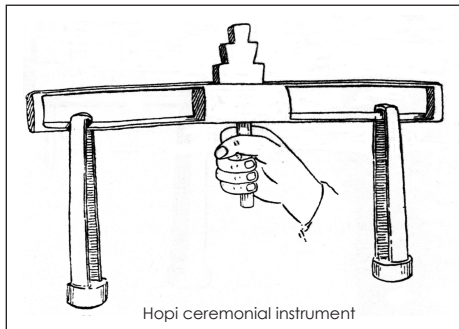


CHACO'S PLACE

IN THE

FORMALIZED LANDSCAPE



Hopi ceremonial instrument

DESIGN AND
SURVEYING OF
LARGE SCALE
GEOMETRIES AS
RITUAL PRACTICE

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Virtually all traditional cultures use formalized ritual spaces at small scales; the technical aspects of accurately surveying similar geometries at large scales are not complex.

DRAFT

Biographic Note

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Introduction:

It has taken some time for the consensus to develop that 11th century Chaco Canyon, at least, was a large scale pilgrimage destination for Ancestral Pueblo people, and that much of it was not intended or used primarily for domestic residence or resource storage. Given this relatively recent definition as a place for religion and ritual practice, rather than trade or political control *per se*, intriguing questions remain. First, how were obvious centers like Chaco and Aztec, as well as other places with large circular great kivas and large apartment like roomblock constructions, located in the plateau landscape. Beyond the process of deciding exactly where to build, why suddenly at this time did they begin to construct monumental multistory walls, often several, seemingly independently oriented within a particular “great house”? What was the purpose of aligning two of these Chaco great houses directly north-south of each other on opposite rims of the canyon? What was the ritual purpose of road segments and related features running to great houses, particularly in Chaco and Aztec?

Evidence of conscious, religiously based, design process is largely evident in all of these examples except the most primary, i.e. the location of a site before construction begins. The two cardinally aligned buildings on the north and south rims of the canyon are not really an exception here, because some design consideration is likely to have first located this schematic pair itself. There is a paradox here. At some point prior to the large-scale organization we associate with monumental Chaco, the landscape had undoubtedly been intensely used as a source of religious power for smaller scale social groups, probably mediated by shaman. How then, could these kinds of societies suddenly coalesce in the 1000's, bursting forth, not only with some sort of religious “draw” at the scale of the plateau landscape, but with unprecedented design elements, formal aspects of which begin to look like temples?

The idea behind the present interdisciplinary based design analysis is that the climax Chaco “Phenomenon” needed several precedent centuries by which to develop the schematic basis--conceptions of Ancestral Pueblo religion itself--of formal physical settings for ritual practice at pilgrimage centers. To make this case, one needs to hypothesize a fundamental religious change in the symbolic use of the larger plateau landscape that occurred several

centuries earlier, perhaps around A.D. 500-600. At this time, possibly also associated with the location and building of the first formal architecture as great kivas at special ceremonial sites, religious specialists became interested in coincidentally formal geometry, e.g. alignments, cardinal relationships, or right angles among prominent natural features which also involved timing contributions of astronomical observations. This, hypothetically, was no simple expansion of shamanistic power, but an “invention” as it were, of a new form of religious social organization, yet one also founded on phenomenological experience of the physical landscape itself. Along with these interests came the use of simple tools to more accurately understand this geometry in the landscape. Using these surveying tools across long distances among the most prominent natural features in the landscape required social interaction with other communities, whose participation became formalized as a new kind of ritual group or “sodality”, rising above more localized and self-interested kinship. The religious experience was as much laying out a sacred pattern in the landscape, as performing ceremony in a great kiva--whose spatial location might well have been part of the sodality’s core definition and origin.

Analyzing the possible design of ritual “frameworks” at the plateau scale, the first formalized patterns may have occurred very modestly at Chaco Canyon, primarily because of its cardinal location south of the highest mountain in the cultural region, Mount Wilson. From there the process of ritual formalization and concomitant social linkage spread across the plateau, restructuring, perhaps, the large scale, but unsurveyed cosmic conceptions of an ancient shamanistic landscape. A triadic spatio-religious belief developed based on two oppositional halves each with their own north-south axes, West (Canyon de Chelly) and East (Chaco Canyon), mediated by a Middle axis anchored on the prominent natural feature Ship Rock. Not dissimilar kinds of space based religious concepts are well documented in the ethnography of successor societies of the Historical Pueblos and Navajo, though laid out somewhat differently using many of the same natural features. It is this developed, formalized, spatial symbolism, actually designed and executed at the largest scale on the plateau that makes possible the seemingly sudden location of major ceremonial sites and new but symbolically related architectural and road features at Chaco and Aztec. They aimed to not only integrate with the existing plateau framework in dramatic new ways, but reproduce it at the visible scale of pilgrimage foci.

Ritual processes of the Ancestral Pueblo had become heavily integrated with the design of landscape and architectural formalities, the explanation of which may begin to answer some of the outstanding questions in the larger inquiry. For this reason, the primary emphasis of this work is based on design analysis from a landscape architecture/architecture perspective, while suggesting interdisciplinary linkage to social anthropology, archaeology, statistics and survey engineering.

READING THIS BOOK FROM DIFFERENT BACKGROUNDS

It is one thing as an architect-social anthropologist, to study the role of formal physical settings in small scale ritual practice, whether in traditional dwellings or villages, but when one suggests that not dissimilar uses of form might be expanded to large scales defined by prominent natural features, red lights start turning on. First among these concerns the radical notion that prehistoric people had the technology to lay out accurate simple geometry across long, often not inter-visible, distances. With some exploratory fieldwork, a limited but illustrative literature, and evaluation by the editor of a prominent journal of surveying engineering, this turns out to be the least problematic part of the present set of ideas. Readers who are most interested in the surveying issues, or who have initial doubts in this regard, should first turn to the book's appendix. It consists of two parts: first, is a full description of the "Geopatterns" software versions that were necessary to describe geometries among points on the earth's ellipsoid and test patterns for random probabilities; and second, is the literature on prehistoric surveying and a detailed simulation of such a landscape process across one of the longer possible ritual lines on the plateau.

Social organization

The first chapter seeks to develop the more important social anthropological basis behind technical aspects of the surveying hypothesis. While good landscape maps of societies with shaman based religion are few and far between, respectable ethnographies can be found that integrate this kind of critical data into this work. Theoretically the religious conceptions attached to these larger scaled natural topographies range from a kind of "spider web" linkage between features of special spiritual power at different loci, to a geometrically formalized "cosmic" map based on locations of significant highly symbolic natural features, particularly prominent

mountains. While some of these features are used in shamanistic practice, no special ceremonial foci for more organized ritual are integrated through accurate surveying. The religious use of shamanistic cosmic conceptions implies limited large scale social organization beyond a kind of equal access of small communities to natural features within the so defined symbolic landscape.

The best evidence for a shift away from shamanistic uses of landscape as cosmos comes from the work of Alfonso Ortiz (1969) on his native Tewa, a post Ancestral Pueblo tribe. Essential here is a rereading of his central thesis, an ethnographically based, theoretical critique at the time, of structural anthropology's (Levi-Straussian) view of hidden organizing processes in smaller societies that belied the spatial dualism of kinship groups in villages. Ortiz strongly argued that the actual physical layout of Tewa ritual in their surrounding landscape, to the contrary, constituted a socially real structuring process for religious societies, one not subtly concealed among kinship groups, but working above them in very mappable ways. Embedded in Ortiz's treatise, however, is something of an anthropological bias for language based means of structuring symbolism. He explained that the layout of paths to sacred features in their three-tiered cosmic structure somehow emerged from Tewa origin myths, in spite of the fact that the most powerful expression and experience of Tewa religion probably came not from telling a story, but from ritual practice out in the surrounding landscape.

The present argument suggests that the transition from more piecemeal shamanistic uses of symbolic topographic features—in spite of or perhaps politically enabled by shared cosmic concepts—to formal surveyed frameworks organizing religious groups was not dependent on any detailed articulation of myth. Myth had always been associated with the shamanistic cosmos, just as it still is with ritual practice in the Historical Tewa. The greater formality of ritual landscape layout and way of integrating different religious groups within the Tewa pueblo community, however, is unlikely to have originated from some social need expressed through ancient story telling. Rather, it could well be a legacy from processes of structuring ritual and religion that emerged from actual use of the large-scale landscape as much as a millennia before—with its integral practices of surveying.

Introducing probability comparisons between existing and random patterns

Statistical analysis supports much academic research and the present work aims to at least introduce its potential contribution in this regard. The use of such methodology to distinguish

and determine aspects of design is however, quite new to fields like architecture, landscape architecture or planning. Usually it is quite evident that an “object” is intentionally designed, particularly through its perception in images, increasingly amplified by computer manipulation. The cognitive maps that ground both formalized architecture and landscape ritual, on the other hand, are less object-like and less immediately recognizable. Little research exists, with some promising exceptions, that identify formalized cognitive map-like design components of traditional dwellings or monumental historical architecture, much less ritual layouts of landscape like those used by the Tewa. Yet one can begin exploration in this direction by assuming that basic geometric forms like alignments, right angles, cardinal relationships, bisected angles and the like will be key components, not unlike formal architecture. The most logical research demand after proposing a causal link between religious societies and formalized landscape frameworks is to analyze existing geometric patterns among natural and built sites attempting to distinguish design from coincidence.

Chapter 2 finds as many prehistoric great kiva sites from about 500-1200 A.D. on the Southern Colorado Plateau as are readily available in existing archaeological literature and data bases, 61 at the time of this exercise. The presence of an adjacent roomblock is not a requirement for inclusion in the list. Given the hypothesis about integrating such ceremonial sites with prominent natural features, 21 of the most logical of these are added to the analysis. Without any specific, possibly designed pattern in mind, the analysis simply inquires about the number of three-point alignments—at ten different accuracies—with which the great kiva-natural feature points are involved. Creating 100 equivalent sets of random points on the plateau, keeping the natural features constant, how do numbers of three-point alignments compare? Revealed is the apparent reality that among any existing layout of sites in this range, some number of random alignments will occur, even though probabilities of some design may be quite high. Distinctions between the involvement of earlier (500-900 A.D.) and later (900-1200 A.D.) great kivas also provide tentative initial correlations to the hypothetical importance of plateau formalization prior to the major “re-formalization” in Chaco Canyon. Possible influence of linear natural features on alignments, at smaller scales, is explored by setting up test boxes in the canyon topography of Chaco itself.

Chapters 3, 4, 5 and 7 include additional probability exercises that test specific, more complex patterns being discussed in phases of design and ritual evolution. The first of these is a

possible partially designed, partially coincidental, meridian from Mount Wilson at the north end, extending south through one additional natural feature and five great kiva sites. The compound pattern creates some number of three-point alignments and cardinal two-point relationships which are modeled and tested against 100,000 equivalent sets of random points. Alternative ways of setting up test areas to better represent the clustering of great kivas in Chaco Canyon are included in the exercise. The second existing compound pattern compared with random phenomena consists of multiple axes of alignments emanating from the Sipapu “emergence” point (in a fan shape) at the confluence of the two Colorado Rivers in the Grand Canyon. One of these lines itself creates multiple three-point alignments among its five points, two natural and three defined by great kivas. A third exercise looks the incidence of three-point alignments among early great kiva sites on the eastern side of the plateau, asking how their involvement in the three ritual foci of the earliest and first formalization at Chaco compares to random phenomena. The final piece of probability testing compares two theories about the orientation of monumental walls of the great houses of Chaco and Aztec. One sees them pointing to horizon points where the solstice and equinox sun rises and sets, and the other, part of present work mainly in Chapter 7, together with examples elsewhere in this book, theorizes wall orientation as symbolic replications of important components of the surveyed large scale layout that located, or founded, these largest of great houses.

“Reading” the design analyses

It is not expected that even readers with backgrounds in professional design or planning will be initially drawn to the landscape patterns presented as an evolution of ritual design lasting about 700 years, climaxing in centers at Chaco and Aztec. While designers and planners are highly skilled in understanding and creating similar geometric complexity associated with the engineering and functional behavioral uses of form--and the precise description needed to construct--little in their background, whether from design history or modern practice, has included the kinds of formal frameworks that traditional cultures use to structure ritual practice. Thus even designers and planners are encouraged to spend time with the anthropologically described spatial patterns of Chapter 1, building up an aesthetic sensitivity of sorts for the kinds of formal logic found in successor Historical Pueblo and Navajo spatio-religious thinking. While composed of simple alignments, cardinal relationships, right angles, and bisects, what, *beyond*

still limited probability testing, distinguishes presently diagrammed existing patterns from geometries created totally by coincidence?

As the hypothetical landscape evolution proceeds, does one recognize repetition of key symbolic forms such as north-south *axis mundis*, and attempts to integrate intercardinal or cardinal cross axes—capturing the power of the corners as well as the verticals of the scheme, as it were? Do these cosmic patterns themselves materialize at several different spatial scales including the entire plateau, its two halves, the layout of Chaco and Aztec centers, and that of some great kivas and great houses? At the symbolic core of these patterns, can the reader imagine how religious specialists created their frameworks by understanding and incorporating the very highest and most prominent mountains of the Southern Colorado Plateau along with the even more unique confluence point in the Grand Canyon, especially when discovering coincidental geometry among them and astronomical rise/set observation points? How did these schemes organize and distribute spiritual power of the landscape to ceremonial great kivas across the plateau, including the eventual centers of Chaco and Aztec?

The severest critics of this kind of work argue that so much random geometry exists even in the presently limited number of Ancestral Pueblo sites and natural features, that it is easy and even dis-serving of academic discipline to pick out certain ones that seem to conform to an ethnographically based design logic. What will the reader think, in this regard, about the author's "choice" of the highest mountain in the center of the plateau as being religiously critical to the location of the two ultimate pilgrimage centers at Chaco and Aztec? How often do relationships like these—those of a high order of symbolic and social importance—occur among the presented patterns? Are the orders of natural features and ceremonial foci consistent and therefore cumulative in an evidentiary sense? Can the design/planning reader develop a persuasive holistic evaluation of the full range of possible intentional patterns?

At much smaller scales, designers will be especially good at judging whether the plan layout and building orientation of one site is intentionally reproduced at another some distance away, in part validating the design of the large scale pattern that connects them. The best example here, recognized as well by some non-designers, is the replication of layout pattern of the three major buildings of the Chaco center layout at Aztec. Many further commonalities of landscape scheme, particularly as sites integrate with distant places are described in Chapters 7 and 8. Other examples at some distance from the two centers are provided, e.g. the design plan

similarities of great houses at each end of north-south alignment at the middle of the plateau, or the replication of angles of one highly coincidental intersection point of three axes in the plan of a large great house on one of the axes some distance away.

One of the most complex and difficult patterns to evaluate, from all reader orientations, will be several hypothetical “X” points as intersections of large-scale axes; most have no built feature to mark them with the exception of the late centroid feature of the Aztec layout. On the plateau there exist two naturally or coincidentally occurring cross-like patterns, each of which has three large scale axes intersecting at common X points of about 20 and 300 meters respectively from their constituent lines. One includes a north-south *axis mundi*, while the other does not. While a very large Chacoan great house on the outskirts of the canyon is built about 600 meters from the most accurate of these natural phenomena, neither reveals any standing built feature on their common “X” point.

The hypothetical X points at Chaco and Aztec, two at each site, were also created by the intersection of two or more large scale lines to distant natural features. The religious intent appears to have been to search for the greatest coincidence possible in connecting cross axes with north-south meridians that had been previously chosen for their own naturally coincidental features. Maximum spiritual power flowed from all regions of the plateau, ultimately being distributed to the built receptacles of great kivas and great houses, not unlike electric substations receiving power from distant dams or plants. This hypothetical use of X points, from a surveying perspective, is not that dissimilar from countless numbers of “benchmarks” used in modern settings. These largely unnoticed little markers are essential in the creation of accurate, legally accountable locations for most of the built features that surround us.

In general our awareness of the underlying design and engineering behind contemporary man-made physical settings is quite limited. Any professional, who has gone through the process of beginning with some natural site with its unique features, then exploring the multitude of ways the setting might be used to satisfy a building program of some complexity, knows full well the amount of work required to arrive at a clean, highly functional solution. Design analysis, whether as a Post Occupancy Evaluation of a contemporary built setting or prehistoric ritual framework, is also complex. The author can only testify that as both professional architect/landscape architect and anthropologically oriented researcher, the geometric patterns of this book--as elegantly simple as many are--required a great deal of time and effort to reveal.

The first foray into Chaco and related phenomena occurred thirty years ago with a successful National Endowment for the Arts grant aimed immodestly at discovering the “origins of design in Anasazi architecture”. A careful read of all the details of the present accumulation of possible Ancestral Pueblo ritual patterns, including accuracy and orientation numbers, will likely be less interesting to most readers than was the long discovery process to the author. Nevertheless, probably the only way the reader can truly evaluate this design analysis work--and ideally an appreciation of the genius of Ancestral Pueblo designers themselves--is to “own” the detail.

A note to archaeologists

This work obviously depends heavily on the archaeological record. However, virtually no use of data within that field by others, with the exception of Steve Lekson (1999), presently seeks to prove or disprove the ability of Ancestral Pueblo people to survey at large scale. Furthermore, relatively little corresponding research works from a symbolic anthropological perspective of ritual design. Thus as yet, the present exercise is only marginally peripheral to mainstream archaeology. The author has made every effort to use extant archaeological literature as accurately as possible, even though having neither the background nor print space to rigorously engage the full record. This is particularly true of interpretations of more purely territorial and ecological uses of landscape that ultimately must be integrated.

Dating is apparently always difficult, even when archaeologists can spend the time and money to seriously dig; and comparing scores of sites across the entire region, from periods spanning 600-700 years is only a rare job for well-funded teams, ambitious PhD candidates, or wise oldsters from the field. More problematic still is the problem of dating the use of landscape features, X points, and other related purely geometric foci that have no yet discovered built form. Even when a datable structure comes into being, the date when the site was located, along with the possibility of some overbuilt small marker may well be difficult to determine. Archaeologically, the present idea of an evolution of plateau ritual design is obviously gross, at best, and will require huge verification from these and other anthropological experts. But what existing patterns reveal from a design perspective is a start. Thus the present work makes no claim to be archaeology, though extensive use of this literature may initially be misleading. At present it is difficult to see how a rigorous discourse on these topics could emerge from anything

other than interdisciplinary research, in which, nevertheless, the role of “outside the box” archaeology will be critical.

1. Toward an Evolutionary Theory of Formalized Large-Scale Ritual Frameworks in the Landscape

In the earliest and organizationally simplest of periods of the Ancestral Pueblo people, shamanism may well have linked dwelling ritual with web-like spiritual trails across the landscape. Timing contributions of astronomy could have been complementary. Yet the most powerful religious symbolism could have come from the landscape, astronomical phenomena included, rather than from dwellings or small village settings, *per se*. At some much later point in the evolution of Southwest social organization, as evidenced in historical ethnographies, somewhat smaller scale, more territorial landscapes are structured into cross-like ritual frameworks that exhibit formal symbolic domains, oppositions, thresholds, and orientations, characteristics found as well in special but modest architectural settings called kivas.

In between these two overly simplified evolutionary poles, occurred unique large-scale social organization on the Southern Colorado Plateau, climaxing with monumental pilgrimage centers and ceremonial architecture. During this period of perhaps a thousand years, did the larger landscape play a markedly diminished role in its religious effect? Was there a concomitant increase in the religious effect of large formal architecture and associated astronomical events? Or, can one develop an alternative theory of how a change in the use of landscape power itself—a process of religious formalization at large scales—preceded and made understandable the big architecture at the end? At its root, such a theory would have to include not only religious practices in both natural and architectural settings, but specific social mechanisms by which political and economic forces are organized. One can begin to trace this hypothetical evolution by taking a closer look at shamanistic use of the landscape.

Shamanistic use of web structures in the landscape

Much of the recent research into “landscape archaeology” has focused on relatively loosely organized, less sedentary, less populous societies. Leading the way, to a certain extent, has been work that identifies minimal, usually non-architectural traces of symbolic acts in natural landscapes occupied by Neolithic hunters and gathers in Europe (e.g. Bradley 2000, 2006), or much more recent Sami occupation of the arctic zone (Mulk & Bayliss-Smith 2006, 2007). Rock art,

quarry sites, unique natural features, associated astronomical phenomena all were religiously powerful at relatively large scales of landscape. In the Southwest, as well, early people at least up to the end of Basketmaker II periods (about 500 A.D.) also used similar material expression of religious meanings across their landscapes. Schaafsma (1994) makes a convincing case that rock images depict and were even created by shaman during the relatively long epochs leading up to the major changes in Ancestral Pueblo society during Basketmaker III / Pueblo periods. Southwest rock panels, e.g. figure 1, are among the most impressive rock art in all America. She cites anthropology widely, describing the shaman's role in making contact with spiritual power to effect curing, possible influence on hunting and gathering, and social conditions.

Most importantly, from our present perspective, is the obvious attachment of these records of shamanistic transformations to specific locations in the natural landscape, rather than being primarily associated with any archaeologically determined residential camp, hamlet or village. Yet in work by Schaafsma, for example, rock art locations are not particularly documented as to landscape location or context. This may not be primarily out of concern for possible vandalism (facilitated by publication) but due to assumptions that mapping is not an important research dimension in this case, either because the record is so incomplete

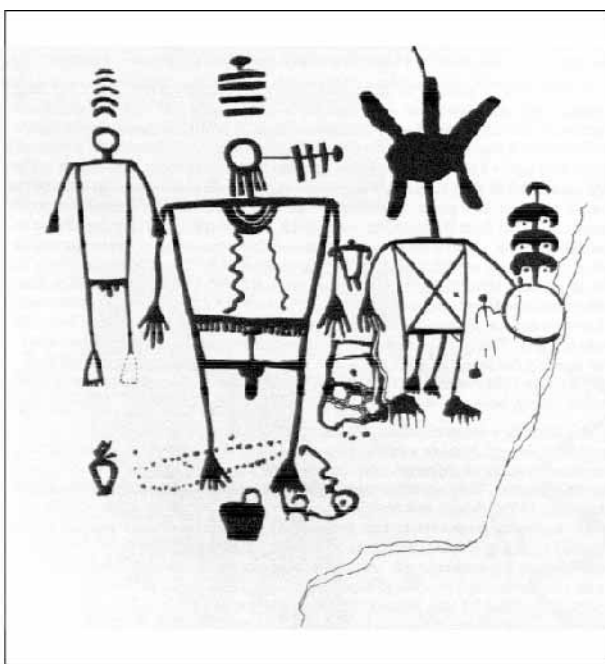


Figure 1. Butler Wash panel detail after Schaafsma 1994, pg 58.

or complicated or the potential additional knowledge of spatial patterns would be minimal.

Much better mapped are the sacred places Paiute Indians describe to applied ethnographers Stoffel and Zedeño (2002), who cite in their introduction Fowler's definition of Yuman and Numic power as residing in plants, animals and rocks (1992) and Miller's (1983) idea of religious landscape as "web", even spiderweb. Using GPS technology, Stoffel and Zedeño's data reveal "web" spatial characteristics of venerated features in Paiute landscapes (see example in figure 2). Webs are created by multiple nodes involving unique natural features, including water features and high points, caves, and storied rocks. Naming and actual symbolic acts,

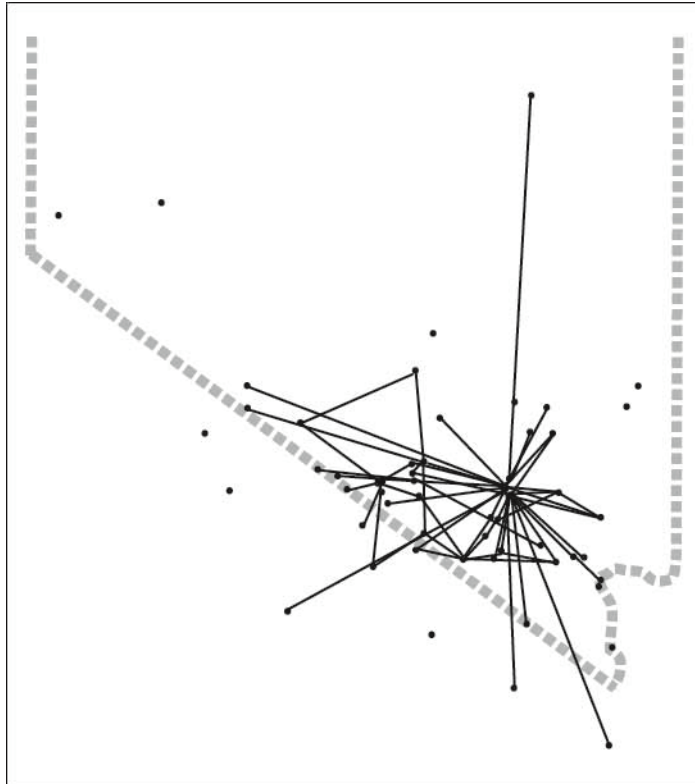


Figure 2. Numic and Yuman spiderweb of landscape features and connecting trails (Wellington Canyon Study, from Stoffel & Zedeno 2002, pg. 183).

often involving song, prayer and dreams at these sites generate religious meaning. The web can be mnemonic in both feature and locational aspects. To Stoffel and Zedeno, the trails of the web are themselves sacred in that the experience of traveling along one changes a person, usually restoring balance or health (202:181). Socially, “spatiotemporal linkages are obvious templates for future movements and for the maintenance of relationships” (ibid:187).

One could argue that to a large extent-- however powerful their symbolic places and acts are--that spider web patterns are not very good layouts for truly formal ritual. If one looks, for ex-

ample at a much smaller ritual layout in a wholly natural landscape, e.g. Turner’s (1968) classic diagram of Isoma, figure 3, several characteristics absent in spider webs can be identified (see larger discussion in Doxtater 1984). Most fundamental are clearly demarked *oppositional* spatial domains with usually axially oriented thresholds between them, essentially the three fundamental elements in ritual, a la Van Gennep (1960). While webs appear to contain a kind of Eliadian structure, as an opposition between sacred center and profane periphery (1959), webs would not be cognitively experienced in this manner. Thus the critique of writers like Smith (1972) who recognize that in more “primitive” societies the outside landscape will actually be the most sacred or most powerful. First of all, much less emphasis exists on any particular “center”, if the term can be used at all. Given the mobility of most shamanistic societies, some total Paiute landscape would look more like a semi-lattice—more continuous networks across larger areas-- than a static radial form (as urban design analogue see Christopher Alexander’s 1965 (2013 reprint) classic piece “The City is Not a Tree”). No clearly defined, relatively stat-

ic structures organize clear oppositions and thresholds so typical of the transformative work of formal ritual.

The Isoma layout of figure 3, does not exist as a permanent spatial layout in the landscape, even though water features and burrows are involved in the layout. Powerful symbolism becomes manifest in the way the designed spatial structure or “framework” organizes specific meanings of objects and animals used in the ritual. The Isoma setting and experiences create the transformation between humans and spirit power, eventually influencing or balancing disrupted kin relationships among the participants. By contrast, in shamanist societies ethnography such primary transformations perhaps do not occur out among the web and its nodes, but in the formally laid out dwelling, with its Isoma-like designed structure, operating on both horizontal and vertical planes. Turner does not talk about how the Ndembu dwelling does or does not participate

in rituals such as the Isoma. To a large extent, the Isoma layout can be seen as not atypical of shamanistic dwellings, yet exemplifies how ritual structure laid out in a natural landscape differs from web structure, even though at different scales.

Perhaps one of the most dramatic examples of how the primary shaman transformation takes place in the formally defined architectural setting occurs in the Yanomami, a slash and burn culture on the Upper Orinoco River in Venezuela. Here the larger landscape, spatially and religiously an extensive web of connections usually along waterways, provides the source of spiritual power at cultural scales not too dissimilar, perhaps, to those of the U.S. Southwest. The ethnography of shaman initiation by Jokic (2008), provides a highly detailed, graphic explanation of how symbolically the larger landscape, in both its object and less formal spatial expression, becomes reconfigured in the body of the initiate (Jokic himself was also initiated). Using the central pole of the village round house or its equivalent as the source of transformational power, specific parts of the landscape from mountaintops and forest are reintegrated into

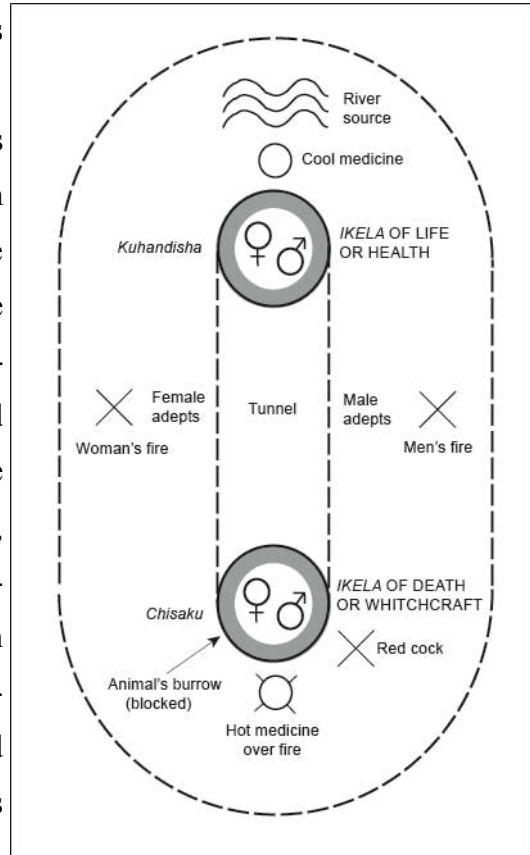


Figure 3. Spatial layout of Isoma ritual (Turner 1968:30).

specific parts of the novitiate shaman's body. Yet, in spite of the spatial structure of the more or less formally laid out human body, no formal Yanomami landscape framework or cosmos exists, nor is homologically laid out on the shaman during the ritual.

The typical anthropological conception of a more territorial, non-cosmic Yanomami space is as a concentric zone around each village. Actual GPS aided analysis of their path patterns, however, not only refutes these anthropological assumptions, but replaces it with the concept of "reticular space"...a "crisscrossing network of sites (points) and routes (lines)" (Albert and Le Tourneau 2007). While only roughly analogous to Alexander's mathematical semi-lattice, the actual maps of these networks look very much like the trails animals might take either along waterways, or cutting through forest areas; there is no sense of center or focus, even on particu-

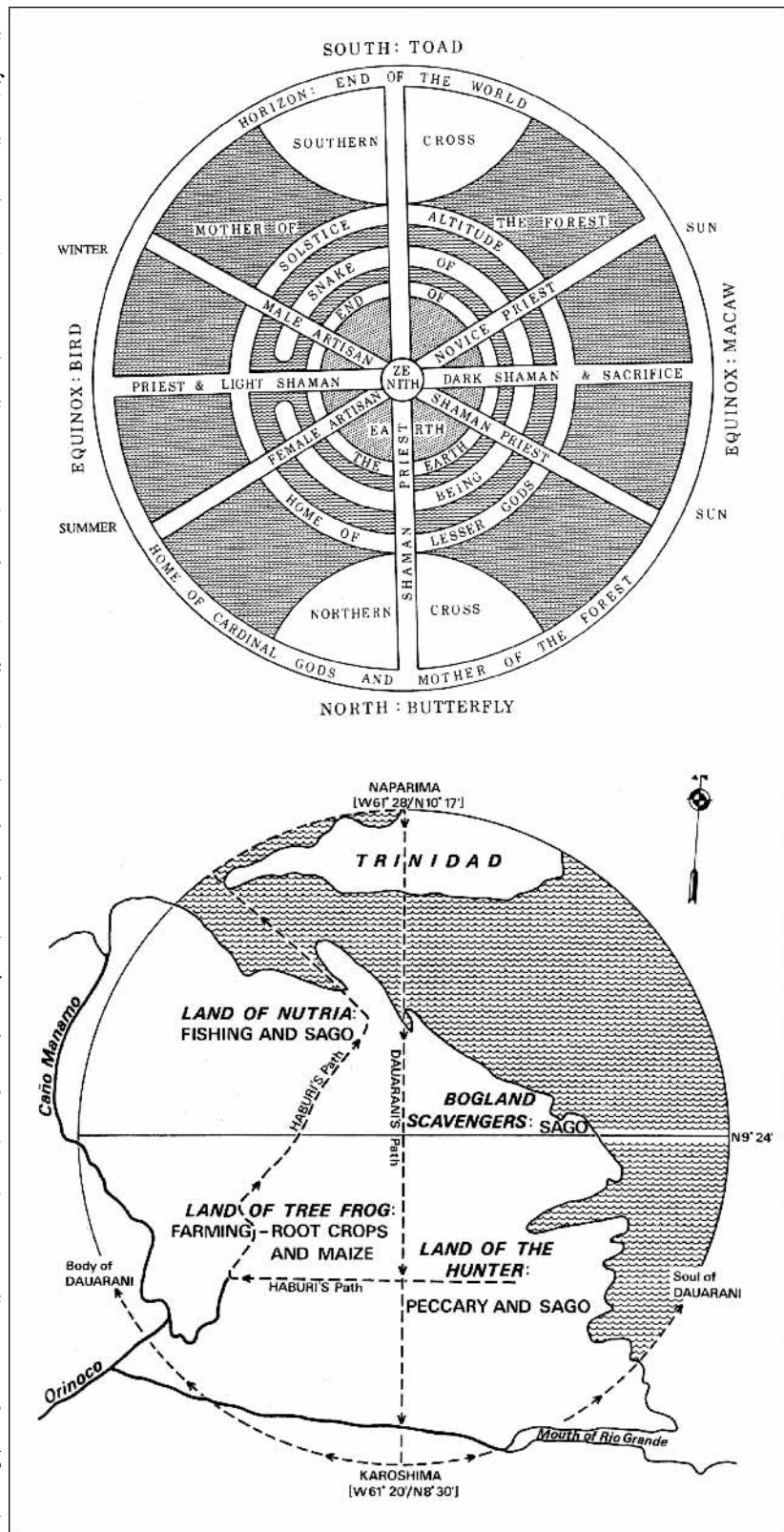


Figure 4. "Cosmic" structure of shamanistic Warao landscape (Wilbert, 1993, pg. 89 above, pg. 11 below)

lar villages. Again, no large scale formal or ritual structure is mentioned in a review of representative Yanomami ethnography.

Yet just downstream, in the Orinoco Delta proper, bands and sub-tribes of traditional Warao people with shamanistic religion not that different on the surface from the Yamomami, actually laid out a formal, 200 km wide, oppositional framework that defined their homeland, figure 4 (Wilbert 1993:13). The north and south points of the Warao world are marked by two “petrified world trees” in the form of mountains and abodes of two gods associated with these directions. These are actual topographical features, Naparima Hill on Trinidad Island to the north and 212 kilometers to the south, Cerro Caroshimo (Wilbert 1993:11). These two points deviate only about nine arc minutes of longitude of being an exact meridian. Wilbert mentions the possibility of laying out such a long line in relatively flat jungle terrain--the two “mountains” are only 192 and 150 meters in elevation--by using astronomical references. The east and west points on the Warao landscape cross are determined by the sun. Solstice points are additionally important in their origin myth. Both cardinal and intercardinal gods inhabit their cosmic frame (ibid:23).

Describing the related Yekuana subgroup in the Alto Orinoco, Barandiaran (1979) speaks of supports for the heavens and the location of the world tree (Yuca Amraga) on the mountain Cerro Kushamakari (912). They understand a mandala-like structure with a vertical axis linked to the Milky Way. This vertical axis of sacred mountain, cosmic pillar and sacred tree functions to connect the Yekuana shaman to spirit power, either relaying messages on the axis, transporting souls or curing health problems associated with the earth (947).

Wilbert as well describes similar sources of landscape power which now involves more formally defined applied or even “designed” spatial frameworks. There are three gods of the *axis mundi* who direct the movement of spirits and souls to and from earth (1993:91); “from an early age the individual Warao remains engaged in a relentless tug-of-war- between himself and the supernaturals...the gods need humans to provide them with food, and the humans need gods to protect their lives and their goods” (ibid:93). Three different kinds of shamans serving different gods of the directions facilitate these processes. The shamans go to their associated direction when they die. Some go to a beautiful city on the top of the mountain at the center of the world (axis) (ibid: 95), which can be interpreted as either the vertical

position of center (Cerro Kushamakari) or the horizontal position of north mountain as zenith of the axis (Naparima Hill). Wilbert suggests the Warao cosmos is strongly “reminiscent” of Aztec and Mayan concepts (ibid 109).

While there exists a geographically real cross structure that defines the Warao world, much of the anthropological sense of its meaning comes second hand, as it were, from myth. In one such example, the “celestial bird could be observed carrying out its mandate to fly at midnight and during the day to the meridian, shake his beautiful wing and sign for the protection of the children on earth” (Wilbert 1993:109). Wilbert, however, knows of no actual ritual practice or pilgrimage that involves the important points on the cosmic structure (personal communication). He has only observed the approximate point where the axes meet from the air, and did not see any obvious ritual elaboration of the location such as permanent shrines or temples. Mythically there should be a sacred tree at this location. Wilbert did mention a vague association of the ancestors of different subgroups with different directions of their cosmos. But any kind of large-scale ritual framework that might have integrated subgroups is unknown. He does mention the more localized ritual congregation of bands, or subtribes, at a clearing in the forest (with no described location relative to their larger cosmos). A simply constructed shrine was built on the eastern side of the clearing and a single row of houses opposite to the west (1993: 101). The patron god of the subtribe is represented in this plaza as a sacred rock. This pattern appears to mirror Gossen’s model of space in the Chamula (1972), and is not atypical in many Mayan ceremonial sites.

While largest scale formalized ritual in the Warao is relatively unknown, both Wilbert and Barandarian give ample space in their volumes to *both* the structure of landscape (figure 5) and related ritual practices at the scale of the domestic roundhouse, where shaman curing and other sacred acts find their focus (Barandarian 1979:948). Perhaps the most impressive thing about spatial structure and ritual in the Warao, particularly in Wilbert, is the emotive intensity or affective power of these devices for making contact with the spirits. Wilbert’s description and interpretation of the Bahana myth and ritual is particularly instructive here. Figure 5 illustrates the concept of a cosmic egg and a competitive coexistence of birds and bees who invade each other houses and cannibalize one another’s offspring (1993:163). This egg and its cosmic axis exist as an attribute of roundhouse symbolism, in-

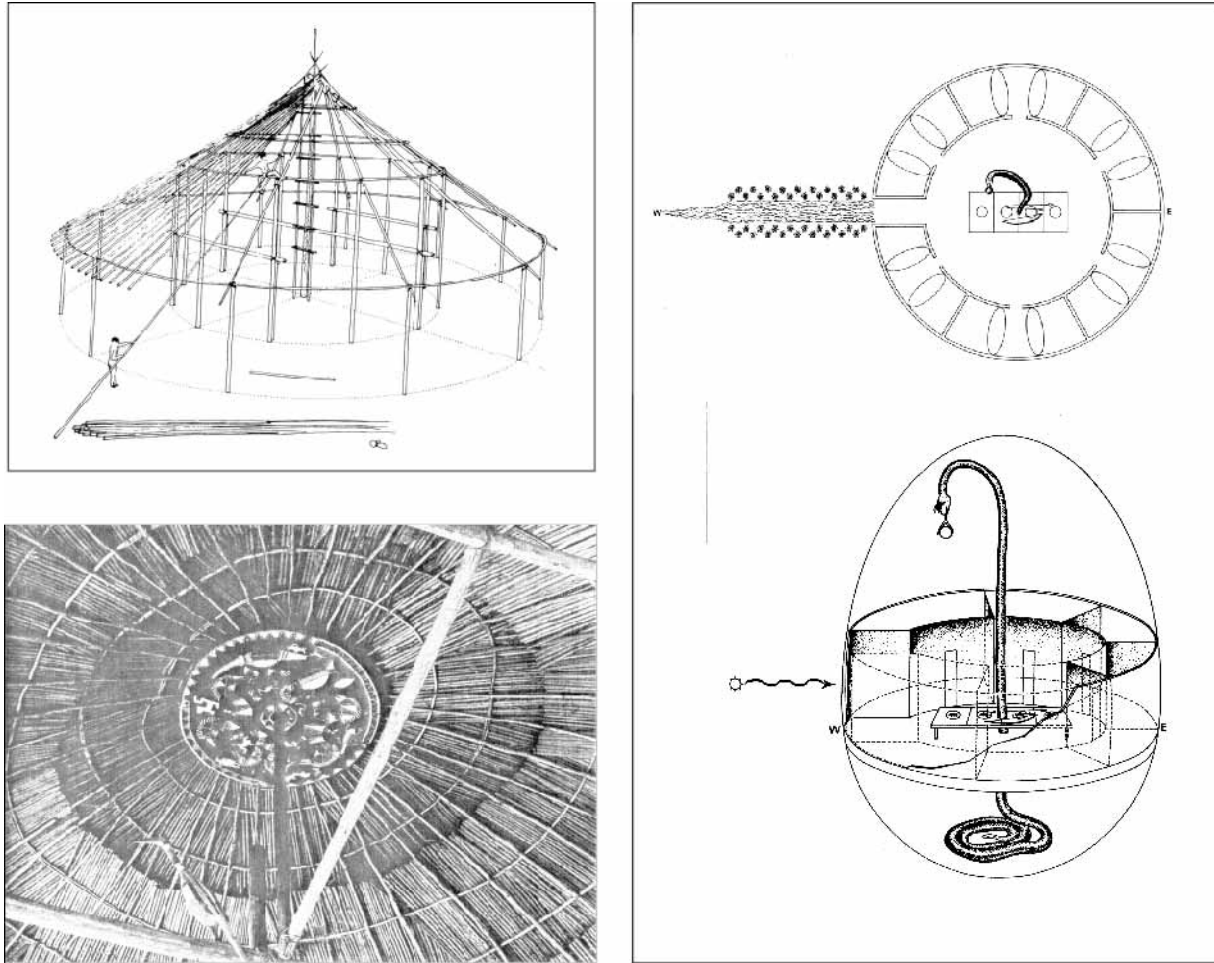


Figure 5. Symbolic structure of the Warao roundhouse (Wilbert 1993; upper left pg.188, lower left pg.199, right pg. 160, 161)

cluding much symbolism of body and sexual union. The world axis, in the function of Bahana, is a bundle of conduits or a dynamic pathway that leads to the anchor point of the rope-bridge conducting Bahana shamans from the top of the sky to the house of tobacco smoke (Wilbert 1993:166). Socially, Bahana imagery signifies the cooperative-competitive tensions of sexuality and related cultural behavior (ibid 171).

In addition to the roundhouse's formal symbolic spatial layout, Wilbert also describes architectural features in the roof that open to the heavens and all allow the sun and other elements of the sky to time their ceremonies, specifically at solstice and equinox (1993:194). In summing up his volume, Wilbert restates the homology of "body-house-cosmos" that connects all scales of space and symbolism to each other. Mythically, the god at Kushamakari Mountain built the first communal roundhouse. The actual roundhouse is modeled after the celestial

sphere as expressed in both myth and actual landscape frame (1993:194).

Clearly, the Warao belong to the category of societies whose religion is based on the transformational power of shaman. Yet unlike what might be a majority of these societies the Warao have for some reason actually surveyed, or formalized, at least some aspects of a large scale frame, raising questions about relationships to cosmic structure in their dwellings and myth. Why, they, unlike the Yanomami, do this is theoretically undefined. Heinen (2003) compares the two groups using the adjectives of “fierce” (Yanomami) and “peaceful” (Warao). The Yanomami have a male supremacy complex, while the Warao maintain much more of an equilibrium between the sexes. Warfare and witchcraft are more prominent among the Yanomami, while the Warao are easygoing and cooperative, having no fear of talking openly about their spirit ancestors. Are these differences in any way related to presence of a more formally defined large-scale landscape of the Warao that somehow moderated heterogeneous bands and sub-tribes with significant dialects and ecological niche histories?

In the U.S. Southwest, the Navajo provide a second apparent hybrid between shamanistic and partially formalized landscapes. Ecologically, their extended kinship residential groups, involved in making an agricultural and hunting living off marginal lands, might have been somewhat similar to late Basketmaker II Pueblo societies. In terms of religion, Lamphere’s overview of Southwestern ceremonialism among all the Native American groups of the southwest (1983:743) begins with shamanistic groups like the Yumans, then Apaches, and then places the Navajos just prior to the Pueblos. Compared to the Yumans and Apaches, “ritual reciprocity (or prestation), and the concomitant themes of removal and sanctification (or identification) become elaborated in the context of Navajo ceremonialism, where cosmology and structure of rituals are more formalized and where the symbolism of song, ritual objects, and actions becomes more apparent” (ibid:749). She continues to define how ritual power is acquired more through apprenticeship than vision experience as in Yumans and Apaches. The Navajo cosmos has more structure, both vertically and horizontally, and involves emergence not unlike Pueblo ceremonialism. “Navajo ritual seems to replicate the cosmos more clearly, and color, sex, and directional symbolism is more fully utilized. Navajo ritual includes more agricultural symbolism as well.” (ibid:753)

What most differentiates the Historical Pueblos from the Navajo, in Lamphere’s overview, are variations of the idea of two parallel worlds, one supernatural and the other social. It

is taken further in the Pueblos where the supernatural is divided into classes to mirror the social world. Moreover, death among the Historical Pueblos changes humans into ancestors who become supernaturals, compared with Navajo beliefs that death creates malevolent, sickness-producing ghosts (Lamphere 1983 :754). Generally, compared to the Navajo model of the universe, Pueblo cosmologies are more extensively structured (ibid:755).

Witherspoon (1983:525) defines two basic social relationships among the Navajo. One consists of those with whom one is related, or a kinship solidarity, and the other is with those unrelated, or non-kinship solidarity. Bonds created by kinship tend to be expressed in “affection, care, kindness, and unsystematic sharing” (ibid :525). Relationships between non-kin groups are more systematic and fundamentally reciprocal. More recently, an extended family group resided in proximity to each other, and all participated in the group’s herd of sheep. A “head mother” determines residence rights. Prior to the introduction of sheep, such groups would have been dependent upon some agriculture and hunting, not unlike Ancestral Pueblo ecology (ibid: 525). In sum, while reciprocity existed between these extended kinship residential groups, there was no clearly defined larger scale group (Witherspoon 1983:531).

How then, more specifically, does the creation and maintenance of Navajo social patterns rely affectively upon the appropriation of a religious landscape? Where do the principal spirits reside, and how then do ritual sites and practices make connection to the spirits and thus provide power to influence? Aldred makes the argument that Navajo land and religion are one (2000:23). The primary spiritual deities are the Holy People. They in turn created “Diyinni” or spiritual beings that possess the entire landscape, including animals, plants, weather elements, and celestial bodies. Beyond this shamanistic relationship, emphasis exists for the four mountains that create their basic cosmos as well as some point of emergence known to every Navajo (ibid: 25). For a comprehensive list of major landscape features see McPherson (1992: 15). Kelly and Francis mention the way the larger landscape framework is repeated (homologically) with structured features at progressively smaller scales of landscape and social groups, though no clear map of such a possibility is provided by these authors (1994:197). They do mention however, as will be mapped later in this volume, the folk record of an apparently survey straight “sunray” running at very large scale west to east across the plateau (2005).

There appears to be little highly structured ritual use particularly of the most prominent mountains of their landscape as cosmos, as was true of the Warao as well. What we have instead, are less structured uses developed and maintained by individual shaman and integrated with myth. Such association can be seen in myths about Changing Woman, one of their most revered deity.

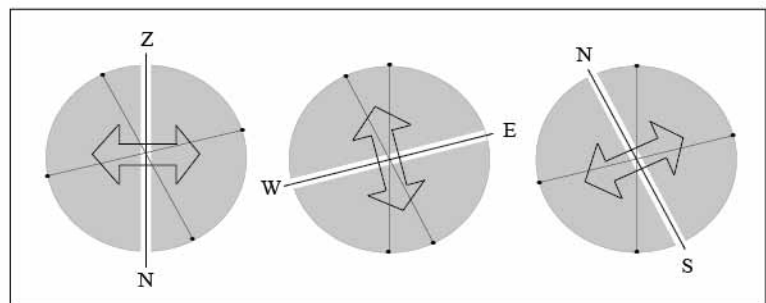
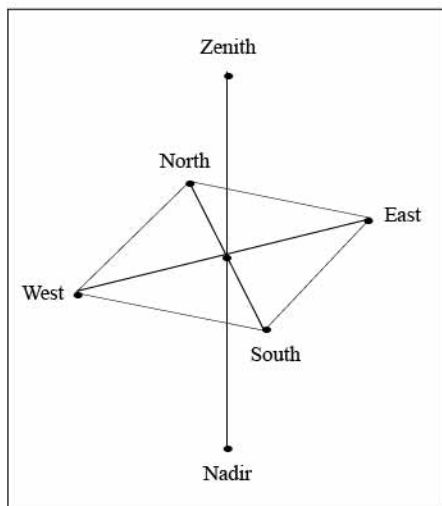
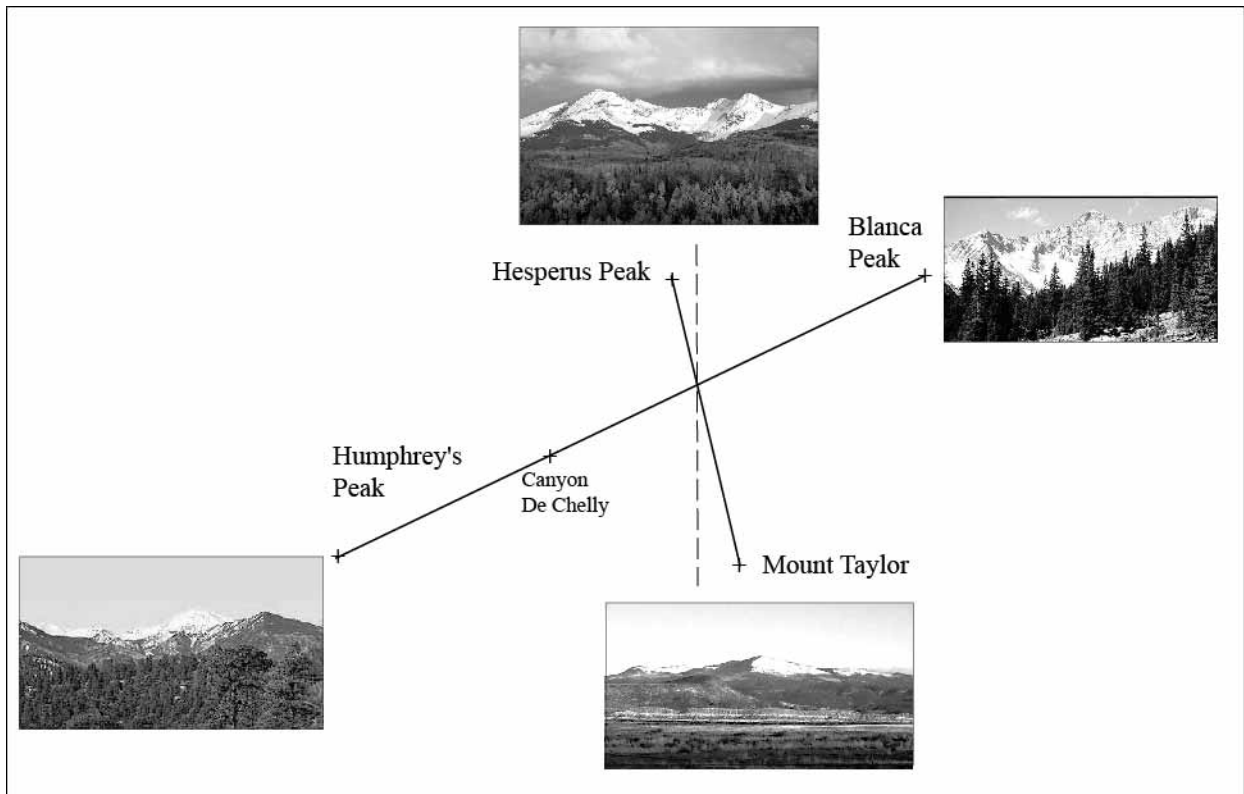


Figure 6. Oppositional structures of the Navajo cosmos (Witherspoon & Peterson 1995:34)

“Many geographical formations in their homelands are conceptualized as organs of Changing Woman’s body. For example, the sacred mountain of the south in Navajoland can be translated as ‘Tongue Mountain’, whereas the sacred mountain of the north is considered the heart of the earth’s form. Between these two lie the earth’s lungs and breathing diaphragm. Changing Woman is often described as the mother who gave birth to the Navajo and as the nurturer of all beings.” (Aldred 2000:23).

A detailed list of features of the natural landscape held by the Navajo to be sacred--including clay sources for pottery, springs, air vents, waterfalls, dinosaur remains, and eagle nests--can also be found in Kelly and Francis (1994:81).

Again, as landscape meaning somewhat more formalized than the shamanistic “web”, Witherspoon and Peterson associate important cognitive and cultural attributes--motifs on rugs, sandpaintings, masks, clothing, staffs, hair buns, or rock walls--to the spatial frame of their large-scale horizontal and vertical directions anchored at four distant mountains. This integrates with a mythology of emergence through four underworlds or previous stages of existence (1995:34). Their diagrams of figure 6 are held to be a kind of cognitive core of Navajo thought and religion. Notably, the diagram structures opposed symbolic domains; the two ends of any one axis are “bipolar”, while spatial oppositions between halves of the cosmos created by the “vertical” or central axis are “bilateral” (ibid 38).

The Navajo dwelling, architecturally not that dissimilar to Ancestral Pueblo pit houses and kivas, seems both shamanistic and specifically linked to larger scale frameworks on the landscape, not unlike the Warao roundhouse. The formal spatial structure, orientation, and meanings of symbolic oppositions as domains of the *hogan* are clearly evident in the diagrams of figure 7. The most important ritual performed in the *hogan* and in immediately adjacent dance circles outside is the Blessingway rite, given historical precedence over other ceremonials, and the “backbone” of Navajo religion (Wyman 1983:540). Changing Woman is a primary focus of the Blessingway. Apparently no aspect of the Blessingway rite involves the actual movement of participants out into the more distant sacred natural landscape, yet not unlike the Warao and Yamomami, objects used in the ritual come from the summits of sacred mountains, e.g. the mountain soil bundle containing buckskin packages of soil and certain stone objects (ibid 540).

