discover was enough. Then their methodology and techniques had to be more explicit for one could not evaluate an archaeologist's conclusions without knowing how he did his excavating, surveying, and laboratory work. Even more recently, archaeologists

argued that their sense of problem and theoretical underpinnings had to be made explicit. For how one did archaeology was dependent upon those theories with which one was concerned and upon the intellectual tradition from which one drew sustenance. This paper suggests that one must be explicit in pointing out how and from what frame of reference one observes the data. Thus, there is a continual development from methodological to theoretical to eventually observational explicitness.

*REFERENCES CITED*

Englebrecht, William
>   1972        The Detection of Patterned Behavior in Iroquois Pottery Decoration. *Pennsylvania Archaeologist* 42(3): 1.

Funk, Robert E.
>   1977        Early to Middle Archaic Occupations in Upstate New York. In *Current Perspectives in Northeastern Archaeology* (Robert Funk and Charles Hayes III, editors), pp. 21-29. New York Archaeological Association.

Granger, Joseph E., Jr.
>   1978        Meadowood Phase Settlement Pattern in the Niagara Frontier Region of Western New York. *University of Michigan, Museum of Anthropology, Anthropological Papers* No. 65.

Houghton, Frederick
>   1909        Indian Village, Camp and Burial Sites on the Niagara Frontier. *Bulletin of the Buffalo Society of Natural Sciences* 9(3):261-374.

MacNeish, Richard S.
>   1952        Iroquois Pottery Types: a Technique for the Study of Iroquois Prehistory. *National Museum of Canada Bulletin* 124.

Parker, Arthur C.
>   1922        The Archaeological History of New York. *New York Museum Bulletin* 235-238. Albany, N.Y.

Ritchie, William A.
>   1980        *The Archaeology of New York State* (revised edition). Harbor Hill Books. Harrison, N.Y.

Ritchie, William A., and Robert E. Funk
>   1973        Aboriginal Settlement Patterns in the Northeast. *New York State Museum and Science Service, Memoir* 20.

Silver, Dilworth M.
>   1923        The Location of the Nations of Indians Called the Wenroes or Wenrohronons and the Eries. Private printing.

Tuck, James A.
>   1971        *Onondaga Iroquois Prehistory.* Syracuse University Press.

White, Marian E.
>   1961        Iroquois Culture History in the Niagara Frontier Area of New York State. *University of Michigan, Museum of Anthropology, Anthropological Papers,* No. 14.

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