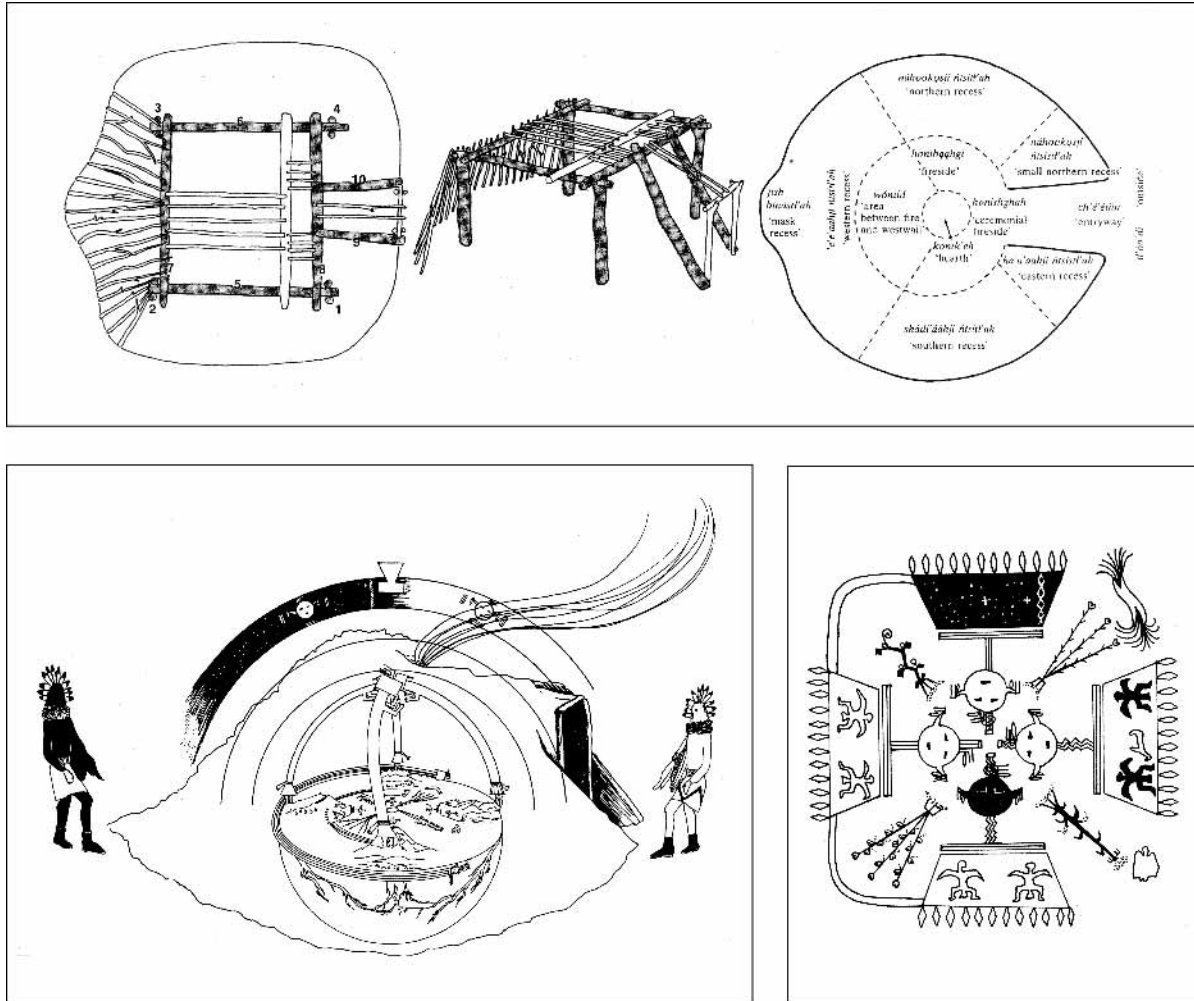


Figure 7. Symbolic meanings of the Navajo Hogan (Witherspoon 1983:532 above; Griffen-Pierce 1992: 93, 111).

The Blessingway rite, like other ceremonials, are conducted by “singers”, religious specialists who apprentice with and pay a teacher. The songs for each rite are so extensive, hundreds in number, such that together with other knowledge about prayers, plant medicines, material properties, symbolic drypaintings, and ritual acts, a singer’s specialization is limited to at most a half-dozen complete chants (rites) (Wyman 1983: 538). Blessingway, according to Wyman, is not a curing ceremony unlike almost all the other shamanistic Navajo rites, even though it as well has its “patient” as a focus. The distinctive ritual purpose of this Changing Woman ceremony, from the others (Enemyway, Ghostway, etc), remains unclear (ibid:541-542). Is it somehow more structural in its reference to landscape frameworks, even though these are not actually used in the ceremony.

There is frequent invocation of the power of the four (or five counting a vertical) direc-

tions, in addition to the basic framework of the *hogan* with its opening to the east from whence comes good, and a smoke hole in the center of the roof to get rid of evil. During these and Holyway chants, all people or objects move “sunwise”, from left to right or from east to south (ibid: 550). A bull-roarer is whirled outside the *hogan* associated with each of the cardinal points. After the ceremony, things that have been used need to be disposed of by helpers in stated directions away from the *hogan*. Ceremonies are opened with a consecration of the structure; the singer rubs cornmeal on four beams of the roof in the cardinal directions. Just after dawn on the first morning a fire is made with a fire drill. Four small sandpaintings, usually of snakes, might be located at the cardinal directions around the central fireplace. (ibid 551).

Certainly the most graphic fusion of landscape as cosmos, *hogan* and ritual process appears in the dry sandpainting on the *hogan* floor during ritual, see figure 7. It is destroyed after the ceremony. Wyman reports that all Holyway chants, most Evilway chants and the Blessingway ceremonies involved dry sandpainting (552). He goes on to describe their structure:

“Place is important to a Navajo; and a locality symbol--the center in radial compositions, the foundation bar in linear ones--is conspicuous. The main theme symbols are arranged according to one of three types of composition: linear, with figures in a row or rows; radial, with important symbols cardinally oriented in a Greek cross and with subsidiary symbols in the quadrants in a Saint Andrew’s cross, around a center symbolizing the spring, pool, mountain or dwelling where the commemorated episode took place; and extended center, with a central motif occupying most of the space. Sequences of color have directional sexual or other ritual meanings. Finally the entire picture is surrounded by an encircling guardian, usually the red and blue Rainbow deity or garland, open to the east for the entrance of good and the expulsion of evil. Sometimes a pair of small symbols enhances control of this eastern aperture.” (Wyman 1983: 552).

Finally, to what degree do highly spatially structured ceremonies, focused on individual problems such as “illness, bad dreams, recollection of violated restrictions, fear of witchcraft, or other reasons” (Wyman 1983: 555), involve effects that influence the social well-being of the extended kinship residential group, or other groups in reciprocal relationships? Nothing is said in Wyman’s overview about rites of passage.

Apparently passage rites such as birth, marriage and death involve far less ceremony than chants, which is somewhat surprising given the kinship basis of the important residential group. The wedding does however, take place again in the sacred *hogan*, though among a

small number of guests. Ritual movements involve much reference to the sacred directions:

“The groom enters the *hogan* and walks sunwise around the fire to a seat on the northwest side. The girl is led by her father to a place next to the groom. The father takes a new basket filled with corn mush and points the opening in the design to the east. He makes a cross and a circle in corn pollen upon the surface of the basket and turns the design opening toward the young people. the two then wash each other’s hands in water. The man takes a pinch of mush from where the pollen touches the circle to the east, then bits from the south, west, and north sides. The girl follows him in each of these acts. In some localities the couple is expected to consume all the mush. Usually, however, after prayers and sometimes songs the assembled relatives and friends eat the rest of the mush. The two fathers deliver little sermons on the reciprocal duties of husband and wife, how they should get along together, and the like. The gathering does not break up until Blessingway songs have been sung at dawn.” (Leighton & Kluckhohn 1948:81)

After a Navajo dies, two of four people who have been with him or her until the end prepare a grave while the other two ready the body for burial (Reichard 1928:141-143). Burial takes place the next day with only the mentioned four people participating:

“One of the mourners leads the horse[loaded with the possessions of the deceased] deliberately toward the grave. He is followed by the two bearing the corpse on their shoulders. A fourth mourner warns travelers that they may change their route.” (ibid:142). At the grave, only the body is arranged and covered with brush or stones to keep the animals away. Reichard mentions that tools used by the deceased are burned or mutilated, and the horse is shot before the mourners return home. During the following four days the mourners remain quiet and leave the *hogan* only when absolutely necessary and then accompanied by the head mourner. A guard keeps the trail between the *hogan* and the grave open by signaling to passers-by. Early on the morning of the day following the fourth night the mourners bathe again. After the entire family has also bathed there is a short period of ceremonial wailing and the mourning time is past.” (ibid:143).

While it is tempting to read some directional opposition into the axis between *hogan* and grave, as might be part of some aspect of landscape structure, Reichard provides no maps of such. Some sort of opposition must exist, however, between the power of the *hogan* (as “life” perhaps), and a place associated with nature (“death”?).

A much more dramatic expression between death and the *hogan* is provided by Griffin-

Pierce (1992:121). When the central fireplace of a *hogan* is abandoned because a young person has died there, a relative has the following options: burn the *hogan* with the body inside, create an opening on the north side to allow removal of the corpse, or block the door and smoke hole with timbers to show that it now contains a burial. Navajos will not approach such a *hogan* for fear of witchcraft (ibid).

Where, then, does one place the Navajo on a spectrum from shamanistic use of the landscape to some hypothetically complex highly formalized ritual use of large scale frames? On the one hand, it is maintained that all the Navajo landscape is sacred and perhaps web-like, even though we don't have Stoffel & Zedeno mapping to document active shamanistic use. Yet one also finds the anthropological assertion that the large-scale cosmic framework thoroughly infuses religious cognitions along multiple symbolic dimensions, especially in the intensively used homologically structured *hogan*. Yet there is little formalized ritual or related architecture in the landscape, and certainly no large scale pilgrimage foci that we see in climax Chaco/Aztec, and possibly earlier in the Ancestral Pueblo.

Ritually used cross frameworks on the larger landscape

Shamanistic landscapes--either as "webs" or more formally structured cross-like "cosmos" with minimal related large scale ritual practice-- may have predominated among the Ancestral Pueblo up to about 500 A.D. on the Southern Colorado Plateau. Curiously enough, there is something of a void of landscape theory in studies of new organizational forms involving villages and larger ceremonial structures that follow. One needs to fast forward a thousand years to the Historic Pueblo period, before finding again anthropological ideas and evidence of religious use of larger scale landscapes.

Alfonso Ortiz' (1969) anthropological description of space in the Tewa world provides perhaps the most detailed example of a series of sites in the landscape being linked together by cross-like alignments to a focus (pueblo). For the Tewa, two cardinal axes with six landscape sites each, integrated a flow of spiritual power from the farthest mountain points, intermediate hilltops, and springs to the sacred center opening in the San Juan pueblo, figure 8. Radiating out from the center, each scale of axially positioned landscape site associated with stages of social and religious "becoming" in Tewa society. All sites in the system involve ritual *sipapu* or

openings between the plane of the earth and the above and below. This spatial, geometric concept in the landscape served as a primary "framework", in Ortiz' terms, for expressive thought and practices. Most importantly, thinking about an evolution of the active use of the landscape by shamans, one recognizes a comparable but perhaps more collectively experienced movement out along the contact points of the formalized ritual trails of Tewa framework.

These openings to the underworld are ritual thresholds. Ancestral spirits living beneath the natural sites become progressively more powerful the more distant they are from the pueblo. Moiety groups associated with "summer" and "winter" domains crosscut membership in groups linked to the three levels of spirit sites out in the landscape. Ortiz describes the meanings of "navel" organized by the symbolic structure of the landscape:

"It (village plaza) represents the 'earth mother navel middle place'. This is the sacred center of the village. Ritual dances and other performances must continue to be initiated here...this is the center of centers, or navel of navels....Whereas the earth navels on mountain tops are formed by a close arrangement of stones shaped like and open-ended keyhole, the mother earth navel consists of a loose arrangement of stones forming a circle...Whereas the mountain earth navels are opened in only one direction, the mother earth navel is open to all four directions....But while the mother earth navel is a sacred center like the others, it is also a condensation of the others...The mountain earth navels gather in blessings from all around and direct them inward toward the village; the mother earth navel is the source of all these blessings, so they are directed outward in all directions...By the system of ideas at work here, everything good and desirable stays within the Tewa world" (1969:21).

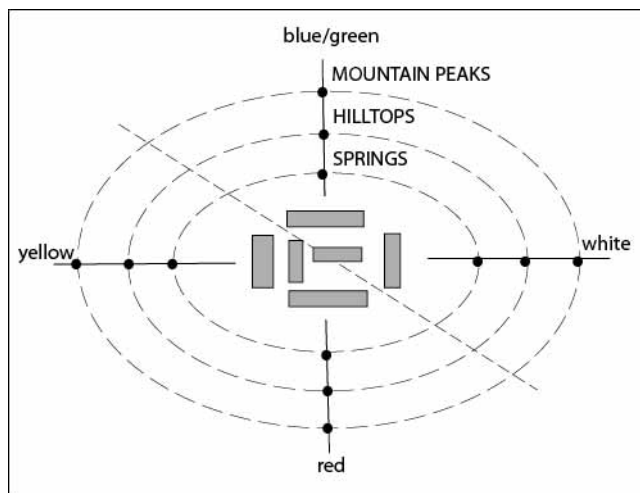


Figure 8. Formally graphic diagram of quartets of natural ritual foci in the Tewa landscape--not laid out via accurate surveying (Ortiz 1969:??).

Ortiz clearly recognizes the Tewa spiritual flow along axial lines and through openings linking the above and the below. Differences between a myth-based Eliadian notion of center where the sacred architectural temple effects dominance over some other, profane peripheral location did not escape Ortiz's notice (see again Smith's 1972 paper). In spite of his methodological dependence on origin myths in determining spatial layout, like Eliade, he reconciles the Tewa pattern as a "balance" between the superiority of gods in

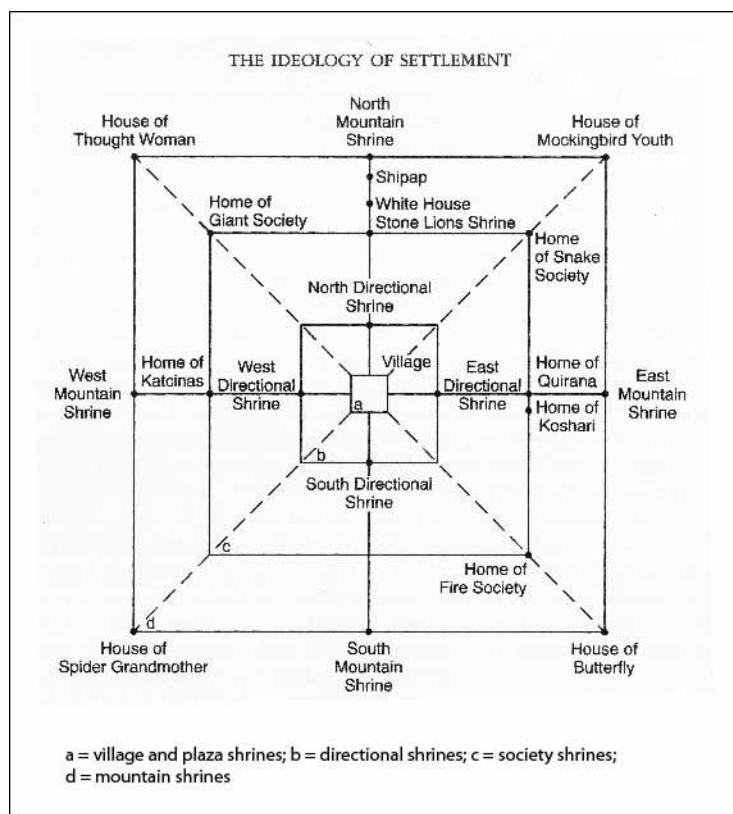


Figure 9. Graphically formal diagram of “Local cosmology” of the Keres Pueblos -- not laid out via accurate surveying (Snead & Preucel 1999:177).

natural places and the powerful ritual effect of the central *sipapu*, only minimally defined by architecture.

Whereas Ortiz was comfortable thinking of the Tewa framework as derived from origin myth, theoretically this may not necessarily be so. If there turns out to be some sort of continuity between shamanistic landscape experience and these kinds of frameworks, then formalization might well have evolved more directly from ritual practices themselves. Had there been some sort of larger-scale formalized frameworks--well beyond a shamanistic cosmos' like the Warao or Navajo--during the interim before

historical landscapes? And did later “reemergent” societies like the Tewa have a greater tendency to mythologically infuse their smaller but nonetheless highly formalized landscape ritual?

Moving south of the Tewa in the Rio Grande area, Snead and Preucel (1999) outline what they call a “local cosmology” designed and laid out by the Keres Pueblos (figure 9), one not unlike that described by Ortiz,. While Ortiz focused primarily on the mother village of San Juan, Snead and Preucel’s examination of more than one village revealed generally similar structures of axes out in the landscape, albeit with some variation. Since Pueblo tribes have each tended to be composed of multiple pueblos or villages, with one or more mother villages, the question arises whether each needed to create its own local cosmos of different landscape features. Snead and Preucel’s “ideological” landscapes suggest as much, though their ethnographic data in this regard was limited. Did pueblos of the same cultural and linguistic group not share any of the landscape elements, not even the four or six principal mountains? Did pueblos of the same tribal group have overlapping or largely independent landscape frame-

works for their ritual?

Examining the period just prior to the historical pueblos, Fowles (2009) found archaeological evidence of a similar landscape structure adjacent to a 14th century aggregated Northern Tiwa village in the same geographical region, figure 10. The positioning of shrines north and south of each other at the edge of the pueblo, however, is at a much smaller scale than frameworks described by Ortiz or Sneed and Preucel. Fowles speaks of a “pervasive dualism” in the layout of his “villagescape”. Significantly, his prehistoric time period of interest comes just after the breakup of the large-scale organization during which the Ancestral Pueblo people for the most part didn’t live permanently in

ceremonial foci with great houses and great kivas, but in surrounding so-called “small sites”. The unusual period of aggregated domestic pueblo living that followed, as Fowles points out, has generally been felt by archeologists to have included less religious use of landscape compared to a new focus on more hermetic plaza ceremony within seemingly independent pueblos. It is not clear from Fowles work how far the ritual framework around his pueblo site extended out into the larger landscape.

Again in terms of Historical Pueblos, some years ago as part of a seminar with Roy Rappaport on ritual, the author as graduate student sought to find a possible landscape ritual frame at the heart of the Hopi ceremonial system at First Mesa or Walpi (Doxtater 1978). This interest was fueled by Ortiz’s work with the Tewa a few years earlier. Certain Hopi clans can be associated with each of the major rituals of the calendar year. By comparing directional color and fetish symbolism of clans with the major symbols of the six yearly rituals, religious groups and their rituals can hypothetically be associated with particular directions of a clock like

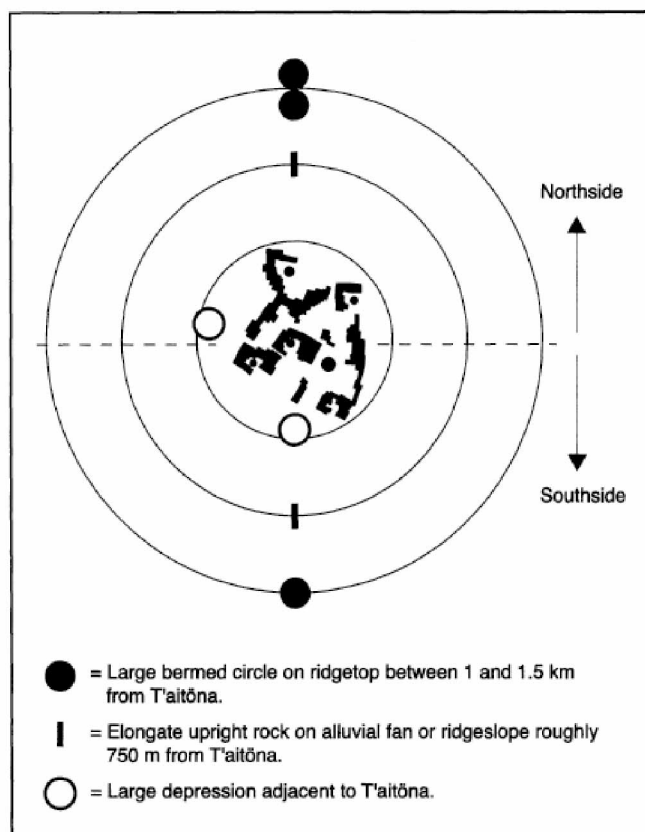


Figure 10. Dualistically structured “villagescape” around 14th century Rio Grande pueblo (Fowles 2009).

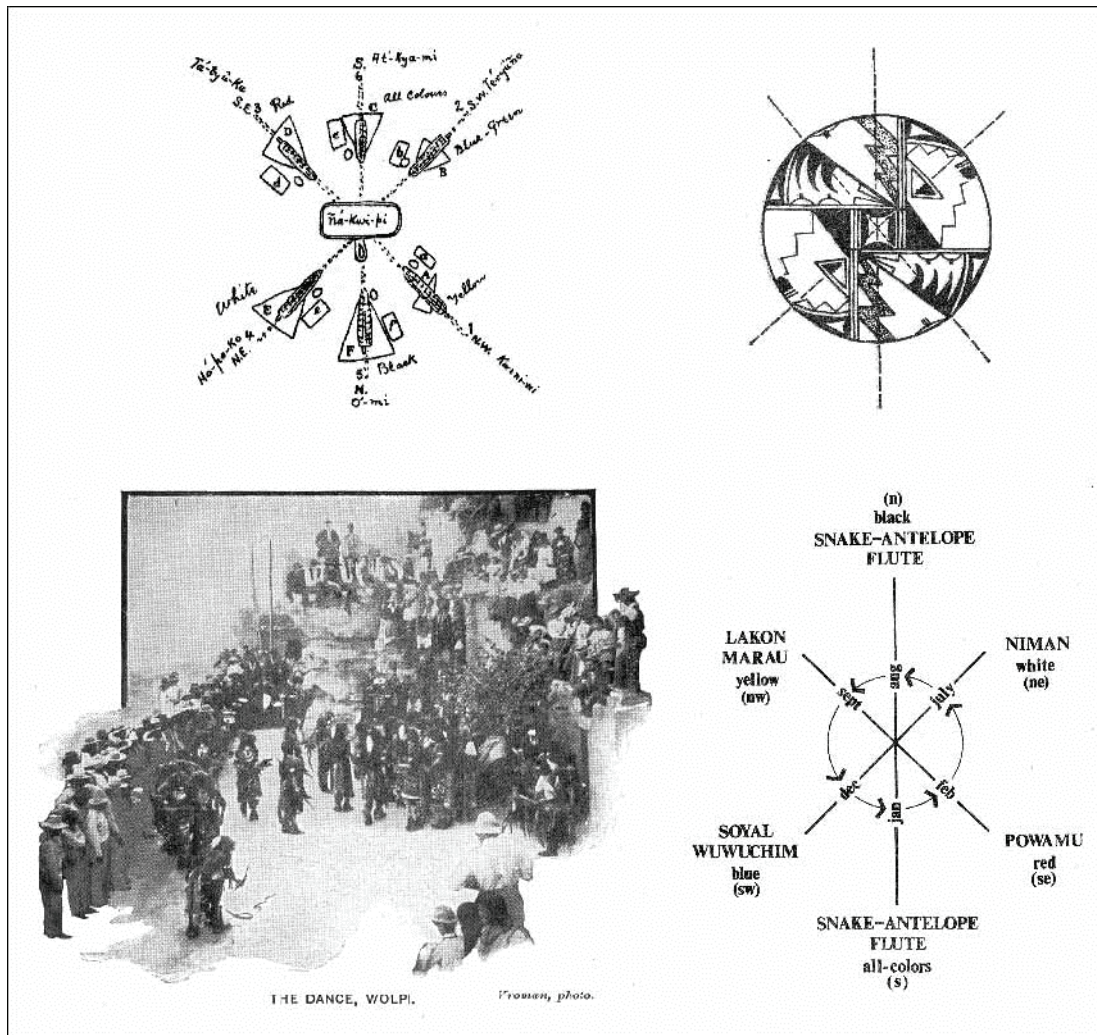


Figure 11. Triaxial ritual structure of Hopi landscape and ceremonial cycle (from Doxtater 1978)

framework, figure 11. This association between spatial structure and social group, present in the Tewa, Keres and Zuni, remains to be fully established in the Hopi in spite of much ethnographic investigation of this Pueblo tribe. Part of this missing discourse is the contrast between kin and sodality (specialized religious group) control of rituals as related to possible landscape frameworks like in the Tewa.

While Stephen (1936) copiously described Hopi journeys out into the landscape to deposit prayer feathers as part of major ritual ceremony, little is ethnographically mapped. The exception here are accounts of the Hopi salt pilgrimage to the place of emergence an all-important *sipapu* in the Grand Canyon. Ethnographically, all Pueblo cultures own elaborate emergence myths which are also expressed horizontally in ritual pilgrimages (again begging the

question of whether ritual or myth is most primary). At the Hopi pueblo Oraibi, for example, Geertz (1984) creates comparative taxonomies of multiple versions, most of which contain clear spatial symbolism of an opposition between some emergence from below to above (horizontal movement on the landscape in terms of actual ritual). Hieb (1994) dedicates his piece more broadly to the concept of “sipapu”, examining the active ritual use of these openings in the ground that are traditionally built in semi-subterranean Hopi ceremonial kivas. As diagrammed in Saile (1977), these liminal openings are also part of Ortiz’s Tewa radiating system of landscape features. In the same religious vein, on the top of Mount Taylor, one of the highest mountains of the southeast portion of the Ancestral Pueblo area, Blake (1999) describes a six-foot deep hole, presumed to have been dug by indigenous people for *sipapu* related ritual.

The Grand Canyon, again, is one of the most dramatic of such openings. Mischa Titiev (1937) recorded the most detailed ethnographic account of the Hopi salt expedition to the canyon from the village of Oraibi. Both the Hopi and Zuni make pilgrimage to gather salt at their respective sacred sources, one to the Grand Canyon (Eiseman 1959, Vecsey 1983:88), the other to Koluwala:wa or the confluence of the Zuni and Little Colorado Rivers (Ferguson & Hart 1985:125). For the Zuni, this is an important pilgrimage made every four years by religious leaders; all Zuni go to this threshold location after death as do the Hopi to theirs. The trip the Hopi make down Salt Trail Canyon (figure 13 ahead) takes them by a supposedly natural mound feature, about thirty meters in diameter. Additional accounts of this pilgrimage experience come from two naturalist/writers, Eiseman (1959) and more recently Engelhard (2004). Eiseman photographed the mound feature and documented other shrines on the way to the actual junction of the two rivers where he located the salt source. Engelhard (2004) also describes multiple shrines along the trail. For both writers, the salt sources and the threshold confluence itself, not the mound shrine, is the ultimate destination of the pilgrimage, as is the case with the Zuni at their confluence point upriver on the Little Colorado. But were pilgrimages to emergence points part of a formalized, cross like framework like the Tewa?

In regards to possible frameworks, and particularly their relation to Pueblo social organization, among the Zuni the order of significance of the colors and associated cardinal directions expresses ranking of religious societies (Potter and Perry 2000:63). Zuni kivas are also hierarchically ordered in a counterclockwise circuit of the village. This spatial order then determines the sequence of rituals through the season (ibid). These are all bipolar or axial associa-

tions. But here again, one has no evidence comparable to the Tewa that these ritual structures existed both in myth, and were laid out on the Hopi or Zuni landscapes. But it is certainly logical. One the primary reasons that we have the Tewa record, in this regard, is because Ortiz himself was Tewa.

In any event, there exists relatively good ethnographic evidence that formally laid out, ritually used large scale frameworks did exist in Historical Pueblo periods, differences between Eastern and Western pueblo religious organization not yet considered.

Archaeological interpretations of the interim between shamanistic and historic landscapes

The present work rests on the idea that ritual use of the landscape did not recede dramatically during the later prehistoric Pueblo periods after a probable ancient intensity of shamanistic practices. Rather than seeing ritual frameworks in Historical Pueblo landscapes as secondary expressions of myth, might they more logically be seen as a continuation or even reflection of formalized landscape structures in preceding Pueblo periods? This approach ideally seeks to shift the focus of investigation from a more exclusive interest in architecture, particularly “great houses” and “great kivas”, to a more inclusive ritual formulation that integrates, and indeed affectively depends upon, a formalized large scale natural landscape. The first formal ritual layouts, beyond domestic dwellings and even great kivas, it will be argued, occurred in the landscape and not monumental architecture.

Moving back in time from the Historical Pueblos—with their evidence of landscape framing—one is drawn to the recent volume *Religious transformation in the late Pre-Hispanic world* (Glowacki and Van Keuren 2011). Scanning these chapters, one finds scant mention of any large-scale ritual landscape structure as important to Ancestral Pueblo societies (1275/1300 – 1540) that immediately followed Chaco. In introducing the main theme of the book, the editors describe the archaeological task of theoretically understanding religious practice from “careful documentation of ritual items, ceremonial spaces, and religious iconography” (2011:12). Again, no mention is made of larger scale ritual use of landscape.

Plog’s discussion about ritual and cosmology in the Chaco, however, the volume’s start point for consideration of the very late Pre-Hispanic period, cites Ortiz’s work and generally associates much of the directional symbolism and even frameworks of historical pueblos with the earlier “Chaco Phenomena” (2011:54), yet without specific spatial examples of possible

large-scale, formalized ritual landscapes in this era. The other contributors to the Glowacki/Van Keuren volume make little reference to any large-scale religious frameworks. Instead, the discussion clearly focuses on an intensity of religious practice in aggregated pueblos, including the new Katsina cults and larger, performance oriented plazas. Yet both also exist in historical pueblos as either integrated into or layered upon formally organized landscape ritual.

Bernardini's (2011) piece on Hopi ethnogenesis provides perhaps the most theoretically interesting discussion. Within Hopi traditions and practice, he defines two distinct forms, traced to differences between autochthonous and immigrant groups. The immigrants brought a different kind of religious orientation that can be associated with larger-scale organization linked to Mesa Verde, Totah (Aztec area) and even Chaco (204). Local populations never participated in Chaco *per se*, while newcomers had. Thus in Hopi religious life, Katsina ceremonies during one half of the year were associated with the autochthonous, more kinship oriented egalitarian traditions, while the other half of the year the calendrical rituals were controlled by immigrant traditions described as being more hierarchical. Interestingly enough, Bernardini associates the calendrical rituals (most associated perhaps with frameworks as in figure 11) not only with sodality histories traceable to Chaco, but with the abuse of ritual power by priestly hierarchies (219). As we will see further below, current archaeological theory sees sodalities as associated with less integrating hierarchical power, while--somewhat paradoxically--kinship controlled Katsina religion is more horizontal or egalitarian. In conclusion, Bernardini says that "Ritual was both a motivating factor behind migration, assimilation, aggregation, and conflict, and a lens through which actors understood these processes. The scales of these religious traditions—can be surprisingly large." (220).

What might be missing in Bernardini's ethnographic projection back into prehistoric theory is a clear set of ideas of how large-scale ritual frameworks function in relation to the two traditions of Hopi religion. In this regard Geertz (1984) is much more specific about actual spatial structure, e.g. that the Katsina cult uses four directional elements, and the calendrical cycle six (234), again more like that diagramed in figure 11. *Both* involve prominent features on the landscape. Geertz clearly argues that the older Sipapuni or calendrical cycle is not something that immigrant groups brought with them, but patterns that were also autochthonous to the plateau, a more fundamental spatial map on the landscape. This gets to the heart of the theoretical issue, i.e. separating control of ritual membership, whether by kinship clans or so-

dality groups, from the integrating effect of large scale ritual frameworks. In fact, it turns the immigration issue on its head. Rather than introducing a new form of control and conflict in the Hopi, for example, as “Chacoans” are held to have done, it may have been the sharing of a common large-scale plateau structure that actually allowed them to make the move to a new location in the first place. This may well be the genius of the insipient cosmic Warao structure, allowing the relatively peaceful movement of multiple social groups within the same culturally defined landscape.

The distinction between kin based religion and cross-cutting sodalities, explained by Bernardini as a product of a kind of ritual brought by immigrants, is cast more broadly as differences between Western and Eastern Pueblos in Ware (2002):

At the westernmost Hopi Pueblos, ritual sodalities are controlled by and deeply imbedded within kinship organizations. At Hopi, each ceremony is “owned” by a particular matrilinear descent group, and the principal lineage of the controlling descent group cares for ceremonial paraphernalia and provides the head priest for a fraternal sodality responsible for conducting the ceremony...In contrast, Eastern or Rio Grande Pueblo sodalities have emerged as centralized village political organizations that function independent of kinship control and that exert considerable influence beyond the ritual life of the community through their control of village political offices, communal labor, inter-pueblo trade and so on. (94 & 95)

Ware describes the standard anthropological view of this “divergence” as related to the inability of kin controlled religion (Western) to accommodate large populations living in post-Chaco aggregations as true pueblos; non-kin sodalities (Eastern) solved this problem. He points to the contrary (not unlike Geertz) that archaeologically, the early origins of Pueblo sodalities might have occurred in one of the oldest forms of Pueblo religion, the “clan-ceremony-sodality-kiva complex”, best illustrated in the historical Hopi (ibid:97). Ware suggests that the Hopi pattern of kinship/sodality layering evolved together and might date back to the Basketmaker III-Pueblo I transition, around A.D. 700.

Using archaeologically defined settlement patterns, Ware describes the need of early segmented matrilinear groups to develop more communal structures where male descent groups could meet apart from the men residing with their sisters. At stake in these religious groups was the control of access to farm land and other resources. Ware does not explore how larger-scale landscape frameworks might relate to *either* matrilinear or male descent (sodality) groups. The use of the kiva or big house as a kind of super dwelling seems to be considered as the pri-

mary ritual setting, not necessarily linked to the landscape. There is an assumption here, perhaps, that the more Tewa like cosmological structure mentioned by Plog developed later along with the monumental architecture of Chaco. Ware (2002) continues to describe how politically centralizing tendencies—separating the sodalities from male descent groups--diverge from the Hopi model in cycles of large-scale P-I (A.D. 700-900) aggregation of Eastern Pueblos, especially in the northern San Juan region, along with the Zuni as part of the continuum of “sodality detachment” (102). Chaco, according to Ware might have been an early expression of new forms of organization based on sodalities without kinship. There exists a clear emphasis on spatial scale and integration in the way these new institutions function under unstable social and environmental conditions, particularly considering “multiethnic contexts where traditional kinship-based organizations are compromised by population loss or dispersal”, and that “ceremonialist networks can thrive at fairly immense scales” (105). Thus in spite of an early BM III – PI separation of male descent group sodality from the most immediate matrilineal kinship group, non-kin sodalities at large scales emerge rather suddenly three hundred years later with Chaco.

Ware and Blinman’s analysis of this non-kin based sodality reorganization emphasizes the role of medicine societies, which integrate and subordinate other sodalities in the ceremonial hierarchy” (2000:385). In this same vein, they cite Ortiz’s discussion of the role of dualistic sodalities, or moieties, expressed at the pueblo scale in a northside and southside division (this structure homologically exists in the larger-scale landscape diagram of figure 8). In the Tewa at least, memberships in medicine and clown fraternities, in addition to warfare, hunting and a woman’s society cross-cut or mediate the dualistic division (388). While moiety chiefs are subordinate to a single village chief, power is balanced by the chief’s selection in alternate years from opposed moieties. One of the key adaptive characteristics of non-kin sodalities is their ability to link across intra and inter pueblos scales for purposes of ritual exchange and a variety of other functions (395).

Much of the reemergence (after Chaco) of non-kinship sodality groups in the East are, according to Ware and Blinman (2000), the result of unique ecological conditions accompanying the aggregations of pueblo ancestors into “true” pueblos beginning in the 1300’s. They describe how original dualistic organization can be spotted in certain architectural layouts stretching back to PII periods, especially at Chaco and Aztec (Totah) (ibid:398), and are still expressed

in the historical layouts of Eastern pueblos. What is puzzling, however, is that “original” dualistic sodalities are associated with the formalities of monumental architecture at the climax period, when populations did not live in large scale true pueblos, but used these great houses and kivas for large scale ritual. And that after Chaco, in spite of a radical scaling down of plateau organization into more territorial tribal entities, and in spite of a radical reconstitution of dwelling into true pueblos where dualism is seldom formalized in architectural or planning, one finds a “continuity” of these non-kinship sodalities.

In addition to a lack of discussion about these apparent architectural distinctions, a potentially far greater spatial discontinuity exists with regard to sodalities, an adequate discourse about which is missing as well. When archaeologists cite Ortiz as to the existence of dual organizations in the Tewa, little mention is made of the larger-scale landscape framework that founds Ortiz’s analysis of “becoming” a Tewa. To a large extent, the aspect of Tewa ritual practice out in the formalized landscape is almost epiphenomenal to the basic religious and political function of sodalities. Similarly, at Chaco and Aztec ritual settings like great kivas are clearly recognized and assumed to be involved with larger-scale sodality organization, but without any evidence, or even dedicated research, that a comparable formalized landscape component existed.

From the perspective (and practice) of landscape frameworks, it appears as though neither the distinction between kin-based and non-kin based (dualistic) kinds of sodalities, nor between dispersed and aggregated residential architecture define linkage to their ritual use. As associated with the more indigenous Hopi populations, some form of spatially structured sodality ceremonialism is quite old, and logically might have involved landscape frameworks associated with dualism, not unlike later Tewa. Yet we have no real theoretical discourse, beyond Ortiz, as to the actual effects of these frameworks and how they might relate to the operation particularly of large-scale non-kin religious societies.

Ortiz’s work needs to be understood in its full theoretical “dimension”. The primary anthropological goal of Ortiz’s thesis was to critique then dominant structuralist understandings of “dual” organization. Levi-Strauss (1955) had essentially demoted dualism, concentrically expressed in the physical form of villages in traditional societies such as the Bororo (128), to a largely hidden triadic flow of marriage exchange. Eastern Pueblos like the Tewa were clearly dualistic in terms of their formally expressed moiety structure. And Ortiz does find a ritual

landscape structure that was actually triadic in a different sense, with clear mediating entities like the Towa é whose members and ritual foci in the landscape stand between the young and deceased Dry Food People. The Tewa framework and “world view”, as seen in figure 8 is a structure of multiple tetrads open at the corners to the flow of power between most sacred distant landscape features and the pueblo as center.

Where Ortiz most differed from Levi-Strauss, perhaps, was in ethnographically determining that the triadic pattern at the heart of moiety dualism was not hidden, but expressively powerful in the actual framework and experience of the landscape. Furthermore, rather than revealing a hidden hierarchical component among “primitive” societies thought to be dualistically egalitarian, and unlike the associations of hierarchy with Eastern dualism (and Chaco), Ortiz often characterizes the effects of the Tewa ritual system as being egalitarian, e.g. 1972:140. Ortiz’ emphasis on the formalized landscape frame rises above the politics of either clanship or moieties--both of which can be described in hierarchical terms. The religious structure in the landscape comes first, as it were, and as long as its relationships are egalitarian, then it functions to integrate the larger community. The fact that Ortiz actually saw landscape frames as theoretically distinct forms of religious “structure” can be discerned in his subsequent discussion about a pan-Pueblo “world view” which begins with a description of space:

“All peoples try to bring their definitions of group space somehow into line with their cosmologies, but the Pueblos are unusually precise about it....the Pueblos attempt to reproduce this mode of classifying space on a progressively smaller scale...the dominant spatial orientation, as well as that of motion is centripetal or inward...a Pueblo priest, when setting out a dry painting, will first carefully set out the boundaries and then work his way *inward* toward the center. The Navajo singer, on the other hand, will work *outward* from the middle.” (142-143)

He is not specific about the actual ritual use of these multi-scaled frameworks in the landscape, but the meaning is clear, given their structural role described in The Tewa World.

Although Ortiz clearly differentiates the triadic Tewa world framework from Eliadian concepts where the sacred center is more powerful than the periphery, he feels that any discussion about which foci of the framework are more affective than others is pointless, given the integrating or flowing character of the process. Nevertheless, one would tend to interpret the four sacred mountains at the distant ends of the cross structure, some with their *sipapu* (Ortiz 1969:19) as being most seriously spiritual. All twelve landscape places are religiously power-

ful, and must provide the ritual efficacy that ultimately integrates these social groups. At what point did these powerful religious devices evolve from intensive shamanistic uses of the natural landscape? Were Ware's sodalities, traceable back to A.D. 700, less the product of local kinship politics than indicators of large-scale ritual frameworks? Was there some sort of evolution of a then ancient Warao-like cross structure stretching well back into the Basketmaker II period? As an entry into theorizing about the advent of early landscape frameworks in the Ancestral Pueblo, one should be as specific as possible about the way Tewa (*and* Hopi) structures integrate their sodality participants.

Looking again at figure 8, clear social hierarchies exist in the six levels of existence, three human and three spiritual, expressed as three concentric rings of sacred sites in the landscape. At the top of the ranking are the Made People, as the humans closest to ultimate spirituality; these are the moiety societies, medicine men and clowns (17). Their power exists not only in their responsibility for the yearly cycle of calendrical rituals—the “structure of structures”—but in mentoring practices of the two lower levels of society. This is the more hierarchical image that archaeologists project back into early pueblo non-kin sodality organization, including Chaco.

Paradoxically, Ortiz (1969:125) calls the Made People, “those of the middle of the structure” and extols their ability to influence or mediate moiety oppositions among people of the two lower identities of Tewa existence. How then, is their association with the outermost ring of four sacred mountains connected with this mediational role? Ortiz is not specific on this point of spatial logic. Yet the answer can be discerned from his analysis. Tewa ritual practitioners might have less imagined the concentric rings of the structure than a series of clock-like axes and directions that corresponded to the calendrical ritual cycle encompassing both Summer and Winter halves of the year. Conceptually, each ceremony is a direction of contact with the most sacred entity at the most distant end of the axis in question. Mediation is built into the layout, since any ritual direction in the Summer half of the year, for example, will have its opposite expression and direction during Winter. One can think of a clock like structure of both space and time. In this view, the notion of “middle” (emphasized in Ortiz as the pueblo dance plazas) expresses the way the two ends relate to each other by the center.

Rather than think of plazas of aggregated pueblos as some new ceremonial focus in Pueblo religion after the break-up of Chaco, rereading Ortiz, it is clearly pointed out that they

play the critical role as third element in landscape lines with bipolar oppositions. Any performance invoking the most sacred power of the mountains and lakes of the Made People, is itself mediated, not only by the opposite moiety and directions of the axis, but by the pueblo wide performance in the plazas. It is primarily the lack of inclusion of theory about formalized landscape frameworks that leads archaeologists to conclude both that Chaco had little of this oppositional mediation, as well as later Katsina or dualistic sodality religion in aggregated pueblos. Again, these ritual frameworks rise above the recruitment and politics of religious societies, whether nominally kin (early male descent groups) or non-kin (later moieties). In the case of the Tewa, they are pure symbolic and ritual expression right at the source of spiritual power, influencing the roles of Made People in their supervision of lower moiety activities. Even though Made People are recruited from within the two moieties, any action involving their access to spiritual power is moderated by participation in the landscape frame.

The Hopi structure, possibly radiating axially out into the landscape, may have worked in a similar manner (Doxtater 1979). Even though these ritual societies are “owned” by clans, each had a paired other, possibly relating to an opposite distant mountain and time in the calendrical cycle. Such an association would also tend to moderate naturally self-oriented kinship realities, even going beyond the paired partner. Hopi ranking does apparently exist, however, just as in the Tewa. While the Tewa expression is a more concentric layering, starting from the lowest in the center and radiating outward to the most powerful, in the Hopi, with three axes rather than two, the center, middle or North-South axis is the most prominent. In terms of the calendrical rituals, this is the Snake-Antelope ceremony. So while each of the three axes are triadic in the mediation of the center with the two distant landscape features and spirits, the North-South axis appears to act at a more intense level of “middle” and mediation. Again this is not part of the four axes Katsina structure, according to Geertz (1984), but part of some older system of ritual frameworks on the Southern Colorado Plateau.

Possible origins of ritual landscape cross structures on the Southern Colorado Plateau

How then might the ritual practices of large scale linear concepts, and ultimately more complex cross-like structures have evolved from the spider webs of shamanistic landscapes? The first issue is the reality of an axis or line in the landscape. Ortiz doesn't precisely map the trails that participants used in their ritual travels out to the twelve contact points in the landscape, i.e. the

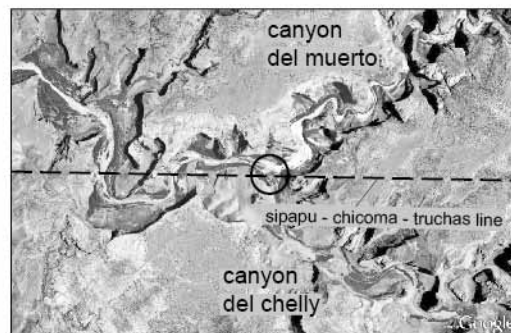
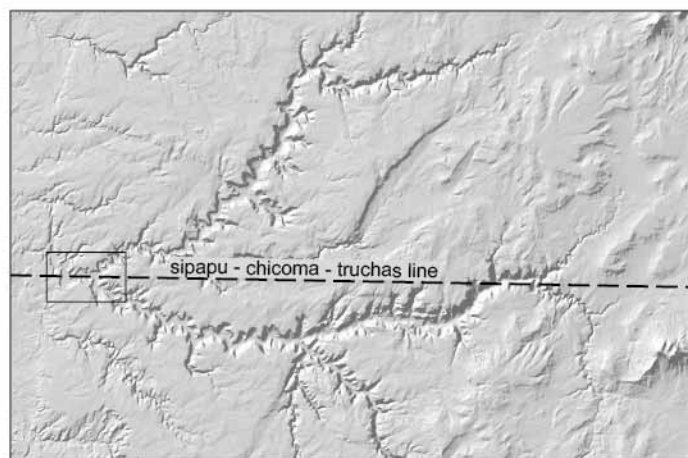
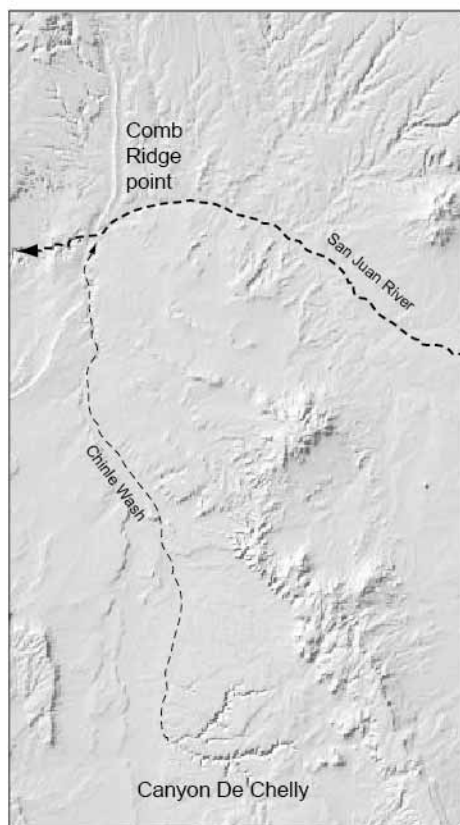
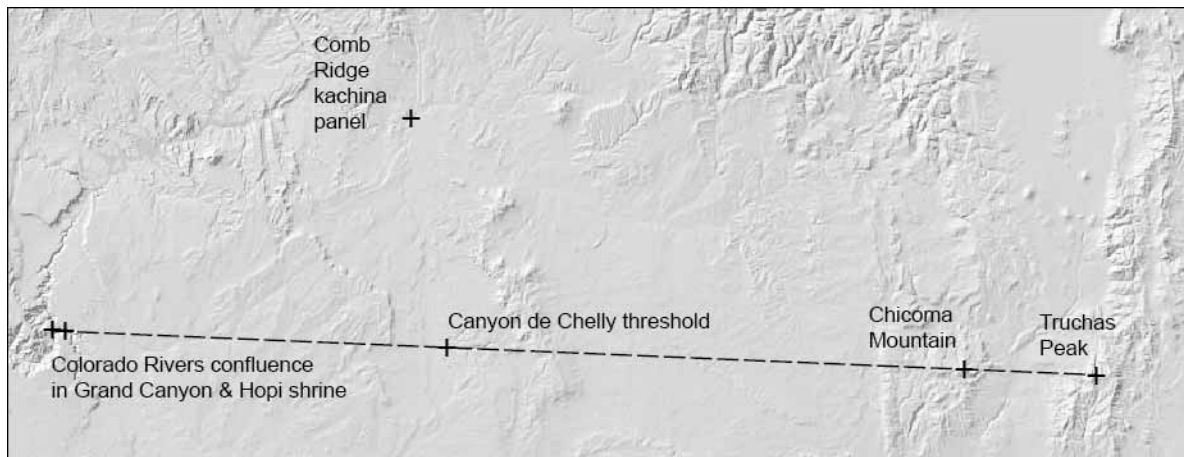


Figure 12. Most coincidentally accurate three-point alignment of natural features: Sipapu, Chicoma Mountain, Truchas Peak; possible early line to Comb Ridge - San Juan River intersection point (above). Relation of alignment to Canyon De Chelly topography (middle and below right). Drainage of Canyon De Chelly north to Comb Ridge - San Juan River point via Chinle Wash (below left).

actual layout is somewhat less formalized than his graphic implies. His pueblo of San Juan (the “Mother” Tewa pueblo) is not precisely at the intersection of his listed four cardinal mountains. It lies, for example about 7.3 km north of the cardinal line between the West mountain of Chi-

coma and the East mountain of Truchas, each the highest in their respective ranges. While politically much different in effect, even reversed, these less than precise “axes” seem similar in their lack of precision to the religious “*ceques*” radiating out from Incan Cuzco (Bauer 1998). The conception of straight lines, even crosses, however, seems evident in the shrine located on the summit of Chicoma which Ortiz visited with elders during his fieldwork. A more recent technical report of the US Forest Service (Anschuetz 2007:150) finds an early twentieth century description of the shrine. It consisted of six directionally oriented trails (*awu-mu-waya* or “rain-roads”) radiating from its center; these represented the spirit trails and pilgrimage routes of the Pueblos of Taos, San Juan, Santa Clara, San Ildefonso, Cochiti and Jemez. The sixth opening expressed the pathway used by the Navajo on their pilgrimages.

The Tewa cardinal mountains of Chicoma and Truchas might actually have been part of a very long West-East line ethnographically documented in Navajo traditions. Kelly and Francis (2005) use this mythic and actual landscape route of “Traveling Rock” as the key example in their piece on traditional Navajo “maps and wayfinding”. This is a very long line beginning somewhere around the junction of the two Colorado rivers in the Grand Canyon in the West--again, the Pueblo place of emergence--and running by or through Canyon De Chelly, Chaco Canyon, and then ending on the Continental Divide to the East (they do not mention the two Tewa mountains and are overall purposefully restrictive in giving precise locations). This route is both an actual path, with cairns along the way and a Navajo “sunray” (“rain-road” to the Pueblo), an arrow straight line through the air, as it were, across the large-scale landscape. Kelly and Francis cannot establish any firm origin date to this spatial “wayfinding” concept and practice, but they feel it could go back well into prehistoric periods, even before the time when anthropologists believe the Navajos moved into the area, about in the 1400 or 1500’s.

The fact that the Navajo (and even historical Pueblo) have a linguistic term for an accurate, straight, large-scale line obviously fits well into the present thesis about prehistoric surveying in the layout of ultimately very formalized landscape frameworks. And factually, one can actually describe a very accurate coincidental *sunray* that might have been the basis of a West-East nominally cardinal line common to not only Tewa and Navajo, but to Pueblo Ancestors as well. The line from the Sipapu in the Grand Canyon aligns coincidentally very accurately with the USGS benchmarks on the peaks of Chicoma and Truchas, among the highest and/or most prominent natural features of the Southern Colorado Plateau, figure 12. It is the

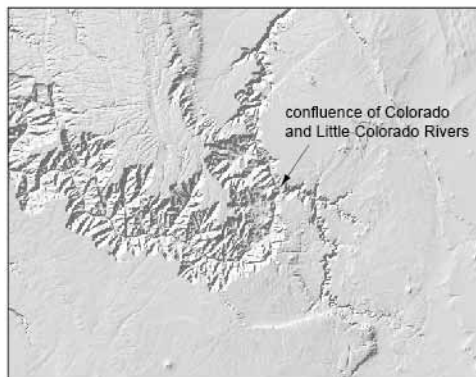
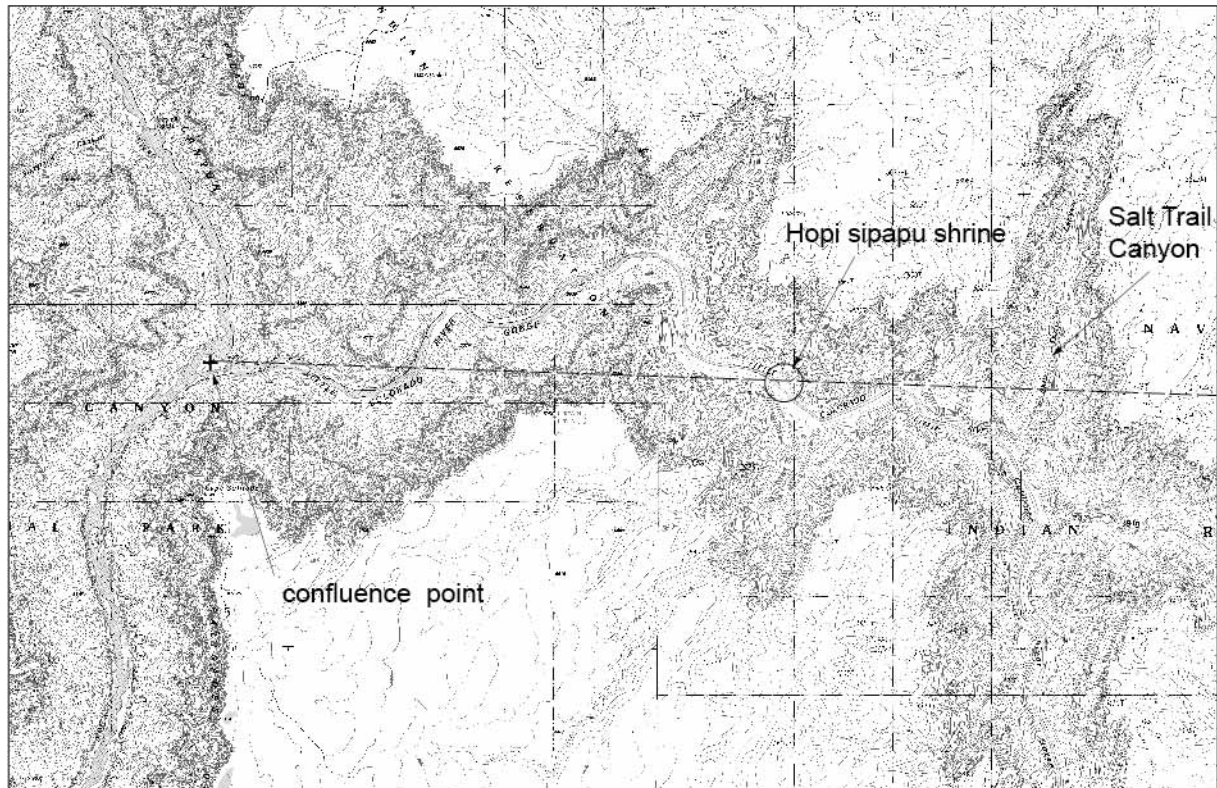


Figure 13. "Sipapu" as junction of Little Colorado and Colorado Rivers in the Grand Canyon, and destination of Hopi salt pilgrimage. Alignment from Sipapu point to Comb Ridge - San Juan River intersection point (possible solstice relationship). Location of Hopi shrine on the Little Colorado River along salt pilgrimage trail.

only accurate, naturally coincidental three-point alignment among most prominent natural features (defined further in the following chapter). This 555.009 km line from the sandbar at the junction of the Little Colorado and Colorado Rivers to the peak of Truchas misses the described shrine on Chicoma by about 39.8 meters. As we will see below, the precise line passes right through the gateway of Canyon de Chelly and 658 meters north of the northernmost great kiva in Chaco Canyon (the earliest great kiva at Peñasco Blanco on the North Rim). As described

earlier in this chapter, the Grand Canyon Sipapu, illustrated in figure 13, has considerable importance ethnographically in relation to Pueblo emergence myths. The tentative location of the Hopi shrine was provided on a USGS quad map by Michael Engehard at the author's request. The great circle distance from the Sipapu to the middle mesa of the Hopi villages is over 125 kilometers. While the overall line may well be a religious reality in traditional Southwest culture, the question of whether prehistoric or historic people actually knew of its accuracy depends on whether they could survey.

Anthropologically, then, why would shamans, at some stage in religious landscape evolution, begin to consider *sunrays* as somehow more sacred than actual less formalized paths of spiderweb networks of sacred foci? According to Wilbert again, Warao shaman actually used observations of either the sun or the stars to lay out quite accurate cardinal axes across their world (again the north-south line being off only about nine arc minutes in 200 km). If they had used the sun, then quite literally these lines were *sunrays* of a sort. In the early Ancestral Pueblo it may not be illogical for shamans to have become interested in straight lines, associated as they might have been with the travel of spirits, in contrast to the actual topographical paths of human participants. Natural coincidence among prominent natural features might have also contributed to the religious importance of a line like Sipapu - Chicoma-Truchas.

Ecologically, Basketmaker II or earlier societies might have had to be mobile for reasons not unlike their successors (perhaps also not unlike the mobility of slash and burn Warao bands). Aside from at least one coincidentally known alignment, Basketmaker communities would certainly have been well aware of, and conducted ritual practice in relation to, the major natural features of the plateau. These might well have been commonly understood by mobile groups in their ecological use of the Southern Colorado Plateau. At some point religious practice by different groups among features of the landscape, e.g. the Sipapu, Chicoma and Truchas, began to recognize "god-given" properties of alignment, stimulating incipient new social organization at an unprecedented scale. Such a process, however, might be more possible in the Southwest landscape with its great visibility, begging the question of how the Warao, in their flat, delta jungle setting might have initiated the process. In this topography the impetus for formalization could have come from the basic structure of astronomical phenomena—positions of solstice and equinox settings and risings--which would suggest a greater originating role for myth perhaps.

In the visually dramatic, large-scale Southwest landscape, however, the oppositional (bipolar) structure of lines or axes in the landscape appear to have been derived first hand from the locations of most prominent natural features. It may not be essential at this point to speculate on the issue of whether some or all of these patterns were understood at a level of accurate surveying. The essential, founding cognitive map of simple lines and even more complex “crosses” could be developed without the remarkable accuracy that characterizes the locations of many of the later architecturally formalized ceremonial structures.

In the search for the first early “cosmic” elements in the Southwest, one logically begins with the West-East *sunray* as the Sipapu-Chicoma-Truchas line. Without necessarily suggesting a temporal order to all the elements, if this long integrating line across the plateau were religiously understood by ritual groups beginning to co-participate, perhaps associating with an ancient “emergence” meaning of the Sipapu in the Grand Canyon, then it would have been structurally logical to conceptualize some also ideally coincidental North-South complementary axis. This might not yet be called “design”, because of the dependence on coincidental geomet-

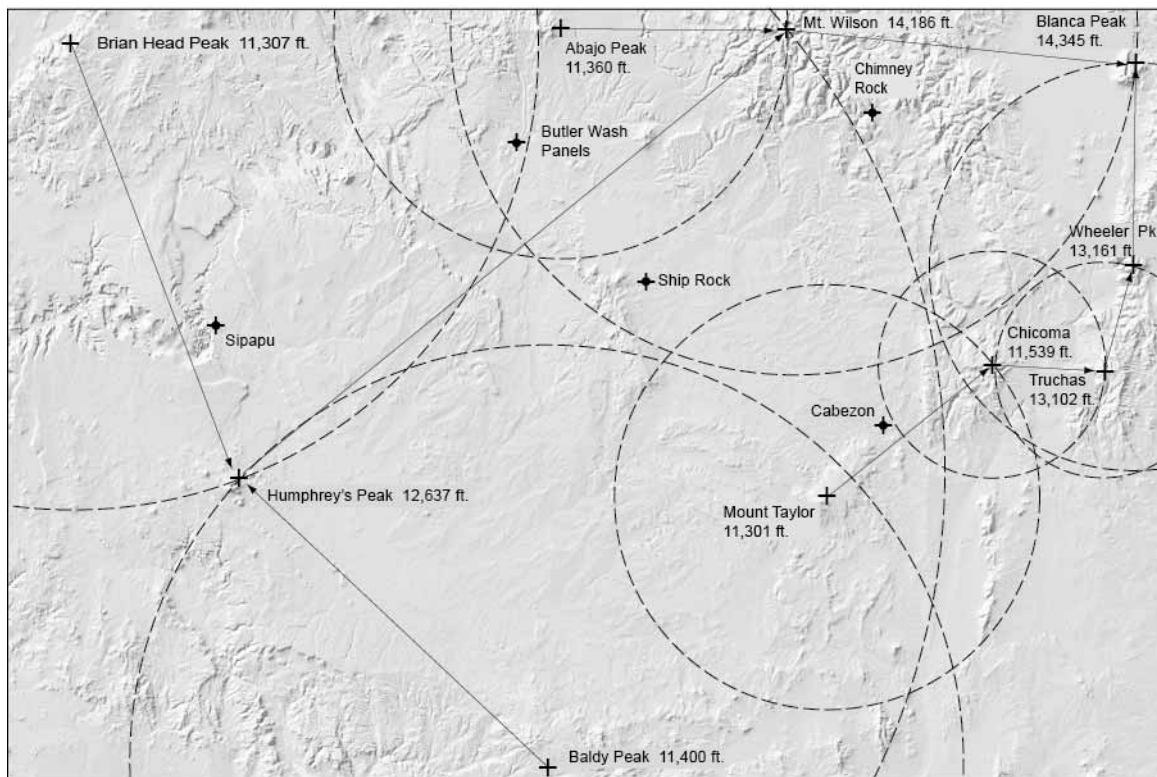


Figure 14. Highest mountains in the Ancestral Pueblo region (Southern Colorado Plateau), plus five other most prominent natural features (Sipapu, Butler Wash Main Panel at Comb Ridge, Ship Rock, Chimney Rock and Cabezón). Radii indicate distance to next higher peak. Blanca Peak (upper right hand corner) is the highest and therefore has no radius.

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lationshiPs. If one assumes that the most dramatic possible intersection point for a vertical axis and the East-West axis is the natural gateway to Canyon de Chelly, again figure 12 (much more so than Chaco), then knowledge of the two highest mountains north and south might have come into play.

Figure 14 illustrates the locations of the highest mountains and most prominent natural features on the Southern Colorado Plateau. It is clear that from the Canyon de Chelly position on the Sipapu-Truchas Peak line, the highest mountain in the North is Abajo Peak, and the highest in the South is Baldy Peak. Little can be reported about Ancestral Pueblo or more recent Ute or Paiute religious use of the Abajo range, the highest point of which is actually known in the literature as “Blue Mountain”; it is called “Furry Mountain” by the Navajos who believe it has a male spiritual inner form (McPherson 1992). Mount Baldy, for its part is the highest peak in the White Mountains and second highest peak in the state of Arizona. The White Mountain Apache tribe regards the mountain as one of their most sacred (Welch 1997:90).

Neither ethnography nor archaeology provides any evidence that the intersection point between these two close to cardinal lines was precisely known or otherwise defined in material terms. Some evidence of inter-cardinal or cross axes, however, exists. Recalling the older Hopi structure that emphasizes inter-cardinal axes in addition to at least the North-South vertical, one can begin to visualize in figure 15 additional axes to some very early landscape frame. Working from Baldy Peak in the south, the two highest mountains in the SW (Humphrey’s Peak) and SE (Mount Taylor) are quite symmetrically located at similar latitudes. Up in the north, the two highest mountains of the NW (Brian Head) and NE (Blanca Peak) are also somewhat symmetrically located at similar latitudes. Coincidentally, the cross lines from these four mountains, *and* the north-south axis of the vertical pair intersect about 330 meters from a common point in Canyon de Chelly, this point itself lies 3.578 km north of the of the Sipapu-Truchas line. Again, no archaeological or ethnographic evidence exists precisely at the coincidental three-axes intersection point, located just north of the Canyon de Chelly visitor’s center. No assumption is being made that these intersection points were precisely located by surveying, just that the large-scale pattern could be cognitively understood and might have begun to foster large scale formalizations.

Humphrey’s Peak and Mount Taylor, at least, are known as significant religious features

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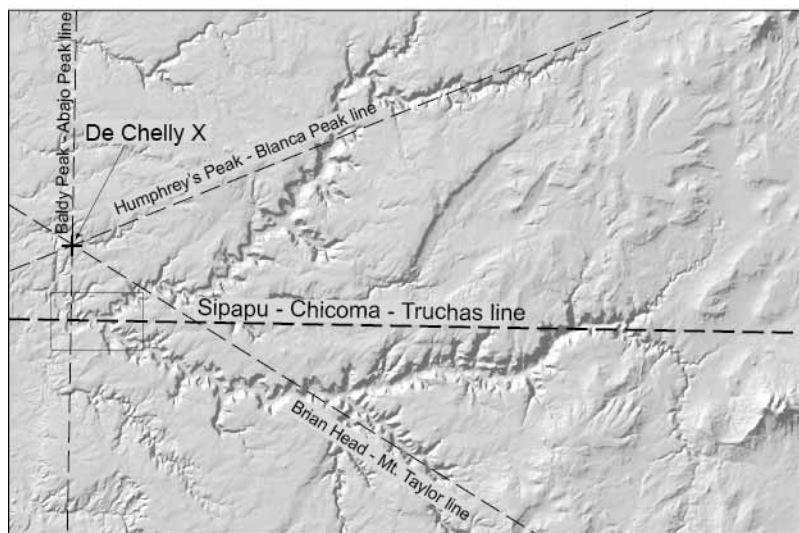
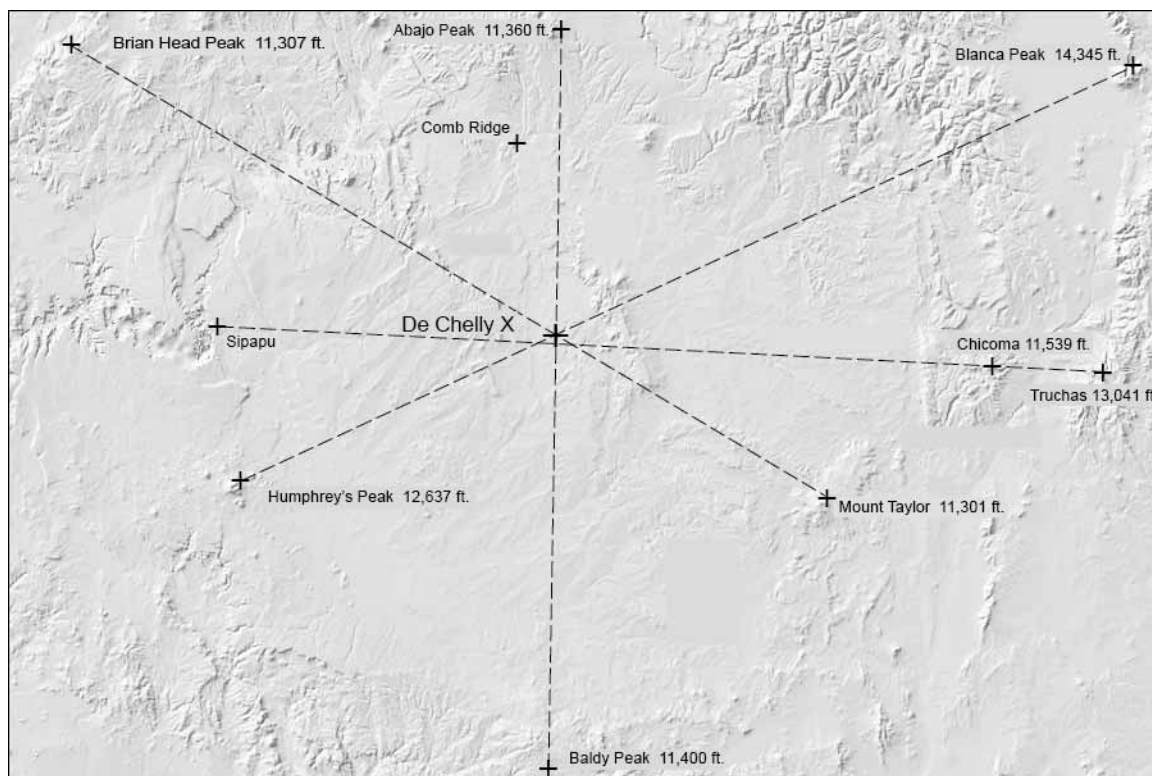


Figure 15. Two coincidental crosses formed by prominent natural features: De Chelly X and Kin Bineola X; and coincidental west-east relationship between Abajo Peak and Mount Wilson (above). Location of De Chelly X with respect to coincidental alignment of Sipapu - Chicoma - Truchas (below).

among Pueblo groups. The Hopi have a very high religious regard for the San Francisco range of mountains (e.g. Bernbaum 1997:9) in which Humphrey's Peak is the highest. On the top of Mount Taylor, citing Blake again (1999) can be found a manmade hole, or possibly symbolic *sipapu*. Little ethnographic information can be found about Brian Head, now just a few hundred feet above the top of a popular ski run; the mountain's name was Monument Peak until 1890. While there is also scant evidence of religiosity from Pueblo culture about Blanca Peak

in Southern Colorado, it is the highest peak in the Pueblo sphere, and historically believed to be the highest point in Colorado (it is the third most topographically prominent peak in the state).

The best evidence that at least one of the cross axes may have been an aboriginal *sunray* comes again from both Navajo and Pueblo ethnography. The Humphrey's Peak-Blanca Peak line is one of the two primary axes of the Navajo cosmos (see again Witherspoon & Peterson 1995 and figure 6), again raising questions about whether the Navajo created this line or adopted a much older linear artifact in the landscape. The fact that the Hopi appear to have also

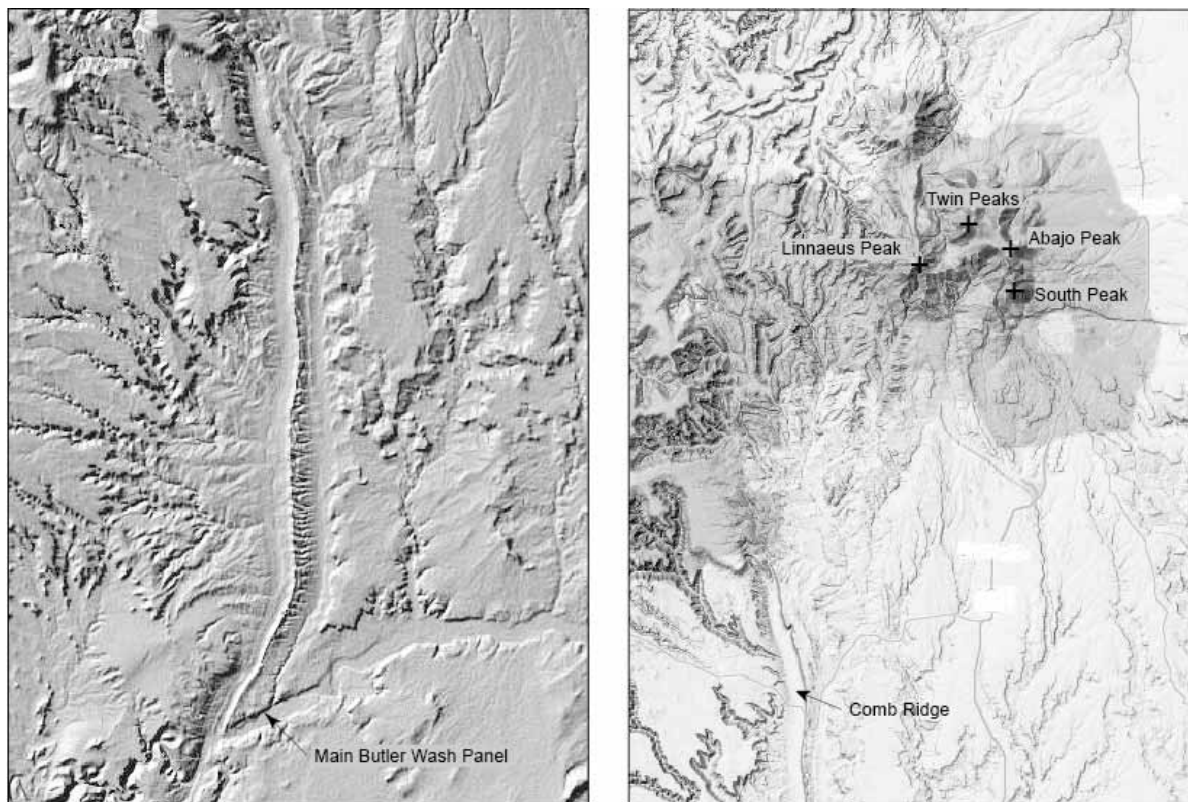


Figure 16. Comb Ridge natural north-south axis mundi, Southeast Utah. Location of Butler Wash Main Panel.

known about and used this particular line may suggest a more ancient patrimony. The most unique common natural features (Toreva Spring and Corn Rock) of Second Mesa, the middle of the three Hopi mesas, are located near (152 m and 645 m respectively) this longest of possible early lines (607.582 km). The formal symmetry of the combination of the two coincidental phenomena—a three-point alignment and cross intersection point of three axes—is readily apparent in figure 15. Considering the somewhat smaller Warao structure, albeit in a much more visually challenging topography, it is not impossible that Basketmaker II shaman—somewhat collectively across the plateau—could cognitively understand this pattern, even if it hadn't been precisely surveyed.

Given a less than precise, non-surveyed layout, the power of North might well have been something of a hybrid of the clustered foursome of highest peaks in the Abajo Range, and more particularly the coincidental vertical topography of Comb Ridge, with its also phenomenal rock art panel at its intersection with the San Juan River, figure 16. Topographically, Comb Ridge's 30 km north-south length culminates in a gentle curve toward the westernmost of the four principal peaks of the Abajo range, Mt. Linnaeus (10,959 ft., compared to the middle Twin Peak at 11,012 ft., and the north south pair of Abajo 11,360 ft. and South Peak at 11,122 ft.). Mt. Linnaeus is actually the most precisely cardinal of the three peaks due north from Baldy Peak (179.904°).

Winston Hurst and Jonathan Till continue to document the unusual network of prehistoric roads and shrines associated with Comb Ridge, creating the first major comprehensive survey of the feature's area. In preliminary presentations, their overall theme emphasizes the almost shamanistic structure of meaning and ritual in this natural landscape, somewhat in distinction to large readily apparent architectural monuments like great houses and even great kivas in the area. They mention that Native American sources still regard the intersection point of Comb Ridge and the San Juan River as a kind of "cosmic center". The feature Hurst and Till do not include, undoubtedly because its broad tourist exposure and image propagation has made it so well known, is the rock art site at Butler Wash, a series of "*kachina*" or shaman looking figures carved into the rock faces of Comb Ridge as it meets the San Juan River, figure 17. This term for the rock art panels is a misnomer since its dating is said to be considerably older, back to the shamanistic Basketmaker II period ending about A. D. 500, and defined as the "San Juan Anthropomorphic Style" by Schaafsma (1980:109-119).



Figure 17. Butler Wash Main Panel (Basketmaker II, A.D. 500 and earlier) as intersection point of Comb Ridge and the San Juan River; petroglyph figures are about human scale.

It is not impossible that transitional shaman not only associated the Comb Ridge feature topographically with the westernmost of the Abajo range peaks, but also, considering the skills of Warao in laying out their vertical axis, understood this western peak to be largely cardinal north of Baldy Peak (this depending more on solar observations, perhaps, then on precise surveying described in Appendix II).

The goal of the diagram of figure 15 of a possible large-scale cross framework is certainly not any attempted proof of its existence. More than likely it will never be possible to firmly establish a Warao-like cosmic framework during Basketmaker II and even most of Basketmaker III periods. Nevertheless, given ethnographic evidence in other parts of the Western Hemisphere, and among the Navajo, the possibility exists. As such it at least introduces a not-unlikely background to surveyed formalization of the plateau that is maintained to have begun in late Basketmaker III, climaxing in Chaco and Aztec, and reemerging in smaller more territorial landscapes like those of the Tewa and Hopi. Driving this formalization is the way landscape geometry itself can structure new social relationships among ritual sodalities.

The most appropriate applied science means to investigating possibilities of large-scale surveying--as an essential part of landscape formalization-- is a cold consideration of simple alignments involving some clearly defined set of religious features built during the periods in question, this in the spatial context of some also clearly defined set of most prominent natural features. Without consideration of possible meaning of more complex landscape patterns, with regard to some framework of plateau religion and ritual, what are the statistical probabilities that the locations of religious foci were intentionally designed to involve accurate, large-scale alignments with natural features and other foci, i.e. that some number of these existing geometries were not wholly coincidental. This is the goal of chapter 2.

2. Probability Comparisons: Alignment Involvement of Great Kiva Locations

While some patterns from design analysis portions of following chapters can be tested against random phenomena, it is possible to first test the simple tendency of a total list of great kiva sites—from Basketmaker III to Pueblo III—together with significant natural features to form three-point alignments. This is irrespective of any design analysis ideas about particular logical looking layouts. If there turns out to be an unusually high number of alignments in this total group--well beyond the probabilities of coincidence--then along with anthropological ideas of the first chapter, most readers might be convinced that some sort of formalization is not impossible in this time period. One can then proceed to look for an evolution of design logic in these frameworks, creating probability tests where possible.

Existing literature on random comparisons

The first critiques of assertions of designed landscape alignments were simple computer procedures testing claims about Ley Lines in England, usually under 10 km in length. As detailed thirty years ago by archaeologists Williamson and Bellemey (1983), random arrays of points at similar scales and accuracies produced many coincidental alignments. Other brief studies of random alignments--as much exercises in computer application--produced similar conclusions, e.g. O'Carroll (1979) and Papadopoulos (2001). For any given number of points (sites) of a given dimension, spread in a defined spatial area, numbers of three, four, five, etc. point random alignments can be predicted for particular accuracies. Generally these facts are taken to mean that most if not all assertions that certain landscape features are intentionally aligned are probably wrong.

Two things have been missing in these peripheral forays into larger symbolic landscape structures. First is the most obvious, i.e. that just because some larger number of random alignments exists among a set of features doesn't rule out intentional patterns among some subset. It just means that one cannot necessarily use comparisons with random phenomena to prove intentional design. While prehistoric builders might have understood a few coincidental alignments, particularly with natural features, and might have intentionally designed additional layouts, they would have had no clue about some much larger number of random patterns. The

second and more important ingredient missing in the limited literature on random geometries is application to a particular cultural landscape setting, where the selection and definition of “points” is clear, and the spatial scale of analysis is well reasoned. The first mainstream archaeological publication to test the alignment of built features in the Americas against random patterns was Swanson’s GIS based analysis of signal fire alignments at relatively small scales of several kilometers on Cerro Moctezuma, the apparently sacred peak with a kiva-like feature (see figure 88) visible to the west of Paquime in Northern Mexico (2003). Using ten randomly generated sets of points on the mountain, and the Student’s *t*-test statistical process, he concluded that the existing pattern of signal locations had a high probability of intentional design. Note the limited number of random sets used and the reliance on statistical methodology to infer probability.

Also more recently, but in Old World archaeology of Scandinavia, Sahlqvist enlisted statistical faculty at the University of Uppsala for his novel dissertation seeking to prove that Neolithic peoples used the locations of small burial mounds, also at smaller scales, to create cardinal cross centers associated with territorial boundaries (2000). By randomly varying points away from existing intersections and along the axes of cardinality (north-south or east-west) related crosses, Sahlqvist and colleagues were able to state a good probability of design, in spite of controversy about whether the patterns were Neolithic or part of Early Medieval organization.

The following exercises compare alignments among existing sites and random ones. While two publications, Doxtater 2007 and 2009 include random comparisons, they focus primarily on specific sites and their patterned relationships. A piece of the 2007 paper does include a simple analysis of points in a specified area, the focus of the first exercise below. The number of sites, however, was quite restricted, only 22, and is subject to questions about impartiality of site inclusion. The primary purpose of that article, however, was an explanation of the use of the Geopatterns application for a computer oriented audience (see present Appendix I).

Influence of large scale natural topography on alignments

One seeks to simply compare the number of three-point alignments, at stipulated ranges of accuracies, between existing and randomly generated points. To do so, equivalent numbers of random points are scattered in a test area encompassing all existing great kiva sites compiled for

the exercise. Before getting to probability numbers of these comparisons, questions need to be answered about the logic of setting up test areas across a varied landscape topography, which might either influence alignments of points, or outright prohibit construction of these large ceremonial kivas. As described in Appendix I, Geopatterns software is only set up to create rectangular test boxes. Figure 18 shows the locations of 61 great kiva sites on the Southern Colorado Plateau in what will become a test area.

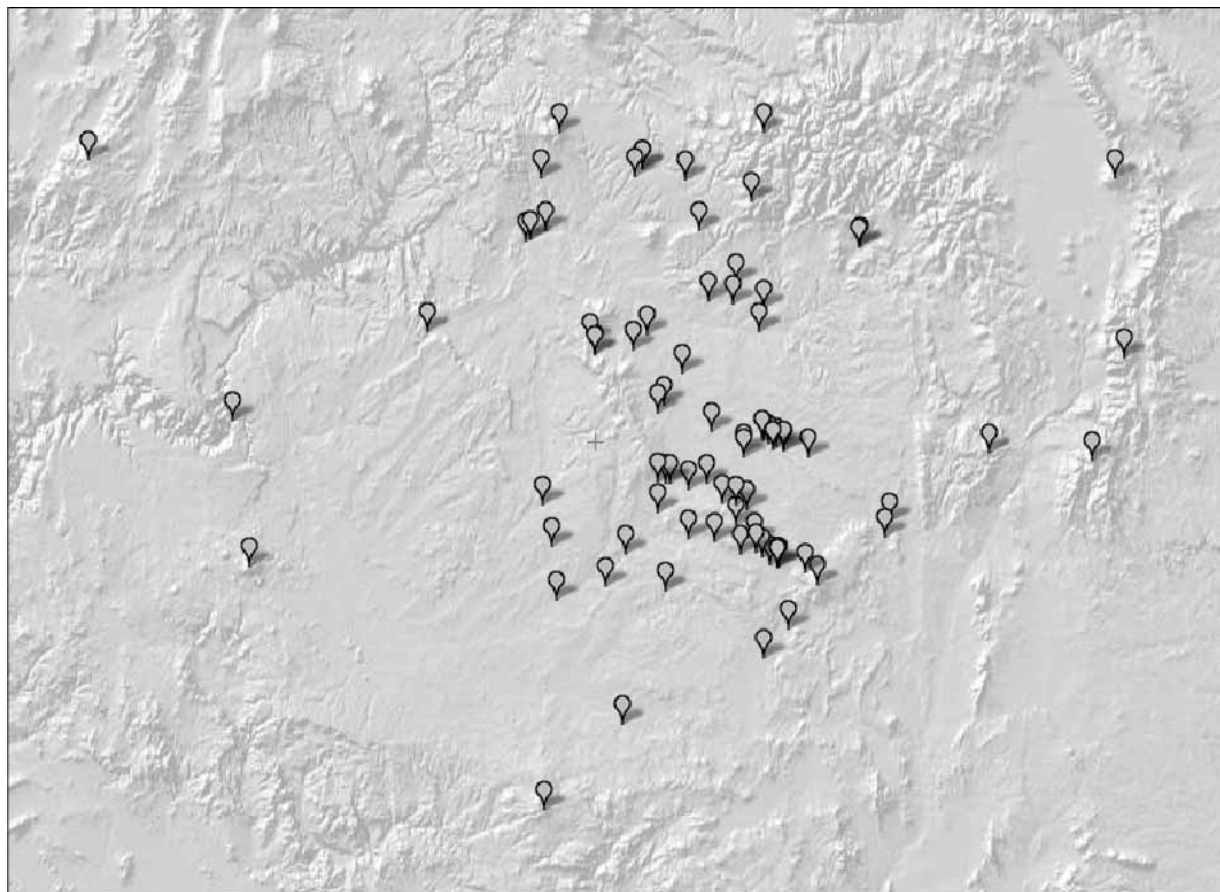


Figure 18. Location of 61 Basketmaker III - Pueblo III great kiva sites plus 21 most significant natural features on the Southern Colorado Plateau (Cerro Moctezuma is off map to the south).

Given the existing topography and great kiva sites, more specifically described below, how many appear to have been somewhat aligned by natural features? While some linearity occurs along the Red Mesa Valley, the greatest influence of topography occurs in the confines of Chaco Canyon, with its seven great kivas included in the larger exercise below. An additional six great kivas are built later, mostly in association with large great houses. Thus thirteen great kivas are located in a relatively linear canyon stretching about 15.5 kilometers from NW to SE. Comparing the physical constraints of Chaco Canyon to the topography of the larger scale plat-

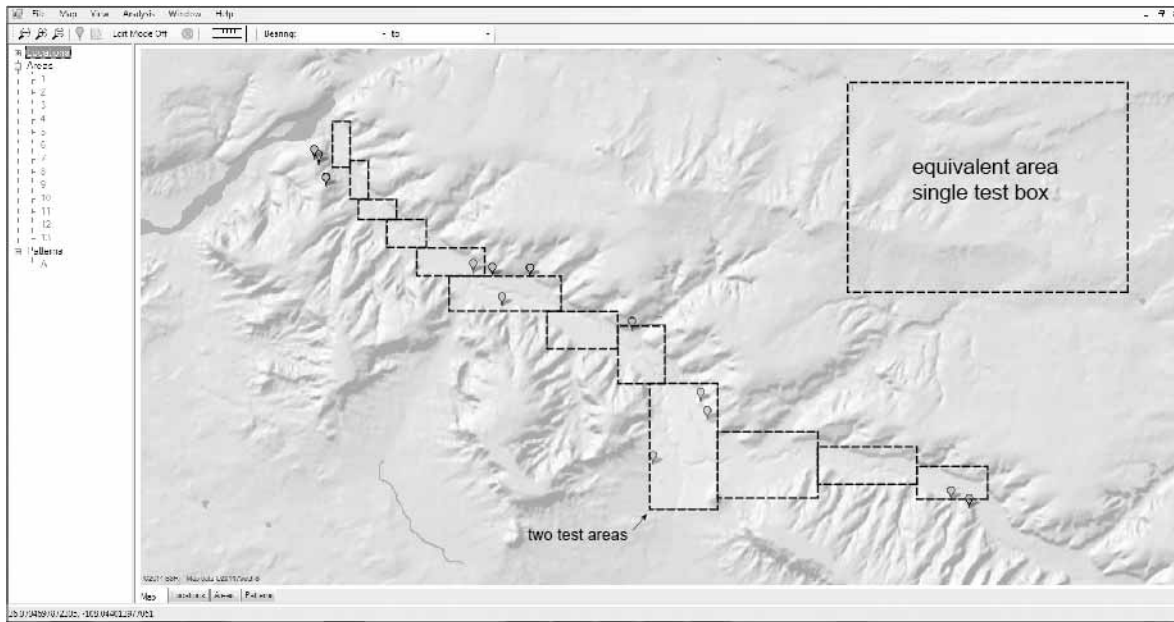


Figure 19. Thirteen random point areas to test the influence of smaller scale linear features on alignment numbers (existing great kiva sites also indicated).

eau of figure 18, if one wished to demonstrate the influence of the natural landscape over three-point alignments, Chaco would be the place to do it. Toward this end, the buildable areas of Chaco Canyon are divided up into thirteen test areas (the largest has one of equal size superimposed), in each of which one random point will be located for each test set, figure 19. This distribution does not match the locations of existing great kivas, clustered as they are in the middle and ends of the canyon, but should nonetheless serve to demonstrate the influence of natural topography on random point distributions. If great kivas were associated primarily with localized communities within the canyon one would expect a more territorial distribution not unlike the 13 test boxes. Their actual clustering, of course, relates to large scale organization, and formalities of ritual practice which may have involved *both* surveyed lines from distant places and geometric relationships within the canyon. Nevertheless one can discuss the relationship between great kiva location and canyon shape as if these ceremonial sites were located entirely for reasons other than formal ritual layouts, a null hypothesis, as it were.

Among the center points of the ultimate total of 13 great kivas (others may well be discovered) five three-point alignments occur at or under an accuracy of 0.15°:

Peñasco Blanco (early) – Pueblo Bonito (kiva in GH) – Una Vida (kiva in GH)	0.009°
Peñasco Blanco (kiva in GH) – Hungo Pavi (kiva in GH) – 29SJ1642	0.048°

Chetro Ketl (kiva in GH) – Hungo Pavi (kiva in GH) – Shabik’eschee	0.051°
Chetro Ketl (kiva in GH) – Hungo Pavi (kiva in GH) – 29SJ1642	0.102°
Peñasco Blanco (kiva in GH) – Chetro Ketl (kiva in GH) – 29SJ1642	0.146°

Because of the large accuracy gap between the first three and the last two, one can use only the three at or under 0.055° to compare with patterns created by random points. The expectation is that given the constraints of Chaco Canyon’s shape, sets of 13 random points each should quite commonly reproduce numbers similar to the existing. What happens however is that in 62 of 100 sets no three-point alignments are created under 0.055°. A match with the existing does occur, i.e. three three-point alignments under 0.055°, but only two times in 100, or a probability of 0.02. Thus the existing are by no means ordinary, suggesting the possibility that some design intent was operating in their placement. Chapter 3 will develop diagrams that suggest linear relationships between 29SJ423, the performance area called Curved Rock that Speaks, and Shabik’esche, early on, and then later a related alignment between early Peñasco Blanco, early Pueblo Bonito, and Kin Nashabas (adjacent to Una Vida)—which may well explain much of the meaning behind the three alignments used in this initial probability test.

Thus it may be likely that even at the small scale of 15.5 kilometers, the shape of a linear canyon and a relatively large number of sites does not create any obviously overwhelming influence in the generation of three-point alignments. The idea that some unique natural topography would exert such influence at the largest scale seen in figure 18, about 300 kilometers across and more when including the most prominent natural features, seems patently false.

What then about buildable vs. non-buildable areas? Could there not be some natural pattern among these site conditions, independent of more extreme limiting effects of canyons, buttes, mountains, washes, watercourses and the like? Obviously some percentage of the relatively flat Ancestral Pueblo plateau is nonetheless not suitable for the construction of a twenty-meter circular great kiva. But it may not matter where this number actually lies, whether 20%, 50% or 70%. The question is, again, whether in this layout of buildable site areas, geological processes created random patterns, portions of which create linear tendencies—apart from those due to more dramatic topographic features. One cannot here map all buildable areas to evaluate any potential influence to natural or coincidental patterns. It seems, however, given the relatively small number of sites (61) and certain enormity of buildable areas, that these would have

far less influence than a feature like Chaco Canyon in positioning sites to create relatively accurate three-point alignments.

The reader of this volume will probably be aware that each time a new random set of points is generated in a specified geographic area, there will be an intuition that some will land on unbuildable topography, regardless of whether buildable areas in themselves have linear patterns. Great kivas have to be built on relatively flat ground. One way around this problem is to think of the existing buildable landscape as a random act, at least from the perspective of possible design location of sites built on it. If most if not all great kivas were located for other, non-symbolic or ecological reasons, their locations would become part of the larger natural random pattern of buildable areas. In this case, one would not expect unusual numbers of three-point alignments in this entirely random combination. There are two issues here, one, the layout or shape of existing patterns of buildable land on the plateau, and two, the percentage this represents in relation to the total. It will be shown that given the existing shape and percentage, the locations of great kivas either do or do not deviate significantly from the random. What assumptions do we make about the random points?

For the present one simply doesn't know the incidence in which a random point will land on an unbuildable setting. Since the amount of buildable land in the test area probably is over fifty percent, perhaps even conservatively, what would be the effect of half of the random points of any given set landing on unbuildable sites? With a very elaborate and very costly mapping/ analysis software one should be able to generate a list of random alignments created only on buildable sites in a set. One could then compare these with existing. If, for the sake of discussion, the buildable / unbuildable areas are roughly a 50-50 split, then with a decent number of random sets, the issue would largely disappear as an influence on the incidence of randomly created alignments. Or, generally, the greater the percentage of buildable area, the less it exists as a factor in generating random alignments.

In the following largely unprecedented kind of test, it is recognized that some of the random points in each set will fall on unbuildable sites, but that because the probably high ratio of buildable sites on the plateau, and number of random sets generated, this effect may be minimal. If it turns out that the existing great kivas are involved in an unusually larger number of alignments--as are a few random sets--it would still remain to be ultimately proved that both existing and exceptional random sets weren't in some way determined by a unique layout of

buildable sites. Again some reassurance that this is not the case comes from the above demonstration that even when natural forms appear to seriously constrain the placement of ceremonial foci, like in Chaco Canyon—*at much smaller scales*—they seem in themselves to only rarely create equivalent numbers of accurate alignments.

Natural features used in the analysis

As introduced in Chapter 1, religious practice among Ancestral Pueblo people likely involved the most significant natural features in the Ancestral Pueblo portion of the Colorado Plateau, examples of which are illustrated in figure 20. In summary, these are the Sipapu at the confluence of the two Colorado rivers in the Grand Canyon, the Comb Ridge feature with its point on the San Juan River, the highest mountains--Mount Wilson, Abajo Peak, Baldy Peak, Humphries Peak, Brian Head, Blanca Peak, Mount Taylor, Hesperus Peak, Mount Chicoma, Truchas Peak, Wheeler Peak--Chimney Rock, McCarty's Flow, Ship Rock, Haystack, Cabezon, Hosta Butte, and the high point of Mesa Verde (MVHP). To this list can be added Cerro Moctezuma (evident in late Chaco); it is somewhat less a highest mountain in its region, but may have been chosen for its coincidental location in relation an earlier understood coincidental meridian on the eastern side of the plateau. For a geographic locations see figure 21 (which adds features involved later in framework evolution).

The present object is to largely ignore the hypothetical cultural meaning of these features discussed in Chapter 1, accepting in this exercise their uniqueness as natural features; the goal is to be as independent as possible from any alignments with great kivas known before the analysis. They must, to the greatest degree possible, stand on their merits as unique features. The least meritorious in this regard are the high point of Mesa Verde where only the fire lookout presently identifies this point on the northern Mesa Verde ridge, the symmetrical but modest Haystack Mountain, and perhaps Cerro Moctezuma. In defense of this selection, however, the list of great kiva sites listed below excludes many of the late Chaco kivas with which these three sites are geometrically connected. In summarizing lists of total involvement in alignments (provided later in the analysis) these site involvements are among the lowest numerically and therefore did not create a bias by being included in the selection.

Locations of great kiva sites

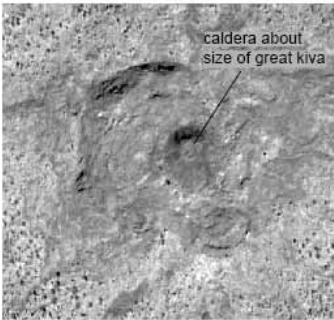
It is considerably more difficult to establish precise locations of a large number of built site ruins compared to most unique natural features. In this latter case, high points are clearly marked on USGS 7.5 quad maps or can be accurately determined from topographic form, such as at Ship Rock's twin peaks where a mid-point must be chosen, or at the junction of the Colorado and Little Colorado Rivers in the Grand Canyon. The following analysis profiles accuracies down to around visual acuity (0.017°), necessitating a high accuracy in site location. In a 100 km alignment of an interim point and two end points, a 0.017° deviation of accuracy amounts to about 15 meters if the interim point is at the center of the line. Site locations are recorded down to tenths of an arc second, about 3 meters, and GPS and mapmaking errors can be expected in the range of two or three arc seconds. All work is done in a WGS 84 compatible map grid.

Prehistoric great kivas, which occur throughout the Basketmaker III (500 A.D.) through Pueblo III (1300 A.D.) periods, run from about 14 to 23 meters in diameter, are characteristically semi-subterranean ceremonial settings with four pillars, central roof openings and floor *sipapu*. At present, while most acknowledge that the great kivas of Chaco Canyon might well have been used by pilgrims traveling from some great distance, the conventional wisdom about outlier great kivas is that they were local, perhaps kinship affairs of one kind or another. The usual Chacoan pattern is for a great kiva to be accompanied by a pueblo-like great house also associated in function with larger social scale ritual (whether pilgrimage or kinship). Kendrick and Judge (2000) speak of a more rhetorical, competitive role of the great houses at the Lowry Ruin compared to a more integrative function of the great kivas within the community. The obvious ritual focus of the overall site is taken in the present work to be the great kiva.

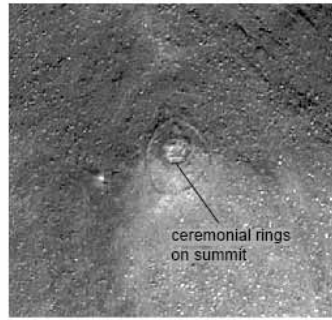
While general site locations are available in archaeological data bases, often important features do not have clear map or GPS locations. In a small number of cases, using general UTM locations in Google Earth, one can find the clear outlines of great kivas, from which accurate positions can be recorded, see examples of figure 22. Most of the time, however, one combs through hardcopy archives, and any library material on sites looking for an "x" marked on a quad map or equivalent. No good location information is available for nine known sites; unknown others undoubtedly exist. Given the large number of sites for which good locations were available, 61, however, it is not believed that the omission of an additional 9 or more seriously impacts the outcome of the study. This is not to say that the site information for all 61 is



Mount Wilson



McCarty's Flow



Cerro Moctezuma

Fig. 20 Examples of most prominent natural features in the Anasazi landscape.



Comb Ridge Point



Comb Ridge Feature



Cabezon from Chacoan outlier



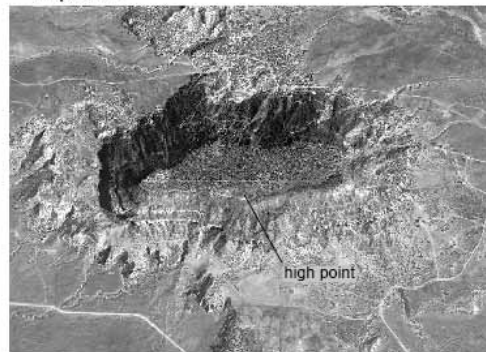
Comb Ridge profile



Ship Rock



Chimney Rock



Haystack Mountain

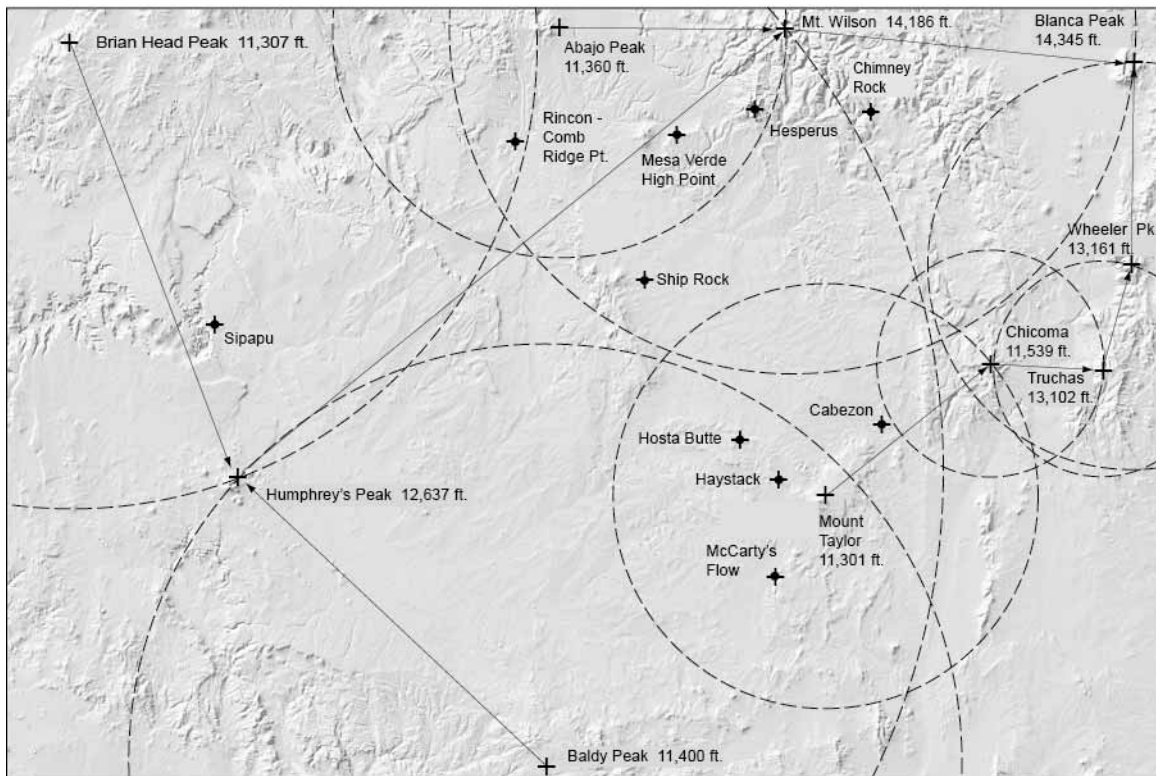


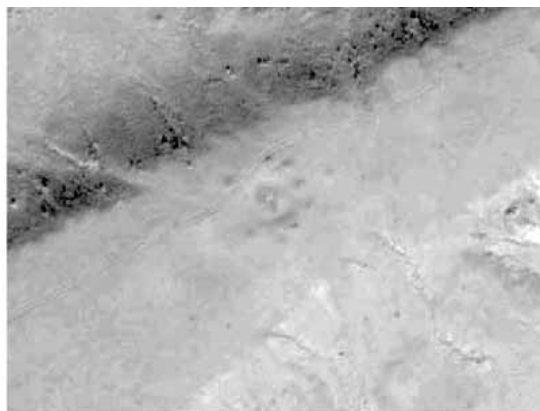
Figure 21. Highest mountains in the Anasazi region (Southern Colorado Plateau), plus eleven other most prominent natural features (Sipapu, Rincon - Comb Ridge Point, Ship Rock, Chimney Rock, Hesperus, Mesa Verde High Point, Hosta Butte, Haystack, McCarty's Flow, and Cabezon). Cerro Moctezuma off map to the south. Radii indicate distance to next higher peak. Blanca Peak (upper right hand corner) is the highest and therefore has no radius.

perfect. At several community foci, more than one great kiva and even great houses are known within a relatively close distance, say a couple hundred meters; Peñasco Blanco in Chaco Canyon is one such example. In this case the largest and earliest (PI), just north of the great house, figure 22, is used as the analysis point for the entire site. At Tse Bee Kintsoh, however, down in the Red River Valley, there are reported to be four great kivas in close association to the great house. In cases such as these, where a map location exists primarily for the largest great house, the probable closest great kiva is used. More often, better site maps allow one to specifically locate the great kiva, particularly if it lies a hundred meters or more detached from the great house. Where great kivas and great houses are a greater distance apart, yet still considered part of the same community, e.g. Ackmen and Haystack, separate locations are included in the analysis.

In many respects the accurate locations of great kivas are more important from the larger probability perspective than dating them in two periods, BMII-PI and PII-PIII. This junction



Red Willow



Los Rayos



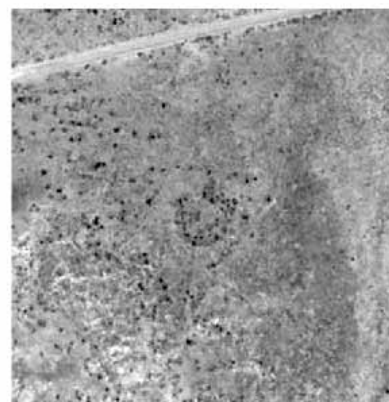
Pueblo Penasco



Casa Rinconada



Dalton Pass



Goesling

Figure 22. Great kiva images from Google Earth

is generally recognized as a distinction between earlier more mobile groups which aggregate at times into great kiva and other “villages” (in the Chuskas, early Chaco Canyon and particularly up in the San Juan area) and subsequent organization into Chaco related “phenomena” (Adler and Wilshusen 1990). A greater climatic variability occurs during the earlier period (Nelson and Schachner 2002).

The reader should consider the selection of sites in the two time periods as provisional. With 61 sites involved, the potential questions from archaeological readers about their dating will undoubtedly be numerous. The strategy, for present purposes only, is to record the most readily available site date given in archaeologically broad survey publications or state archives. More specifically, it is the date of the community (and probable focus), not the great kiva or great house architecture that is used. The logic here is twofold. In that alignments are contexts with other sites, it seems less likely that a great kiva would be built and aligned on an earlier established *unaligned* site, unless of course the alignment and the distant context originated at the site at a later time. Paramount, perhaps, is the site location, not the fact that an architectural great kiva was built. Secondly, some early shrine, kiva or *sipapu*-like feature might well have been obliterated in subsequent, more architecturally formal ritual settings. The shrine/kiva feature at the Comb Ridge point might be an example here (figure 46), or the simple *sipapu* and shrine at the tops of most sacred mountains like Mount Taylor and Chicoma. A parallel example can be observed in the historical Hopi village Walpi, where architecturally defined kivas and their *sipapus* are essentially subordinate to the naturally formed village plaza with its most sacred *sipapu*, just a simple, small hole in the ground.

Given the above considerations, the 61 sites are divided into an early group of 34, and a later one of 27 as detailed below. While outlier sites exist that do not have associated great kivas, every attempt has been made to include the greatest number of those with great kivas for which site information is available. The great kivas associated with the Bonito Phase great houses of Chaco Canyon (Pueblo Bonito, Chetro Ketl, Pueblo Arroyo, Hungo Pavi, and perhaps Wijiiji) are excluded from the analysis because of the possible fact that most of these locations were determined by small scale relationships within the canyon after the formalized landscape meaning of Chaco itself had been laid out. Included in Chaco Canyon are two Basketmaker great kivas (in “villages”), two singular (without great houses) possibly also early great kivas, and three later features associated with the first three early PII great houses: Peñasco Blanco,

Casa Rincoñada (built later but spatially adjacent to Pueblo Bonito), and Kin Nahasbas (also built later but spatially adjacent to Una Vida). Interestingly enough, contrary to the free-standing character of those included, those excluded great kivas seem to be all confined within great house plazas.

Basket Maker III – Pueblo I

1. **29 SJ – 1253** Unexcavated great kiva in Chaco Canyon, not related to a great house. Listed as late PI-early PII in Marshall, et.al. 1979, pg. 273. Located from UTM's provided by Chaco Canyon National Historical Park.
2. **29 SJ – 1642** Unexcavated great kiva in Chaco Canyon, not related to a great house. Listed as early PII in Marshall, et.al. 1979, pg.273, but more recently Dabney Ford at Chaco Canyon National Historical Park is inclined to earlier dating, even BMIII (personal communication). This location is marked as "ruins" on quad map, as explained by Park staff. See also photo in Van Dyke 2007:115)
3. **29 SJ – 423** Excavated BMIII (516-557) "village" in Chaco Canyon. Marshall, et. al. 1979, pg. 273 summarize from Windes 1975. Located from UTM's provided by Chaco Canyon National Historical Park.
4. & 5. **Ackmen (N) & Ackmen (S)** Situated about 200 meters from each other, these two great kivas are dated as PI, about 855-872 A.D. by Martin and Rinaldo 1939. Summarized in Marshall, et.al. 1979, pg. 311. Great kiva locations from topo map in Martin and Rinaldo, pg. 325.
6. **Andrews** Van Dyke (1999:62) lists two habitation sites with dates in late PI (about 882-889 A.D.); two great kivas are built around 924-941 in early PII. The great house-great kiva complex dates from about 919 A.D. (this is the great kiva location used in the analysis - location determined from map on page 58).
7. **Bad Dog Ridge** Listed as having a BMIII component in Gilpin and Benallie Jr. (2000), page 162. They list five great kivas (two in BMIII) on the large site extending well into PII. The location of the largest was determined from UTM's by Gilpin and from map on page 167. Largest of the possible great kiva depressions (apparent focal point) is used as point.
8. **Bluff** Cameron (2009) states that this site had been used since BM III times, pg. 298. Great kiva location from GPS by author.
9. **Broken Flute Cave** Listed as dated A.D. 623-635 (Morris) by Gilpin and Benallie (2000), pg. 162. UTM's supplied by Dennis Gilpin used as great kiva location.
10. **Chimney Rock Great Kiva** From Parker (2004) the Chimney Rock community was active throughout the PI period, as well as PII, pg. 54. Coordinates for great kiva were determined from quad map provided by Kane (2004) pg. 105.
11. **Coolidge** Kantner (1999) gives a 883 A.D. beginning date for the site (pg. 123). Site location clearly indicated on quad map copy from ARMS (Archaeological Records Management Section NM). Both great kivas are quite close to the great house; point between two kivas used.
12. **Cottonwood Falls** Severance (2004) defines the beginning of the site in the mid 800's A.D. Site location of great kiva from GPS by author.

13. **Dalton Pass** Kantner (1999) summarizes this site with starting dates in the mid 800's A.D., pg. 116. Site location from map on same page; can be seen in Google Earth.
14. **Ganado** Listed as BMIII-PI by Gilpin and Benallie (2000) pg. 162. Site location of approximate center point between the five possible great kivas from GPS by author.
15. **Grass Mesa** Clearly defined as beginning in BM III in Lipe, et.al. (1988). Great kiva location from maps on pages 2 and 14, among others.
16. **Haystack 3 (LA 12573-D)** This southern of a pair of great kivas about 280 m apart is given a date of late PI-early PII by Marshall, et. al. (1979), pg. 166. Site location from their quad map of the area on same page.
17. **Juniper Cove** Listed in Gilpin and Benallie Jr. as 650-675 A.D. Sketch map in Gilpin and Benalli Jr. 2000, pg. 163.
18. **Kachina Panel** (Butler Wash "Main Panel") Rock art style, "San Juan Anthropomorphic Style", dated to BMII period by Schaafsma (1980:109-119). UTM's of main panel noted on Winston Hurst's field documentation (checks with author's GPS reading).
19. **Kin Bineola K1** (immediately adjacent to great house) Site occupation begins around 750 A.D. according to Powers et. al. (1983) pg. 243. Location from GPS by author.
20. **Kin Bineola K2** (3.023 km to the south of great kiva/great house complex) Assumed to be related to Kin Bineola K1 with its date of 750 A.D. Site location from quad map in Marshall, et. al. pg. 58.
21. **Kiva Mesa BM III** Basket Maker III site about 800 m. from PII great kiva/great house complex, as defined by Reed(2000). UTM center of BMIII village with its three great kivas provided by Paul Reed.
22. **Los Rayos** Dating stated as PI on ARMS data sheet. Associated UTM's enabled recognition of great kiva on Google Earth.
23. **Lowry Ruin** Great kiva is tree-ring dated to PII at 1086 A.D. (Martin 1936, pg. 195) but a population of widely dispersed BMIII pit houses was found in Kendrick and Judge's (2000) survey of the "Lowry Community", pg. 116. Great kiva location from GPS by author.
24. **Mitten Rock** Described in Reed (2000) as a BMIII/PI community site, pg. 1016. Site location from quad map in Peckham & Allan 1990, pg. 2.
25. **Morris Site 39** Powers, et. al. (1983) found ceramics from BM III in the site cluster, pg. 142. Site location from topo map on file with ARMS.
26. **Morris Site 41** Powers, et.al.(1983) describe a range of occupations from BMIII to PIII within the site cluster, pg. 147. Great kiva is located via a combination of three topo maps on file with ARMS (from Morris).
27. **Peach Springs** Earliest dating from BMIII period comes from Powers, et.al.'s survey of the outlier site (1983), pg. 72. Later great kiva can be located from quad maps provided in survey.
28. **Red Willow** From ARMS data sheets, this site begins in PI. Provided UTM's enable location of great kiva in Google Earth.
29. **Rincon Great Kiva/Shrine** Feature at southern tip of Comb Ridge has not been excavated. Included in earlier period because of adjacent PI village. Site location from GPS by author, and is visible in Google Earth. This point is also included in set of natural features as it defines the point of Comb Ridge at the San Juan River.
30. **Shabik'eschee Village** One of two BMIII villages with great kivas in early Chaco Canyon (Wills & Windes 1989). Site location indicated on USGS quad map.

31. **Skunk Springs** Has a PI component together with PII and PIII, Marshall, et.al. (1979), pg. 109. Site location of great house (with both PI and PII, PIII components and great kiva) can be determined from topography in map on pg. 110.
32. **Squaw Springs** Marshall, et.al. 1979, pg. 249 suggest an occupational span of the nuclear community beginning in late PI. Probable location determined from site description in Marshall & Stein (1978, pg. 1) together with UTM's provided by ARMS.
33. **Tohatchi** Described as BMIII village in Marshall, et.al. 1979, pg. 285. Site location from GPS by author.
34. **Tse Bee Kintsoh** Kantner (1999) provides a 750 A.D. beginning date for the community (pg. 124). There are reportedly four great kivas at this site; the one closest to the great house is used in the present analysis (from map in Kantner 1995 pg. 16).

Pueblo II – Pueblo III

35. **Allentown** Marshall, et. al. 1979, pg. 289 cite Roberts (1939:252) to date the community locus as PII. Approximate site location determined from map in Roberts, Plate 1. Great House ruins visible in Google Earth; great kiva location derived from site plan in Powers, et. al. pg. 234.
36. **Axtec Complex Center** A PIII site as defined in Powers, et.al. 1983, pg. 151. Center of complex determined by author's GPS and site map in Stein and McKenna (1988) pg. 69.
37. **Casa Rincoñada** Marshall, et. al.(1979) give tree ring date of 1027-1054 A.D., pg. 269. Location from GPS by author.
38. **Casamero** Marshall, et. al. (1979) give dates of 1000-1125 A.D., pg. 131. Great Kiva adjacent to great house is used for GPS position by author.
39. **Coyotes Sing Here** Marshall, et. al. (1979) give a late PII date for the outlier site, pg. 145. Site location from marked quad map in ARMS files.
40. **El Rito** Powers, et.al.(1983) give site dates as early PII, pg. 222. Great kiva location determined by Gauthier's map reprinted in Powers on page 224, together with quad maps.
41. **Escalon** Dating comes from Van Dyke's (2002) list of Classic Bonito Phase (1040-1120 A.D.) outliers with great kivas, pg. 236. Site is located on quad map on file with ARMS.
42. **Fort Wingate** Marshall, et.al. (1979) give an establishment date of late PI-early PII, running up to PIII pg. 155. The great kiva on the site was destroyed in the construction of I-40, but can be located by UTM's from ARMS (general location), quad map topography, and site plan on pg. 156.
43. **Goesling Pueblo** ARMS lists the earliest date as PII on their record sheet. Accompanying UTM location allows visual recognition in Google Earth.
44. **Guadalupe** Durand and Durand (2000) begin their site dates right at 900 A.D., pg. 106. Good topo maps in the publication allow for great kiva location.
45. **Haystack 1** Marshall, et. al. (1979) give a late PII-early PIII date to this great kiva directly adjacent to its great house, pg. 159. Great kiva point from GPS by author.
46. **Haystack 2 (N)** (LA 12573-A) Located just 800m. north of LA 12573-D, Marshall, et.al. (1979) give dates of PII, pg. 163. Kiva location determined from quad map provided on page 166.

47. **Kin Hocho'I** Dating comes from Van Dyke's (2002) list of Classic Bonito Phase (1040-1120 A.D.) outliers with great kivas, pg. 236. Site location from UTM's in Fowler, et. al. (1987), maps on pages 33 and 41.
48. **Kin Nahasbas** Discussion about this great kiva site in Vivian and Reiter (1960) centers on PII dates, pg. 103. GPS located by author.
49. **Kin Ya'a** Marshall, et.al. (1979) give PII-PIII dates, pg. 201. GPS great kiva location by author.
50. **Kiva Mesa PII** Reed (2000) documents the PII components of this site, pg. 995. Great kiva can be located by photo on page 998.
51. **Las Ventanas** Marshall, et.al. (1979) place this site in PII-PIII, pg. 187. Site located on quad map on file with ARMS.
52. **Muddy Water** Marshall, et. al. (1979) give a temporal affinity of PII, pg. 207. Topo map on page 208 allows location of great kiva.
53. **Navajo Springs** Warburton and Graves (1992) place this outlier site at PII, pg. 51. Great kiva can be located from aerial photos and site drawings in article.
54. **Newcomb** Site dating from PII given in Marshall, et. al. (1979), pg. 101. GPS by author was taken at great kiva large midden at center of linear site.
55. **Peñasco Blanco** There are four great kivas directly associated with this great house in Chaco Canyon. The largest, just north of the great house is used (located via Google Earth). The kivas are undated according to Marshall, et. al. (1979), pg. 270; they give two dates, 900 A.D. and 1050-1088 A.D. for the great house.
56. **Pueblo Pintado** Marshall, et.al. (1979) give a date of 1060 A.D. for construction of the great house, and 900 A.D. to 1250 time range for the associated community, pg. 81 & 86. GPS location by author.
57. **Salmon** Excavated Chacoan component date for great house and great kiva is 1080, Marshall, et. al. (1979), pg. 304. GPS location by author.
58. **Sanostee** Temporal affinity given as PII by Marshall, et. al. (1979), pg. 105. Great kiva/great house location not marked on quad map segments on file with ARMS, but with these as starters, probable great kiva is just visible in Google Earth.
59. **Standing Rock** Marshall, et.al. (1979) give dates as late PII – early PIII, pg. 231. Great kiva can be located from map on pg. 214 in Powers, et.al. (1983).
60. **Toh La Kai** Temporal affinity of late PII-early PIII in Marshall, et.al. (1979), pg. 235. Site marked on quad map segment on file with ARMS.
61. **Village of the Great Kivas** Dating by Roberts (1932), pg. 156 gives a tree-ring date of the great house at 1015 A.D. GPS location by author.

[Great kiva sites not included for lack of maps or other information by which to position: Padilla Well, Cove, Whirlwind Lake, Ida Jean, Vidal Great Kiva, Jackson Lake, San Mateo Mesa, Nez Site, Heaton Canyon]

As shown in figure 23, one can first locate the existing 21 natural and 61 great kiva sites and then draw a test area around the area within which all 61 great kivas occur. In the test area one can delete all of the existing and replace them with 61 randomly located points. The 21 natural points are constant and participate equally in the generation of random alignments. The reader

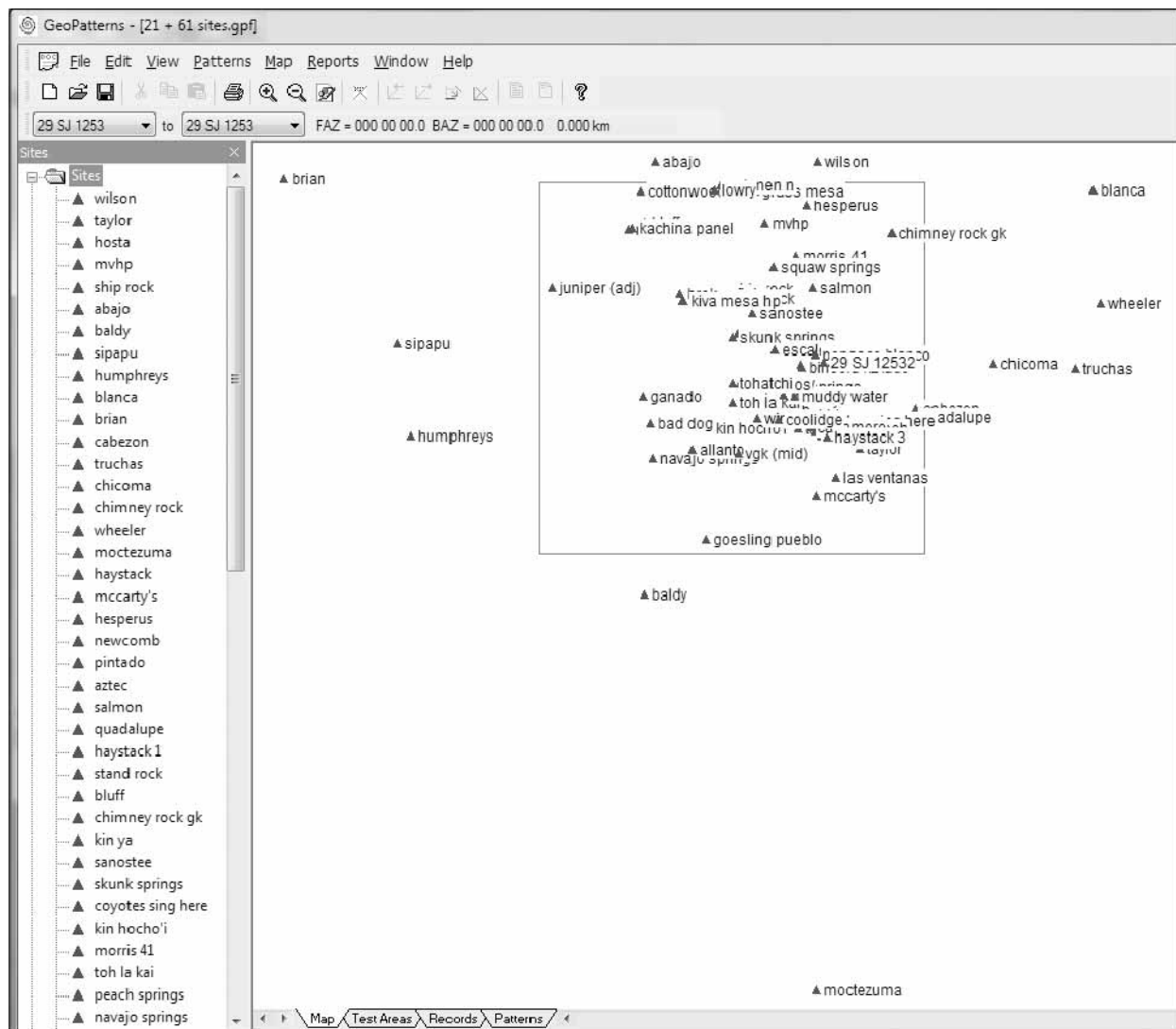


Figure 23. Location of test area in which all 61 existing great kiva sites occur, and in which 100 sets of equivalent numbers of random points are scattered; 21 natural features remain constant.

will recall that one naturally coincident large-scale alignment occurs among the 21 natural points: Sipapu – Chicoma- Truchas (average deviation of 0.019° , overall length of the line is 555.009 km). Each random set takes about half a minute to set up and record the number of three-point alignments at a particular accuracy. Twenty such sets were initially examined to determine the number needed to establish an acceptable random average with minimal variation between groups of like numbered sets. The total was increased to 100 sets, which proved to be quite stable. Perhaps because the overall number of points involved, $21 + 61 = 82$ is quite high, the 100 set group even seemed quite stable across increasing numbers of alignments at ten dif-

ferent accuracies. Since visual acuity is said by optical scientists to be around 0.017° , it seemed appropriate to start close to this level of alignment accuracy, in this case 0.015° , incrementally adding 0.015° up to a maximum deviation of 0.15. Thus 100 sets of 61 random points each were created for each of the ten levels of accuracy, for a total of 1,000 sets.

There is an overlap of natural and built points in one instance, the Rincon great kiva/shrine. This point is accurately both the natural tip of Comb Ridge, and a built ceremonial feature. Recognizing that random distributions of 61 points in the test area might also load up two points virtually on top of each other, a point is entered into the existing list for the natural and built features separately (the same location for both points). In the consideration of total number of alignments created by the existing 82 points, the coincidence of the Rincon point with Comb Ridge point essentially doubles the number of associated alignments with this location.

The range of randomly created 3-point alignments at the middle accuracy of 0.075° runs from a low of 64 to a high of 112, a 48 point difference, with an average of 82.6. How does one, then, think about the possibility that with the existing set of 82 (again 21 natural and 61 built), some number might be intentionally aligned, i.e. designed? In a case with a very small number of points in a given area, say three, with a given accuracy, accurate alignment would essentially only happen if they lined up intentionally (some very large number of random sets would be necessary to equal the feat). With much larger numbers of points where large numbers of random alignments occur, one can imagine the opposite effect, i.e. where intentionally aligned points are largely masked by randomness. Is there a range of points in between where intentional alignments can be additive, i.e. independent of random patterns, actually influencing the total count?

Given 82 existing sites, if there are intentional alignments, there will also surely be random ones as well. The diagram of figure 24 attempts to communicate the logic of the situation.

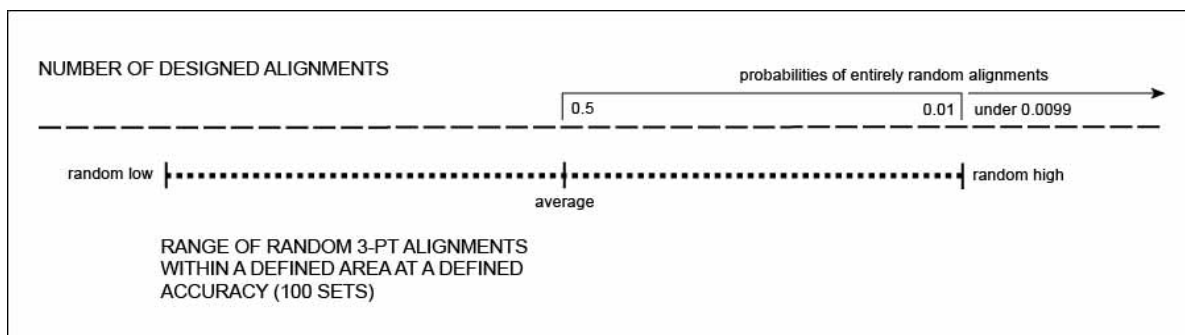


Figure 24. Probability relationship between random and designed alignments.

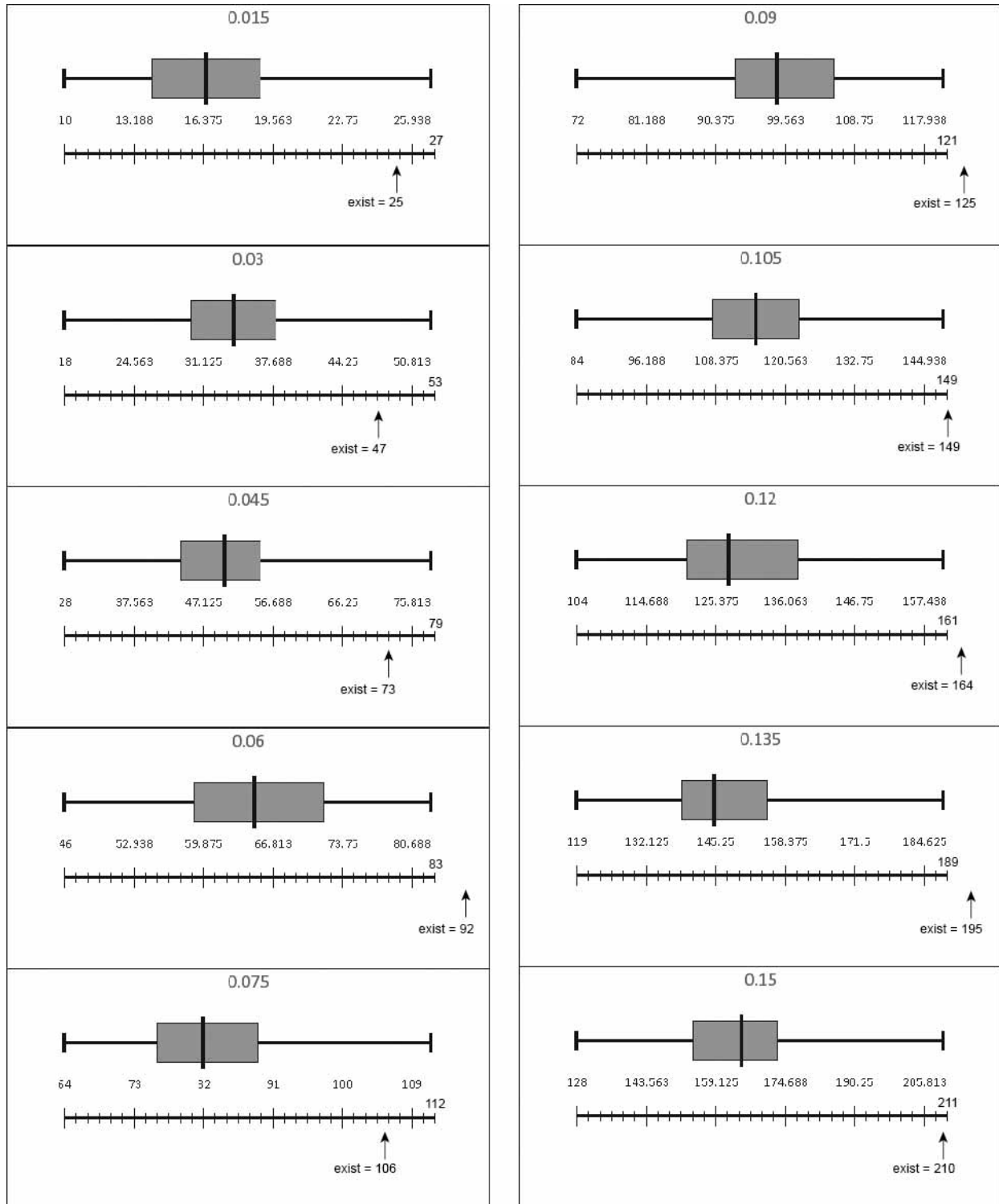


Figure 25. Box and whisker plots for tests of random alignments at ten accuracies: each plot expresses results of 100 sets where each set has 82 points (equivalent number to total great kiva sites plus natural features); number of alignments among great kiva and natural points is indicated on each plot.

It assumes that in the range of the present number of sites, some independence exists between designed and random alignments. The diagram shows that below the lowest number of random points, 64 in the 0.075° case, any intentional alignments will be totally masked for all practical purposes. If the number of existing alignments falls within range from 64 to 112, however, an increasing probability exists that its total number contains some number of designed alignments. Working with sets of 100 as a base, as existing numbers appear close to or above the highest random set, one finds the greatest probability that at least some number of alignments are not random.

The results of the 100 set tests at 10 levels of accuracy are shown in the box and whisker plots of figure 25. The existing 61 great kiva sites, in context with 21 natural features, exceed the highest random set at four levels of accuracy: 0.06°, 0.09°, 0.012° and 0.135°. Here the probabilities that the existing set is totally random are lower than 0.0099. While Geopatterns software does have the capacity to run very large numbers of random sets for very unique geometric patterns with a small number of points, it cannot at present economically run multiple number tests on sets with many alignments and many points (much more automatically, though version 3 is somewhat better in this regard as explained in Appendix I). Intuitively, if one ran 1,000 sets for each level of accuracy, one would most likely find at least one set that exceeds the existing, suggesting a range of probability somewhere between 0.0099 and 0.00099. The highest alignment producing random set of the 100 at 0.105° creates a number identical with the existing landscape pattern, and five have one or more random sets better than the existing: 0.015° (two sets higher = 0.02), 0.030° (one set higher = 0.01), 0.045° (one set higher = 0.01), 0.075° (two sets higher = 0.02), and 0.15° (one set higher = 0.01). Since the behavior of these comparisons is quite similar in all ten ranges of accuracy, one cannot say at present that if some number of designed alignments is present among kivas and landscape features that any particular degree of accuracy is more representative than another.

Comparing BMIII/PI and PII/PIII

As part of the larger data set showing the number of alignments each site is involved with, figure 26 also potentially reveals a distinction between the early and late sites (using the middle accuracy of 0.075). Again the purpose of the present exercise is to look only at numbers, and not attempt to archaeologically profile early sites that have later components (e.g. Ganado, Bad

BUILT BMIII-PI 0.075	NATURAL BMIII-PI 0.075	BUILT BMIII-PI (w later) 0.075	BUILT PII-PIII (w earlier) 0.075	NATURAL BMIII-PIII 0.075
8 lowry	6 sipapu	9 lowry	8 kiva mesa PII	8 sipapu
5 rincon	5 rincon	8 29SJ423	7 vgk	7 wilson
5 bluff	3 taylor	7 dalton pass	6 standing rock	6 mccartys
4 tohatchi	3 wheeler	7 broken flute	6 penasco blanco	5 hosta
4 squaw springs	3 mccartys	7 main panel	5 aztec	5 humphreys
4 29SJ423	2 hosta	6 bluff	5 coyotes sing here	5 rincon
4 shabik'eschee	2 humphreys	6 ganado	4 haystack 2	4 taylor
3 ganado	2 brian	5 kiva mesa BMIII	4 casamero	4 ship rock
3 kiva mesa BIII	1 ship rock	5 andrews	4 navajo springs	4 wheeler
3 dalton pass	1 baldy	5 coolidge	3 newcomb	4 haystack
2 main panel	1 wilson	5 cottonwood	3 pintado	3 mvhp
2 29SJ1253	1 mvhp	5 los rayos	3 salmon	3 baldy
2 ackmen n	1 blanca	5 rincon	3 quadalupe	3 blanca
2 coolidge	1 truchas	5 squaw springs	3 sanostee	3 cabezon
2 bad dog	1 chicoma	5 tohatchi	3 kin hocho'i	3 chicoma
2 bineola k1	1 haystack	4 skunk springs	3 nahasbas	3 moctezuma
2 broken flute	1 hesperus	4 ackmen n	3 rinconada	2 brian
2 cottonwood	0 chimney rock	4 bineola k1	3 goesling pueblo	2 truchas
2 peach springs	0 moctezuma	4 red willow	2 toh la kai	2 chimney rock
1 ackmen s	0 abajo	4 shabik'eschee	2 escalon	2 hesperus
1 andrews	0 cabezon	3 haystack 3	2 fort wingate	1 abajo
1 bineola k2		3 peach springs	1 haystack 1	
1 los rayos		3 morris 41	1 kin ya'a	
1 red willow		3 29SJ1253	1 el rito	
1 29SJ1642		3 ackmen s	1 las ventanas	
1 mitten rock		3 bad dog	1 allantown	
1 morris 39		2 bineola k2	1 muddy water	
1 morris 41		2 tse bee kintsoh		
1 tse bee kintsoh		2 grass mesa		
1 skunk springs		2 mitten rock		
0 grass mesa		2 morris 39		
0 haystack 3		1 chimney rock gk		
0 juniper		1 29SJ1642		
0 chimney rock		1 juniper		
AVG = 2.12		AVG = 4.15	AVG = 3.26	

Figure 26. Number of involved alignments for each site, natural and built, during early and late periods; average involvement for great kiva sites for the two periods.

Dog, Bluff, Coolidge, Chimney Rock, etc.). If in fact some number of the existing alignments were designed, from the present perspective only, then one might expect the earlier sites to grow in alignment connections as later sites come on line. If integration is occurring early on, then new locations would not logically be independent of BMIII/PI landscape structure, unless of course all later sites are wholly of a Chacoan definition and operate, as it were, in their own

world. A tendency in this direction is what appears to happen. The average alignment number of early sites is 4.15, compared to the average for later sites of 3.26. Not only is there a larger number of sites in the early period, but each of these sites are ultimately more involved in alignments than the later ones.

Yet, this imbalance between a group of 34 and one of 27 can also happen by chance. One can divide each of ten random sets (61 each @ 0.075°) into two groups of 34 and 27 to represent early and late sites (random alignments of the ten sets ranges from 112 to 71). The greatest difference between any two groups in average number of alignment involvements per site is 0.96, where, reversed from the existing, the first 34 sites has the *smaller* average. The difference between the averages of the existing earlier and later groups is 0.89. Nevertheless existing/random comparisons of early and late site groups may be approached in other ways.

The alignment averages imbalance in the existing split could actually be real, yet indistinguishable from this form of random comparison. One can inquire about how the early group performs independent of the later sites with their

lessor alignment averages. Fig. 27 shows how the 34 early sites (again in the context with 21 natural features) compare with 100 sets of 34 random points each at four lower accuracies of $0.03^\circ - 0.075^\circ$. Does the greater numbers of alignment involvement per site somehow translate into a clearer distinction between the existing and the highest random sets at these accuracies? Not really. While no random set of the four accuracies is higher than the related existing one

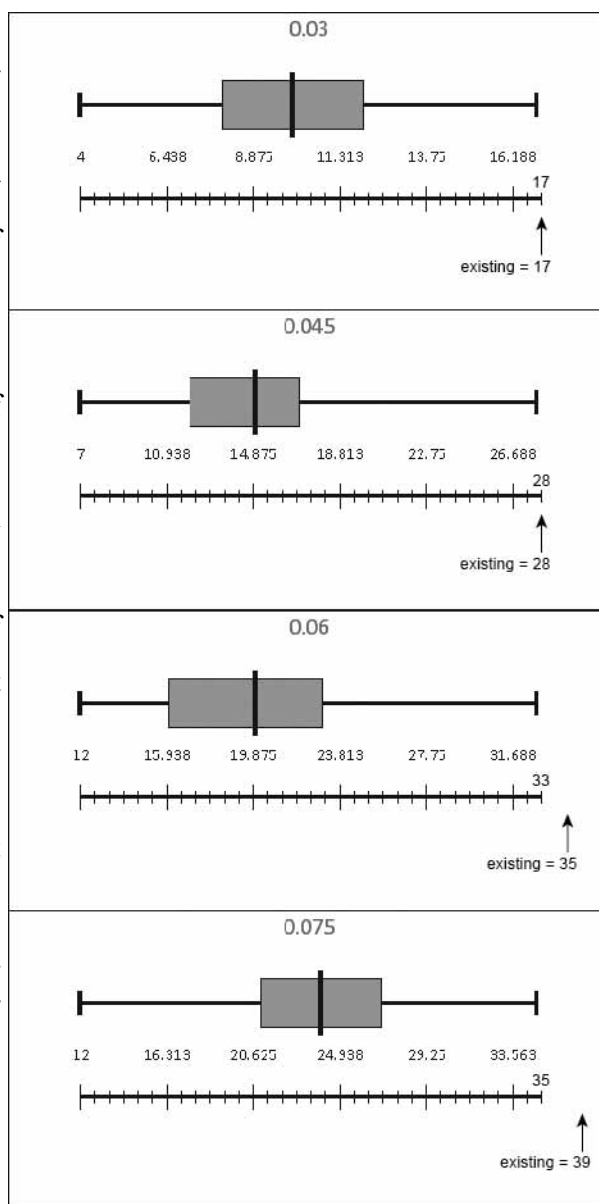
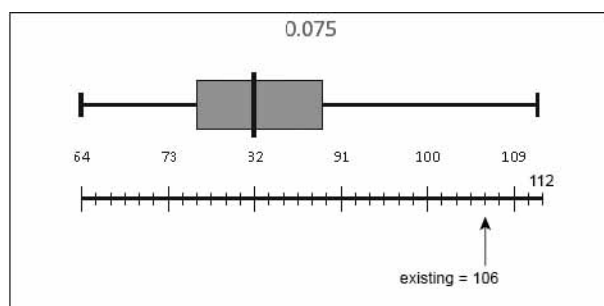


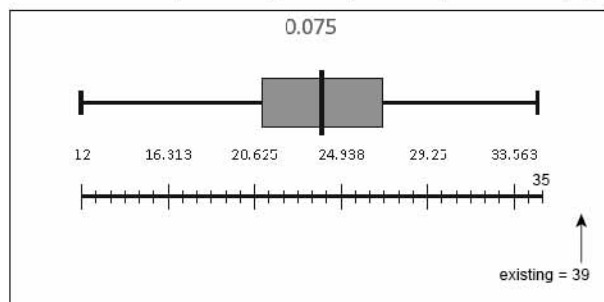
Figure 27. Box and whisker plots for alignments created in 100 sets of 34 random points (plus 21 natural) each, at four accuracies, compared to the number of alignments among 34 early great kiva points.

(two are lower, two are equal), overall the strength of early sites is quite similar to that of the combined group of 61. It is tempting to look at four plots for just the late group. This however cannot happen since the early sites were always there when later ones were located. In this regard, early/late comparison ideas might shift to some possible effect of the natural 21 points. In this case it makes some sense to consider both groups independently as they interacted with the natural features. Interestingly enough, the plots of figure 28, show a major difference between early and late sites.

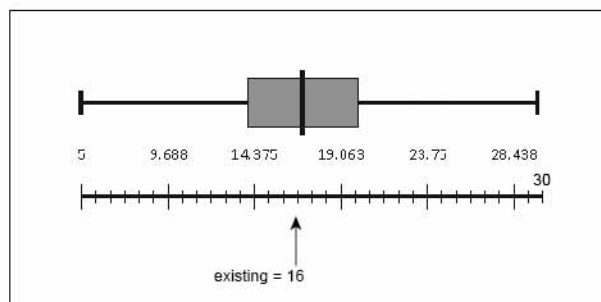


100 SETS: EARLY (34 random) + LATE (27 random) + NATURAL (21)

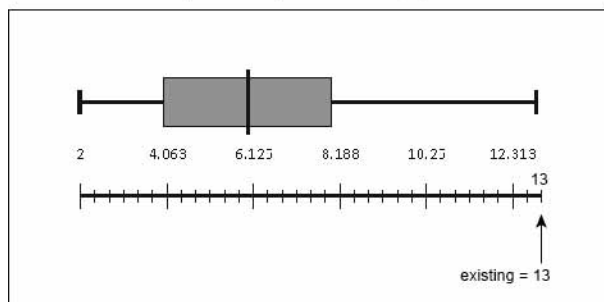
Figure 28. Comparisons of early and late great kiva groups in combination and individually, with and without natural points--all box and whisker plots express the number of alignments at 0.075 created by 100 sets of random points with the number of points in each set indicated--the number of alignments among great kiva (and natural) points are shown on the plots.



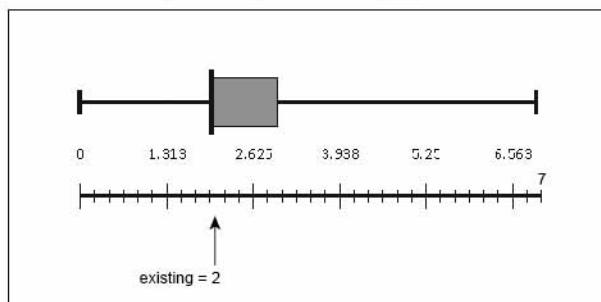
100 SETS: EARLY (34 random) + NATURAL (21)



100 SETS: LATE (27 random) + NATURAL (21)



100 SETS: EARLY (34 random)



100 SETS: LATE (24 random)

As we knew from figure 27, the early 0.075 existing group is considerably above the highest of the 100 random sets with its 35 alignments. The late group by itself, as if they were the first to be built, performs very poorly, actually at a level below the average for the 100 random sets. Nevertheless, when one looks again at the list of sites and their alignment numbers (figure 26), the late group with its average of 3.26 doesn't seem to be doing *that* poorly (they

after all do quite well when part of the entire group of 61) suggesting that its sharp drop into the middle of the random spread could be due to the severing of alignments with earlier sites. Again this coincides with the greater numbers of early than later great kiva sites and the two averages themselves, i.e. earlier sites are around longer and will therefore have more involvement than later ones.

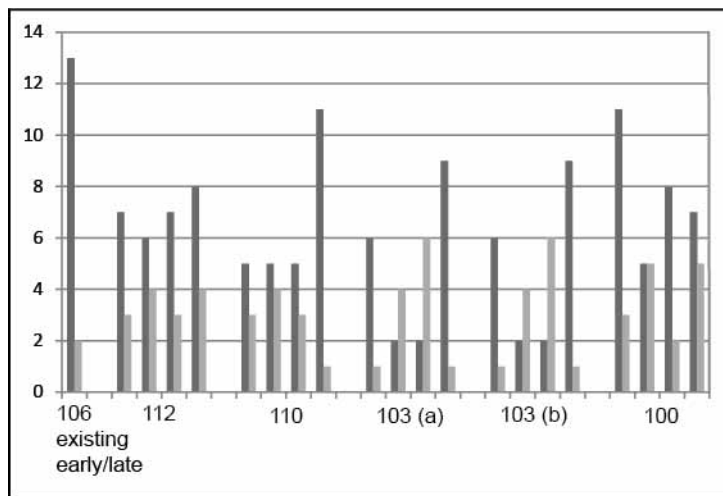


Figure 29. Comparisons of numbers of alignments in the existing 34 and 27 groups taken independently w/o natural features with four variations of 34/27 splits in each of five high random sets of 61 at an accuracy of 0.075 (numbers of total random alignments for each set listed below; exist = 106).

no natural features. In these twenty different 34/27 splits of high random 0.075° sets, the existing has the greatest difference between numbers of alignments in the two groups. Yet much random variation occurs. The next most dramatic difference occurs in the Middle 27/Ends 34 of the 110 alignment random set. Its numerical difference is 10 while the existing is 11. When the site averages for the two groups in this best random example are summed (lumping both groups together with the 21 natural sites), the difference between the averages is 0.45, about half of the existing difference of 0.89.

These comparisons of early and late groups attempt to create more dimensions to the effort of raising possible existing designed alignments from the shadows of the random. There exists a certain consistency of ideas, perhaps, first of all that possible intentional alignments are happening just as frequently if not more so in the earlier group. Secondly, these early sites continue to attract new relationships when later sites are located and built.

Without creating any unwarranted focus on any particular pattern as being intentional,

Once again, one must ask whether this effect of independent subgroups could also occur randomly. Five higher individual random sets of 61 points were subdivided into two groups of 34 and 27 via four different strategies: first 34 second 27, first 27 second 34, middle 34 ends 27, and middle 27 ends 34. It was determined that the presence of the 21 natural sites made little difference in the kind of comparison seen in figure 28; thus in the exercise shown in figure 29 only the 61 points were used with

one can compare the Geopatterns maps of the early existing 34 and the highest individual random set of 34 (of 100), at the accuracy of 0.075°, figure 30. Of particular interest are alignments greater than three points.

The existing set has one 5-point alignment and no 4-pointers, while the random has three 4-pointers. The random has three 4-pointers. The numbers of 3-point alignments (as listed in Geopatterns initial record) associated with each of these greater alignments are also shown in the illustration. One can also see from the illustration that in addition to the 5-pointer, the Sipapu also is the western terminus of two ad-

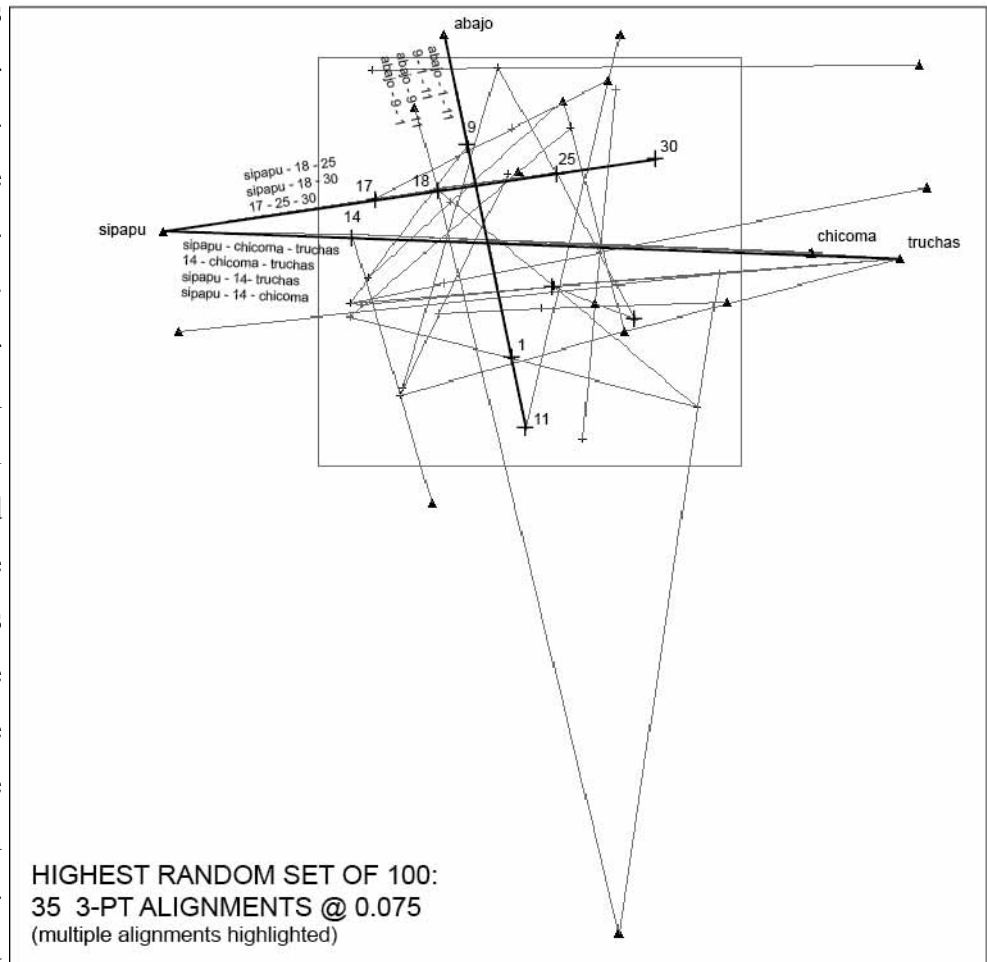
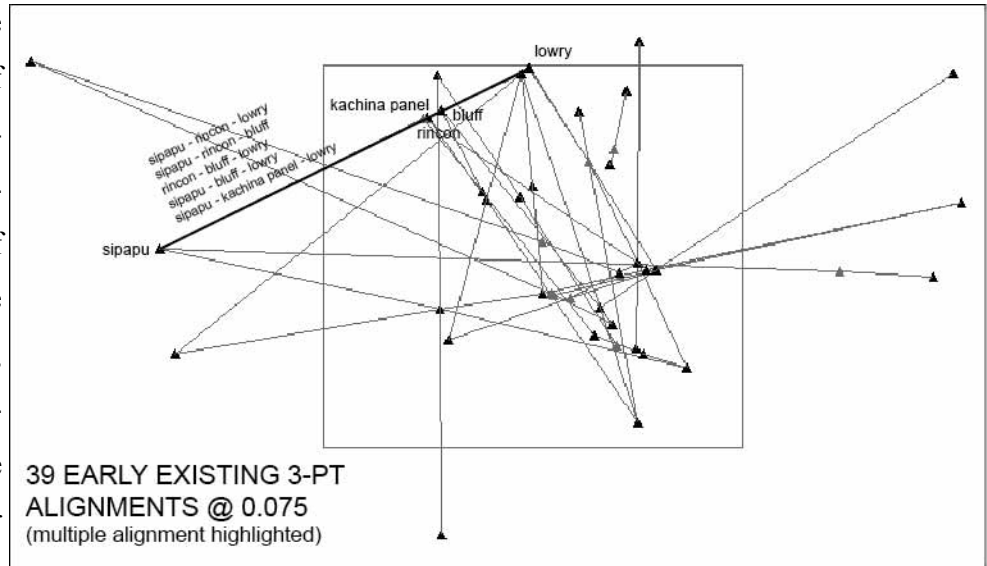


Figure 30. Map comparison of existing early group alignments (above) with highest random set of 34 points each of 100 sets (below) at an accuracy of 0.075.

ditional 3-point alignments.

One can now consider the pattern maps for the existing total 82 sites and highest random set of 100, both at 0.075° . Again, particularly at these higher numbers of site/feature locations and 3-point alignments, there is likely to be considerable numbers of random patterns created by the existing location of kiva sites. This being said, the array of alignments in the existing appears on the whole to be more focused or constrained in relation to the five multiple alignments indicated by heavier lines in figure 31. Part of this effect is because, compared to the random, the existing sites are somewhat more clustered toward the southeast center of the test box, where proximities to multiple alignments are most intense.

The random map shows six multiple alignments, including one 5-pointer, again loading up on the most coincidental natural 3-point alignment Sipapu-Chicoma-Truchas. This line is about 2.25° off from being cardinal east-west. In the map of the existing, a more complex set of alignment and cardinal relationships

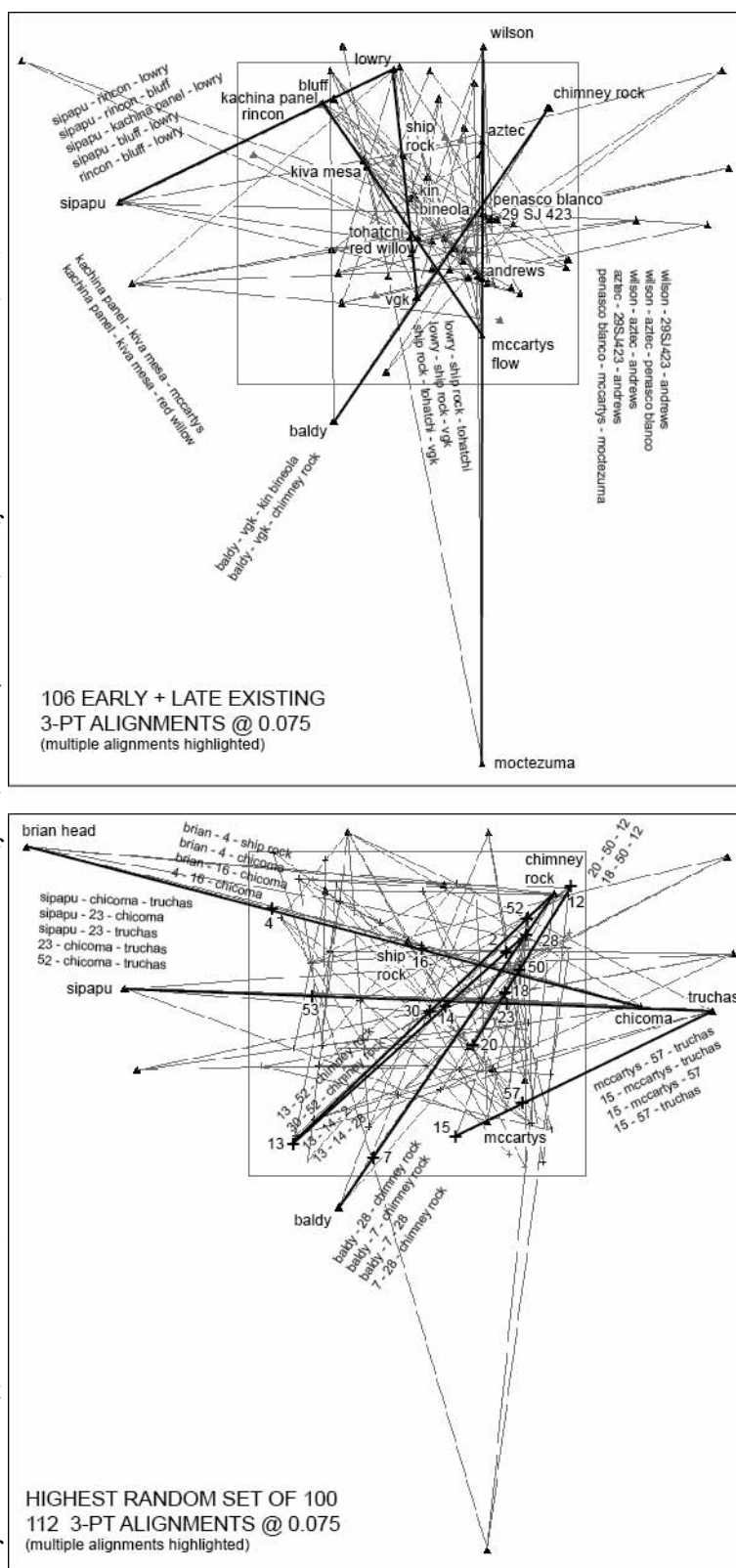


Figure 31. Map comparison of total existing alignments (above) with highest random set of 61 points each of 100 sets (below) at an accuracy of 0.075° .

occurs between Mount Wilson and Cerro Moctezuma, the natural feature McCarty's Flow and four great kiva sites in between: Aztec, Peñasco Blanco, 29SJ423, and Andrews. In total this complex includes five overlapping 3-point alignments and ten different north-south cardinal relationships between pairs of points (at the range of 0.075°).

Returning to the primary issue of simple numbers of alignments--leaving complex patterns for later chapters--what then, can we understand at this point? Questions remain about how one conceptualizes relations between the real and the random. For example, if one takes the smaller set of existing early sites, along with the 21 natural, it is possible to lay out or design 34 hypothetical points (at 0.075°) connected by alignments in a most efficient manner, i.e. that each site is located by only two alignment relationships to other sites (minimum necessary to precisely create an intersection and site location). There are no random alignments considered in this design, although some number is undoubtedly also created. In this exercise, using the present landscape context, the number of alignments necessary is roughly identical to the number of sites. The existing 34 great kiva sites create 39 alignments at the same accuracy suggesting the possibility that all might be designed. But the average number of alignments in 100 sets of random points is only 24.29. If one expects the random to contribute the average in the existing patterns, in this case about 24 (24.29), then 39-24, or 15 is an approximate number that might be designed. This is about half the number if 34 hypothetical sites are located to create greatest design efficiency, yet a relatively high percentage.

Consider then the larger group of 61 (always in the context of the 21 natural), and about 60 or so alignments that would be the most efficient designed means of linking all together. The total alignment number of existing sites is 106, minus the 60, leaving room for a contribution of about 45 random alignments. But since the lowest of the 100 random sets (all at the 0.075° range) is 64, and the average is about 82, the most likely number of designed alignments would be much less than 60, more in the range of 24 (106 minus 82). Thus in the larger and later group, the likelihood of design drops off considerably as a percentage.

This of course is but a mental game where the existing are independent from the random, and the random contribution is likely to be around the average. In actual situations one cannot be certain that the random contribution isn't an unusually high or low number. It is also probably true that there is a range, perhaps even in the present analysis, where designed alignments exert some influence over the numbers of random. This probable continuum from very

small numbers of points, where the random exert greatest influence, to the very large where any independence of the existing becomes invisible, needs to be much better understood.

In sum, however, it would seem to be unscientific to conclude that the Ancestral Pueblo, *in all probability*, did not survey *any* alignments, totally dismissing this kind of research, just as it would be even more illogical to believe that *all* alignments of a particular range of accuracies were designed. Together with the preceding more anthropological chapter, the introductory pieces of probability analysis listed below can be carried forward as this volume moves into its design analysis mode—with periodic tests of some particular layouts against random phenomena.

1. The existing alignments between great kivas and landscape features are in a probability range of 0.02 to 0.0099 compared to 100 sets of 61 random points in each of ten levels of accuracy.
2. The greater number of great kiva sites in the early BMIII-PI period (34) is a first indication of possible early alignment importance.
3. The greater averages of alignment involvement per site in the early group contributes to the possibility of alignment importance in early sites, i.e. that later ones build upon early ones, always in the context of the 21 natural features.
4. A comparatively high difference in numbers of alignments among the two groups taken independently from each other, and without the natural features, follows the logic of the other two early-late indicators.

3. A Surveyed East Meridian and First Triadic Structure at Chaco Canyon

While anthropological theories discussed in Chapter 1 pushed the formation of sodalities back to the early PI period around A.D. 700, accuracy in the location of the two Basketmaker III villages with great kivas in Chaco Canyon, with respect to large-scale lines, suggests an earlier horizon for the advent of these religious organizations--an expressive link, perhaps, between acts of surveying and the development of great kiva ceremonial architecture. The previous chapter examined the probability that some number of alignments among a largest set of great kiva sites (Basketmaker III-PIII) were intentionally laid out or designed; the location pattern of one of these two Chaco great kiva sites will also be compared to probabilities of a similar pattern occurring randomly. Why might plateau sodalities have formed earliest in Chaco Canyon, and how might this process have involved the formalization of shamanistic practices associated with the Canyon de Chelly "cross" diagramed in the preceding chapter? Would social-ecological exigencies need to exist, particularly involving larger-scale movement of populations and the need to integrate diverse social groups? As discussed in Chapter 1, archaeologists do not totally discount the possibility of large-scale relationships in the function of first sodalities in the upheavals of PI beginning in the 700's. The present argument simply pushes the date back about 150 years.

The most causal component to the first Chaco formalization might logically have been some sort of religious impetus coming expressively from the landscape itself, a sort of affective mandate as it were. Was this need initially felt less in the loosely organized shamanistic practice of the hypothetical Canyon de Chelly cross, then at greater distances from this focus, e.g. on eastern or Chaco side of the Chuskas? Would groups living farther from Canyon de Chelly have been less inclined to share the shamanistic resources of the cross, even though spatially adjacent to some of its features, particularly Mount Taylor in the Southeast? The more structured linkage of newly developing sodalities to ancient powerful oppositional axes (not *that* unlike what individual shaman had likely been doing for some time) could be seen as an attempt to gain greater religious power, given different locational and ecological motivations. Most im-

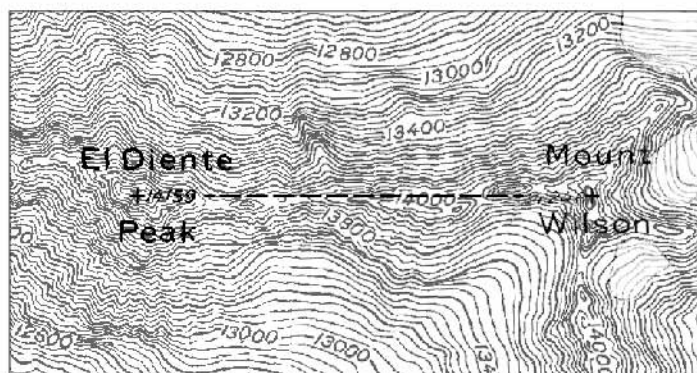


Abajo range from near east

Figure 32. Coincidental natural cardinal (west-east) alignment between Abajo Peak, El Diente and Mount Wilson.



Mount Wilson seen from El Diente



(mountaineer) traverse between El Diente and Mount Wilson

portantly, from a theoretical perspective, would have been the means of effecting this new evolution of plateau religion, accurate surveying. While this technology was relatively simple (as detailed in Appendix II), its practice may well have been symbolically integral to more formal-

ized ritual relationships with distant others.

Imagine small groups of shaman/priests in the northern San Juan region becoming aware of the geometric relationship between Abajo Peak and Mount Wilson (named after the topographer A.D. Wilson who made the first historical ascent in 1874); these are two of the most northerly mountains in the sphere. Figure 32 pictures the precise and totally coincidental alignment of actually two “fourteeners” with Abajo Peak. Mount Wilson (14,256), the highest in the San Miguel Range of the southwest area of the San Juan Mountains, connects to El Diente (14,159 ft) via a 1,289 m traverse, one of the “most famous” in Colorado (according to mountaineer blogs). The latitudes of the two precise benchmarks are virtually identical (Mount Wilson $37^{\circ} 50' 21''$ and El Diente $37^{\circ} 50' 21.7''$). These points in turn, are equally identical, a fraction of an arc second again, to the latitude of the benchmark on Mount Abajo ($37^{\circ} 50' 21.8''$). Thus if a signal fire were built on the top of Abajo Peak, the peak of El Diente, as shown in figure 32, would have provided a remarkable sighting feature from the peak of Mount Wilson.

The question can be raised as to whether they could determine the precise cardinal, east-west, accuracy of the line. The movement of the sun was likely tracked not only from Abajo Peak but from Mount Wilson as well. Equinox sunrise, over Mount Wilson, and sunset, over Abajo Peak, could well have been observed from these opposite locations 129.457 km apart. The 2,896 foot difference in elevation between the two peaks means that risings and settings will occur about 655 meters south of true east (rise), and the same distance north of true west (set) (Seymore & Edberg 1979). Certainly the observation of the equinox sunrise would be more dramatic, if the pinnacles of the El Diente-Mount Wilson pair could be discerned on a clear day at this distance. If priestly groups hauled firewood up to the peak of Mount Wilson, then its fairly precise location in relation to the equinox sunrise could be determined. While the first glimpse of the sun’s crown would occur a little less than 655 meters to the south (because of the three hundred feet lower elevation along the ridge), at its full width, its northern edge would come close to coinciding with the signal fire on the peak. The sun’s diameter is 0.5° , which at the distance from Abajo Peak is about 1,129 meters. Yet it is difficult for the naked eye to easily define the edges of a half risen sun. Thus while the symbolic equinox rising and perhaps setting might logically have been associated with the Abajo Peak – Mount Wilson line, cardinality of this geometry could have been interpreted as just slightly off, in

spite of its absolute coincidental precision described by modern means.

On the other hand, if shaman (becoming priests) had the ability to measure a fairly accurate solar determined cardinal north (much more so than the approximate full degree deviation of the north star beginning about 500 A.D.), then using the flatter terrain at the signal point on the top of Abajo Peak, some sort of perpendicularity might have been determined. This could have been more accurate than the 0.29° angle the sunrise crown misses Mount Wilson.

Here, then, may have been a readymade, quite precise, linear opposition between two highest peaks, complete with the affective power of its equinox sunrise/sunset experience. Related to this religiosity could have been traditions of East-West dualities associated with the Great Sipapu and its line east to Chicoma and Truchas. While the more modest Abajo Peak might have been used by shamans in its relation to the Canyon de Chelly cross, Mount Wilson, the highest in the San Miguel range, might as well have been the object of shamanistic practice, though perhaps initially in a less integrated manner (not as part of any cosmos). Significantly, however, this oppositional structure of the two northern peaks occurs within the larger reach of the de Chelly cross. If shamans from early Basketmaker III communities to the east had begun to participate in some sort of emerging “twin peaks” cult of the evolving religion (Abajo & Wilson, and homologically at a smaller scale El Diente & Wilson), then it might have been logical to imagine a second vertical axis running south from Mount Wilson to pair up with the Abajo Peak-Baldy Peak vertical. At some point in this thinking by a small group of incipient priests, a decision might have been made to conduct a novel survey, a southward prolongation, to find some also oppositional south feature to religiously anchor the new east axis.

This would have been no technical act, *per se*, but an extension of religious practice perhaps involving participation of individuals from different areas along the way, the line-associated group of religious specialists amounting to a sodality, cross-cutting different communities on the eastern side of the plateau. This same sort of fusion of spatial path and religious sodality may well have energized the later transport of tree trunks across larger distances and through different communities during the construction of major Chacon architecture in the canyon (see figure 102). If Warao shamans laid out a north-south line between two poles, off about nine arc minutes—in the flat jungles of the Orinoco Delta—how accurate could first Ancestral Pueblo surveyor-priests prolong a line south from Mount Wilson across the more visible larger scale Southwest topography? As will be seen in the technical Appendix II on surveying

of this volume, prolongation *per se* is less labor intensive than creating an accurate line between two distant points when they cannot be seen from any one interim position. Would a north-south cardinal prolongation have been by observing shadows of the sun cast by a vertical gnomon, then somehow sighted to some next point south in the visible landscape? One can illustrate the topographic profile of high points running due south of Mount Wilson as in figure 33. The use of tall tripods, described in as well in Appendix II, would be necessary to align two adjacent existing points with a prolonged new point southward, and so on until a suitable southern feature as anchor was found.

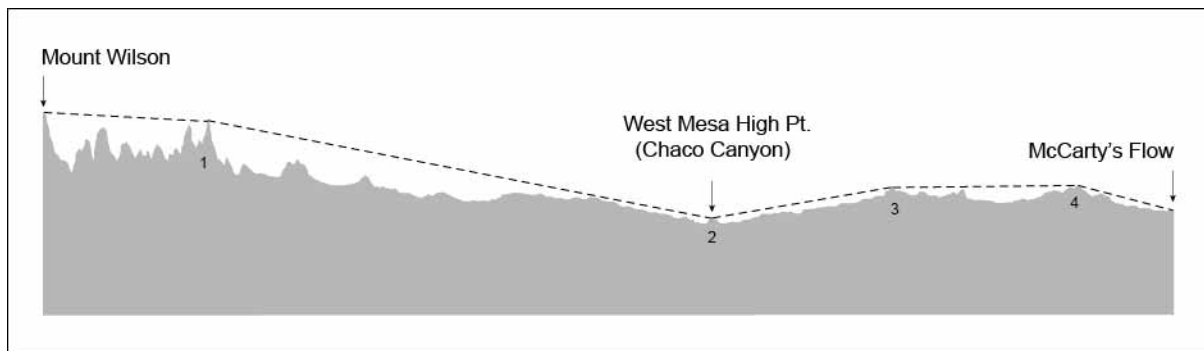


Figure 33. Simulation of required station points in cardinal north-south survey from Mount Wilson to McCarty's Flow.

As seen in the profile, only one high point stands between Mount Wilson and the highest Chaco Canyon point (the high point of West Mesa) roughly on the cardinal path south. It would take some trial and error for surveyors to find this interim high point from which both Mount Wilson and a signal fire on West Mesa could be seen. Or, if they guessed right in finding the first point in the move south from Wilson, the West Mesa point could have simply been a most distant and economical next high point in the prolongation. Or, as a more religiously influenced component, if the Sipapu-Truchas line as apparently partially understood by the much later Navajo was known as part of the De Chelly framework, then Chaco and West Mesa might have been religiously used as part of some possible journey from west to east—though there is only very modest natural beauty in canyon itself to attract unique religious consideration.

Moving south from a Chaco Canyon high point, again figure 33, priest-surveyors would have found no dramatically prominent mountain peak coincidentally due south of Mount Wilson. However, prolonging across two additional interim points, a good cardinal relationship

could have been discovered with the most recent basalt flow in the Zuni-Bandera volcanic field, McCarty's Flow, as seen in the photo of figure 34. Based on collected legends, Nichols (1949) dated the flow to within collective memory of present day Pueblo Indians, particularly at Acoma. His date was about 700 A.D.. More recent, and more technologically advanced analysis pushes the geological date back further to somewhere between 500 and 2,000 B.C. (<http://geoinfo.nmt.edu>) At a distance of 336.564 km from McCarty's Flow, Mount Wilson deviates coincidentally from a precise true north by 0.152° . This is a difference of about thirty-six arc *seconds*, compared to the nine arc *minutes* in the 200 km Warao scheme. The Mount Wilson-McCarty's line is again a totally

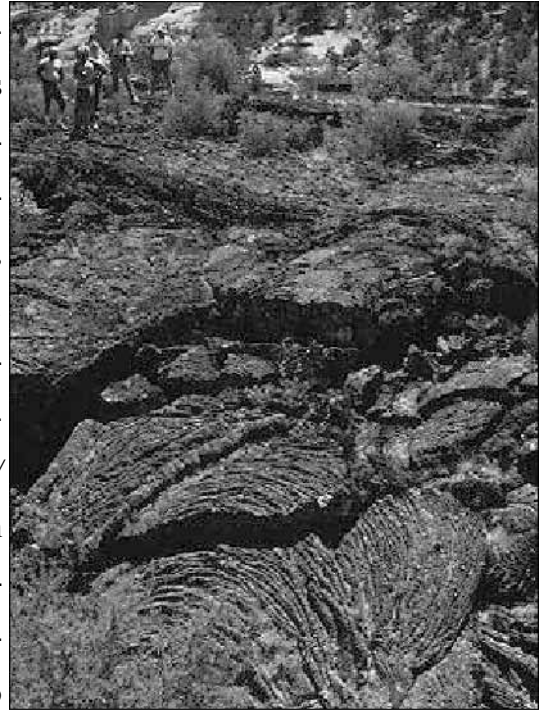


Figure 34. McCarty's Flow; most recent volcanic event in the Zuni-Bandera field (note figures in upper left for scale).

coincidental relationship. But one cannot assume from the selection of the southern point itself, that their initial surveying was this accurate. They could have gotten within the “ballpark” of the location, and chosen it without fully understanding its relatively accurate coincidence as a meridian with Mount Wilson.

The first built ceremonial site as mediator of a large-scale bipolar line

In neither the Warao nor possible De Chelly frameworks were permanent ceremonial sites apparently built at their centers. About one hundred and fifty years earlier than the anthropologically described origins of sodalities, in the 500's A.D., two unusual Basketmaker III “villages” were built on northwestern and southeastern flanks of Chaco Canyon. They were unusual because of numbers of pithouse dwellings, their large or “great” kivas (one at each site) and generous food storage. The location of the western site, identified as 29SJ423, is initially most interesting because of its relationship to a Mount Wilson – McCarty's Flow line. While the site's location is precisely due north of McCarty's Flow (longitudes of $108^\circ 00' 02.0''$ and $108^\circ 00' 03.0''$ respectively), it deviates from a mathematical line between Mount Wilson and McCarty's flow by about 348 meters (0.122° as the average of the two deviations from each pole of the

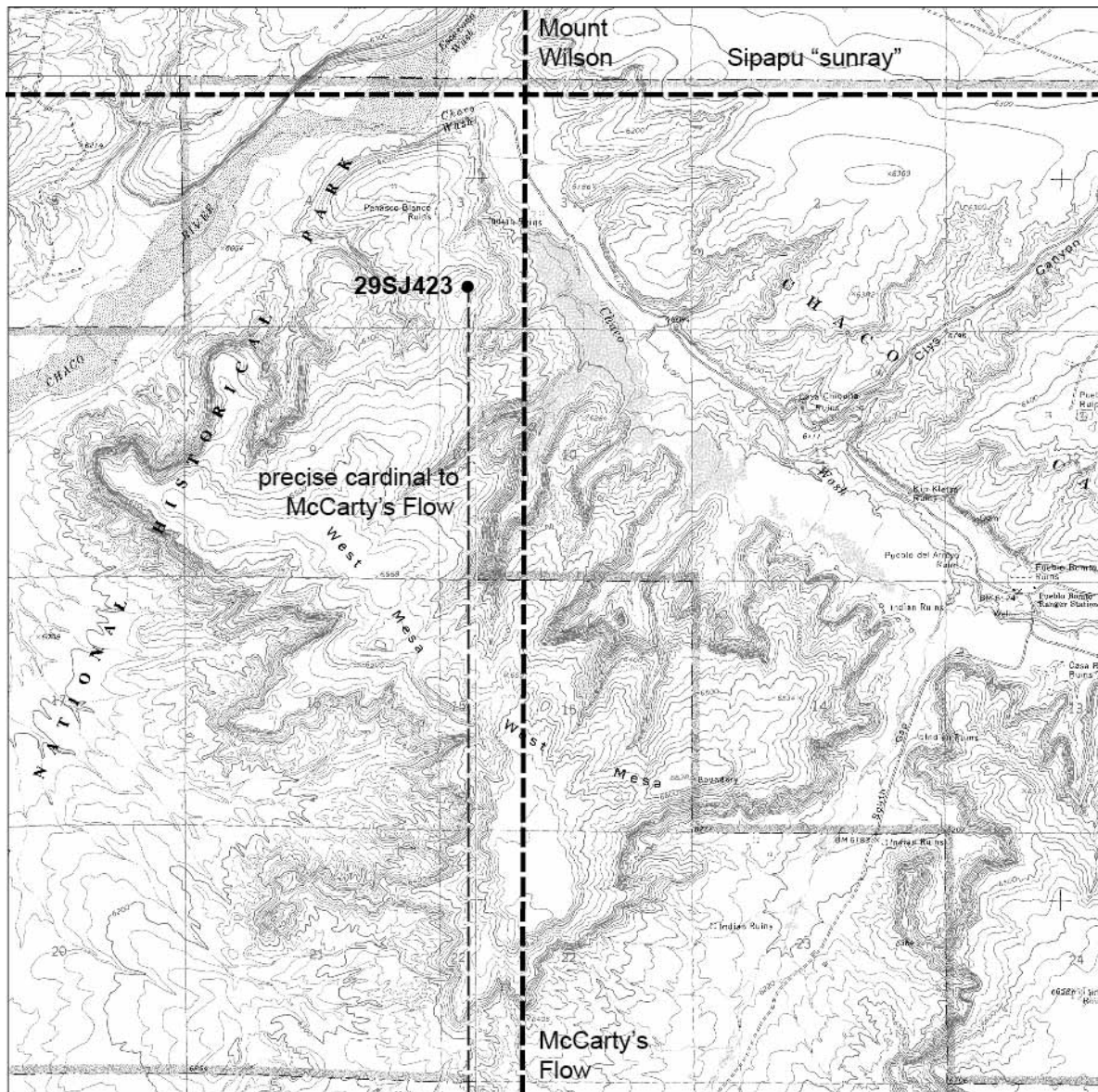


Figure 35. Chaco Canyon intersection of Mount Wilson - McCartney's Flow (north-south) axis with the Sipapu "sunray" (west-east) to Mount Chicoma and Truchas Peak.

line). At even less accuracy, but nonetheless interesting at this possibly earliest stage of surveying, is the relation of 29SJ423 to the Sipapu-Truchas line. The great kiva site lies about 1,202 meters south of the line (0.262°), as seen in figure 35.

Once the southern pole of McCartney's Flow was identified, a more precise resurvey of the line up to Mount Wilson (now involving reverse backsighting) might have disclosed the coincidentally very accurate position of the West Mesa high point. As an interim point on the North – South axis, it has a calculated accuracy of 0.002° , or within 4 – 5 meters (not that this level of accuracy could have been determined). Understanding a generally accurate alignment

of the West Mesa high point, but without surveying the established but perhaps less precisely understood Sipapu-Truchas line, the great kiva site 29SJ423 might have been located logically close to the intersection of the two lines. As seen in figure 35, this intersection area occurs down on the floor of the Chaco River canyon. The later PI-PII great kiva just north of the eventual Peñasco Blanco great house (the earliest at this site) actually is the closest great kiva in Chaco Canyon to the intersection point in question. Yet the vantage point is superior from the higher position of 29SJ423.

Intercardinal axes and a triadic ritual definition in Chaco Canyon

Yet in spite of all of the eventual ceremonial sites built in the canyon to the east of 29SJ423, the second BIII great kiva “village”, Shabik’eschee, also to the east, might not have been the next point to be located. If emerging sodality groups in the east were being so bold as to lay out a new dualistic North-South meridian, perhaps creating a cross with Sipapu-Truchas, then they might have sought two possibly coincidental inter-cardinal axes to complete the framework--like those of the shamanistic De Chelly cosmos--expanding the number of religious societies and communities involved. The ability to survey would have been becoming increasingly essential. From probably ancient cognitive wayfinding, without surveying, it could have been understood that the positions of Abajo Peak and Mount Taylor have the potential to serve as a NW-SE line for the emerging eastern focus. An actual survey would have shown the line to run about 15 km southwest of 29SJ423. A complementary line from Baldy Peak up to some point in the NE, however, might have been less evident. If a line had first been laid out between Baldy Peak and the first 29SJ423 in Chaco, and then prolonged up to the northeast, it would have come in the general vicinity of what was undoubtedly already a highly religious, if still essentially shamanistic, natural feature, Chimney Rock, figure 36. Additionally, from a formal design perspective, this feature is roughly north of the SE feature of Mount Taylor (unlike Blanca Peak in the De Chelly cosmos).

Once the accurate survey of a line from Baldy Peak to Chimney Rock was accomplished, not necessarily in any highly organized time frame, then its intersection point with a surveyed line from Abajo Peak to Mount Taylor could have been determined. This mathematical point lies about 602 m northwest of the Chacoan great house, Kin Bineola, largest built outside of the canyon, and larger than Hungo Pavi and Wijiji in the canyon (Powers 313): it is vir-

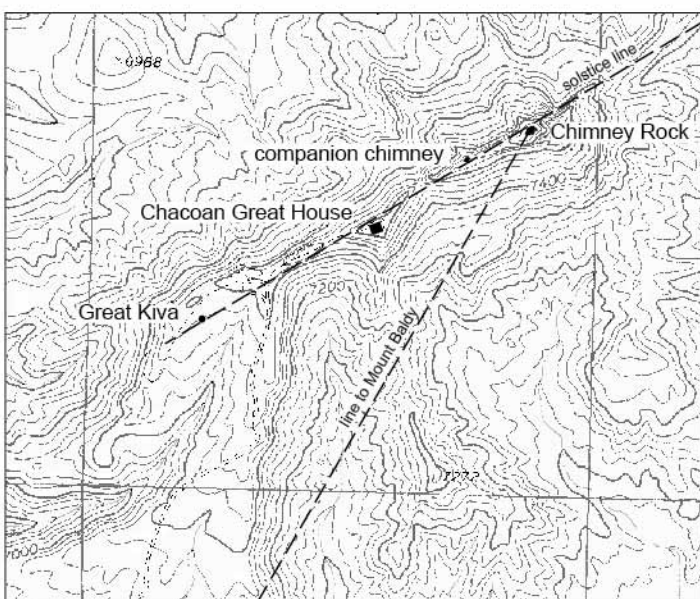
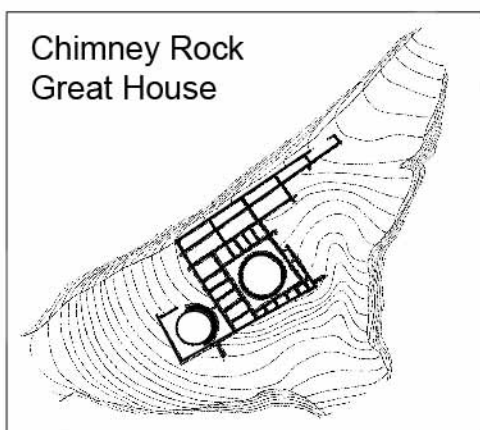
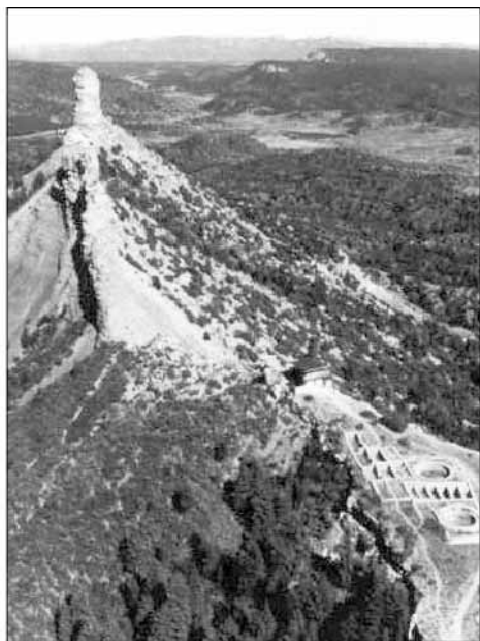


Figure 36. Chimney Rock natural feature and associated later PII Chacoan “outlier” great kiva and great house. Lunar rise photo courtesy of J. McKim Malville (top right); aerial photo courtesy of *permission pending* (top left); view from northeast courtesy of *permission pending* (below). Great house plan and larger site information redrawn from Malville 2004. Apparent site alignment with solstice rising and settings at this latitude; line to Kin Bineola X and Mount Baldy (below).

tually the same size as Salmon, a similar distance from and largest outside the Aztec complex (Totah). As seen in figure 37, the eventual location of Kin Bineola's great kiva, immediately adjacent to the great house on its western flank, lies about 253 m from the Abajo Peak – Mount Taylor line (0.105) and 342 m. from the Baldy Peak – Chimney Rock axis (0.101).

In earlier work by the author (Doxtater 2002), this intersection point shown in figure 37 was assumed to have been known because of its highly unique coincidental alignment with a third axis between Brian Head, the NW mountain of the De Chelly framework, and Cabezon in the SE, a prominent volcanic feature of some importance later in this volume. The three lines run about 20 m from a common point at alignment averages from 0.006° to 0.008° . Yet it is perhaps more likely, given less precise earliest surveying, that accuracies even up to 0.15° might have been used, as described in the previous chapter. In many respects the inclusion of only two intercardinal axes, without Brian Head – Cabezon, makes more sense as a kind of eastern mirror image of the De Chelly cross. Regardless of how the Kin Bineola point was understood early on, the site becomes unusually complex not only for its eventual very large great house and length of occupation, but for linear features and an outlying singular great kiva to the south, as seen in figure 37 (Marshall et.al. 1979:58).

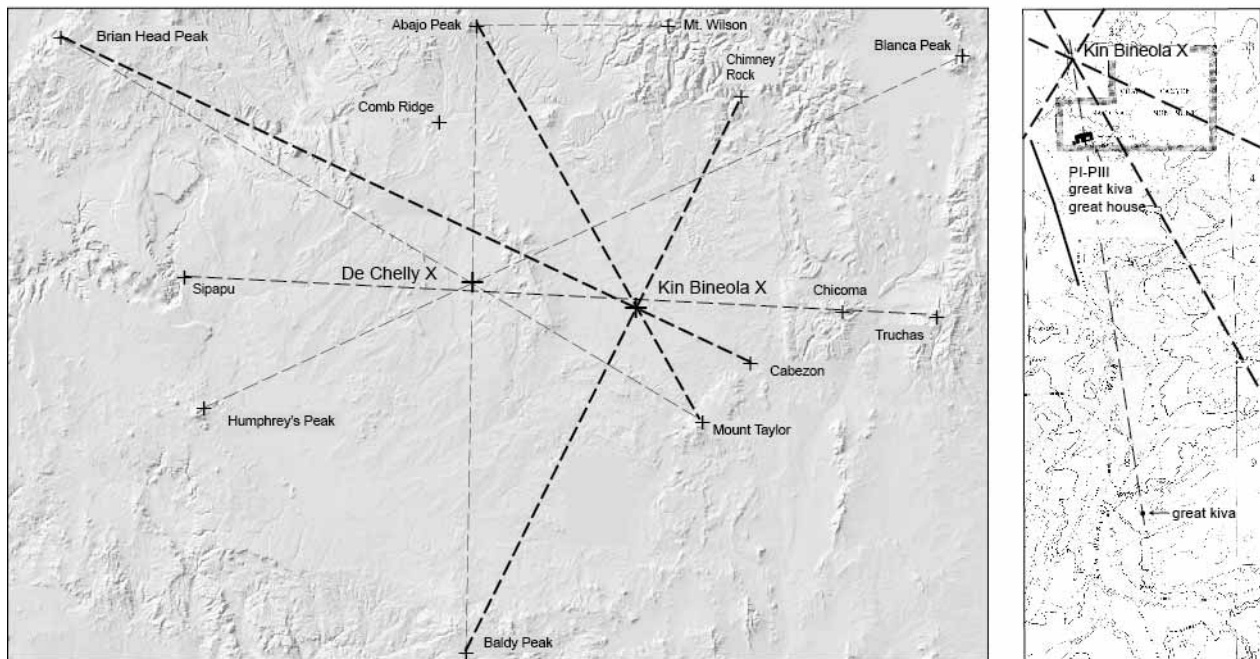


Figure 37. Most precise coincidental triaxial intersection point on the plateau; adjacent to later major Chacoan great kiva and house, Kin Bineola

In terms of the planning of the evolving frame focused on 29SJ423, both the intersection point of the two or three axes, and the location of the Kin Bineola great kiva are interesting. The most obvious of both, however, is that they lie some 15 km from the possible first Chaco great kiva site on the Mount Wilson meridian. If considerable surveying had established a point to the west of 29SJ423, in the search for two coincidental inter-cardinal axes, then that point would have to have had a recognized opposite site to the east, reflecting the basic triadic structure of the De Chelly cosmos in all things religious. The location of the second great kiva site, Shabik'eschee, is also about 15 km from 29SJ423, more precisely 15.095km, figure 38. The distance of the Kin Bineola eventual great kiva from 29SJ423 is 15.101 km, only 6 meters difference. To the coincidental three axes intersection point about 602 m northeast of the eventual great house, the distance is 14.805 km. A second consideration in the triadic location of Shabik'eschee is its latitude similarity to Kin Bineola. Shabik'eschee is $36^{\circ} 01' 00''$, while the three axes intersection point is closest at $36^{\circ} 00' 30''$; the eventual great kiva adjacent to the great house is $36^{\circ} 00' 10.5''$. Thus while the great kiva's distance from 29SJ423 is almost exactly that of Shabik'eschee's, its latitude is less close than that of the intersection point.

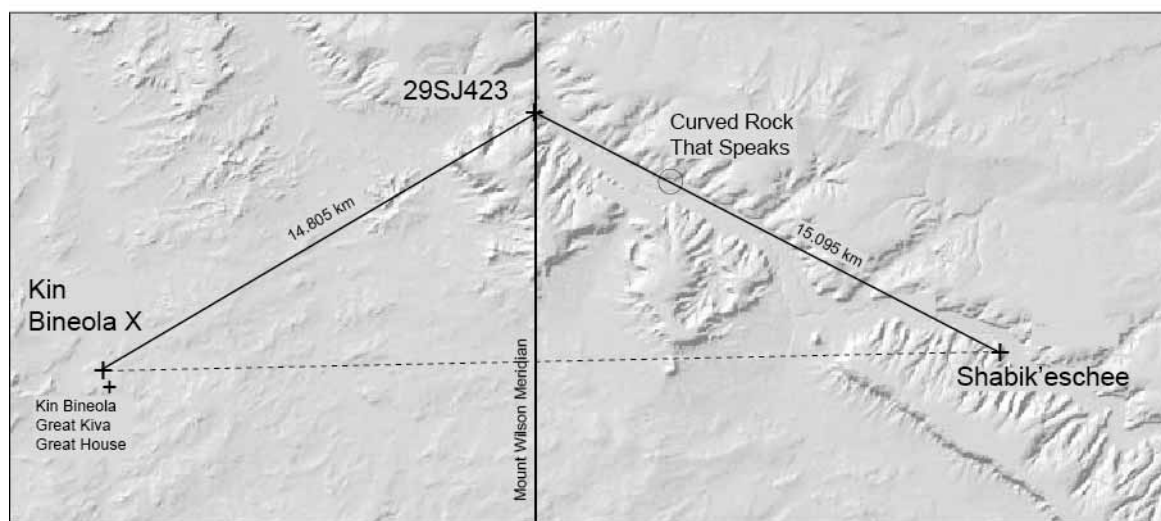


Figure 38. Hypothetical unification of Mount Wilson meridian, natural amphitheater and most precise triaxial intersection point on plateau (Kin Bineola X).

Shabik'eschee, like 29SJ423, sits up on the south rim of the canyon. While the two cannot be seen from each other, setting up tripods on the highpoint in between, from which each can be seen, could easily define how the line between the two runs through the canyon.

Prior to either the measuring of distances or determinations of latitude similarities, a azimuth from 29SJ423 could have been struck directly through the natural amphitheater called “Curved Rock That Speaks” (Loose 2008), a position just between the largest two eventual largest canyon great houses of Pueblo Bonito and Chetro Ketl, figure 39. Thus there may have been as many as four possible components of determining the location of Shabik’eschee: 1) equidistance from 29SJ423 with respect to Kin Bineola, 2) similarity in latitude with Kin Bineola, 3) alignment with the Curved Rock That Speaks, and 4) location on a high point on the South Rim.

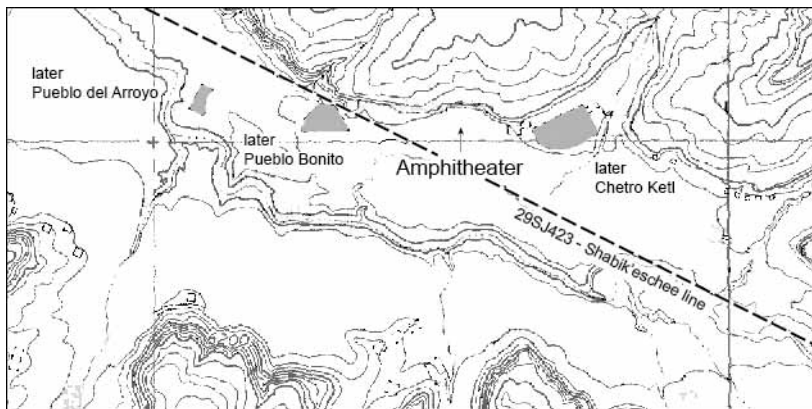


Figure 39. Location of “Curved Rock That Speaks” natural amphitheater with respect to 29SJ423 - Shabik’eschee line.

Given that there is no known contemporaneous great kiva “village” built at Kin Bineola, though there might well have been a singular great kiva subsequently obliterated by great house construction, the actual ceremonial focus appears to lie in the probable ritual relationship between 29SJ423 and

Shabik’eschee, mediated by the performance focus of the Curved Rock that Speaks—again, a bipolar axis with interim and mediating performance setting. The asymmetry of the large-scale cross axes, or the non-coincidence of the intersection of the two north-south and west-east cardinal lines with the two (or three) intercardinal ones (near Kin Bineola), may have been balanced not just by Shabik’eschee’s location, but the entire ritual axis running through the canyon. This line is spoken of by Wills et. al. (2012:342) and Lekson (May 15 2012 blog) as defining the canyon’s Basketmaker III community.

In all of the theoretical debates over many decades about the meaning of the unusually large “village” of Shabik’eschee, figure 40, no archaeologist has ever offered the above interpretation of the location and meaning of the site. The primary existing discourse has focused on ecological causes related to increasing sedentism during the Late Basketmaker II - Basketmaker III periods. Archaeologists agree that the large site consisting of residential pithouses and an unusually large number of storage cists, and especially the singular, large or “great”

kiva, represents some evolutionary move in integrative or hierarchical social organization beyond a highly mobile use of the landscape not unlike the traditional Navajo. Notable in this discussion is Wills & Windes (1989), and most recently Wills et. al. (2012) diverging view that Shabik'eschee was less a big-man's permanently occupied village having to do with the control of resources, than a stable focus for a large number of people moving about and farming in a larger but discrete area, typically inhabiting and re-inhabiting numerous small hamlets of a few pit houses scattered throughout the Chaco Canyon vicinity. The size of the Shabik'esche site is due more to the number of storage areas (and great kiva) than to any large number of permanent residents. Storage cists were not controlled by residents but were clearly to be used by some larger community.

Discerned in the twenty years between the two articles cited, is a shift from describing the availability of piñon nuts from higher elevations as one possible basis for the common storage and ceremonial usage, to a more dualistic formal appreciation of the way the two great kiva sites, Shabik'esche and 29SJ423, appear to define the Chaco cultural community, complete with references to good views toward the center of the canyon (though again, the eventual center and the amphitheater cannot be seen from Shabik'eschee). There are certainly enough people living in and sharing the varying agricultural opportunities in the Chaco Canyon area to envision two formally located, dualistic, probably supra-kin sodality foci, perhaps reciprocating in ritual performance in at least three if not four different lo-

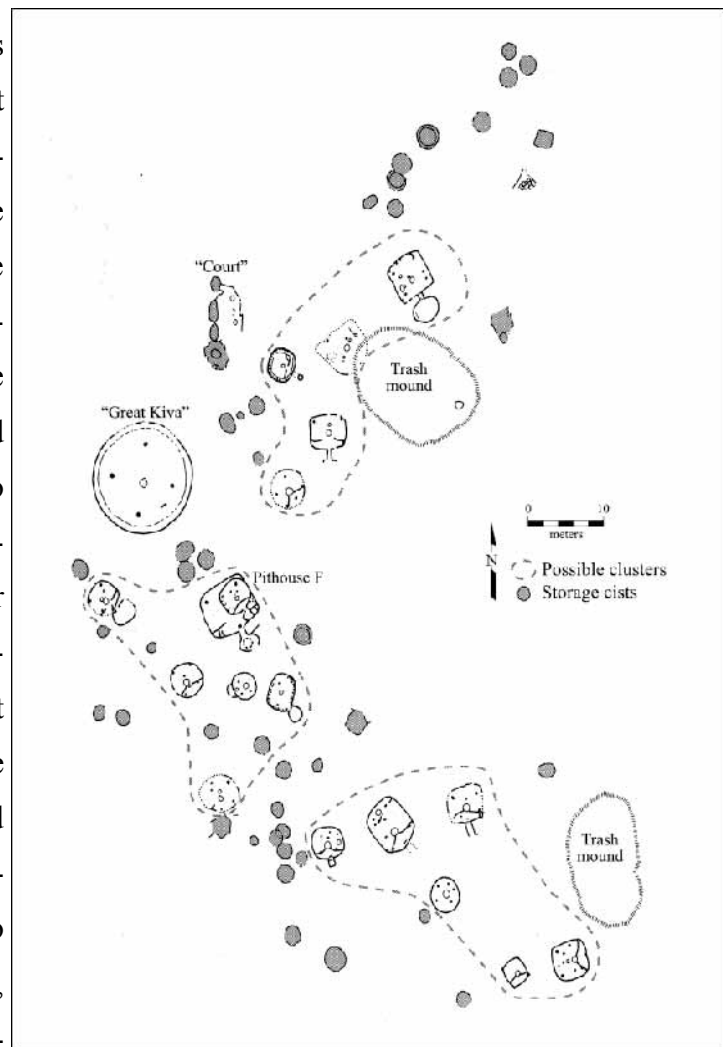


Figure 40. Shabik'eschee Basketmaker III village in Chaco Canyon, from Kantner 2004:63.

cations: the two great kivas, the amphitheater and perhaps at Kin Bineola. But from the purely ecological perspective, whichever of the two theoretical archaeological views one subscribes to, what would have caused such a departure from the ancient shamanistic use of the landscape? After all, Navajos used the canyon similarly for long periods of time without ever needing more highly organized and permanently fixed ceremonial sites. Wills et. al. (2012:346) concludes their (re)investigation by suggesting that both the density of “dispersed” population in Chaco Canyon and its reliance upon formalized ritual organization continued on into PI periods, (hypothesizing about lost evidence in this period due to alluvial effects), and right up into the major expansion of the 10th and 11th centuries. Is this a move among prominent archaeologists to recognize some ancestry of formalized ritual processes, particularly in the canyon?

Two questions should be addressed. First, is ritual formalization, a triadic expression with two end poles and an interim place of mediation, in an area like Chaco *essential* to the ecological sharing of the agricultural resources among mobile occupants? Perhaps not; while Lightfoot and Feinman (1982:81) see these larger villages as created by local competition among big men primarily due to the fact that some pit houses are larger than others, part of their rationale could well relate to the development of linear landscape structures, i.e. to attract individuals to certain locations through migration, to increase regional exchange ties, and to encourage the production of agricultural surplus. In many ways their ideas seems to relate better to larger scale social space. How, for example, would only two big men among the large population around Chaco, emerge to locate their “villages” as relatively formal oppositions at higher ends of the canyon—not to mention the possible role of the Curved Rock That Speaks? The “big man” concept is essentially territorial rather than ritualistic.

Another clue to larger-scale socio-cultural organization can be found in Washburn and Webster’s (2006) analysis of variations in basket and ceramic graphics in Basketmaker II and especially III. Significant design differences translate into large-scale migrations in these periods, and by implication possible religious integration. They suggest: “that whereas some of these developing agriculturalists were long term inhabitants...others were immigrants from regions more distant from the Four Corners area”. While much of the data for Washburn and Webster’s piece comes from Chuska areas, the implications for migration and integration to more isolated areas such as Chaco might be even more pronounced, hence the earliest of these

unusual ceremonial great kiva sites.

In late Basketmaker II and early Basketmaker III there may be a more pronounced initial west east dimension here. Is it possible, at least on the east side of the plateau, that people were inspired to move to the vicinity of the newly surveyed location of an emerging second cross? What would the benefits have been of being close to these new foci with large-scale dimensions? If surveying had developed social associations along the axes, say between people living in the San Juan area, and those to the south in the Red Mesa Valley, or even around Chimney Rock and Mount Taylor, what would the advantage be to participating in ritual practices with people this far away, compared to the assumed much more local population in the Chaco Canyon area?

The answer could lie in the basic politics of shamanistic practices of the De Chelly cosmos. Traditionally, in this not improbable pre-survey framework, people would have been empowered to make contact, via shaman, with all parts of the larger landscape. It would have been known to shamans, perhaps with some specialization according to directions and the like. But if people in the east had felt less connected spatially--perhaps the motivation of the Mount Wilson survey in the first place--then religiously it might have felt necessary to ritually affirm the *difference* between traditionalists (West) and Chacoists (East). One solution might have been through early ritual exchanges created by formal linear structures in the large-scale landscape. In this view, the unusual first great kivas in Chaco were places where locals could meet and maintain relationships with participants from afar, essentially not that unlike the function of Chaco five hundred years later. Some of these visitors might well be related, if some populations had actually moved to the Chaco area following its establishment as the East focus.

Part of plateau politics would have been the emerging religious formalization of West – Middle-East, perhaps expressed in the landscape position of 29SJ423 and the way Shabik’esche pairs up with Kin Bineola X, but also, more importantly as a basic cognitive, structural pattern that could be invoked homologically not only in terms of the largest scale frameworks, but in many aspects of religious life, not unlike the reverberation of spatial structure in the Navajo (again Witherspoon and Peterson 1995).

Great Kiva linkage to the landscape: “villages” in the West

While perhaps the earliest of these unusual Basketmaker III great kiva sites, it is somewhat mis-

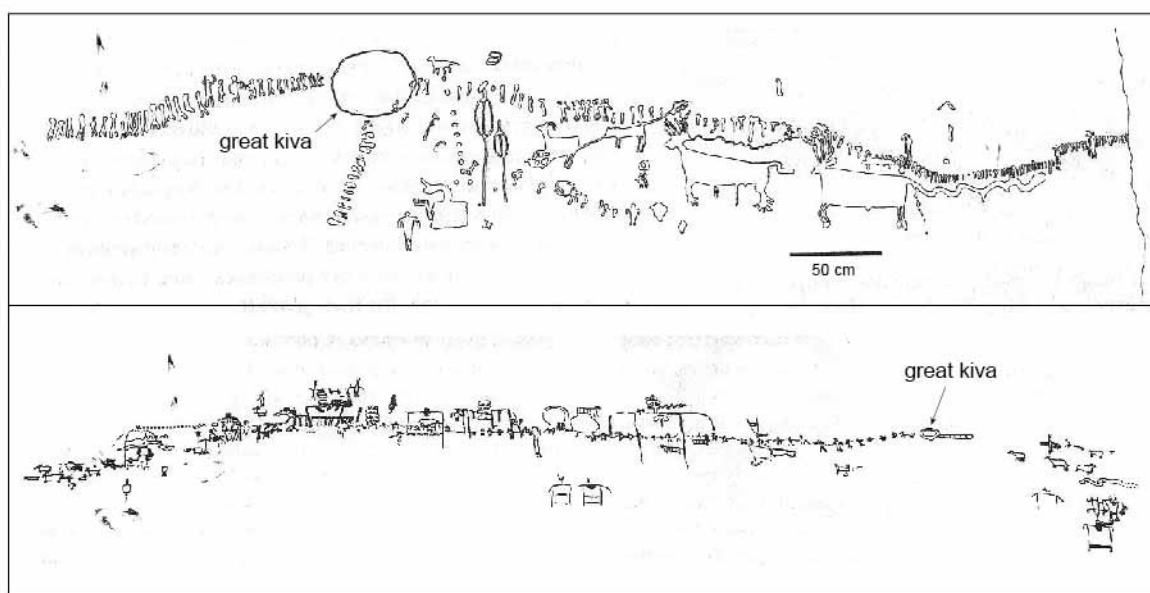
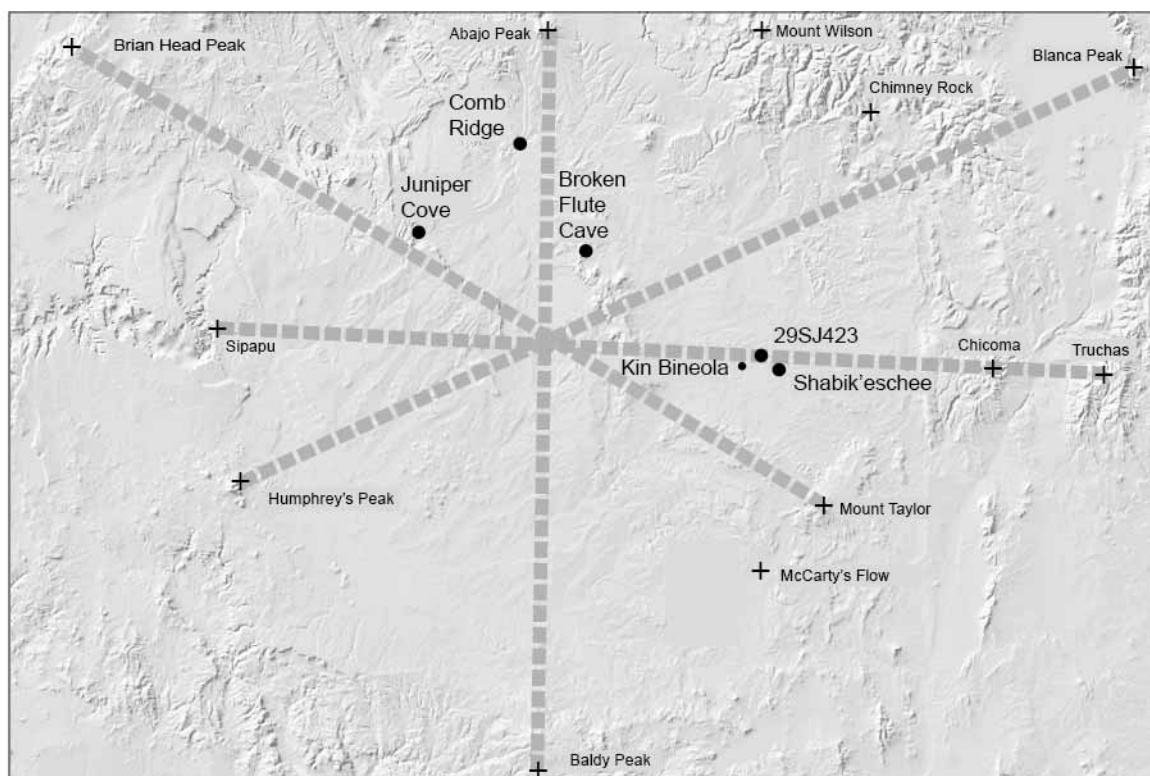


Figure 41. Location of early great kiva sites (above), and possible evidence of early large-scale ritual (middle, procession to great kiva, from Wilshusen et.al. 2012), (below, Broken Flute Cave procession, from Robins and Hays-Gilpin 2000:243).

leading to base much of the discourse about Shabik'eschee (and 29SJ423) in Chaco to the East, when six such sites have been identified in the west, particularly in and around the Chuskas.

Until the mid-700's there is nothing comparable elsewhere in the east, even up in the Mesa Verde area (with the exception perhaps of the 6th century Dillard site).

Whether in the possibly formalizing East or West, these kinds of sites are still quite rare in the landscape. During the 500-700's, village-like sites with large more specialized ceremonial structures are the exception, not the rule, among the more numerous strictly residential clusters across the landscape (Gilpin and Benallie 2000:172). Reed's volume on the foundations of Basketmaker III offers a multi-authored overview of Basketmaker III. Generally the volume contrasts with Wills & Windes 1989 view of the Chaco sites as related to less sedentary strategies of land use, maintaining the idea that these "villages" emerged primarily in response to permanent occupation related intensive agriculture. New, however, is the volume consensus that this happened earlier than conventionally thought. They are relatively permanent settings compared to habitations used occasionally. If Wills et.al. 2012, a decade later, have really subtly moved the argument away from piñon nut harvesting events to something possibly involving some ritual formality laid over canyon topography, then would Reed's authors possibly alter their critique of Chaco village interpretation? The Basketmaker volume does spend text space on discussions of great kivas, though few large-scale associations are specifically discussed. Reed's introduction cites Vivian and Reiter (1965) who suggest that the origin of great kivas probably predates Basketmaker III. More specifically they compare Shabik'eschee with the site of Broken Flute Cave, built about one hundred years later (late 500's or early 600's) up in the Redrock Valley (Chuska associated), figure 41.

Thinking more of a unified religious and migration causality in the formation of ceremonial great kiva sites, particularly if the early Chaco layout did in fact express large-scale formalizing ritual, then what would one expect over in the "West" hemisphere? To a certain extent the term "hemisphere" may be misleading, since the center of the hypothetical traditional shamanistic plateau cross would have been associated with Canyon de Chelly in the Chuskas. Thus the larger number of Basketmaker III great kiva sites could have had more to do with traditional meanings of the cross's *axis mundi* and its unsurveyed but perhaps known focus, rather than with any West dualism responding to an emerging East at Chaco. As shamanistic landscapes transitioned to more formally organized religious sites would there have been constraints against revising the de Chelly framework? If so, how were these sites located to achieve a more powerful and more formalized symbolic connection to landscape? The earliest, Broken

Flute Cave, at least, suggests that the natural phenomenological character of the setting might have been important, perhaps even in addition to some cognitively understood location in symbolic areas of the cross (cardinal and inter-cardinal).

Robins and Hays-Gilpin's piece in the Reed volume (2000:241-2) describe rock art depicting ritual procession at Broken Flute Cave in association with its great kiva, and associated "village" pit houses and storage (the kiva is from the 600's but the site was used earlier as a Basketmaker II pit house site). The processional rock art at Broken Flute Cave is not unlike that found near Butler Wash at Comb Ridge. While a search for possible alignments with large-scale natural features, like Chaco, does not turn up likely candidates, nevertheless, this location is clearly the locus of significant ritual. Robins and Hays-Gilpin do leave the reader with a sense of larger integrative religious space in the landscape in their comments particularly about similar, even more important, ritual going on at Comb Ridge. They say that, "at least one of the Butler Wash panels may have been in use during the seventh century as a focal point of movement and interaction between populations living at Bluff Bench and Cedar Mesa, and possibly even on a larger scale" (2000:241). They also describe cardinal directional (cross) symbolism implicit in the panels.

In spite of implications for formalized larger scale ritual, Robins and Hays-Gilpin do not necessarily see the emergence of these practices as part of some larger religious formalization of any very large scale plateau framework. Great kivas are built partly because men need a means to integrate with others from different natal communities into their spousal groups (*ibid* 239). There is little discussion about why there would be so relatively few of these sites across an area with widely dispersed but large populations. Alternatively, one can interpret the rock art panels as expressive of ritual scales much larger than patriarchal kinship linkages. Particularly at Comb Ridge, one can imagine people traveling from some distance to participate in rites associated with the northern pole of the vertical axis of the Canyon de Chelly cross.

A second early great kiva, Juniper Cove, was located curiously west of both Broken Flute Cave, and the vertical axis associated hypothetically with Comb Ridge and Abajo Peak. Of the six Basketmaker III or early PI listed by Gilpin and Benallie Jr., Broken Flute Cave and Juniper Cove may be the earliest. Thus following Shabik'eschee and 29SJ423, a second pair might have been established (Dillard notwithstanding) also forming a triad of large-scale sites to the west, see again figure 41. While Broken Flute Cave and Juniper Cove do not appear to

have been located by surveying, rather in context with more traditionally understood cognitive or cosmic frames, their positions with respect to the Butler Wash panels and Comb Ridge might reveal the first formalizing remodeling on the western side of the plateau. A logical equivalence could have been seen between the Comb Ridge intersection point (vertical axis and San Juan river axis which points to the Grand Canyon Sipapu) and 29SJ423, sitting as it does nearest to the Mount Wilson meridian and the Sipapu – Truchas line. Might West and East sodalities at Juniper Cove and Broken Flute Cave have had emerging ritual correspondence to Kin Bineola and Shabik’eschee? If the Chaco triad had been formally laid out, it could have provoked responses for Chuska areas in the traditional cosmos to create their own large-scale associations. Some discord might well have developed between populations that continued to use the landscape more traditionally with shamans—even visiting major sites like Comb Ridge—and those intent on formalizing permanent great kiva sites.

Foremost in this admittedly most speculative design analysis of earliest plateau landscape structure is the assertion that the first Chaco great kiva, perhaps 29SJ423, was positioned by survey on a new eastern meridian to Mount Wilson and that it may have been the stimulus to change in the West. Eventually through later periods, this coincidental axis with McCarty’s Flow spatially integrates four additional great kiva sites. The following exercise focused on this compound pattern includes all of the eventual built sites, not just the first at 29SJ423. While a single site might more frequently be randomly located on the coincidental Wilson meridian with McCarty’s Flow, alignment of five built sites will obviously be a much rarer phenomenon. Depending on just how frequently this compound pattern occurs randomly, if the late combination is ultimately considered intentional, then it would be likely that 29SJ423’s location was designed as well.

PROBABILITY TEST: THE MOUNT WILSON MERIDIAN

The diagram of figure 31 in the preceding chapter illustrates a compound “alignment” that produces five intertwined 3-point alignments among seven total points: Mount Wilson, Aztec (site centroid), Peñasco Blanco (earliest kiva), 29SJ423, Andrews, McCarty’s Flow, and the kiva like feature on Cerro Moctezuma. More will of course be said about later built sites in subsequent chapters. This exercise uses the new version of Geopatterns (3) software described in Appendix I. While the previous version also allowed searching large numbers of random sets

for specific pattern compounds--unlike the simple aggregates of a more limited number of sets in Chapter 2--the new version can search for more complex combination patterns. Within this compound, at the range of 0.075° (the median of the Chapter 2 exercise) the following individual patterns occur:

3-pt alignments (5)

Andrews – 29SJ423 – Mount Wilson (0.008°)
Peñasco Blanco – Aztec – Mount Wilson (0.020°)
Andrews – 29SJ423 – Aztec (0.053°)
Andrews – Aztec – Mount Wilson (0.054°)

[Peñasco Blanco – McCarty's Flow – Cerro Moctezuma]

2-pt cardinal relationships (10)

29SJ423 – McCarty's Flow (0.010°)
Mount Abajo – Mount Wilson (0.011° west – east)
Peñasco Blanco – Andrews (0.047°)
Aztec – McCarty's Flow (0.068°)

[Cerro Moctezuma – Mount Wilson]
[Cerro Moctezuma – McCarty's Flow]
[Cerro Moctezuma – Aztec]
[Cerro Moctezuma – 29SJ423]
[Cerro Moctezuma – Peñasco Blanco]
[Cerro Moctezuma – Andrews]

One first notices in these lists the preponderance of cardinal relationships created by Cerro Moctezuma. The geometric or mathematical reason why this particular location is so involved at or under 0.075° appears to be simply because of its great distance south from the other sites. The greater distance a point is from others, relative to a precise north-south meridian, the smaller the angle of deviation. The design analysis of Cerro Moctezuma as a somewhat latter day extension of more fundamental Chacoan layout is discussed in Chapter 8. At present, however, the inclusion of Cerro Moctezuma in probability tests seems unwarranted, particularly in its cardinality, because of the influence of distance *per se*, in spite of the fact that the alignment extensions from the earlier Chacoan layout will be shown to be very precise. This issue is moot, however, because of present software limitations. Even the most recent version cannot process extremely long compound strings of patterns such as a test the full Wilson complex, including Moctzuma, would require. Needed would be a string of 15 individual patterns, 5 (3-pt.) align-

ments and 10 (2-pt. cardinals).

Eliminating Cerro Moctezuma from the above lists, leaves four 3-pt. alignments and four 2-pt. cardinals which seem to connect three natural and four great kiva sites; the west-east relationship between Abajo Peak and Mount Wilson is included (this is the only naturally coincidental cardinal relationship at this accuracy). Within the present limitations of Geopatterns 3, these can be modeled with the search string: A+A(2)+A(2)+A(3)+C(2)+C(1)+C(2)+C(1), i.e. that given the existing 81 sites, the computer finds this particular compound pattern when given the “site analysis” command. The geographic area in which sets of 61 random points (great kiva equivalents) are located, keeping the now 20 natural features fixed, is the same as in Chapter 2. In this test the accuracies of the existing alignment and cardinal patterns are used as the limits for the random. The four alignments are under 0.055°, and the cardinals under 0.070°.

At these accuracies two such compound patterns occur in the 44,706th and 95,180th sets of 100,000 sets, each with 61 random points. A third set with the search string is reported, but is an east-west line involving the Sipapu. The two matching patterns are reported as follows:

Patterns Investigated (1):

A+A(2)+A(2)+A(3)+C(2)+C(1)+C(2)+C(1) (1)

1: set 44,706

Alignment: 34(34.51745 , -108.00153) , mccartys , 29(36.78737 , - 107.99285) , 359.849576

Alignment: 34(34.51745 , -108.00153) , mccartys , wilson , 359.866611

Alignment: 34(34.51745 , -108.00153) , mccartys , 19(36.48130 , - 108.00031) , 359.935174

Alignment: mccartys , 29(36.78737 , -107.99285) , wilson , 359.858773

Cardinal: 19(36.48130 , -108.00031) , 34(34.51745 , -108.00153) , 179.970918

Cardinal: wilson , abajo , 89.989038

Cardinal: 19(36.48130 , -108.00031) , mccartys , 179.985454

Cardinal: 12(34.82285 , -109.45693) , abajo , 0.069079 id=2

AlignmentTolerance = 0.055

CardinalTolerance = 0.07

Patterns Investigated (1):

A+A(2)+A(2)+A(3)+C(2)+C(1)+C(2)+C(1) (2)

1: set 95,180

Alignment: 61(37.10040 , -108.00249) , mccartys , 43(34.19284 , -108.00173) , 179.981699

Alignment: 43(34.19284 , -108.00173) , mccartys , wilson , 359.889305

Alignment: 43(34.19284 , -108.00173) , mccartys , 56(36.18631 , -107.99691) , 359.899000

Alignment: mccartys , 56(36.18631 , -107.99691) , wilson , 359.847741

Cardinal: mccartys , 61(37.10040 , -108.00249) , 0.033535

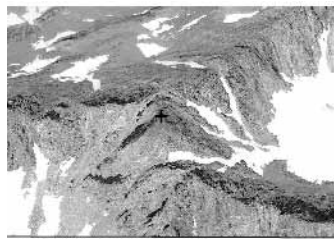
Cardinal: wilson , abajo , 89.989038
Cardinal: mccartys , 43(34.19284 , -108.00173) , 179.930768
Cardinal: abajo , 2(34.82071 , -109.46315) , 179.973854 id=1

AlignmentTolerance = 0.055
CardinalTolerance = 0.07

As the reader will see from figure 42 that compares the existing Wilson compound pattern, in each of the two random matches an additional east-west point on the Wilson – Abajo line is created as a cardinal relationship within 0.07° (though not necessarily aligned within 0.055°). Thus in both random sets the north-south combination of alignments and cardinals generates five point compounds, compared to the six points in the existing (all three without Moctezuma). The involvement of Mount Wilson is also greater, given its appearance in four patterns in the existing, compared to three in each of the random matches. The reverse is true with McCarty's Flow, which occurs in only 2 existing patterns, while the random sets have five and six respectively.

What can be said then about the two sets of 100,000 that mostly satisfy the best model of the Wilson meridian complex? To a certain extent one would expect random points to cardinally align with Mount Wilson and McCarty's Flow even though these two points are about 0.16° off a precise north-south (the much more coincidentally cardinal Abajo Peak – Mount Wilson is too short of a distance to attract the numbers of random points needed to create a 5-point alignment). But one near match in 50,000 random sets defies such expectations. If the four existing great kiva sites were randomly located for other reasons, yet somehow along the Wilson – McCarty's axis, it would not seem to be due to any great propensity for random points to line up with this unique coincidental natural meridian.

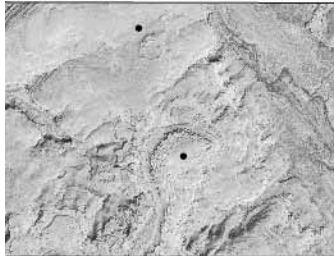
This probability exercise raises more specific questions about the logic of creating a single test box for distributing random points that mirrors the actual area where the existing 61 great kiva sites are located. Looking at the pattern of the existing 61 sites, figure 23, there is clearly a clustering of existing sites roughly south of both Abajo Peak and particularly Mount Wilson. At first the fact that seven of the 61 great kiva sites are in Chaco Canyon would seem to work against using a single large scale test box. Could it not have been that the location of one of the first two great kivas in Chaco on the Wilson – McCarty's meridian, 29SJ423, was itself a random phenomenon with respect to meridian alignment? While there is nothing in the



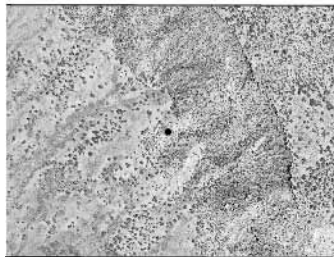
Mount Wilson 107 59 26.6



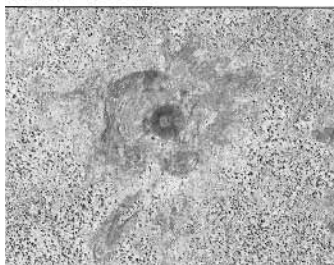
Aztec complex center kiva 107 59 52.3



P. Blanco 108 00 13.5 29SJ423 108 00 02



Andrews 108 00 16



McCarty's Flow 108 00 03



Cerro Moctezuma feature 107 59 48.4

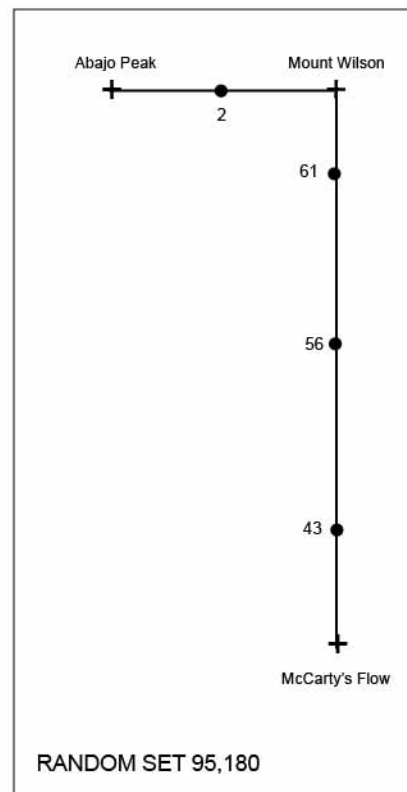
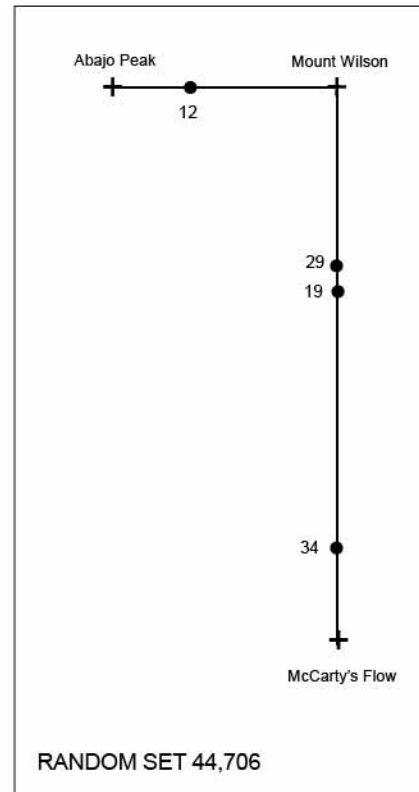
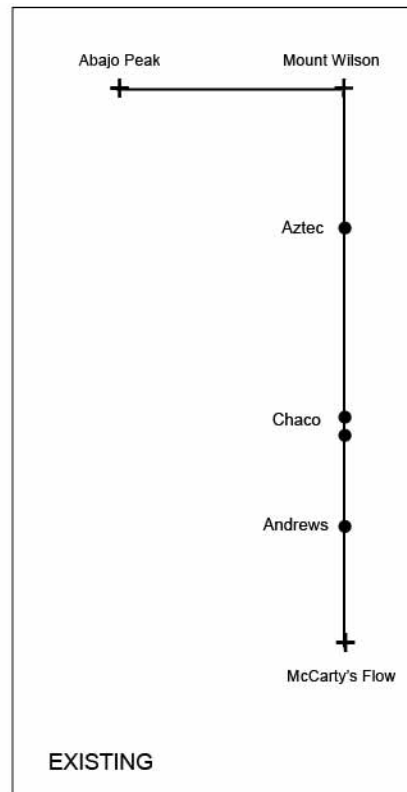


Figure 42. Coincidental natural and built features cardinally associated with Mount Wilson; best two comparable patterns from 100,000 random sets.

present literature that says that subsequent great kiva development in the canyon, almost five hundred years after, was influenced by the locations of the first two ceremonially important “villages”, still, if these two had unusually framed earliest Chaco as a special religious focus, then the locations of later great kivas would have been influenced by a single, though perhaps random, location with respect to Mount Wilson - McCarty’s Flow. In this respect, one might think about creating a test area around Chaco itself, within the larger scale test area. If then one locates seven of the 61 random points within the Chaco box, would it likely better reflect the possibility of a single random early point (29SJ423) and its influence creating a later Chaco

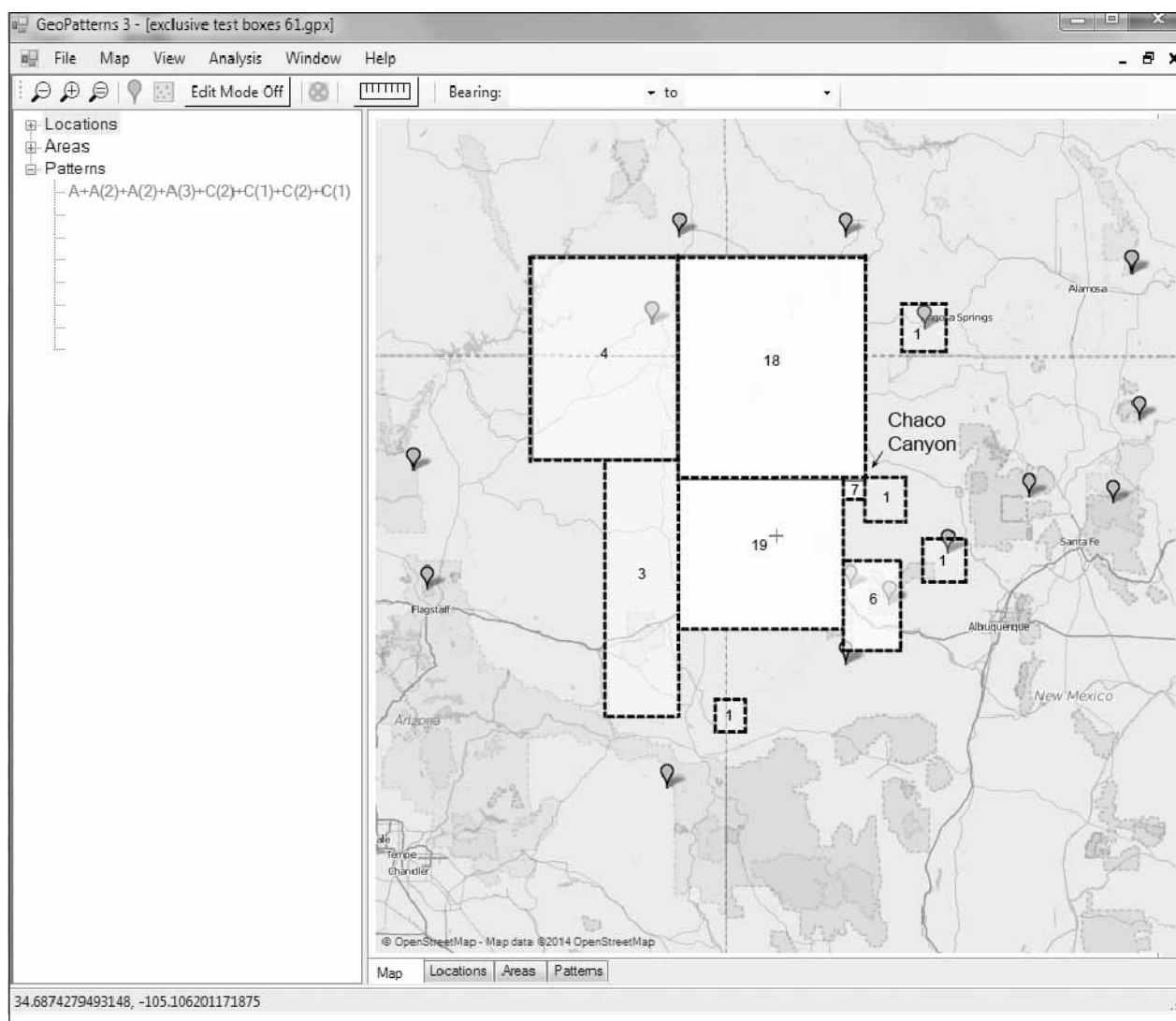


Figure 43. Alternative test areas for Mount Wilson meridian (multiple alignments and cardinal relationships); numbers indicate existing great kiva sites and random points located in each set in the analysis.

cluster of sites? How does this influence contribute to the Wilson meridian? Does constraining seven points to the Chaco box increase the probability that two or more of them will be located on the meridian, while decreasing the chances that two of the 54 points outside of Chaco will also align?

The Geopatterns screen of figure 43 shows this different tactic of setting up test boxes. To keep larger boxes from also dropping points into the small Chaco area, nine separate additional boxes need to be drawn, each associated with the number of existing sites found within. The reader should pay particular notice to the two test boxes on the meridian just north and south of Chaco Canyon. These two boxes contain 18 (mid n) and 6 (se) great kiva sites, which together with Chaco's 7 add up to 31 random points, or about half of the plateau total. Clearly there is clustering of great kiva sites along this eastern meridian. One would expect the probabilities of matching the stated (again same as existing) search pattern to be greater than with the single largest test box.

In 5,000 sets of 61 points distributed appropriately in the nine boxes, the compound pattern at 0.040° (alignments) and 0.070° (cardinals) occurs twice in sets 409 and 1,615 as in the following reports:

Patterns Investigated (1):

A+A(2)+A(2)+A(3)+C(2)+C(1)+C(2)+C(1) (1)

1: set 409

Alignment: se 3(35.03127 , -108.00553) , chaco 2(36.05830 , -107.99953) , mid n 15(37.05620 , -107.99462) , 359.749250

Alignment: se 3(35.03127 , -108.00553) , chaco 2(36.05830 , -107.99953) , wilson , 359.749925

Alignment: mccarty's , mid n 15(37.05620 , -107.99462) , wilson , 359.821685

Alignment: se 3(35.03127 , -108.00553) , mid n 15(37.05620 , -107.99462) , wilson , 359.759952

Cardinal: chaco 2(36.05830 , -107.99953) , mccarty's , 179.951494

Cardinal: chaco 7(36.03917 , -107.99407) , mid n 15(37.05620 , -107.99462) , 0.024593

Cardinal: mid n 15(37.05620 , -107.99462) , chaco 7(36.03917 , -107.99407) , 180.024593

Cardinal: wilson , abajo , 89.989038 id=4

AlignmentTolerance = 0.055

CardinalTolerance = 0.07

Patterns Investigated (1):

A+A(2)+A(2)+A(3)+C(2)+C(1)+C(2)+C(1) (2)

1: set 1,615

Alignment: mccarty's , chaco 5(35.99197 , -107.99823) , wilson , 359.855728

Alignment: mccarty's , chaco 5(35.99197 , -107.99823) , mid n 8(36.85498 , -107.99691) ,
 359.912946
 Alignment: mccarty's , chaco 5(35.99197 , -107.99823) , mid n 7(37.42048 , -107.99670) ,
 359.923707
 Alignment: mccarty's , mid n 8(36.85498 , -107.99691) , mid n 7(37.42048 , -107.99670) ,
 359.946436
 Cardinal: mid n 7(37.42048 , -107.99670) , chaco 5(35.99197 , -107.99823) , 179.951070
 Cardinal: wilson , abajo , 89.989038
 Cardinal: mid n 7(37.42048 , -107.99670) , mid n 8(36.85498 , -107.99691) , 179.983372
 Cardinal: chaco 5(35.99197 , -107.99823) , se 5(35.39946 , -107.99851) , 179.977364 id=1

 AlignmentTolerance = 0.055
 CardinalTolerance = 0.07

While the two random sets satisfy the search string derived from existing patterns, and are 6-point alignments like the existing, some variation exists in the respective participation of random and natural sites (Wilson and McCarty's Flow). In the existing, Wilson is again involved in 4 patterns (including the cardinal to Abajo), and McCarty's Flow in 2, while in set 409 these numbers are 3 and 2 respectively, and in set 1,615, the two natural points occur 2 and 4 times respectively. Thus the existing has greater association with Mount Wilson, while at least one of the random involves McCarty's Flow twice as much. Given that the stated search string "matches" the existing, but contains some variation, one can only say that random are quite comparable, though not exact.

Clearly, the clustering of test boxes in this second Wilson meridian exercise increases the probability of the compound pattern occurring randomly from roughly about 0.00002 (1 in 50,000) to about 0.0004 (1 in 2,500). Interestingly enough, constraining seven random points within Chaco Canyon only produces one pair of sites (to match the existing 29SJ423 and Peñasco Blanco) in set 409, while set 1,615 has only one random point in the canyon. But loading up 24 points north and south of the Canyon is apparently what does the trick. Thus we return to one of the most vital issues of this volume. Was the location of 29SJ423 designed to be aligned with Mount Wilson and McCarthy's Flow, or was its location in this regard a coincidence? Why does the clustering of great kiva sites occur with respect to the Wilson meridian? Was an early large scale integrative function of 29SJ423 (and its framing partner Shabik'eschee) the primary reason why BMII populations and especially classic period ceremonial sites are located in Chaco Canyon? If so, then this second probability test with more exclusive boxes is moot, i.e. that religious symbolism of the large scale structure causes the clustering and therefore dis-

torts any probability testing that creates exclusive areas in this manner.

Even if one accepts the lesser odds in the two exercises above that the Wilson pattern is a random phenomenon, other facts can be entered into this analysis of design intent. With the exception perhaps of Andrews, the other three great kiva sites on the vertical are not just any ordinary 3 of 61. Ideally, one should rank existing sites to give weight to pattern participation of those much more ceremonially or organizationally important than others. First, 29SJ423 is the most northerly (intuitively most sacred) of the only two early great kiva sites in Chaco Canyon (the meridian alignment happens here not with Shabik'eschee). Then later the most northerly of the perhaps second pair of canyon great kivas in PI is built on the line (the large early kiva north of Peñasco Blanco). Finally at the build-out climax of Chacoan influence, the new center successor of Aztec is located precisely on the line from the Peñasco Blanco great kiva to Mount Wilson. These facts, taken together with random probabilities likely lying towards the lower end of a 0.0004 – 0.00002 spectrum, make a decent hypothetical foundation for formally designed large scale, ritually based locations of these highly symbolic, ceremonial foci on the Wilson – McCarty's Flow meridian. Logically the design implications of the total pattern can be extended to 29SJ423.

One also does not know at present how a search string fully including Cerro Moctezuma would compare, i.e. whether the distance factor would negate the seven additional patterns (alignments and cardinals) created by the southern point.

4. Formalizing the “West” and a Triadic Plateau Frame

Given the possibility that the first formalized large-scale ritual patterns were focused on the Mount Wilson – McCarthy’s Flow meridian, and Chaco Canyon, this in a not unlikely context of an already very old shamanistic cosmos on the plateau, what is the detailed evidence that this new surveying and integral forms of ritual sodalities might have spread to other regions of the sphere?

Kiva Mesa – Broken Flute Cave

In Gilpin and Benallie’s (2000:162) list of seven Basketmaker III great kiva sites, Shabik’eshchee in the East is again the oldest (29SJ423 not reported), then in the West Broken Flute Cave and Juniper Cove. Kiva Mesa is listed as emerging about the time Juniper Cove is no longer used (A. D. 675). No specific date ranges are given for Bad Dog Ridge, Ganado, and Tohatchi. Given the limited excavation and dating of at least three of these sites one cannot necessarily say that Kiva Mesa preceded others, even though it might be the most thoroughly described archaeologically (Reed 2000). From our present perspective, because of unusually high numbers of alignments associated with two of these four sites and other indicators for the other two to be illustrated, it is here suggested that they possibly were located via accurate surveying, perhaps the first in the West, *after* Broken Flute Cave and Juniper Cove had been established. Secondly, because of the statistically unusual characteristics, two sites, Kiva Mesa and Ganado, appear to be new ritual foci in the West, perhaps rivaling earliest Chaco.

In the Chapter 2 probability exercise of the group of 61, 34 BMIII-PI period sites are distinguished from 27 during PII-PIII. Great kivas in the earlier period generally have a significantly higher propensity to have alignments associated with them, giving some credence to the present view of early formalization of large-scale ritual on the plateau. Again, however, as explained in Chapter 2, this analysis of all three-point alignments associated with each great kiva site did not distinguish random from designed patterns, only that the greater the number of associated alignments, the greater the probability that some number are intentional.

Kiva Mesa, in addition to its uniqueness as a Basketmaker III site with three great kivas,

also has a later PII component with an additional great kiva (Reed 2000), about 801 meters northwest and below the mesa top where the Basketmaker “village” lies, figure 44. At accuracies of 0.15 or less, the early component is involved in 5 of the 60 total alignments found among the combined 34 great kiva and 21 natural feature points on the landscape. During this early period Lowry is the site with the greatest involvement at 10, with the next most involved sites having only 5, including Kiva Mesa. When the PII component is added, as well as all the other great kiva sites of that period, the significance of Kiva Mesa becomes even more pronounced. The BM III component adds four more alignments involving later period sites for a total of 9. Then the adjacent PII sites itself adds four alignments that do not “overlap” (because of common azimuth of the two Kiva Mesa points). Thus the total involvement of the combined two Kiva Mesa sites is 13 at 0.15° accuracy or below. Highest of all the 61 great kiva sites for the combined periods is 29SJ423 at 17, followed by Village of the Great Kivas at 14, Kiva Mesa, Bluff and the Butler Wash Main Panel at 13, and Lowry at 12 (all at or under 0.15°).

Kiva Mesa (A.D. 675-775) is only 7.989 km from Broken Flute Cave (A.D. 623-635), and might logically have been a ritual replacement of sorts to the earlier, hypothetically non-surveyed location. Likely the mesa’s modest natural character was not a major motivation, compared to the more dramatic cave setting. Which of early Kiva Mesa’s five lines might be the most likely to have been designed, and conceived of as the rationale for shifting the location of the ritual focus? Most interesting in terms of design analysis, is the line from the Butler Wash Main Panel to McCarty’s Flow, which passes only about 10 meters from the USGS high point of Kiva Mesa site (again, the “village” is on the top). In relation to the overall 308.487 km line, the average deviation (from both ends divided by two) is 0.019°, close to the visual acuity of the unaided eye at 0.017°. This is an extremely accurate line for surveyors perhaps just developing their skills. If in fact surveyed, Kiva Mesa priests might well have erred on the side of accuracy.

The ritual meaning of a line from the Comb Ridge rock art panel to McCarty’s flow might signify an increased effort to link the new surveying religious sodalities of the West to those of the East. The relationship between two highest northern mountains, Abajo Peak and Mount Wilson, may have already been ritually understood, but nothing yet connected what may have been the primary ritual focus of the West, Comb Ridge. Cognitively, shaman/priests would have understood the direction from the Butler Wash Panels toward Broken Flute Cave,

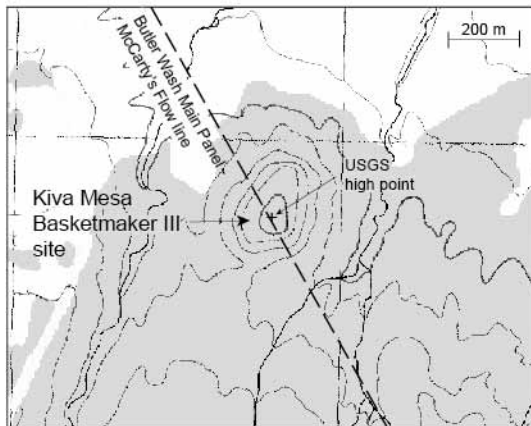
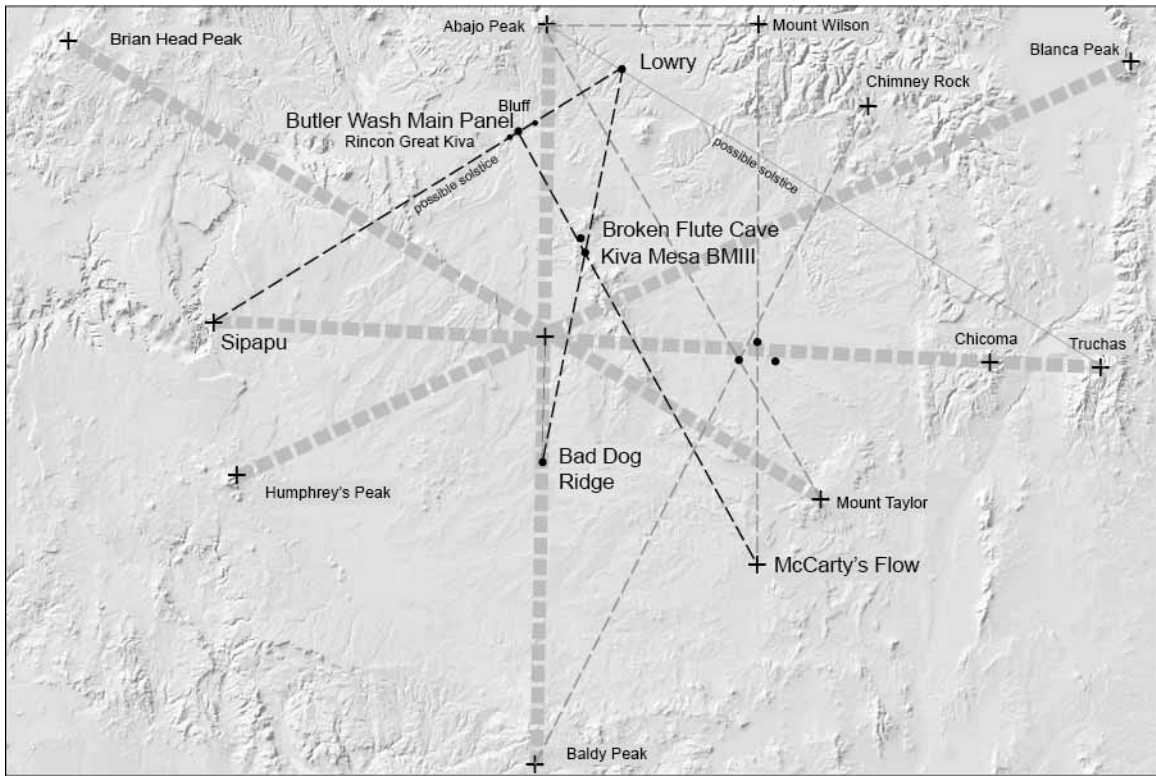


Figure 44. Kiva Mesa BMIII great kiva site in large scale context with possible other early ritual foci.

perhaps suggesting the southern pole of the new Mount Wilson meridian, as appropriate terminus. Organizing participants along the way, a surveyed line between the two could have then discovered the coincidence with the modest Kiva Mesa, only a couple hours walk from Broken Flute Cave. While this line somewhat mimics the hypothetical Abajo Peak – Mount Taylor intercardinal axis that helps create Kin Bineola X, symbolically it is a much more powerful and ritually accessible axis, perhaps socio-politically engaging populations in the Red Mesa Valley and El Malpais lava flows connected to McCarthy's.

A second axis from Sipapu: Butler Wash Main Panel - Lowry

Not only is Lowry among the highest of the 61 great kiva sites (with VGK) in terms of involvement in alignments, but it is located very precisely on a prolongation from the Sipapu point shown in figure 13, through the Butler Wash Main Panel, figure 45. Using the Sipapu point taken from its USGS quad map and a GPS reading taken at the Butler Wash Main Panel, this mathematical line comes within about 2 meters of the center of the reconstructed Lowry great kiva (GPS reading and Google Earth), shown also in figure 44. The average deviation of the overall line of 299.695 km is 0.0006° . While again this kind of accuracy would not have been possible, except by error, even with simple techniques that can get close to visual acuity at 0.017° . The azimuth of this line from the Sipapu is $301^\circ 53' 03.5''$, which falls within two degrees of summer solstice sunrise at this latitude, suggesting possible additional religiosity.

If this seemingly powerful line from the Grand Canyon and the southern point of Comb Ridge had been prolonged from the Sipapu up to the Lowry area, what second line, or geometric consideration could have provided the necessary intersection point? One of Lowry's 13 (three-point) alignments within the 0.15° range is a line from Abajo Peak to Truchas Peak at the end of the coincidental Sipapu – Chicoma—Truchas line. The average angular deviation of the 398.839 km Abajo-Truchas line is a modest 0.083° , meaning that it misses the center of Lowry's great kiva by about 138 meters to the northeast. It actually runs between Lowry great kiva and the North Great House (shown in greater detail later in this chapter) much or all of which may have been built after the establishment of the Lowry point. Interestingly, given the possible *summer* solstice involvement of the Sipapu – Comb Ridge line (now extended to Lowry), the Abajo-Truchas azimuth, $239^\circ 40' 48''$, is close to the *winter* solstice sunrise angle, $239^\circ 18' 00''$ as seen from Abajo Peak (this angle could vary depending upon the height of the sunrise horizon relative to Abajo Peak). The azimuth to the Lowry great kiva, $239^\circ 32' 15.8''$, is a little closer. The clearly visible distance between Abajo Peak and Lowry is 55.547 km. Recalling possible shamanistic observations from Abajo Peak of the equinox sunrise over Mount Wilson, a winter solstice association to both Lowry and the Eastern pole at Truchas is noteworthy, though less precise than the hypothetically surveyed line from Sipapu and the Butler Wash Main Panel.

A pattern to be fully described shortly is Lowry's location as an emerging largest scale "Middle" component in the new triadic frame with East (Chaco) and West (Comb Ridge – Aba-

jo Peak) verticals or *axes mundi*. Given Lowry's also possibly solstice related line to Sipapu, the great kiva site has a roughly equal angular relationship to *both* ends of the Sipapu –Truchas *sunray*, i.e. 120° 09' 17.1" to Sipapu, and 120° 37' 43" to Truchas. It is difficult at this point in the present research to suggest which geometric pattern might have been most in priest's minds, the Abajo-Truchas alignment, or the equal angles to west-east axis end points with respect to cardinal north, or even whether one or both were only coincidental and religiously unincorporated into ritual practice—this considering an early great kiva site south on the Middle axis, and possible source of the positioning second line for the northern terminus of Lowry.

An early consideration of the important point of Lowry deviates from Gilpin & Benalíe's (2000) list of BM III great kiva sites. Lowry's great kiva and great house were dated by the early excavation by Paul Martin (1936:195) to the climax Chaco period about A.D. 1085-1090 (tree ring dating verified by Ahlstrom 1985). Within a 20 km square kilometer area, Lowry was one of two great kiva Pueblo II "communities" (900-1150), the other at the Cahone site about 6.65 km to the NE. The roughly contemporaneous Cahone site is not usually listed as a Chacoan "outlier", with numerous smaller pueblo buildings adjacent rather than a clearly evident great house (Lipe & Varien 1999:248); it nonetheless has a great kiva.

Even though the Lowry area was populated in Basketmaker III, the ritual use and meaning of the great house and great kiva built on the site--some three to four hundred years after the hypothetical origins of surveyed, large-scale integrative ritual frames of this volume—is said to be essentially a local, kinship driven experience, though with limited larger scale implications. To both Martin and recent researchers such as Kendrick and Judge (2000), the possible distinctions between outlier great kivas (Lowry) and some sort of more local great kiva (Cahone) or large earlier pithouse are largely diminished in the wake of socio-ecological studies that define both sites as centers of geographical territories or "communities" with changing patterns of politics:

"From our perspective, great house construction at the Lowry Ruin, North Great House, and possibly Casa del Valle may be interpreted as precocious attempts by households or lineages to pool labor in order to gain competitive advantages over resources vis-à-vis other lineages... We believe local households used Chaco-style architecture and landscape settings to attract (or pull) related members and thus control more producers" (2000:127).

This competitive basis of great houses, however, does not in Kendrick & Judge's opinion, ne-

gate the possibility that at the same time more religiously apparent structures like great kivas, roads and other landscape related features provided a “grammar” for larger scale regional interaction (the authors don’t use the word “integration”). The purpose of these more ritually dedicated components was to gain access to resources for economic or religious activities from beyond local boundaries (ibid 127). If in some new excavation of the Lowry great kiva, one found evidence of a prototype that stood long before the great houses were built, this wouldn’t necessarily run counter to Kendrick & Judge’s interpretation. Yet the location might have been important early for its role in a triadic plateau frame, and for this large-scale integrative reason,

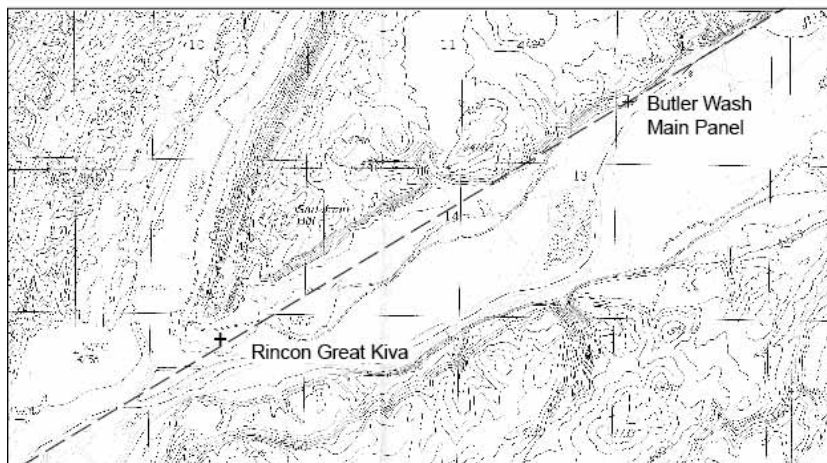
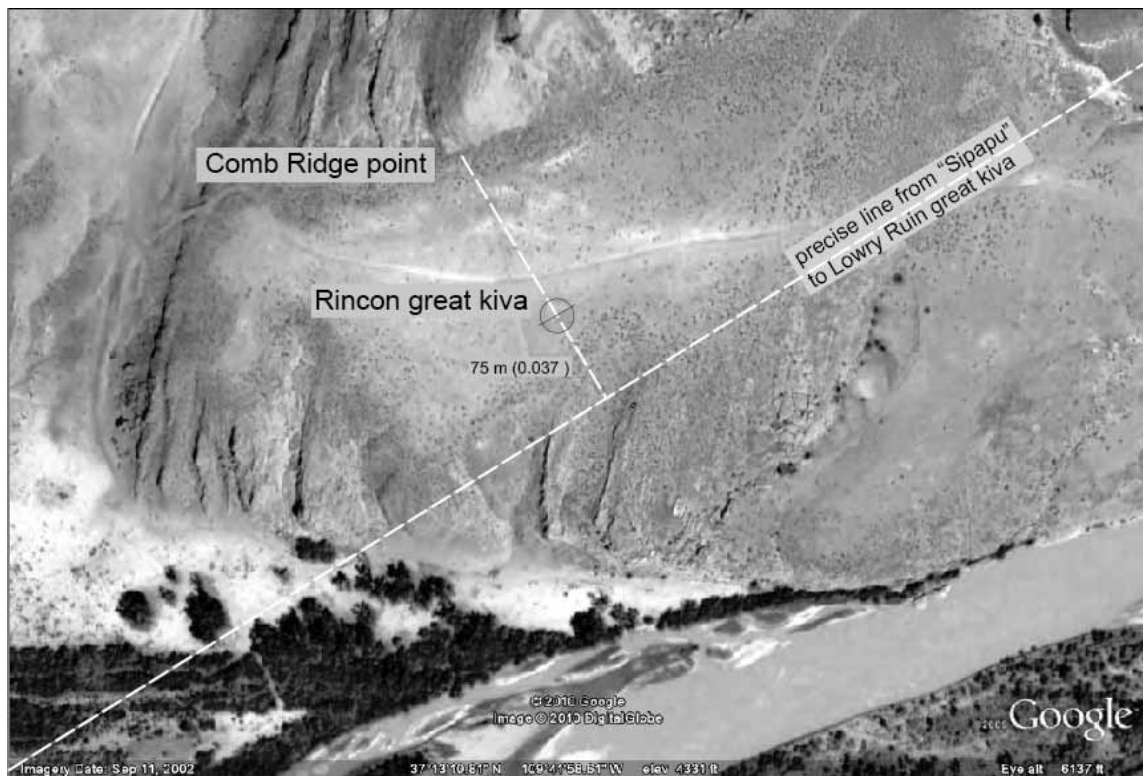


Figure 46. Location of Rincon “great kiva” at the topographic tip of Comb Ridge with respect to the Sipapu - Lowry line and the Main Panel at Butler Wash. Perpendicular relationship of prominent ridge point to Rincon feature and Sipapu-Lowry line.

had been constrained in terms of more competitive, kinship related great house construction. Only late in the plateau experience of formalized triadic religion and landscape based ritual, might sites like this have been “architecturalized” as part of the final evolution of the largest scale system. Early great kiva sites like Kiva Mesa, Ganado and Bad Dog, for example, eventually all have at least small great houses built on or adjacent to them.

If the Lowry position had been created at the end of Basketmaker III, then it might well have partially determined the location of two subsequent great kiva sites, also aligned with the Sipapu and Butler Wash Main Panel. The dating of the Rincon great kiva-like feature right at

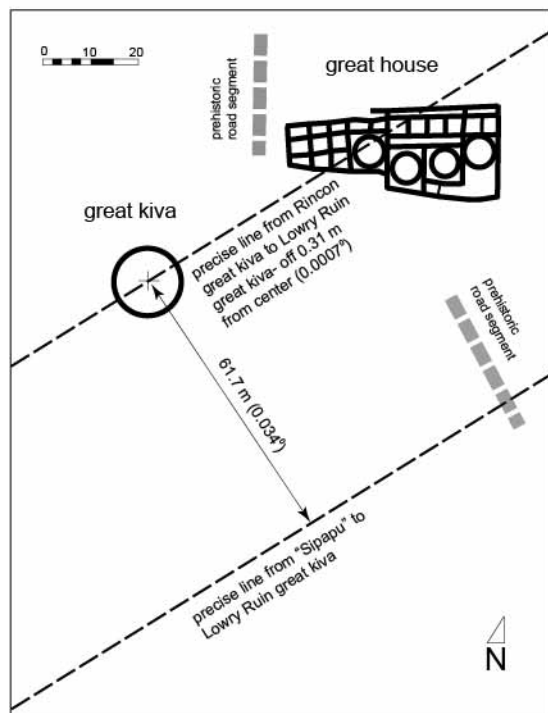
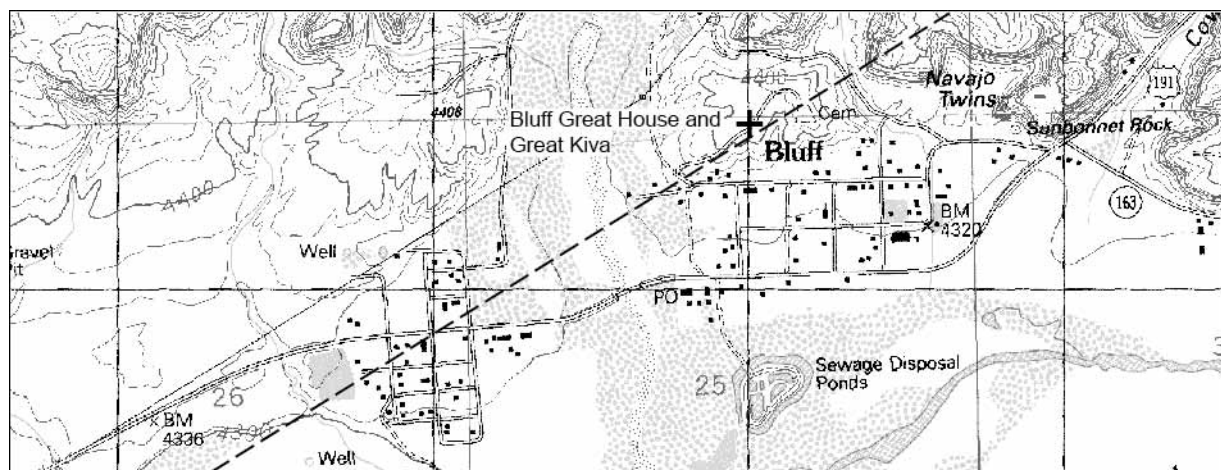


Figure 47. Location of Bluff great kiva and great house in Bluff, Utah (above). Relation of great kiva to Sipapu - Lowry line and to two other great kiva sites: Rincon and Lowry (below). Site layout redrawn from Cameron 2009.

the southern tip of Comb Ridge is said to be probably PII (Hurst 2000), though a PI room block lies only a stone's throw from the circular structure. The outlier kiva and great house at Bluff, like Lowry's, date to PII. Most impressive about this Rincon-Bluff-Lowry threesome is the extreme accuracy of their alignment, perhaps relating to shorter distances that could have facilitated surveying, figures 46 and 47. The center of the Bluff great kiva in regard to this precise 80.059 km line between Rincon and Lowry is only off about 0.31 meters, another overly accurate alignment (given possible inaccuracies of three to four meters for each GPS position at the three sites). If the three were intentionally aligned, the Rincon kiva-like feature might have been second after Lowry, in PI, or even earlier.

The Rincon ceremonial ring west of the Butler Wash Main Panel might have been a repositioning of the traditional ritual focus at the Comb Ridge rock art panels to a more precise topographic and surveyed position. While the Sipapu-Main Panel-Lowry line is extremely precise, Rincon's location is about 75 meters north of the line, for an average angular deviation from this longer line of 0.037° . If Lowry had been established first, then Rincon's subsequent position might well have been symbolically regarded as part of the Sipapu-Lowry line, and perhaps no surveying was involved. It was only the addition of the Bluff outlier location that might have precipitated surveying the line between Rincon and Lowry.

Bluff Great House, adjacent to both San Juan River and the major Cottonwood Wash has been investigated more than most outliers (Cameron 2009:297-315). One of the primary motivations for the work is the attempt to understand, again, the relationship of Chacoan outliers to Chaco Canyon, almost two hundred kilometers away. For a fuller description of Chacoan great house characteristics particularly in this area, e.g. pottery profiles, multi-storied construction with large rooms, blocked-in above grade smaller kivas, associated great kivas, associated roadlike features, and associated community, see Hurst's introduction to *Edge of the Cedars* "outlier" site in Blanding, Utah (2000:63). At Bluff, local people appear to have occupied the site periodically, including Basketmaker III, up to the time of great house (and great kiva) construction beginning about A. D. 1075. But in terms of who built it, Cameron states that "the Bluff great house, like others in the region, was built primarily by people who had recently arrived in the area, rather than exclusively by residents of a long-established community" (2009:298).

Was there an earlier great kiva on the Bluff site, not unlike Lowry? If something like

the minimally architectural Rincon feature had existed at Bluff as well, it certainly might have been totally destroyed by these newcomers in the eleventh century. Bluff seems to be a very important location, again with high involvement of 13 alignments at 0.15° for the combined BIII-PII, though only 5 are associated with the early period. It is suggested, again, that many of the great kiva sites with the highest total period involvement in alignments may well have had early origins. Their minimally architectural positions could have been important ritual focal points, part of surveyed frameworks, several centuries before Chacoans began building great kiva/great house complexes on them.

The Ganado Cross as more defined southern pole in the West

Compared to early Chaco's layout--particularly the triadic unification of 29SJ423, Kin Bineola X, and Shabik'eschee--the patterns at Kiva Mesa do not seem to attempt any kind of similarly formalized focus, considering the site's adjacency to the Baldy Peak – Abajo Peak meridian. Furthermore it seems unlikely that any such newly surveyed location in this part of the plateau could compete with or displace the ritual power of Comb Ridge (including Abajo Peak) points. But thinking in terms of axial oppositions, it might have been religiously and politically possible to create a balancing southern location, in relation to the newly surveyed Comb Ridge points to the Sipapu, a newly defined north-south pair (*a la* Chaco) intended perhaps to replace the shamanistic symbolic power of Canyon de Chelly.

Logically, if the cardinal of Chicoma - Truchas and the Comb Ridge – Lowry line were founded at the place of origin, the Sipapu in the Grand Canyon, then the southern pole should be created with this same spiritual source. Such an emerging structure is also triadic, in keeping with the formalizing leitmotif of large scale Ancestral Pueblo religion. Where then would the southern line terminate? No more logical choice could exist, given the necessary southeast direction from Sipapu, than the traditional SE mountain, Mount Taylor, also essential to early Chacoan structure via Kin Bineola X. As a cross structure, a western related NW-SE axis from Mount Taylor to the Sipapu would have needed a complementary SW-NE line, one with a roughly equal opposite azimuth. The logical SW point would be Humphrey's Peak, the possibly shamanistic southern intercardinal partner to Mount Taylor. The new line's NE point is as yet less clear in terms of the available major traditional natural features. The final Basketmaker III site listed by Gilpin and Benalli (2000), Tohatchi, mathematically works in this role. It is

suggested later in this chapter that the Tohatchi “village” predated what was constructed at the West intersection point in question, and that its importance might have related to the earlier, but perhaps almost contemporaneous creation of a Middle plateau axis from Lowry.

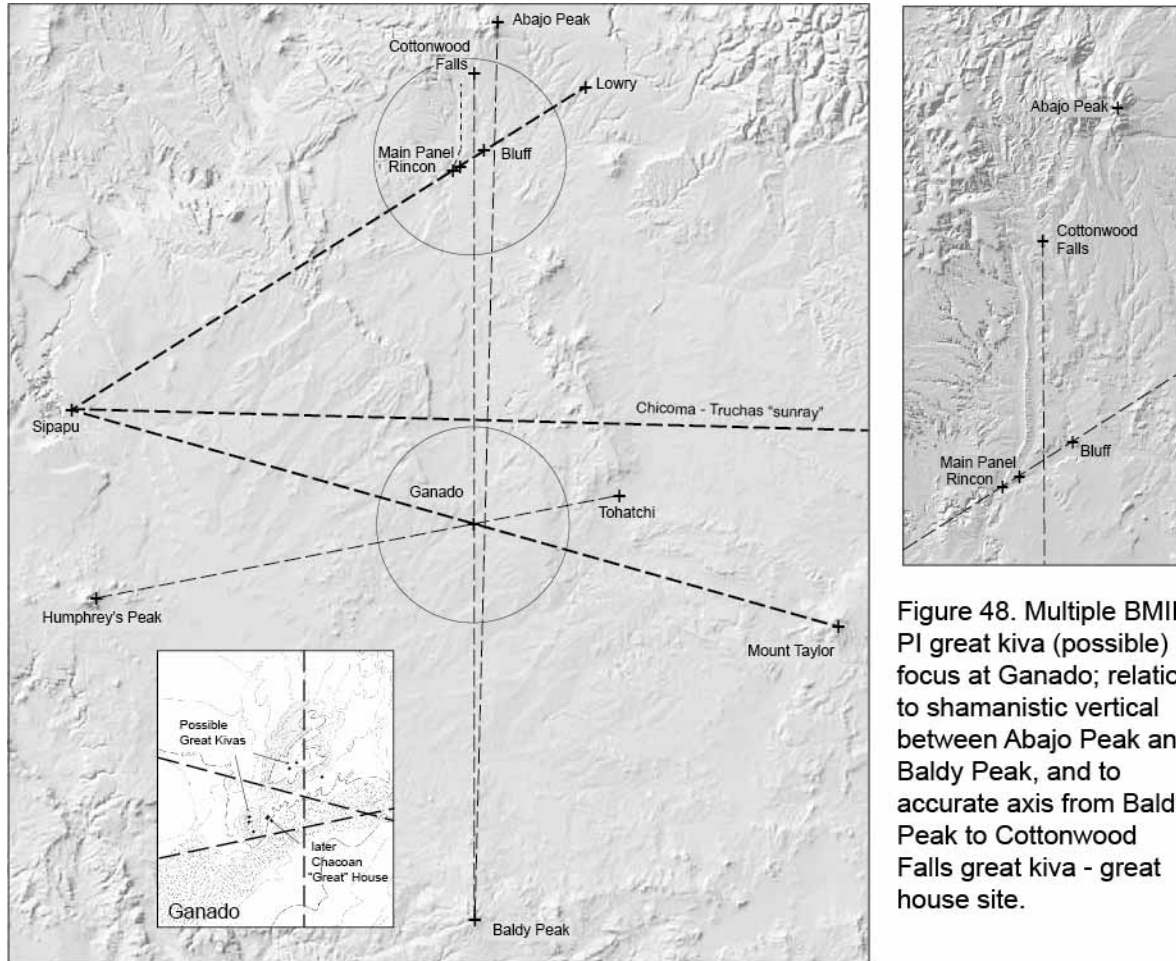


Figure 48. Multiple BMIII-PI great kiva (possible) focus at Ganado; relation to shamanistic vertical between Abajo Peak and Baldy Peak, and to accurate axis from Baldy Peak to Cottonwood Falls great kiva - great house site.

The intersection of these two cross axes occurs just east of the natural draw between the two hills on which the five large circular depressions and associated pit houses and storage structures of the Basketmaker III-PI site of Ganado were built, figure 48. In Gilpin and Benalili's (2000) list this is by far the largest site, both in terms of numbers of “possible” great kivas and site area. This intersection point of the two cross axes—given the Chaco experience of unifying three and possibly four axes—raises the question of its relation to a West vertical. Cognitively, priests could have known of Ganado's position roughly south of the traditional Canyon de Chelly focus, and by extension of its approximate cardinal location to Baldy Peak to the south, and the combination of Comb Ridge and Abajo Peak to the north.

One possibility in regard to creating a meridian element at Ganado, is an accurate align-

ment that exists between Baldy Peak, Ganado, and the complex site of Cottonwood Falls, with its largest great kiva in Southern Utah (Hurst personal conversation) and multiple road segments. This 407.327 line misses the small Chacoan great house at Ganado by about 194 meters (0.055°). While Cottonwood Falls has not been extensively excavated, Severance (2004:144) describes the site as the center of an extensive farming area from PI-PIII, though he believes a midden on the site is Basketmaker III. Also interesting about the Cottonwood Falls site location, besides its accuracy with Ganado and Baldy Peak, is its topographical relation to Comb Ridge and its San Juan points, and Abajo Peak. As seen in figure 48, Cottonwood Falls lies at the northern end of the Comb Ridge feature, with a clear view of the Abajo peaks. While there are many other sites in this area, Cottonwood Falls is apparently one of the most interesting, or important, not just because of its largest of great kivas, but also large adjacent room block with possible embedded kivas. Given its accurate cardinal alignment with Ganado and Baldy Peak, it is not impossible that Cottonwood Falls played a horizontally mediating ritual role between the two verticals of Comb Ridge (natural feature) and the long (cosmic) line from Abajo Peak to Baldy Peak. Ganado, for its part would also be Middle, a vertical southern opposition to northern Cottonwood, with the axis from Sipapu – Truchas in between. Unlike Chaco, however, with 29SJ423's association to this west-east naturally coincidental line, there is no site or other evidence to more clearly suggest similar meaning of the Sipapu – Truchas line to the mathematical alignment between Baldy Peak – Ganado – Cottonwood Falls.

Did shaman traditionalists continued to use non-formalized Canyon de Chelly focus in spite of the new developments at Chaco? Or, did surveyed locations and built sites such as Ganado and Cottonwood (including Rincon and Bluff) largely displace Canyon de Chelly as a focus? And in this case what would their relationship have been to Chaco?

A Ship Rock Mediator between West and East

In spite of the obvious eventual ritual power at Chaco during its climax, the earlier developing frame, possibly responding to a diminished shamanistic meaning of the Abajo Peak-Baldy Peak meridian, may have been intent upon somehow integrating a West vertical and focus (perhaps Ganado) with an East vertical (Chaco). Since Ganado (BMIII-PI) was created 100-200 years after the first great kivas in Chaco the possible initial impetus of that formalization, the Abajo Peak-Mount Wilson (equinox) cardinal, might well have given way to alternative meanings of

Abajo Peak, either as NW pole in an axis through Kin Bineola X to Mount Taylor, or as part of an also formalized Comb Ridge – Cottonwood Falls context.

The location of Lowry has already been introduced as the possible initial and northernmost, now formalized, Middle element, with its relatively equal angular relationship to the ends of the Sipapu-Truchas axis. Looking for features or sites to the south that might have been chosen to help structure this new Middle vertical axis from Lowry, three points can be candidates. The first, an undoubtedly already sacred natural feature, Ship Rock, looms majestically over the plain as immediately seen in figure 49. This volcanic “neck” or “central feeder pipe” reaches about 600 feet into the sky. It also may have been symbolically appropriate that this ultimate mediating element have twin peaks to express the West – East duality.

Difficulties of setting up tripods in the precipitous saddle between Ship Rock’s twin peaks notwithstanding, a relatively accurate line exists, perhaps prolonged by priests from Lowry through Ship Rock, down to Tohatchi, again, on Gilpin & Benallie’s (2000) Basketmaker III list. The precise line from the center of the Lowry great kiva through the Ship Rock saddle misses the center of the great kiva on the Tohatchi mesa by about 91 meters. As a three point alignment its average accuracy is 0.027° . Ship rock stands close to the center of the 194.774 km line (off by about two and a half kilometers). The fact that this prolonged line mathematically hits the top of the modest Tohatchi mesa is coincidental, and perhaps one of the reasons why the site was chosen for this particular “village”. Again, Tohatchi was hypothetically located prior to its participation as one of the intercardinal axes of the Ganado cross. Unlike the position of most other BMIII “villages” in the area, including some with large pit structures, this setting is said to be unusually “defensive” in character (Kearns et.al. 2000). Alternatively, it can also be interpreted as unusually religious for all the reasons of ritual positioning in relation to the Ship Rock Middle and the Ganado southern focus.

It is also not impossible that Lowry’s location on the Sipapu line was created conversely with a prolongation from the Tohatchi – Ship Rock line, assuming that Lowry priests were not aware of its very large scale equal relationship with the ends of the Sipapu Truchas axis. The question is why Tohatchi would have been so important as to be the southern terminus for the plateau Middle. Of course if Ganado had been created just prior to, or integral with the positioning of BMIII Tohatchi, then causality would be much more evident. Tohatchi will again come into play with the final restructuring of Chaco’s center complex. In the analysis of 61

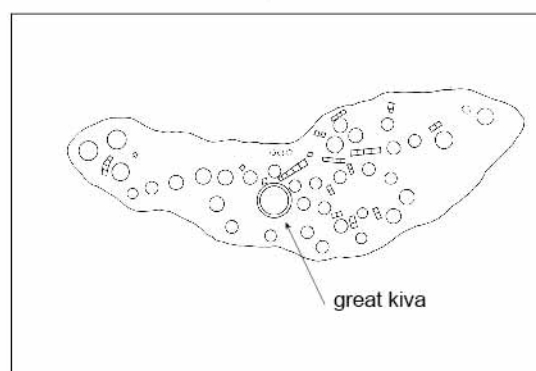
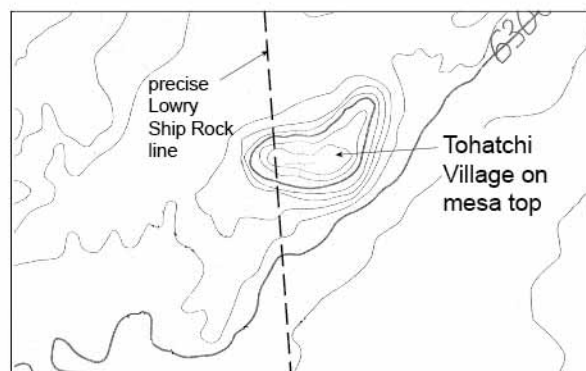
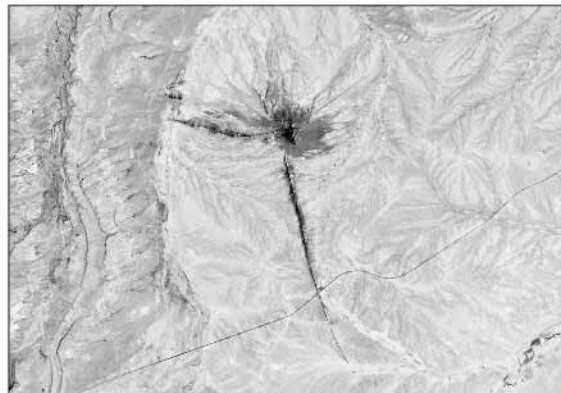
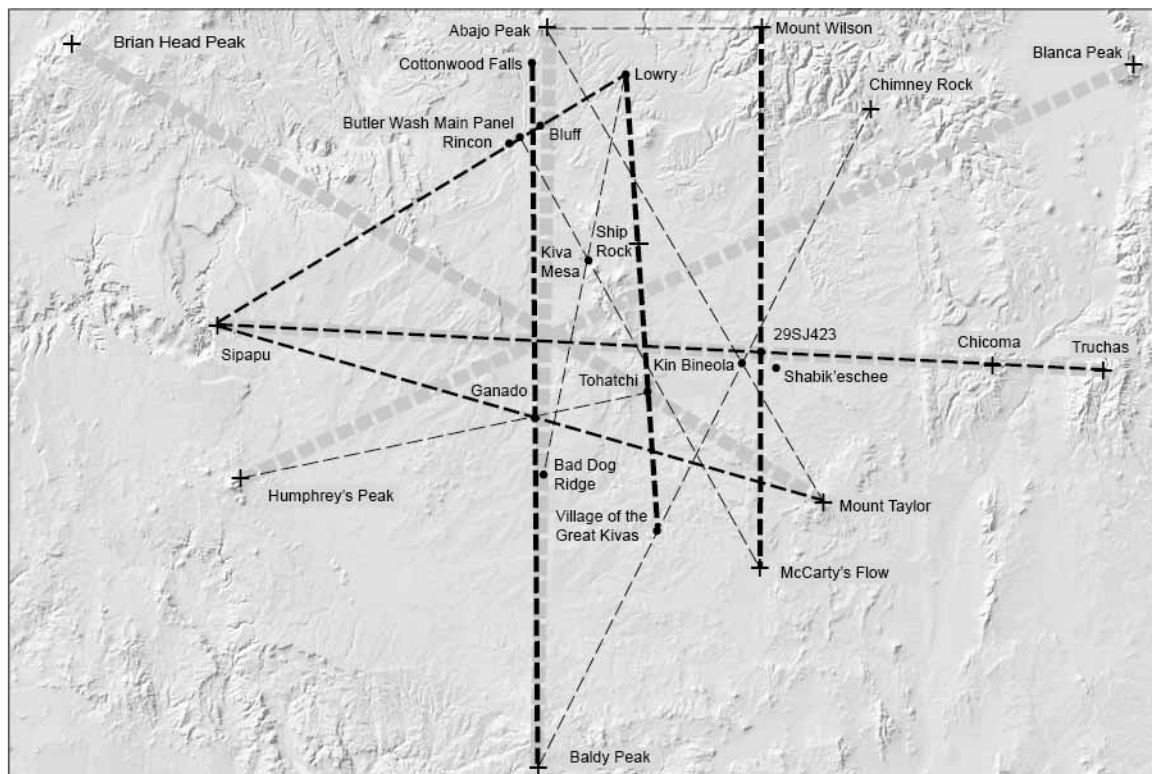


Figure 49. Ship Rock - Lowry - Tohatchi - Village of the Great Kivas as "Middle" vertical.

great kiva sites in context with 21 natural features, Chapter 2, Tohatchi is in the middle range of involvements, with 8.

Later Lowry and Village of the Great Kivas: an introduction to major changes in Chaco

“There seems to be a conspicuous absence of formal great kivas in Chaco until about A. D. 1050” (Windes, et. al. 2000:45). While it may be that Windes & Wills (1989) do not include Shabik’eschee’s and 29SJ423’s great kivas some five hundred years earlier as part and parcel to any kind of large-scale ritual definition of Chaco (“formal great kivas”), nevertheless, a clear hiatus of these major ceremonial foci existed at least up until two great kivas were added in the late 800’s A.D. at the very beginning of major Chaco formalization (to be discussed in the next chapter). During this hiatus, perhaps, the rest of the plateau was being formally integrated into something of a whole—hypothetically a principal motivation for and ritual motif of the creation of Chaco as major pilgrimage center. Part of this eventual expression also took place at other locations on the plateau some distance from Chaco.

The “outlier” site of Village of the Great Kivas is actually dated about 35 years before the first classic great kiva in Chaco, about 1015. We will also see that at this time in the canyon, it is possible that the first formalized great house is being built with oriented, large monumental walls, and a triadic plan of central and wing room blocks. The relatively early dating of the Village of the Great Kivas (VGK) comes from its two great houses and the northern of two great kivas (Roberts 1932:156). Very few great kivas have been tree ring dated because of the lack of roof structure; most, like the northern one excavated at VGK, are assumed to be contemporaneous with the dates of adjacent great houses. The larger, southern great kiva was not excavated and perhaps if less formalized in architectural character, might be earlier. While this volume argues that Lowry was located in Basketmaker III, in relation to its Sipapu and Ship Rock lines, VGK and the later 11th century construction at Lowry might have been conceived as an expression of Middle axis strength during classic Chaco.

Roberts’ view of this remote site at least fifty kilometers from any contemporaneous or later great kiva/great house site (see map in Warburton and Graves 1992:52-3) is clearly intrusive. He writes that, “there are no indications in this immediate vicinity of an earlier group. Hence the conclusion that the builders must have come from the north and brought their architectural practices with them.” (Roberts 1932:157). This could have been the case for an earlier

singular great kiva as well. By “north” Roberts means Chaco Canyon, yet only six years later Paul Martin excavates Lowry Ruin located more geographically to the north. At this site tree ring dates for the great kiva exist, but are substantially later than those at VGK, i.e. around A.D. 1085 – 1090 (Martin1936:195).

What is it then that pairs up classic period Lowry with VGK, perhaps replacing earlier Tohatchi as the southern pole of the Middle? First of all, again in terms of the analysis of 61 great kiva sites and 21 natural features, VGK has a second high number of 0.15° involvements in three point alignments, at 14 (Lowry has 12), strongly suggesting that at least some of them were designed. Two stand out as most analytically interesting. Mathematically, as a Middle prolongation from Ship Rock and Tohatchi, the VGK site forms a relatively accurate 0.068° three point alignment, or if prolonged from Lowry and Ship Rock, an alignment of 0.056° . The second intersecting line which might have locked in VGK’s position on the Middle axis is the Baldy Peak – Kin Bineola – Chimney Rock axis which was hypothesized as one of the intercardinal axes of the first Chaco layout and Kin Bineola X, figure 49 again. This line from the benchmark on the top of Baldy Peak to the center of the PII great kiva at Kin Bineola (adjacent to the great house) misses a center point between VGK’s two great kivas by about 5 meters, an overly accurate line of 0.002° . The outer walls of the two great kivas are about 30 meters apart. If the Kin Bineola great house/great kiva point had existed from about late PI, early PII (with Kin Bineola X being much earlier), it would not have been necessary to resurvey the entire line to Chimney Rock, just perhaps the southern leg on which VGK is located. Thus the Baldy Peak – VGK – Chimney Rock axis is less accurate, though at 0.062° , in the lower half of the 0.15° total range considered in the analysis of Chapter 2.

In many respects, i.e. formalized multi-point and cardinal alignments, and building orientations, the site geometries of Lowry and VGK reveal similarities to the north-south pair of great houses on the north and south rims of Chaco Canyon, Pueblo Alto and Tsin Kletsin (though neither have great kivas). This most widely recognized example of formal symbolic landscape integration between two Ancestral Pueblo sites, about 3.754 km apart, may have been laid out in the early 11th century, about the time VGK’s relationship to Lowry was established. Following chapters detail the meaning of the Alto-Tsin Kletsin pair as intimately intertwined with the meaning of the ultimate Chaco frame, and in doing so may clarify why similar knowledge and resources were put into the physical settings of Lowry and VGK, also related to

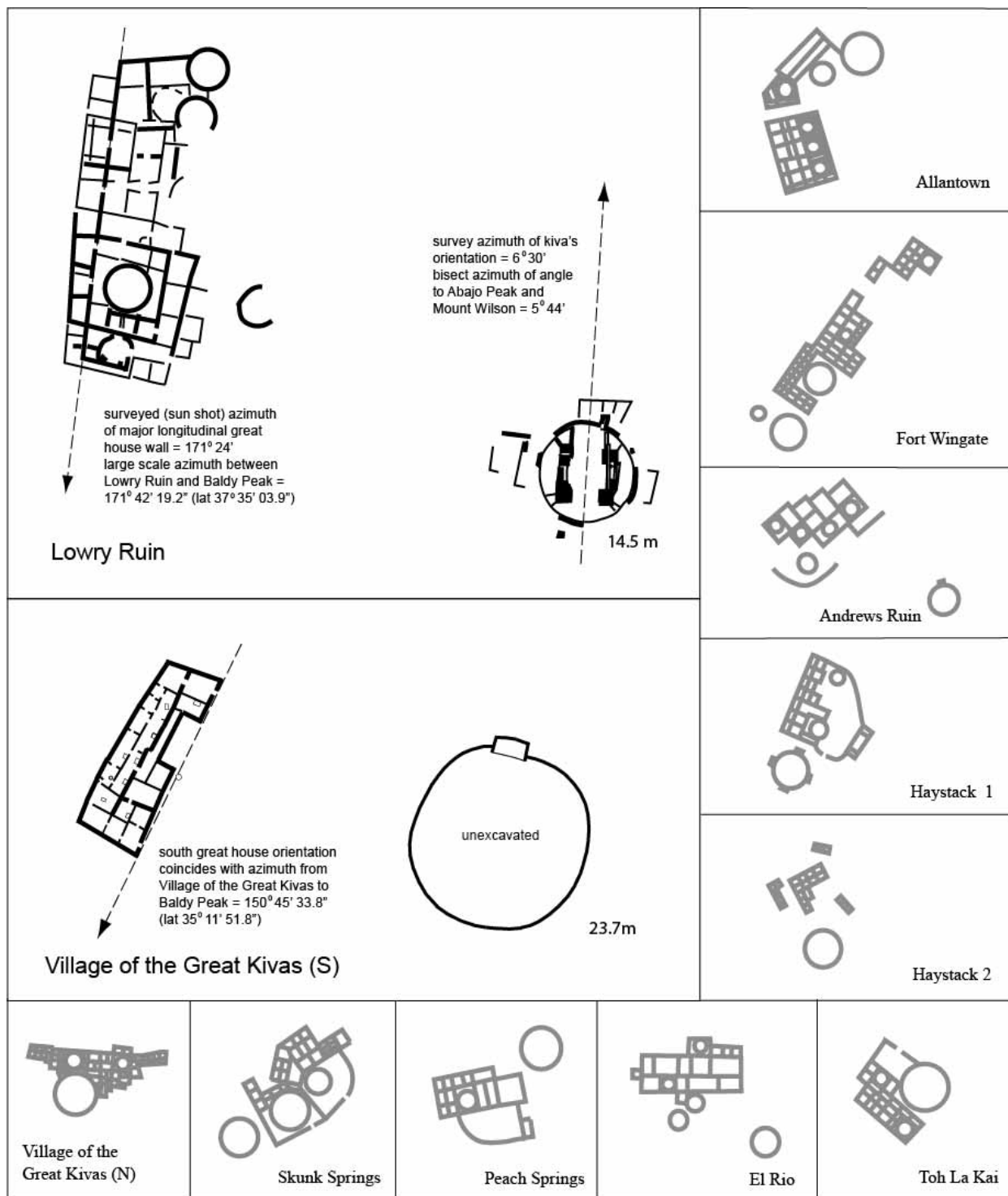


Figure 50. Similar great house plans of Lowry and Village of the Great Kivas compared with other Chacoan “outliers”.

Middle expression, though at the plateau scale.

When working on the first version of a Ship Rock *axis mundi* idea (Doxtater 2003), the author kept mistaking the loose zerox sheet of the Lowry great house plan with that of the second or southern great house at VGK. For a licensed architect and studio instructor of many years' experience, this similarity of plan layout became the first of several evidentiary pieces pointing to a designed, probable ritual relationship between the two outliers aligned to each other via Ship Rock (and Tohatchi). Plans of other outliers, provided as well in figure 50, are so comparatively varied in their building geometries and site relationships with adjacent great kivas, that the relatively cohesive plan, similarly angled walls, and location of apparent entry are as of Lowry and VGK (S) must have been intentionally designed as a pair.

The 2003 article, however, failed to investigate the orientation of these two buildings, particularly in respect to the first formal straight walls possibly symbolically oriented to aspects of large scale frameworks being laid out in Chaco. Current work took new GPS positions at the centers of the two great kivas at VGK to verify accurate building and site orientation. An absolutely precise determination of center points is not possible without site intervention, however, because the north kiva was backfilled after excavation as were test areas of the unexcavated southern kiva.

According to the best present establishment of site orientation, as seen in figure 51, the major building orientation of the southern VGK great house very accurately mimics the alignment from VGK (center of the north kiva) to Mount Baldy. Once the archaeological site was correctly oriented in Adobe Illustrator, a dotted line was oriented the same as the azimuth to Mount Baldy (Chimney Rock) and moved to the building plan; it aligns very cleanly with the two corner points of the great house east wall. What then about the Lowry great house built some seventy years later? The author had twenty or so years ago taken theodolite sun shots to determine the orientation of about forty Chacoan outlier great houses (together with those in the canyon). The measurement at Lowry read about $171^{\circ} 24''$. If Lowry was a larger scale copy of VGK(S), and religiously needed to be oriented to a large scale alignment, it would have been logical for the Lowry great house to mimic its southern analogue. The azimuth from Lowry at its higher latitude to Mount Baldy is $171^{\circ} 42' 19.2''$. If this is a symbolic, designed feature, its establishment would have required a surveyed line from Lowry to Mount Baldy, perhaps as part of a pre-construction consecration.

More directly relevant to the present idea of a Ship Rock Middle, however, is the orientation of the axis between the two great kivas of VGK. This computes as $4^{\circ} 43' 40''$, compared to the azimuth from VGK to Lowry of $4^{\circ} 14' 52''$. It may have been expressed in the middle “great road” that radiates from the Lowry great kiva; the other two roads do not radiate from the great kiva, relating instead to the great house. UTM’s at the end points of the three prehistoric roads at Lowry were obtained from the Anasazi Heritage Center (BLM). The “Lowry South Road”, is not precise in its relation to the Ship Rock axis; its road azimuth south is $182^{\circ} 07' 11.6''$, in comparison to the large scale line of $184^{\circ} 18' 34.1''$, a difference of over two full degrees. It is not impossible, however, that the road was built much later than the establishment of Lowry’s ritual position, and no careful resurvey of the Ship Rock line was made.

Much more accurate is the orientation of the great house road that connects Lowry great house with its North Great House partner. The ends of this road create an azimuth of $289^{\circ} 23' 03.7''$, only off about four arc minutes from the azimuth from Lowry to Mount

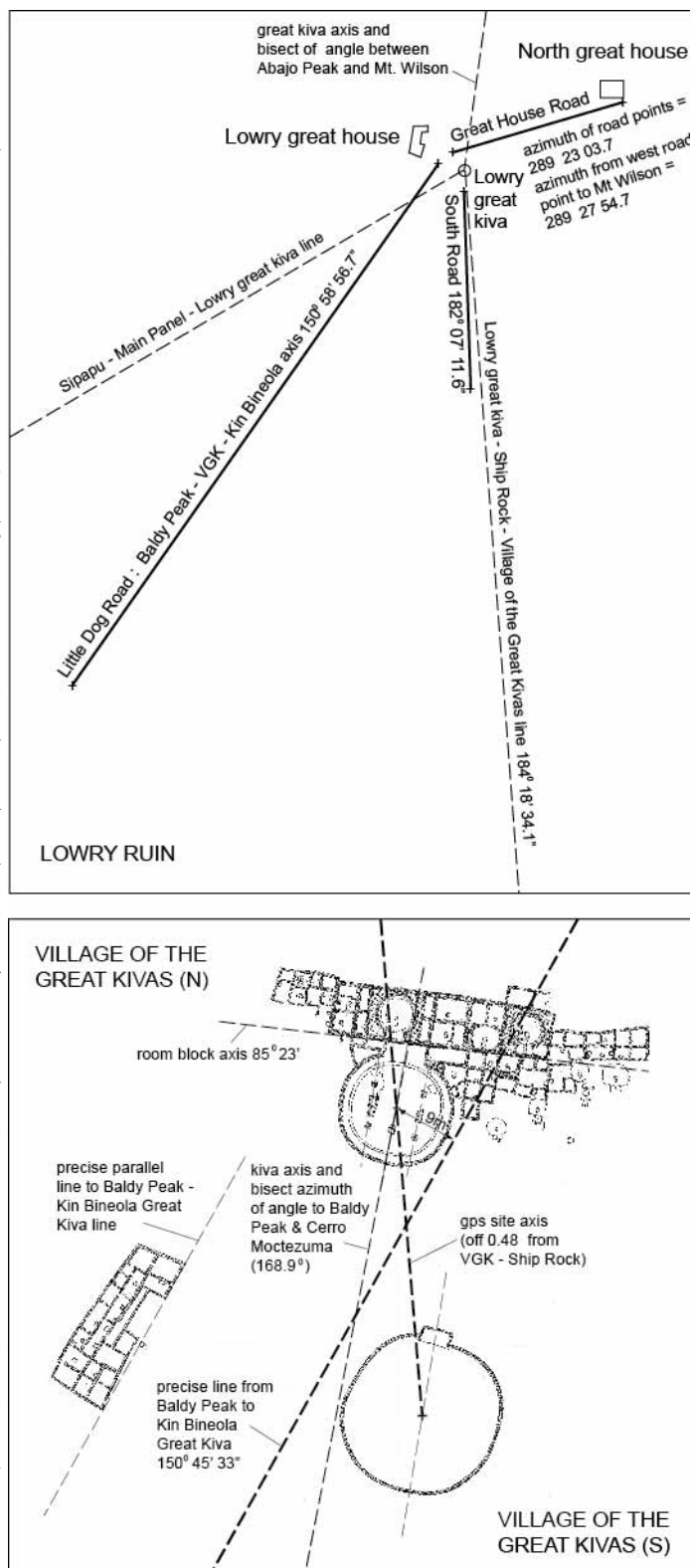


Figure 51. Site analyses of great kiva and building orientations, alignments of buildings and prehistoric roads at Lowry Ruin and Village of the Great Kivas.

Wilson at $289^{\circ} 27' 54.7''$. If the Chacoan influenced priests at Lowry were intent on associating the northern pole of the Ship Rock axis with the northern pole of the Mount Wilson (Chacoan) meridian, then one would expect this kind of accuracy given the good direct visibility of the peak 86.627 km away.

The third linear feature, “Little Dog Road”, more associated with the Lowry great house itself, has an azimuth of $150^{\circ} 58' 56.7''$. Curiously enough, this road closely mimics the alignment of the great house’s prototype at VGK to Mount Baldy, i.e. $150^{\circ} 45' 33.8''$. If this is an intentional design feature, the priests at Lowry would have felt so strongly about VGK’s relationship to the Mount Baldy-Kin Bineola -Chimney Rock axis that they expressed the orientations from *both* latitudes. VGK’s position on the Baldy Peak – Chimney Rock axis makes most sense during earlier Basketmaker III (PI?) as the framework becomes integrated at its largest scale. While the classic period construction at VGK (and Lowry) pays homage to the old Kin Bineola X line and particularly the West (southern) pole at Baldy Peak, it also provides a somewhat startling indication of a radical extension of scale in the ultimate Chaco layout, particularly in an extended final location of the southern pole of the Mount Wilson meridian. This perspective became clearer after first investigating the orientation of the great kiva at Lowry. Relying on a professional survey of the orientation of the exposed (restored) central pillars of the Lowry ceremonial structure, it was determined that its central azimuth, $6^{\circ} 31' 59''$ is within a degree of the bisect of the angle from the kiva center to Abajo Peak and Mount Wilson, $5^{\circ} 49' 18''$.

In reanalyzing site orientations for VGK, the question loomed whether the great kiva (N) at the southern pole of the Ship Rock axis as well might express a bisect. The angles, however, from the kiva’s central axis to Baldy Peak and McCarty’s Flow, are many degrees off from being possibly designed. But, as we will see in following chapters, the ultimate southern extension of the Mount Wilson meridian runs to Cerro Moctezuma, clearly visible west of Paquimé (Casas Grandes, Mexico). As seen in figure 52, the graphically determined axis of VGK’s north great kiva (from Robert’s correctly oriented drawings) is an azimuth south of about 168.9° , while the bisect of the angle from the center of the north VGK great kiva, to Baldy Peak and Cerro Moctezuma, is $168^{\circ} 55' 43''$.

The dating of VGK’s northern and probably youngest great kiva is important here. Could its orientation be one of the key clues to when the extension of the Mount Wilson meridian to Cerro Moctezuma took place? It will be suggested that the ultimate Chaco framework,

while neatly including the extension, tends to cast it as a somewhat minor addition, given the overwhelming priority of the intensely formalized ritual layout that positions and makes understandable wall orientations of the new major great houses. If the northern great house room block at VGK had been built first, recalling that the great kiva is not tree ring dated, and the (second) great kiva attached to the structure a few decades later, then the Mount Wilson extension, might as well be later than much of the major work at Chaco. Interesting here is the fact that orientation of the northern great house, as a perpendicular to the kiva axis, is off several degrees; its measured axis of $85^{\circ} 23'$ (west of north) might point closest to Humphrey's Peak at $85^{\circ} 39' 46''$ (see discussion of great house wall orientations and probability analysis in Chapter 7). If the orientation of the northern VGK great kiva was symbolically important, why wouldn't the room block have been adjusted the few degrees necessary to be perpendicular? Of course often great kivas stand apart from great houses, many of which have multiple symbolic wall orientations, suggesting a certain symbolic independence between the two.

Regardless of the timing, if the orientation of VGK's northern great kiva is a geometric artifact with respect to Baldy Peak and the extension to Cerro Moctezuma, it reveals that at the scale of the formalized plateau, the new southern pole represents the East vertical related to the Ship Rock Middle and the West vertical.

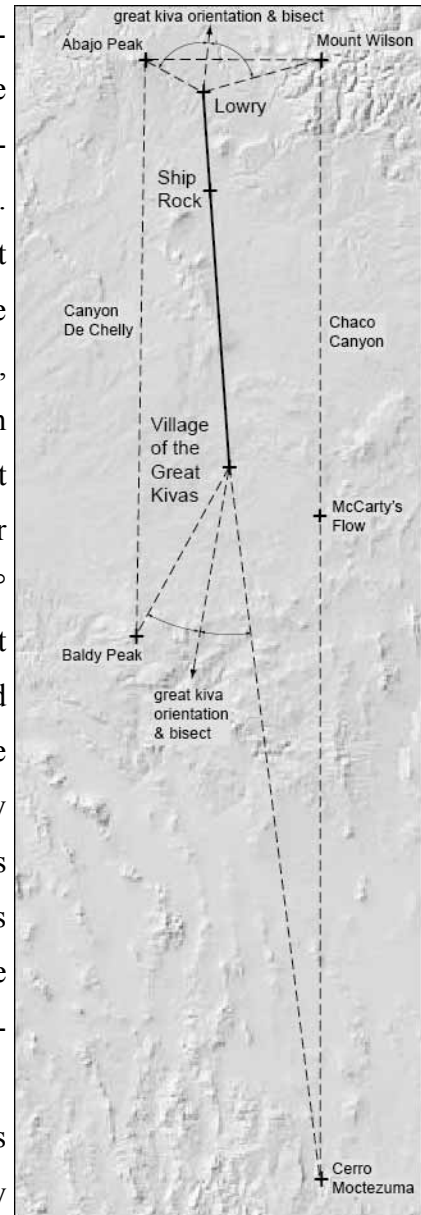


Figure 52. Orientations of great kivas at Lowry and Village of the Great Kivas: integration with ultimate Mount Wilson meridian.

PROBABILITY TEST: THE “FAN” PATTERN OF LINES FROM THE SIPAPU

Possibly surveyed major alignments emerging from the Sipapu during the early periods of evolving landscape structure have been discussed. The five point alignment seen in figure 48 includes Rincon, the kiva-like feature at the southern San Juan tip of Comb Ridge, the Main

Panel at Butler Wash, one of the most remarkable rock art sites in the SW, the Bluff great kiva, and Lowry Ruin, located at the northern terminus of the four-point plateau Middle Axis running south through Ship Rock, Tohatchi and Village of the Great Kivas. Lowry is also about mid-way between the two ends of the plateau's only naturally coincidental three-point alignment, the coincidental alignment from the Sipapu to Chicoma and Truchas Peak. Also prominent and quite accurate is a line from the Sipapu to Mount Taylor that possibly helped locate the early western focus at Ganado.

Later in the Chaco build out, other lines from the Sipapu may also have been religiously important in providing important emergence symbolism. One such line involves the layout of a central Chaco "X" intersection point, via a construct through Kin Bineola X and Pueblo Pintado, while another may have been part of locating the New Alto/Pueblo Alto pilgrimage entry to the canyon. A tenth line running through early Broken Flute Cave to the Aztec center is also quite accurate but could not have been, as we will see in later chapters, a primary determination of Aztec's important location on the Wilson meridian. An eleventh line through the South Road's termination site of Kin Ya'a and Guadalupe far to the east adjacent to Cabezón, can also be included in this group of quite accurate Sipapu radiations. As listed below, four more alignments under 0.15° are much less accurate and might be first candidates, perhaps along with Broken Flute Cave – Aztec, to be considered random—though again random alignments can be quite accurate as well.

Five point alignment:

Sipapu – Main Panel – Lowry	0.0006°
Sipapu – Rincon – Lowry	0.037°
Sipapu – Rincon – Bluff	0.036°
Sipapu – Bluff – Lowry	0.035°
Rincon – Bluff – Lowry	0.0007°

Other Sipapu lines under 0.04° included in test

Sipapu – Chicoma – Truchas	0.019°
Sipapu – Kin Ya'a – Guadalupe	0.021°
Sipapu – Broken Flute – Aztec	0.026°
Sipapu – Ganado – Taylor	0.039°

Additional Sipapu lines up to 0.150°

Sipapu – Kin Bineola X – Pueblo Pintado	0.016°
Sipapu – White House – New Alto	0.050°
Sipapu – White House – 29SJ423	0.080°
Sipapu – Tohatchi – Cabezon	0.101°
Sipapu – Coolidge – Casamero	0.109°
Sipapu – Los Rayos – Cabezon	0.140°

Returning to the analysis methodology of Chapter 2, one can set up a test box again placing 61 random points in each set. Moctezuma is excluded for the same reason described more specifically in the Mount Wilson meridian exercise (previous chapter), working with 20 fixed natural features. The test area covering all of the existing great kiva sites on the plateau seems to work well with the goal of finding random “fans” of alignments radiating out from the Sipapu. In the existing set of sites, the five-point alignment from the Sipapu can be modeled as A+A(2)+A(3)+A(3)+A(2), and is the only such compound pattern that occurs when the existing set is searched in “site analysis”. The ten additional three point alignments that also use the Sipapu point in the west at or under 0.15° cannot be simply added to this search string. Adding another “A(1)” with only one point in common with the compound creates an endless set of such connections working from the other four points of the Sipapu – Lowry line. In the early stages of defining the specifications for Geopatterns 3, the ability to have additional patterns to the search string limited to a single “fan” point, such as Sipapu was discussed. Because of construction time and money, this feature was eventually dropped. There is in the present case, however, a strategy that produces good numbers and isn’t too time consuming to run.

If one tests A+(A(2)+A(3)+A(3)+A(2)) separately, its involvement with the Sipapu is relatively rare and immediately limits the numbers of test sets that need to be examined more or less manually for additional lines to the Sipapu. The additional rays to Sipapu, outside of the five-point search string, can be recorded by inspecting a single search string of “A’s” that is simultaneously reported for each of the same random sets. Because most of the interesting existing Sipapu lines are much more accurate than the 0.15° or even 0.075° range, one can use the lower number of 0.04° in the analysis. Of the total existing 15 in the 0.15° range, ten are under 0.04°. Because the test only works with great kiva locations, the very accurate line involving the Kin Bineola X line is not included; four from the range of 0.080° - 0.14° are also excluded.

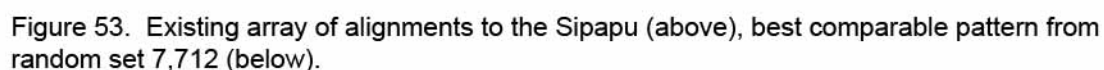
This in no way biases the process, since the random points are competing in the same range. Thus we are looking to match the existing five-point alignment and four additional rays to the Sipapu, all under 0.04° .

In 10,000 sets of 61 random points each, the stated five-point pattern occurs about two or three times in a hundred (0.025). Of these 247 five-point alignments, about a fifth (57) are formed with Sipapu as their westernmost point (0.0051). Thus randomly produced Sipapu five-pointers occur about once every 200 sets (0.005). As one might imagine, the naturally occurring three-pointer between Sipapu-Chicoma-Truchas will more frequently become a five-pointer, needing to add only two, compared to three (Sipapu with some other natural feature) or even four aligned random points (with no additional natural feature). Forty-seven of the 247 (of 10,000 sets) five-pointers have no natural features at all. Of the 57 Sipapu five-pointers, 51 are formed with the help of Chicoma and Truchas. Two of the 57 link up with Mount Taylor or McCarty's Flow respectively, not unlike the existing's use of the natural (Rincon) point of Comb Ridge, and four work only with the Sipapu. The existing set has 8 total three-point alignments coming from Sipapu (not including Rincon-Bluff-Lowry which is part of the five-pointer). The chart below summarizes these data:

- 10,000** sets of 61 random points each with 20 fixed natural features
- 247** sets contain a five-point alignment at or under 0.04°
- 57** of the 247 involve the Sipapu
- 51** of these five-pointers were formed on Sipapu-Chicoma-Truchas
- 3** of these equal or exceed the total number (8) of existing three-point alignments to the Sipapu (2,656 has 9, 4,201 and 8,416 have 8 each)
- 6** of the 247 Sipapu five-pointers do **not** include Chicoma/Truchas
- 2** hook up with Mount Taylor (7 three-point alignments total) and McCarty's Flow respectively (6 total)
- 4** use Sipapu only in their five-pointers (#7,712 equals the existing total of 8 three-point alignments, the others having 5, 5 and 4)

Only one set of 10,000 exceeds the total number of existing Sipapu three-point alignments. This is set number 2,656, with 9 total, which along with random sets 4,201 and 8,416, each with 8 total Sipapu lines, match or exceed the existing. But the five-pointers of these sets are created with Chicoma-Truchas, seeming to diminish the match comparison. Looking at those six sets

EXISTING PATTERNS
8 Sipapu 3 pt. alignments
among 20 natural and
61 great kiva sites @ 0.040



three-point lines, perhaps a greater comparative consideration than using a second natural feature since there is less likelihood of pairing (2 of 10,000) up than lining up only with Sipapu (4 of 10,000).

The odds that the existing eight three-point alignments at or under 0.040° to the Sipapu—four of which are part of a five-point alignment—are randomly located with respect to possible designed large scale geometry appears to lie somewhere around 1 in 10,000 (considering set 7,712 as the only best match) and 2 in 10,000 (including the Chicoma-Truchas set #2,656 with its 9 total three pointers). As figure 53 illustrates, random patterns similar to the existing do occur, though very rarely. In this case of #7,712, Sipapu's five-pointer runs at the bottom of its "fan" to random points 45, 23, 30, and 46. It has four other lines terminating at Blanca Peak, Truchas Peak, random point 25 (Haystack is the interim point) and random point 11 (Taylor is the interim point). The existing Sipapu pattern involves four additional natural sites (Rincon, Chicoma-Truchas, and Mount Taylor), while set #7,712 involves five (Blanca, Chicoma-Truchas, Haystack and Taylor) and might be considered a bit stronger considering symbolic religious content. But #7,712's five-pointer has no other natural features, compared to the existing Sipapu line through Rincon as the southern natural tip of Comb Ridge; nor is #7,712 possibly solstice in orientation. The terminal points of the two compared five-pointers of figure 53, most likely symbolically important, show somewhat greater strength for the existing. Lowey has 9 three point alignments, while random point 46 has 7. Overall, as a random set, #7,712 isn't particularly high in total number of three-point alignments. It has only 48 compared with the existing 69 (at or under 0.040°).

When added together, the very low likelihood of being a random set together with the symbolic value of Comb Ridge, the Butler Panel, Lowry and Ganado, seem to create a modest hypothesis of some sort of symbolic emergence symbolism for the Sipapu "fan"—not yet including the importance of other lines from this Grand Canyon point to be profiled in coming chapters.

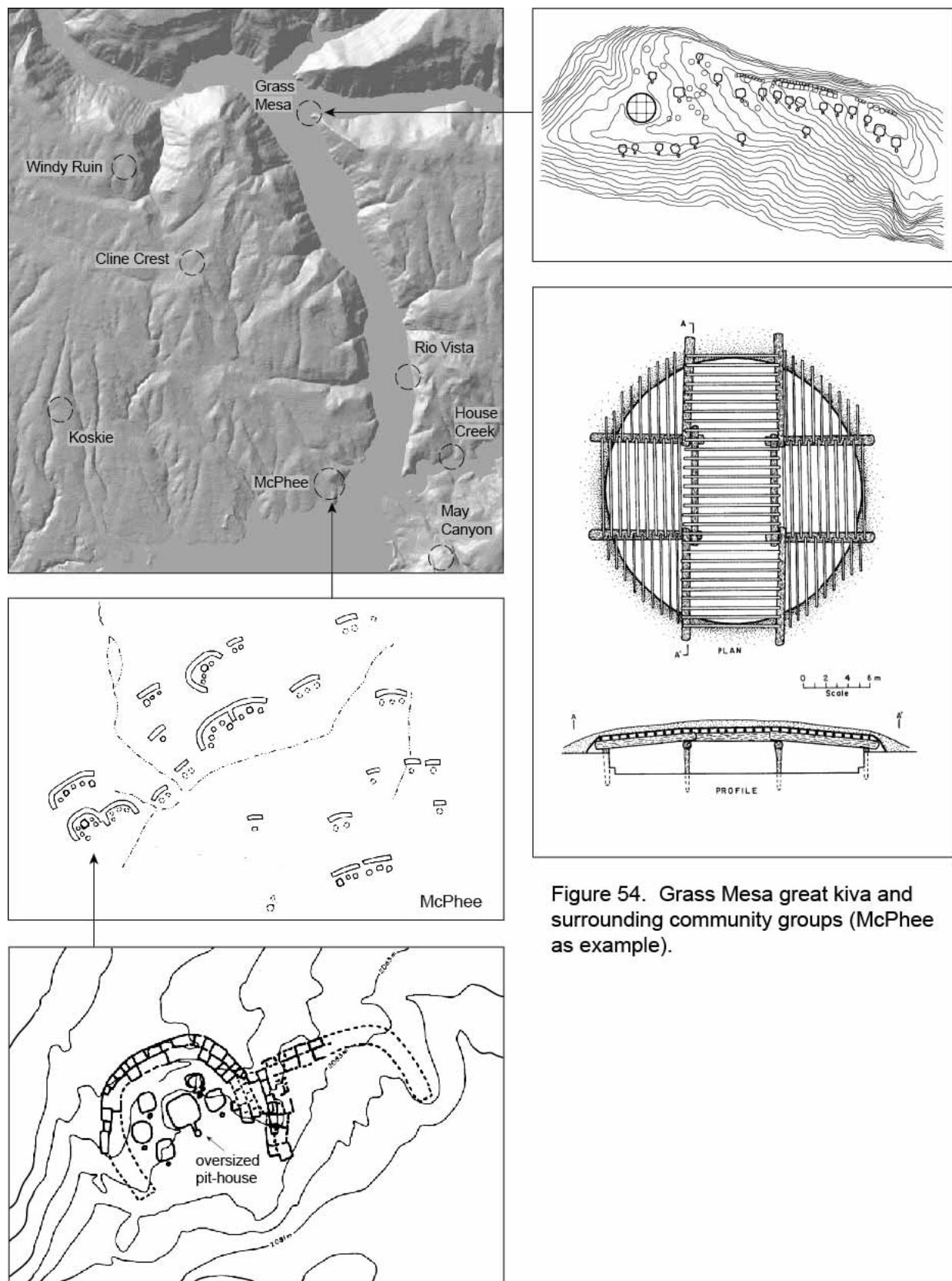
5. “East” Communities and Integration with the Triadic Chaco Focus

Again, the clan-ceremony-sodality-kiva complex may be very old, dating to the Basketmaker III – Pueblo I transition around A.D. 700 (Ware 2002). Furthermore, according to archaeologists, it wasn’t until the advent of “villages” that this need for integration arose. Architecture and other material evidence is quite similar to both western and eastern organization until A.D. 700; and it is with the new village forms shortly after that sodalities are felt to emerge. Given the present hypothesis that sodalities first formed earlier at Chaco in the 500’s, based on a more purely spatial concept of ritual organization, the *bipolar landscape axis*, how does one interpret the variations of village aggregation and religious structures that occur at the end of Basketmaker III and into PI?

The PI period saw much movement and exploration of new settlement forms, people with different backgrounds moving into aggregated “villages”. These new “villages” represent significant social change and necessitated high-level integrative facilities (Adler & Wilshusen 1990:143). More recently Wilshusen and Potter (2010:170) see “villages” as a means of providing safety in numbers, but also a means of social and religious integration:

“Village settings also provide a means to socially integrate ethnically or historically diverse populations and diffuse or even suppress group differences....Whereas the direct ties of blood, marriage, or residence might have sufficed to establish an individual’s or household’s identity in a dispersed community, it is more common to see more-complex organizational forms, such as dual organizations or clans, in settings that are more aggregated or highly populated (Gross 1979; Tuzin 2001). While clans and dual organizations often are imbued with kinship associations and may regulate marriage, they are fundamentally not tied to a particular set of blood ties or local connections....They are the means of creating regional linkages and ways of wresting corporate control of resources out of localized lineages or kin groups.”

In terms of landscape and architecture, there are two kinds of “villages”, one more hierarchical and kinship oriented with oversized pit structures of prominent families with adjacent room blocks built from the excavated soil, and the other with a more isolated great kiva structure seemingly owned by the community (Wilshusen & Potter 2010:176). To Ware this split would



eventually create in classic Chaco (mostly PII) one of the “first large-scale battlegrounds in the war between descent group and sodality” (2002:104), and that hierarchical priests associated with great houses would be the prime movers. Yet Wilshusen and Potter emphasize the religious strength of the communally organized great kivas, at least during the PI period. They talk about the rock art images of great kiva ritual (as in figure 41), and how feasting and ceremonialism were a necessary part of integrating diverse social elements. They even mention a formal quadripartite ritual structure as evidenced from the art:

“our sense is that these early Pueblo I great kivas brought together a variety of subgroups of people with a number of leaders, organized into four main groups (from panel). While ritual and social organizations must have been part of the lure that drew diverse people into these early villages and bound them together with a common shared set of identities, the threat of warfare appears to have been part of what kept people in villages.” (2010:171)

While both oversized pit structures and great kivas, part of figure 54, were clear loci for ritual, it seems difficult to ascribe fundamental differences in practice, aside from implications of social control by either more hierarchical big men, or a more egalitarian community. Most interesting, in the well-researched example in the Delores River area around the Grass Mesa Great Kiva, is that both kinds of religious forms appear to coexist somewhat peacefully and contemporaneously in close proximity. The oversized pit structures of one of McPhee’s “great houses” were likely built by kinship groups, again using the excavated material for the room blocks. Lightfoot’s (2008) engineering analysis of the 22.5 meter structure at Grass Mesa sought to determine how much labor it would take a different, community group to excavate and build the challenging roof structure. His conclusion is that it would have been possible for the people living in proximity—in its immediate “village”—to build it, but nevertheless Lightfoot says that it... “seems likely that in BMIII and Pueblo I times such a structure functioned to integrate several communities ...(as) regional interaction” (242).

It is perhaps unfortunate that early archaeologists, interested as they were in unusual forms of aggregation, used the term “villages” for great kiva sites such as Shabik’eschee and 29SJ423. Even though the concept has more recently moved a bit from some natural settlement expansion of kinship or lineage to something involving larger even regional integration, the basic premise may be problematic. When archaeologists interpret the aggregations around

the Grass Mesa great kiva, even though admitting a larger integrative purpose, the thinking begins with aggregation and not integration. The idea of a dangerous landscape and the need to cluster together for safety appears to be the primary motive to aggregate. This happens first, and then because of the diversity of people that have moved into the area from a distance, facilities like great kivas are eventually created to moderate the more natural hierarchies of kinship and their great house like dwelling patterns (room blocks and pit houses). Curiously, this only happens within particular villages, not unlike those in earliest Chaco.

From the perspective of a possible formally evolving religious landscape the concept of “village” doesn’t really seem to adequately characterize either new aggregated domestic patterns, or the great kiva foci. The author’s master’s thesis in socio-cultural anthropology (Doxtater 1971) described commonalities in the architectural and settlement patterns of small village-like societies in the anthropological record. Having also done later work on pueblos in Spain (Doxtater 1989), it seems in retrospect that the concept of “village” really suggests a social situation where the strongest glue, as it were, is simple propinquity, a term used more than once in Pitt-Rivers (1971). In cross-cultural studies of small spatial “aggregations” of the master’s thesis, there is almost always an unmistakable formality in the arrangement of dwellings, one undoubtedly integral to some sort of ritual practice. Even in the Spanish pueblo, where assumptions of propinquity and safety were certainly at least partially true, at least originally, a deeper semiotic interpretation of pueblo form revealed a set of practices and related spaces that structured a kind of “local” ritual, spiritually effective but not founded on distant mountains and other natural features, yet with structural remnants of such (see a wider discussion in Doxtater 1994).

When Basketmaker groups shift from dispersed hamlets of two or three pit-houses to aggregations of up to several hundred, the propinquity assumption and its associated concept of “village” has always been the logical cause. Yet compared to very tightly clustered, defensive settlements, Basketmaker or PI aggregations really do not exhibit this kind of protective territoriality, nor really the closeness or propinquity that Pitt-Rivers felt to be more of an internal social organizing effect. What has been missing in the Southwest pueblo evolution is an understanding of where the religious, ritual structure exists, and its relationship to dwelling and great kiva form. Most likely the greatest source of religious power in pit-house periods is in the shamanistic landscape. Furthermore, it makes sense that during this period hamlets are dis-

persed, alleviating the potential conflict of formalized small scale settlements, which again from a theoretical perspective, are practically universal when people *without* large-scale landscape frameworks live closely together.

So why isn't this a problem when Ancestral Pueblo people first aggregated to some extent? First of all, even though people are living closer to each other, as illustrated in figure 54, the basic architectural pattern is still essentially one of dispersed family units. Architecturally, there is no village as such. Thus the transition from shamanistic landscape religion appears to be rather smooth. But, as is presently being suggested, the formalized axes-based, sodality organized shift is being strongly expressed in the great kiva and its location. In effect this turns the propinquity/defense assumption on its head. Rather than first grouping together because of safety and related internal cohesiveness, these societies are instead intent upon participating in the formalizing large-scale landscape frame. The spider web like structure in the landscape may be shifting to formalized foci at great kivas. In this view, the location of the Grass Mesa great kiva--while not necessarily the eventual building--was chosen first, and became the magnet for aggregation. Integration didn't follow aggregation, but was there from the start, in effect moderating or even eliminating simple kinds of inside-outside territoriality--and maintaining the conceptual dispersal, and subordination, of domestic kinship units.

In the Grass Mesa case, calling all of the five or six different groups of aggregated dwellings "villages" in the area, including the one around the great kiva itself, creates an illusion of two different kinds of aggregations. This thinking even generates ideas about different kinds of small scale social organization, one focused on more domestic oversized pit-house structures and the other on a great kiva as a kind of more community dance hall. In the absence of any consideration of the religious meaning of the large scale landscape, either shamanistic or more formally structured, one is left with the appearance of competing religious practices, one more hierarchical and the other more egalitarian. While ritual practiced in over-sized pit-house structures might well have been more hierarchically controlled by family elders it likely did not operate independently of more collective ritual in the great kiva, and most importantly of the large-scale meaning of the landscape and other sodality groups at a distance.

Certainly much shamanistic ritual in pit-houses has always been focused more, perhaps, on the more self-interested well-being of family members, though mediated by shamans from the community. Much of these practices could have continued with one fundamental change.

Rather than a shaman going directly out into the landscape to access the spirits, priestly power became funneled, as it were, through the great kivas, with their connections to more formalized religious organization. Remnants of this kind of relationship between family dwelling and collective ritual places can be found, for example, in the Shalako rites at Zuni, where *kachinas* (masked dancers impersonating spirits) coming in from the landscape take over or otherwise dominate the dwellings. A socially similar ritual occurred at the folk winter solstice in Scandinavia as the gods invaded the domestic dwelling in a kind of ritual death of the hierarchically inclined family; at summer solstice, families journeyed to a community place in nature where they were integrated with ancestral power (Doxtater 1981).

Archaeologists such as Wilshusen and Potter (2010) will probably be quick to point out a major caveat to an idea that sees sacred points in a formalizing landscape as a cause for aggregation. Not all or even most of the dozen or so earliest “villages” appear to have great kivas associated with them, that is they are not close enough to great kivas to appear to be clustering around them. They begin their 2010 article describing the earliest two aggregated sites at the eastern and western fringes of the area north of the San Juan, i.e. at Alkali Ridge to the west and Sacred Ridge to the east, about A.D. 775. There is no presently known prominent great kiva at Alkali Ridge with its arc-formed room blocks and oversized pit-houses, but at Sacred Ridge, more recently excavated, a somewhat formalized plaza with ceremonial features, including a tower structure has been discerned. This could be the religious equivalent to a great kiva,

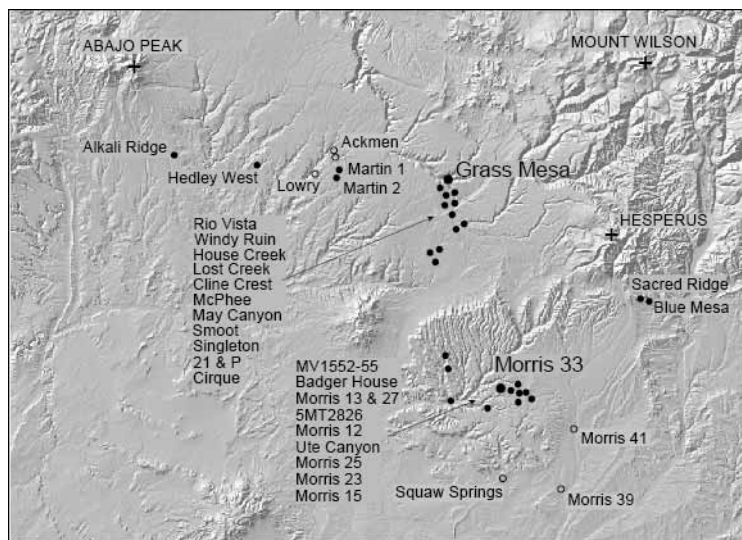


Figure 55. Location of northern PI communities (from Wilshusen & Potter 2010:167)

remembering that it is not the architecture *per se* that creates the primary ritual effect in a framework, but the location. The rest of the aggregations that Wilshusen and Potter list, occurring through most of the 800's, seem curiously to cluster around great kiva sites of Sacred Ridge, Grass Mesa, Morris 33, Badger House, Ackmen and Skunk Springs, and perhaps one or two others.

Clearly, much more information about sites and locations is needed. Certainly it is true that at least in the later classic Chacoan periods that some outlier aggregations or communities cluster around great houses, but without evidence of a prominent great kiva construction. Regardless of the time period, without much more detailed excavation to determine whether some sort of less architecturally defined plaza existed at some sites, like at Sacred Ridge, and without studies of the locations of communities without big great kiva structures, one cannot yet say some places were “off the grid” so to speak, while others were forming in relation to new nodes of spirit power. Furthermore, considering figure 55, what were the distances from these loci that would influence aggregation around them?

Hypothetically, specialized, ritually related aggregation had been symbolically associated with formalizing loci at least two hundred years before the relatively short lived “villages” north of the San Juan, and continuity in this regard would likely have existed in this region (perhaps including the recently investigated Dillard site). But could there have been a social conflict between those following this new direction of plateau religion. Would traditionalists with only oversized pit-structures have aggregated at locations without linkage to the frame? In such a case one would expect propinquity and territorial defense to be in greater play, and therefore a different settlement pattern, more like true villages. This, however, does not seem to happen.

PROBABILITY TEST: LOCATIONS OF PI GREAT KIVAS AND THEIR ALIGNED RELATIONSHIP TO THE GREATER LANDSCAPE AND TRIADIC EARLY CHACO

If one could show that a defined set of great kiva locations in all probability involved designed large-scale patterns, then the reverse aggregation idea should immediately become more interesting. If great kivas were built on framework loci, then these locations could have predated domestic clustering around them. If aggregation occurred first in locations chosen for reasons other than linkage to sacred mountains and the like, then any large-scale alignments existing among these “secondary” great kiva locations should not be distinguishable from purely random phenomena. This is testable.

In the probability exercises in Chapter 2, large-scale patterns of a relatively complete list of great kiva locations from Basketmaker III through PIII, some 61 in all, are compared

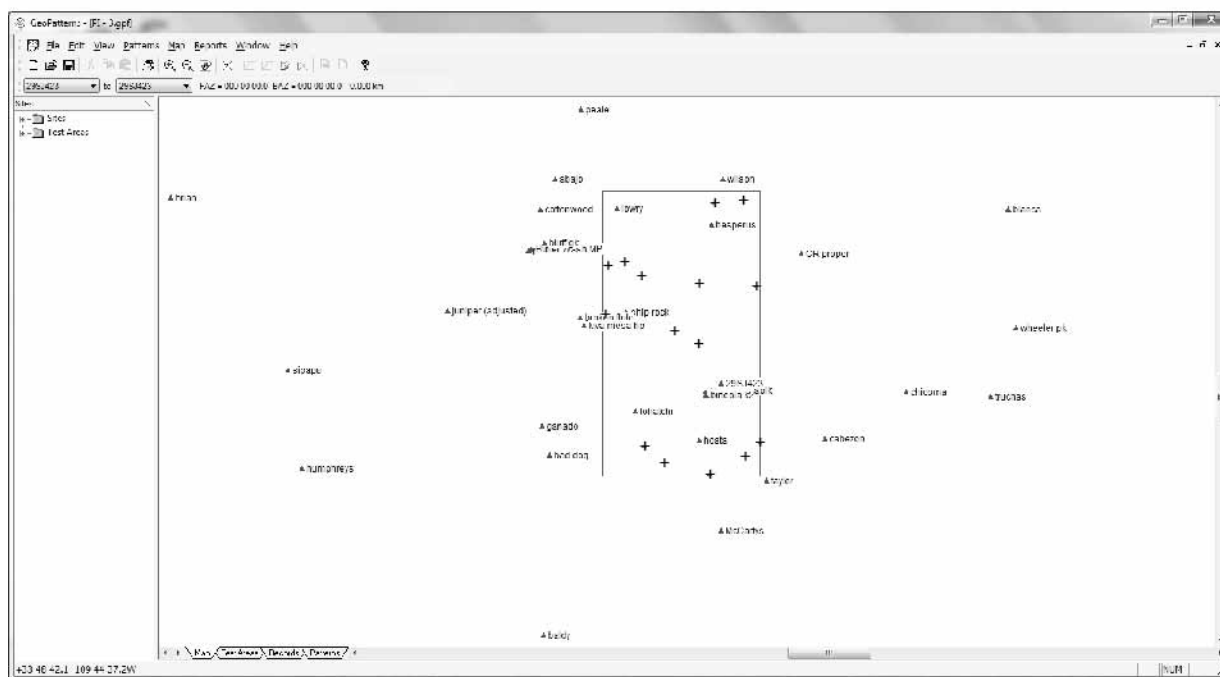
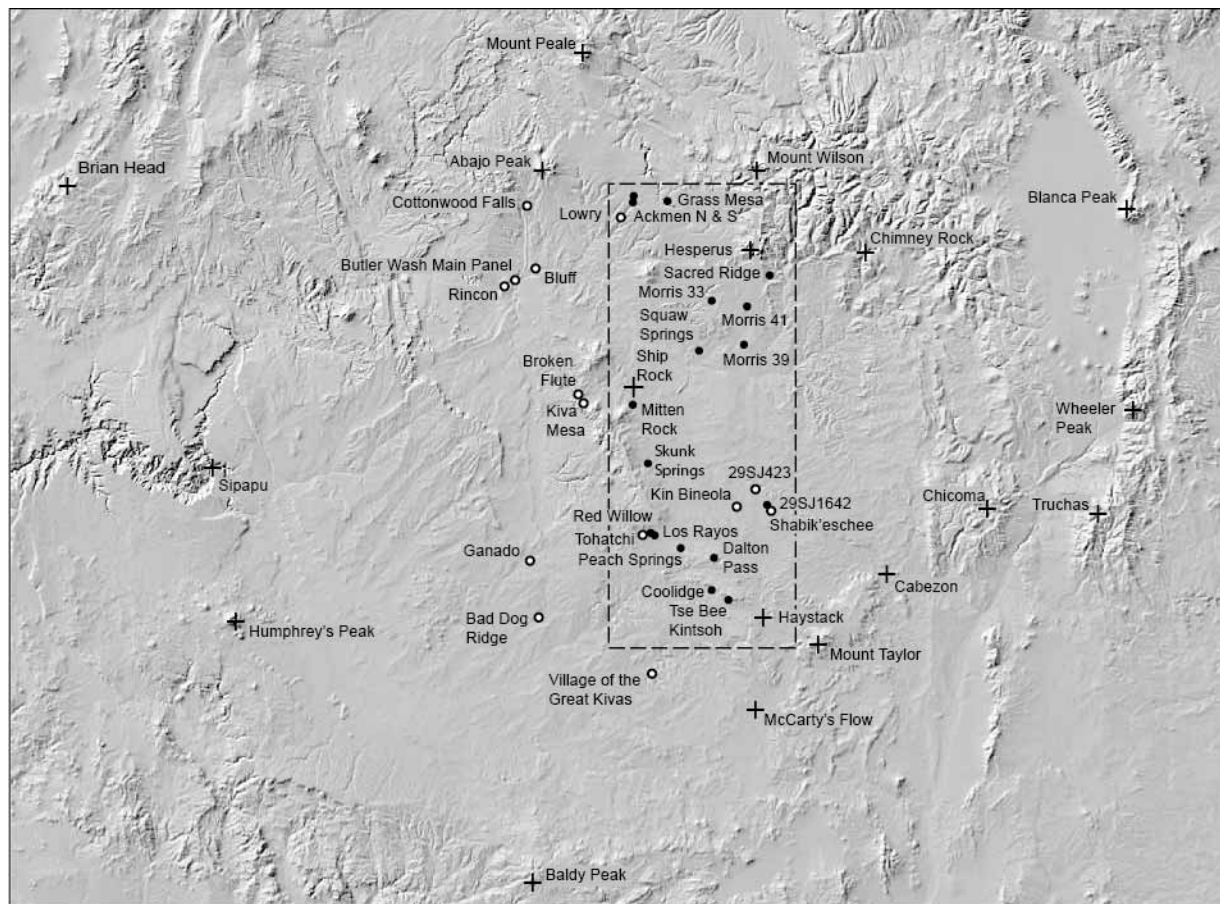


Figure 56. Map of 17 Eastern PI great kiva sites (above); test area for probability analysis with example of one random set.

with patterns created by random points located in the same geographical area. In brief, the total group of existing great kivas clearly separated itself from almost all random patterns, strongly suggesting some design, even though an unknown number of random alignments are likely to be mixed in with the existing as well. When separating the great kivas into BMIII-PI and PII-PIII groups, again, the earlier do better in regard to the likelihood of design, though it is not determined in Chapter 2 whether the outcome of the group separation itself might be coincidental (within the overall clearly positive results of the entire list of great kivas). In the present chapter's context, however, it is possible to shed further light on the behavior of the more numerous segment of the early group. These, as it turns out, are built almost exclusively in the eastern side of the plateau about 200-300 years after the hypothetical first ritual focus at Chaco, and subsequent larger scale formalization of the whole cultural sphere.

The map of figure 56 identifies seventeen PI great kiva sites, described in greater detail in Chapter 2, all on the eastern side of the plateau. Notably, while identified on the map, three locations are not included in the analysis: Sacred Ridge because of the lack of great kiva structure *per se*, Morris 33 because of a lack of precise GPS site location, and Badger House because of very recent acquisition of site location (these three sites are not part of the larger study of 61). Thus the following analysis looks at large-scale alignment patterns of fifteen sites: Ackmen N, Ackmen S, Grass Mesa, Morris 41, Morris 39, Squaw Springs, Mitten Rock, Skunk Springs, 29SJ1642 (440 meters from Shabik'eschee), Red Willow, Los Rayos, Peach Springs, Dalton Pass, Coolidge, and Tse Bee Kintsoh.

Two questions are asked: 1) in the hypothetical context of early great kivas and 21 natural features, how many three point alignments do the fifteen PI sites create compared to an equal number of random points in the same area, and 2) is there a tendency for alignments created by the PI sites to focus on the three possible Chaco foci sites of Kin Bineola, 29SJ423, and Shabik'eschee? The null hypothesis is that there was no surveyed positioning of great kivas among the 15, predicting that the number of three point alignments generated by these sites should fall within the expected range of random phenomena, and that like other random alignments, they should not particularly focus on the Chaco triad.

One hundred different sets of 15 random points each located within the test area of figure 56 generate varied numbers of three-point alignments in the context of earlier great kivas and 20 natural features (minus Moctezuma). The level of accuracy is set at 0.15°, the upper

limit of the larger study in Chapter 2. As seen in figure 57, the number of randomly created new three-point alignments (excluding those created by earlier kivas and natural features) ranges from a low of 11 to a high of 32, with the mean at 23. The number of three-point alignments generated by fifteen PI actual sites, again at or under the accuracy of 0.15° , and in the same context with earlier and natural points, is 36. The probability, therefore, that alignment involvement of these existing sites is the result of random phenomena is less than 0.0099.

The second graph of figure 57 shows the number of three point alignments at 0.15° or less that each of the 100 sets involve the three formalized points around Chaco Canyon. The number of great kivas here is actually four, including Kin Bineola's second kiva lying to its south (see again figure 37). The random set with the lowest involvement in the Chaco triad has 0 connections, while the highest has 11. The median involvement is 5. The existing fifteen PI great kivas create 13 (of 36) alignments with the Chaco trio (two of which involve the southern great kiva at Kin Bineola). Similarly, the probability that the existing PI great kivas in the test are randomly located, with respect to the generation of three-point alignments with Chaco, is less than 0.0099.

Intuitively, looking at the position of the Chaco trio to the southeast of the test area, this location wouldn't seem likely to randomly attract an unusually high number of alignments. Of the 48 total points only eight lie east of Chaco, and 36 (excluding the canyon trio) lie to the west. From the null hypothesis, one would think that sites in the center of the plateau, like Kiva Mesa would involve the greater numbers of alignments created by the PI fifteen. In addition

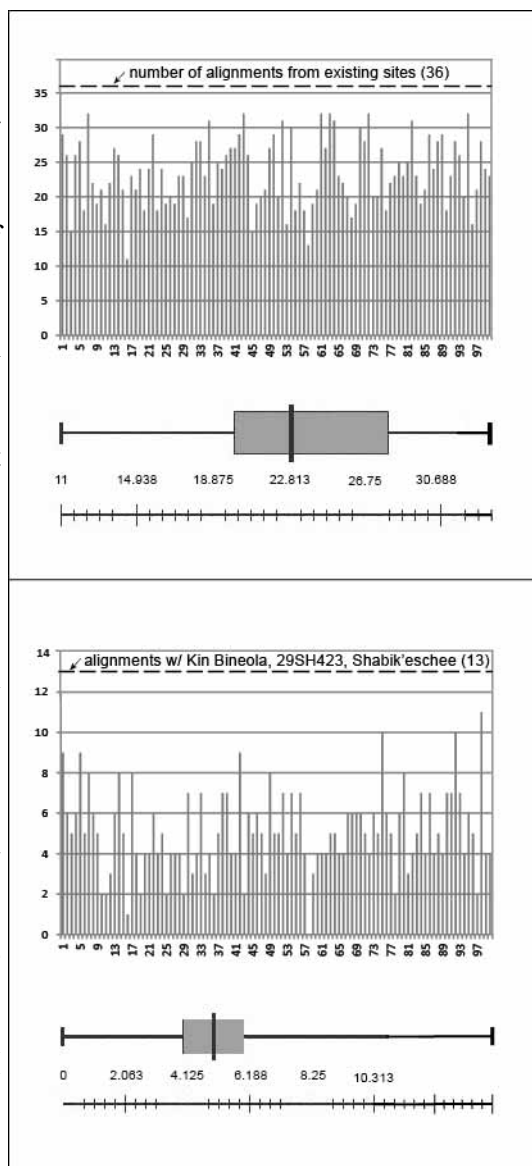


Figure 57. Comparison of existing and random alignments with three early Chaco foci: all alignments among 36 existing sites (above), alignments with Kin Bineola X, 29SJ423, and Shabik'eschee (below).

to the largest numbers of Chaco related alignments, related to the 100 random sets, the existing PI great kivas seem to create a relatively balanced association with Kin Bineola (6 alignments), Shabik'eschee (5 alignments) and 29SJ423 (2 alignments). Was there a balanced effort to populate the western and eastern components of the trio, perhaps with less involvement of 29SJ423 because of its powerful location on the Sipapu-Truchas axis and Mount Wilson meridian?

The pair of great kivas at Ackmen, 158 meters apart, create in effect two double alignments with Kin Bineola (because of the orientation of its pair 3.023 km apart), and one double with Squaw Springs and Shabik'eschee. The azimuth between the Ackmen kivas, as presently determined, is $203^{\circ} 44' 54.4''$, and that to Shabik'eschee is $207^{\circ} 03' 50.5''$ (at the small scale of 158 meters between the two kivas, small inaccuracies in digital positioning can easily account for the three degree variation). The 100 sets of 15 random points each were evaluated to see how often pairs similar to Ackmen occurred, asking whether one such pair in the existing PI

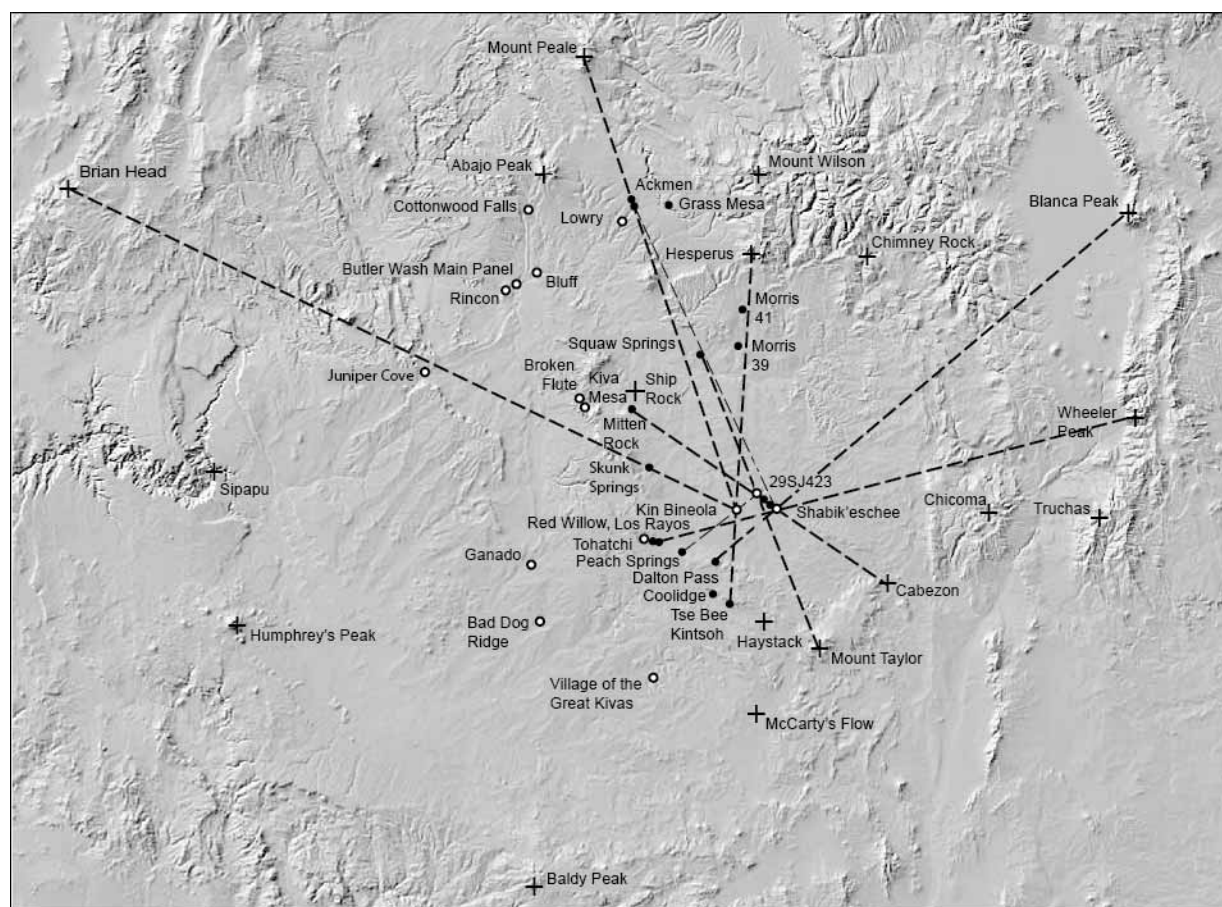


Figure 58. Alignments of distant great kiva sites and natural features with Kin Bineola, 29SJ423, and Shabik'eschee.

kivas is skewing the comparison. Of the 100, similarly spaced pairs occurred randomly 31 times, with two sets having two pairs. Thus random pairs are not uncommon and the presence of one existing example in the 15 PI kivas shouldn't seriously bias the analysis.

Also evaluated in a visual scan of the dispositions of the 15 random points in the 100 sets was the effect of a random point landing in or very near the Chaco triangle. This is similar to the way 29SJ1642, again only 425 meters from Shabik'eshchee relates to the Chaco trio. It too seems to generate an unusual number of alignments, acting like one of the Chaco trio, perhaps paring up with Shabik'eshchee. 29SJ1642 is an alignment focus for five aligned relationships with the other 14 PI points. In the 100 random sets, a single point lands in or near the Chaco triangle 15 times. Four of these points create no alignments in the total created by the 15 random points for each set. Only alignments are counted that involve at least one other point of the 15; this replicates the basic pattern of a community great kiva site being linearly connected to one of the Chaco points and a distant natural feature.

In seven sets, the Chaco random point involves one such alignment. In two sets, the number is two; in one set it is four, and in one set the number is five, equal to 29SJ1642. Thus the ability of 29SJ1642 to act like one of the Chaco trio is as good as one of the 100 random sets, and better than 99 others. Furthermore, when one looks at the particular random set (number 95) that produces the five Chaco focused alignments, it matches the highest overall number of alignments, 32, produced by any set of fifteen. But in looking at the second graph of figure 57, set 95 only creates six alignments that focus on the Chaco trio (not including those generated by the random point in the canyon area. Adding these six to the five generated by its random point falling in the Chaco area, gives only 11, compared to the 18 of the existing (13+5) when 29SJ1642 is added to the earlier trio. The next best random set is 62, whose random point in the canyon area creates 4 of these alignments. But again, of its total number of alignments created by 15 random points, only 4 focus on the canyon. Thus its total is only 8, compared to the existing 18.

Mapping the the existing alignments focused on the Chaco trio (excluding 29SJ1642), does not attempt to persuade the reader that *all*, figure 58, were intentionally laid out or designed. Again, as discussed in Chapter 2 at greater length, it is likely that some number of random alignments will occur in any or perhaps all analyses of existing patterns of great kiva locations in the landscape. Chapter 2 also tells us that the range of accuracy up to at least 0.15°

seems to have higher probabilities of design, and therefore that the different accuracies of the 36 three-point alignments created by the 15 PI sites shouldn't necessarily be used as a means of weeding out patterns that seem less "artifactual".

One can, however, observe that of the thirteen alignments focused on Chaco (several are doubled up in figure 58 and cannot be shown graphically at the drawing scale), only one does not involve a natural feature (Peach Springs – Kin Bineola K1 – 29SJ423). Since at least a good number of the others might have been designed, it appears that any community creating a new line through Chaco could have been compelled to involve a distant mountain. With the exception of Mount Taylor, none of these distant peaks duplicate those used to lay out the original Chaco frame (Mount Wilson, McCarty's Flow, Abajo Peak, Baldy Peak, and Chimney Rock). Clearly, not all the fifteen PI great kiva sites are integrating with Chaco. If one includes the five alignments that focus on 29SJ1642, exactly half of the total 36 are Chaco oriented.

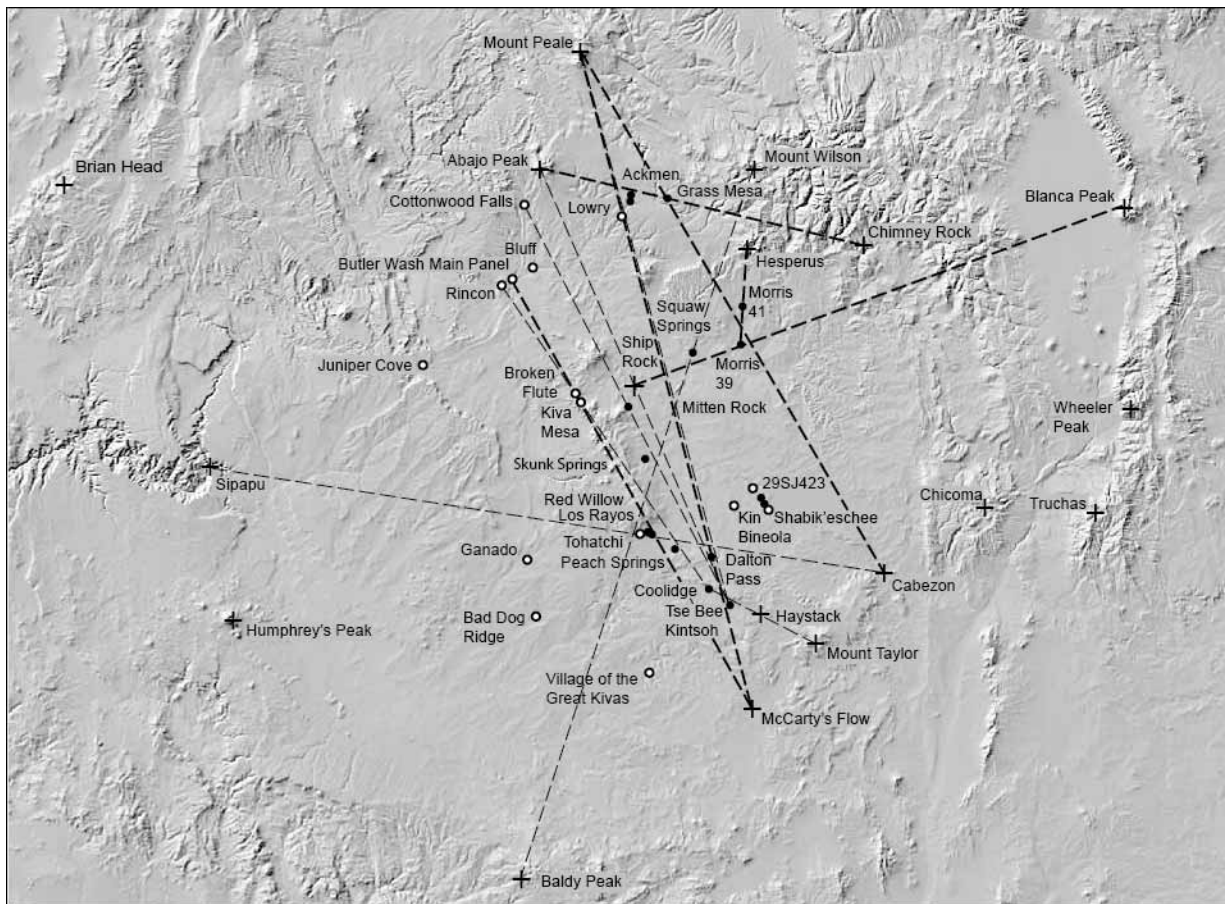


Figure 59. Large scale PI alignments not involving the three Chaco foci.

Early alignments not involved in the Chaco triad

The other 18 alignments created by the 15 PI great kiva sites are shown in figure 59. Of these, only one does not involve a natural feature (Cottonwood Falls-Mitten Rock-Tse Bee Kintsoh). Again, which ones might be more likely to have been designed and which ones are random? At least one of these lines is suspect because of its connection to both Mount Wilson and Baldy Peak. Considering what these two peaks might already have been doing in the developing frame, it would be somewhat subversive for a Skunk Springs community to lay out such a line with it as interim point. The location of Los Rayos as interim point on a Sipapu – Cabezon line also similarly seems illogical. Yet such a line with Tohatchi might have been involved in the laying out of Ganado, and the location of Los Rayos could have been conceived of as part of this earlier and important line. The trio of Tohatchi, Red Willow and Los Rayos are an unusual cluster of great kivas, five and two kilometers apart. It may be unlikely that the Humphrey's Peak- Lowry-Ackmen N was designed because of the proximity between the two great kiva points. While Lowry is hypothetically a very important Middle point at the scale of the plateau triad, a line from close by Ackmen to very distant Humphrey's Peak seems symbolically unbalanced, and even more difficult to survey.

Most immediately striking about figure 59 is the number of diagonal lines from areas around Comb Ridge and Abajo Peak to McCarty's Flow and communities to the southeast of Chaco. Given that some of these alignments are likely to have been designed, among the most interesting would be the position of Dalton Pass and Tse Bee Kintsoh on a five point alignment that includes Mount Peale, Lowry, and McCarty's. Every possibility of three-point alignment at or under 0.15° does not occur among these five points, but three patterns do, together including all five. Notably, Lowry does not form a 0.15° or under alignment with Mount Peale and McCarty's, which enters into the discussion of ideas about an earlier location of this Middle site. An interesting four point pattern also occurs in the larger array of northwest-southeast diagonals. Three alignments involve the foursome of the Main Panel at Butler Wash, Kiva Mesa BMIII, Red Willow, and McCarty's.

Morris 39 and 41 connect to each other by two alignments that terminate at three natural features, Ship Rock, Chimney Rock and Hesperus, a seemingly contained simple frame focusing on the intersection at Morris 39. In addition to Grass Mesa's prominent natural setting at the former confluence of the Dolores River and Beaver Creek (now a reservoir), it sits on an

intersection created by four mountain features, Abajo Peak- Chimney Rock and Mount Peale-Cabezon. While either of these lines might be random, or even both, there could be some coincidence of the peninsular natural setting with surveyed alignments, making the location more ritually powerful.

Finally, to what extent are there two groups of PI great kiva sites, one focused on Chaco and the other more diversified and less integrated, perhaps. Up in the San Juan region, Grass Mesa, Morris 39 and Morris 41 have no lines involving Chaco, while Ackmen, close to Lowry has possible connections to both Kin Bineola and Shabik'eschee, the early West/East pair. Again Wilshusen & Potter 2010 do not include the Ackmen pair, or Morris 39 and Morris 41 in their map of PI villages. But from the analysis thus far, Grass Mesa, the apparent ritual focus of a large Delores River aggregation, has no connection to Chaco. Yet archaeological blogs talk about the resemblance of the arc formed room blocks, particularly at McPhee (and at Morris 33), to the earliest great house forms at three sites in Chaco Canyon. It is even speculated that when the PI village area north of the San Juan vacated at around A.D. 900, they went south and became more involved in a reenergizing Chaco focus. But others counter that these first room blocks in Chaco were being built about the same time as McPhee in the 800's (Windes 2003 Neitzel 2007).

If key northern great kiva foci like Grass Mesa were apparently not integrated into Chaco, did they hook up with West or Middle elements of the overall plateau frame? Mount Peale-McCarty's Flow most likely might not been part of the positioning of Lowry, given its 0.327° inaccuracy. The Abajo Peak – Grass Mesa – Chimney Rock line is three times more accurate at 0.098° , providing a possible connection to the West vertical. And the Ship Rock-Morris 39-Blanca Peak line, if designed, could have associated with the plateau Middle and the traditional shamanistic NE feature, left behind, so to speak, when Chaco created its cross axes at Kin Bineola. Is it possible that Grass Mesa and other great kiva foci up north (aside from Ackmen) were somewhat more competitive and separate from Chaco at this time? Could they have been responding to the new religious mode of landscape formalization by creating several great kiva foci, aligned to natural features, and developing great houses, but little integration in any sort of focus like Chaco?

REVISED TRIATIC EXPRESSION OF CHACO /CURVED ROCK THAT SPEAKS

Hypothetically the three earliest ritual foci in or near Chaco canyon, Kin Bineola, 29SJ423, and Shabik'eschee were created by Abajo Peak's cardinal relation to Mount Wilson and Sipapu-Chicoma-Truchas. The tripartite ritual setting may also have functioned as the East component of a largest scale plateau framework also structured in three components. How then, might the addition of PI axes and associated communities focused on the three Chaco locations have altered the organizational character of the original triad?

The number of possible PI great kiva communities linking with Chaco is relatively small, eight in all. Associated with either or both of the Kin Bineola great kivas are Tse Bee Kintsoh (south), Skunk Springs (central) and the Ackmen pair (north). Shabik'eschee involves Dalton Pass in the south, central Los Rayos and Mitten Rock farther north. The final two locations, Squaw Springs and Peach Springs involve 29SJ423. The Peach Springs line that connects Kin Bineola K1 with 29SJ423, however, doesn't fit the pattern of a community site, a Chaco point, and a distant natural feature. All other seven do, including the Squaw Springs – 29SJ423 – Mount Taylor line. Not mentioned above for this reason are the alignments from the Ackmen pair through Squaw Springs to Shabik'eschee (no natural feature). The close by 29SJ1642 essentially duplicates all of the lines to Shabik'eschee, with the exception of its line to Peach Springs and Bad Dog, again an axis without a natural feature, and perhaps more likely to be a random alignment.

If these eight, or perhaps seven communities traveled to Chaco to conduct formalizing axis based ritual, they logically would have met at their associated particular site of the triad. Evolving rites that integrated West, Middle and East religious sodalities, might well have been held in the natural amphitheater plaza, originally aligned with 29SJ423 and Shabik'eschee (figure 39). With respect to the fundamental plateau scaled, triadic spatial symbolism of the evolving religion, the location of and practice focus at the amphitheater creates a kind of cognitive dissonance. The ritual focus, acting to integrate West and East sodalities, should logically be associated with and conducted by priests from the Middle, symbolism perhaps early on tied to 29SJ423 and its important location on the Mount Wilson meridian and Sipapu-Truchas line.

At Chaco in the 800's, three arc shaped room blocks or great houses are constructed, perhaps along with two new great kivas, figure 60. One great kiva and roomblock is very close

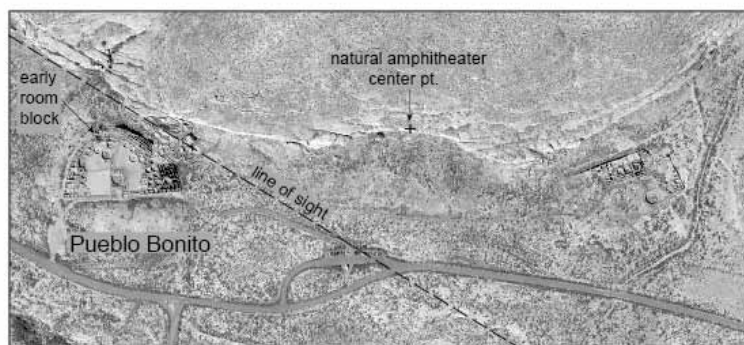
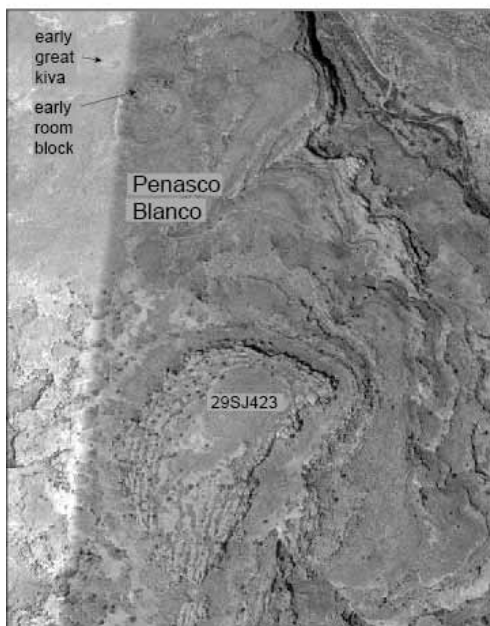
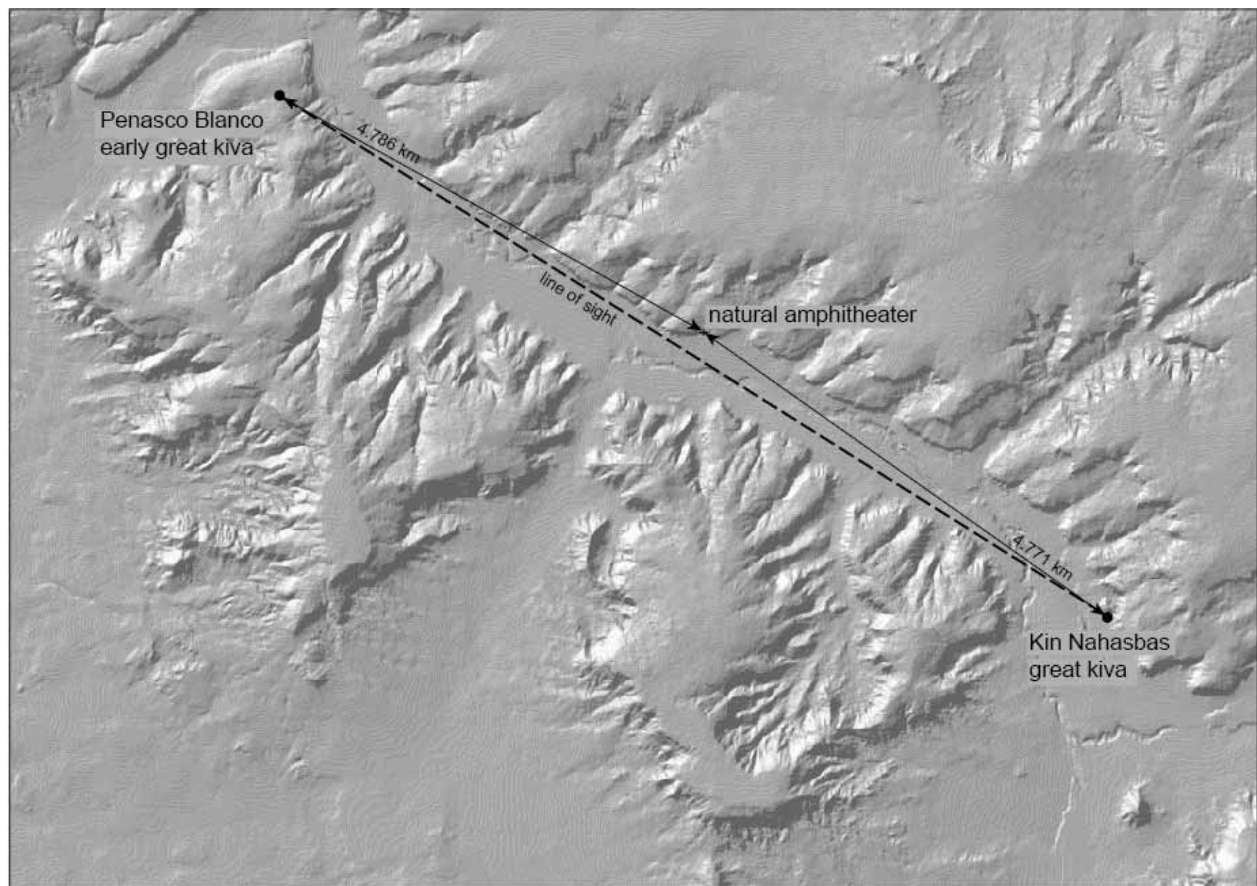
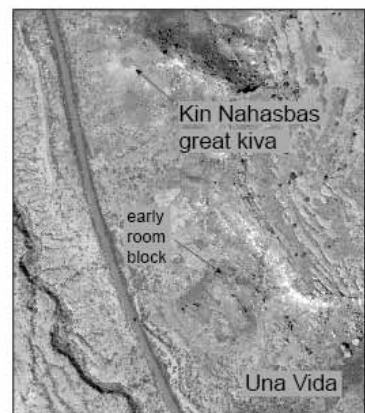


Figure 60. Alignment of great kivas and natural amphitheater adjacent to first three great house arc room blocks in Chaco Canyon.



north of 29SJ423, Peñasco Blanco; another such pair at Una Vida is built at the eastern end of the canyon near Fajada Butte; and then the central roomblock of Pueblo Bonito was located adjacent to the amphitheater plaza. The western great house likely continued ritual associations with the important location of 29SJ423, with this subsequent PI great kiva now being more accurately aligned with the Sipapu-Truchas line (0.138°); no other new alignments appear to be added at this point 637 meters due north. The presumptive early eastern ritual focus at Shabik'eschee, however, has been moved much closer to the Curved Rock That Speaks. The PI great kiva of Kin Nahasbas (late ninth century: Lekson 2006:74), just north of Una Vida could have been located to form a visible triad with the amphitheater plaza and Peñasco Blanco's kiva (also north of its great house). The distances from the centers of the two "West" and "East" great kivas to the center point of the amphitheater are remarkably similar, only off about 7 meters from being equal. The new great kiva of Kin Nahasbas was apparently located only in relation to the other two components in the new triad, rather than via large-scale alignments.

While the new layout is clearly triadic, and may also be evidence of surveying skills, symbolically the new element of Pueblo Bonito may be interesting for other, less evident reasons. Part of this mix is the recognition that Kin Bineola might have continued its West identity by creating its own late PI roomblock, and prospers in the classical PII/PIII period, even picking up a dualistic partner to the near southeast of the canyon at Pueblo Pintado. Thus it doesn't seem immediately logical to see the religious function of Kin Bineola as being shifted to Peñasco Blanco in the new PI layout of Chaco with Pueblo Bonito perhaps assuming the Middle role of 29SJ423. Una Vida does seem to replace Shabik'eschee as the East focus. To a certain extent, the building of Pueblo Bonito, which might have been the first move of the new scheme, seems intrusive. Even though the plaza could have been used communally for over two hundred years prior to the building of a great house there, it is as if some entity came into the canyon and sought to replace 29SJ423's Middle role linked to the Mount Wilson meridian, with a Middle concept that was uniquely Chacoan.

Recognizing that the associations of PI communities to the Chaco triad may have been focused on the much earlier BMIII points, perhaps after much of the ritual had shifted away from these early "villages" to the amphitheater area, one can see the two sites of 29SJ423 and Peñasco Blanco as expressing two different and still active meanings. First of course is the link to the early plateau frame and Mount Wilson, and second is a reconstituted West entity, perhaps

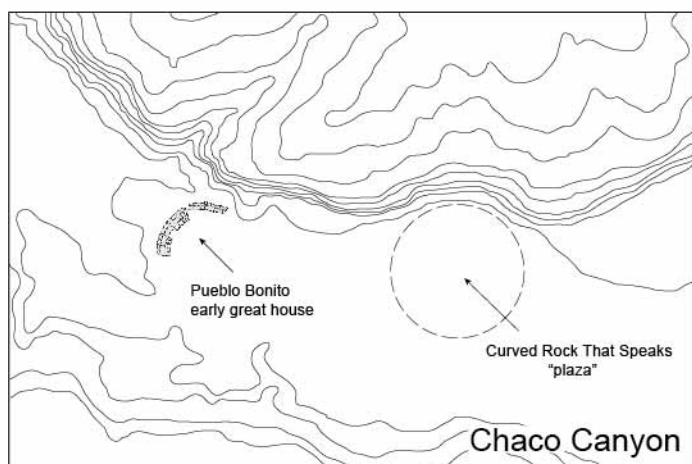
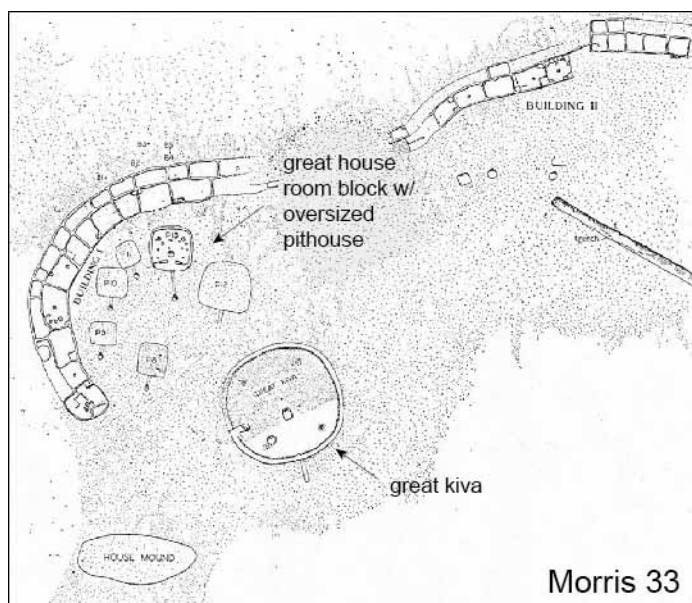


Figure 61. PI room block forms at Morris 33 and Pueblo Bonito in Chaco Canyon.

linked to but not replacing Kin Bineola, somewhat subordinately integrated to Pueblo Bonito and at least the concept of a unique Chaco Middle. As seen in Chapter 2, the great kiva site 29SJ423 is most involved, in terms of alignments with other sites, of all the great kiva sites of the analysis, all time periods included. Thus 29SJ423 and Peñasco Blanco, might well have functioned in tandem, albeit with a certain diminution of Chaco's participation in the total plateau frame.

Finally, what can the architectural and site layouts of the first three great houses in Chaco tell us about their hypothetical use at this time as foci for bipolar axial rituals. If we return to the conundrum of permanent vs. temporary residence in the pit houses associated with Shabik'eschee, this problem still plagues explanation of these unusual great kiva

"villages" or "pueblos" some three hundred years later. In spite of relatively large populations, whether in dispersed hamlets or aggregated clusters, living in proximity to great kiva foci, some small number of dwellings and storage facilities can often be found immediately adjacent to the ceremonial structure. At Grass Mesa, figure 54 again, family oriented crescents of room blocks and pit-structures occur on the limited top of the mesa, while a large number of other identical crescents occur in the larger aggregated area. Architecturally, however, the highly formal great kiva at Grass Mesa is not spatially part of the implicit linear plaza front of the adjacent crescent, thus moderating the notion of family control of the community ceremonial structure. But at Morris 33, figure 61, the great kiva sits rather formally in front of the typical

family arc with its smaller and oversized pit houses.

Eventually at Pueblo Bonito, also figure 61, its great house will have a great kiva integrated into its plaza space, not unlike what we see in Morris 33. If we assume that the first Pueblo Bonito great house room blocks, and possible pit structures were built in relation to the Curved Rock That Speaks plaza as a kind of great kiva, then this pattern seems more similar to that at Grass Mesa than Morris 33. At first this would seem to suggest a kind of kinship control of the great kiva at places like Morris 33, and some greater community authority at other places like Pueblo Bonito, Grass Mesa, as well as Peñasco Blanco and Una Vida where their room blocks were originally apart from their great kivas to the north. Ritually, however, even where the great kiva becomes more architecturally integrated into the great house, the basic social opposition might well have still obtained. Most great kivas, hypothetically, involve axial sodalities and social organization at large scales. While great houses in all their manifestations probably always involved more hierarchical control by kinship or other individually motivated social groups, spatially integrated great kivas would have involved sodalities whose membership was not determined by kinship, nor controlled by these family oriented “sponsors”.

Furthermore, some usage of the great house facilities, depending upon scale, not unlikely had to do with providing accommodations for guests from afar and thus could have been more neutral in terms of social control. The occupation of caretaker dwellings associated with great kivas might not have been determined by one kinship group, but by either the various kinship groups of the aggregation, or even by participants of distant sodality members.

Thus the plan of Morris 33 might not point to direct control of what goes on in the great kiva by the adjacent family crescent, whether as sponsors or caretakers, but could begin to show a kind of homologue effect (same spatial, symbolic structures at different scales). In the site layouts of Grass Mesa and the contemporaneous trio in Chaco, the different spatial relationship could indicate a kind of supra-level ritual focus. If, for the sake of discussion, Grass Mesa not only attracted an aggregation relatively close by, but was conceptually a more regional focus for the entire northern San Juan area, then the closer architectural relationship between great kiva and crescent at Morris 33, and perhaps at the other great kiva sites in the region, could have expressed a certain subordination. At whatever scale, there would always be a tension between great house and great kiva, one more subject to kinship or hierarchical

control, and the other in the hands of large-scale sodalities, both socially and in terms of linkage to distant natural features. As largest scale foci emerge in BMIII-PI, next smaller scale great kiva sites may have tended to “architecturalize”. This may have had more to do with recognition of a great kiva-great house’s subordinate position in relation to regional foci, than with any actual kinship takeover of large-scale great kiva functions.

Chaco of course becomes the ultimate regional focus, at least on the eastern side of the plateau. Pueblo Bonito’s first room blocks are adjacent too but do not spatially or architecturally incorporate the amphitheater wall and its inherent plaza. While it may have had pit-structures and soon after small kivas immediately in front (Windes 2003, Neitzel 2007: 21), one hasn’t the sense of strong control by some particular kinship group. Besides, the room block crescent, unlike the more architectonic arcs up in the San Juan area, is composed of three distinct construction segments, perhaps a first example of great house constructions by multiple groups (as documented in the ultimate build outs of these enterprises, Hudson 1972). Rather than think of these Pueblo Bonito room blocks as being built and used by kinship groups, they more likely would have accommodated people belonging to the Middle coming into the canyon to do ritual among themselves--there may have been three plateau groups within the Middle itself--and among those from Peñasco Blanco (West) and Una Vida (East).

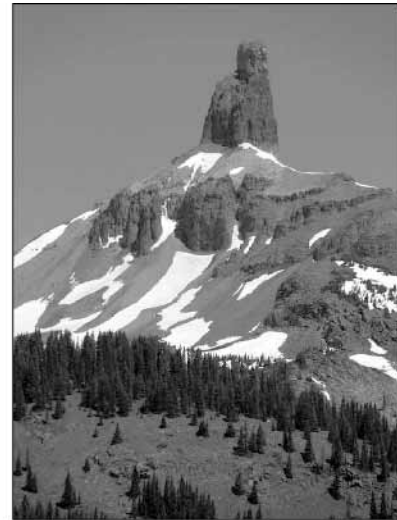
New meaning to Curved Rock That Speaks/Pueblo Bonito: a Lizard Head meridian

It may not have been only the recognition of Chaco’s natural amphitheater as the three hundred year ultimate ritual performance focus that fueled the building of Pueblo Bonito and the movement of the eastern component to Una Vida. More spiritually profound, perhaps, was the earliest knowledge of what may have been the greatest motive behind the looming classic build out of Chacoan landscape and architecture in PII/PIII. The analysis of the next chapters present the design logic that just as early shaman-priests may have been struck with the phenomenology of the cardinal coincidence between Abajo Peak and Mount Wilson, similarly might later religious specialists have been captivated by two additional features to the east of Wilson: the volcanic Lizard Head and the protruding rock formation called Black Face, figure 62.

These three unique features, beginning with Mount Wilson, are all visible from each other in the Wilson Group (of peaks). Given the meridian relationship of Mount Wilson with early Chaco and the new Peñasco Blanco via 29SJ423, it could have been later discovered that



Mount Wilson & Lizard Head



Lizard Head



Black Face Mountain feature



Figure 62. Mount Wilson, Lizard Head and Black Face feature (in Wilson Group).

the meridians from Lizard Head and the prominent feature of Black Face run curiously close to the other two locations of the revised canyon triad, the Curved Rock That Speaks (Pueblo Bonito) and Kin Nahasbas (Una Vida). While the great house locations were clearly not surveyed

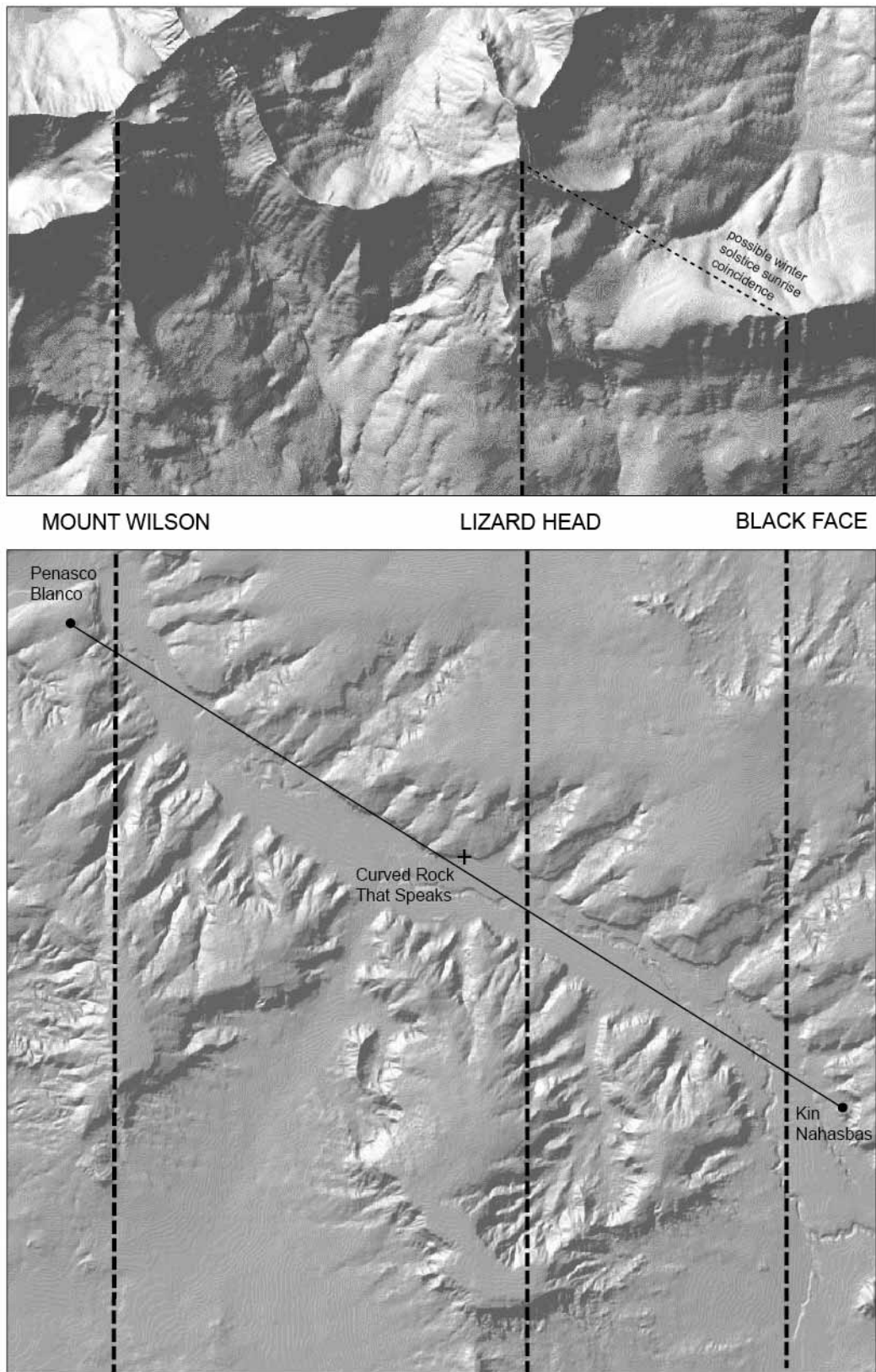


Figure 63. Relation of three Wilson Group features with triadic PI Chaco.

to align with the two additional meridians, a scalar similarity between the Wilson trio and the canyon length from 29SJ423 to Fajada Butte might have been understood.

As dramatic as Lizard Head is today, it was apparently even more so in the prehistoric past. In 1911 a large portion of the projecting spire of the ridge collapsed during the night, the event being heard from some distance. Only a smaller portion of the original feature remains. Photos of Lizard Head before the collapse are difficult to find, if they exist. Its crumbly rock gives it the reputation as Colorado's most difficult peak to climb. The Black Face feature seen in figure 62, for its part, is also unique as a climbing venue, but has a far less striking perceptual profile than the two peaks to the west. Yet it is in the right location for a triadic analogue to the PI threesome in the canyon. The possible symbolic involvement of both Lizard Head and the Black Face feature will be much more evident in the description of surveyed relationships in the following chapters. Understanding ultimate meaning of these two additional natural features will undoubtedly reflect back on how one explains the PI triad. Most specifically, did priests understand the Lizard Head meridian's 601 m location east of the central Chaco ritual space, Curved Rock That Speaks? Was it the voice of a new powerful spirit associated with Lizard Head that could be heard at the amphitheater? Not unlike the natural coincidences that may have founded Chaco three hundred years earlier—Abajo Peak – Mount Wilson – now in the 800's, additional meridian related power may have been part of the religious motivation to build the first great house triad, as yet, however exhibiting architecture far less formalized than the landscape.

6. The Lizard Head Meridian: Framing the Large-Scale Foundation for Formalized Great Houses in Chaco

The huge discourse which sees Chaco Canyon as the first large scale ceremonial center on the Southern Colorado Plateau, beginning with the first three modest roomblocks in the 800's, does not really explain why a hundred years or so later the massive investments in pilgrimage architecture begin. If, however, there had been a formalized triadic ritual structure established for centuries at the plateau scale, and Chaco was but an East component in it, how might this idea potentially better explain the 11th century "phenomenon"? First of all, people using the Chaco focus had hypothetically introduced the surveying based religious practice of using ritual landscape axes, and associated priests may have been instrumental in the subsequent laying out the larger triadic plateau. Again, these frameworks were not just social organization, *per se*, but more fundamentally the basis of a shared religion, structured at all scales by spatially opposed domains involving both natural and social entities, mediated by those of the Middle. What then, in the early 1000's, drove such large numbers of plateau communities to invest in a kind of re-formation of their basic beliefs about geography and religion?

Certainly others are much more adept than the present author at presenting ecological reasons including effects of drought, resource exchange strategies, and outright political will or agency that may have been part and parcel to the big build out. But the agreement among these experts that above all else, Chaco was a relatively egalitarian pilgrimage center (Renfrew 2001), clearly suggests that religion was not only one factor in the mix, but perhaps the major one. If a triadic plateau religion had existed for three or four hundred years, its maintenance, perhaps not that unlike the use of large-scale cosmologies by shamanistic groups like the Navajo, certainly was under no central control by any priestly element in any part of the plateau, even Ganado or Chaco where modest formalized expression may have had foci. Nor is a central place known to have existed at or near Ship Rock as some all-powerful pilgrim destination that expressed the plateau whole. Political balance among the different community groups in both West and East might have been achieved by more subtle flows of ritual exchange at different scales, perhaps involving some more or less stable "maintenance" structure necessary at the two foci.

The Chaco “phenomenon” might have been most fundamentally the expressive recasting of plateau religious framework within the eastern half, i.e. the shift from a largest scale, plateau integrated Mount Wilson focus at 29SJ423 in the canyon, to a more exclusively eastern focus at the Curved Rock That Speaks. Above all else, this layout would have been consciously designed, even initiated by priest surveyors. Given that surveying practice may have been at the very basis of religion, these individuals were the ultimate creators and keepers of sacred knowledge. While the idea of a somewhat scaled-down symbolic expression of plateau structure and creation of a unified pilgrimage center on one side of the plateau seems to have strong political overtones, one has difficulty pinning down who the actual movers and shakers were or where they lived in the canyon, particularly during the first stages of laying out the new design.

To the contrary, not unlike the idea that populations aggregated in part because of large scale landscape structure--and their foci--if religious thinkers more or less on their own began laying out a revised structure that more powerfully captured the essence of a formalized plateau religion, then communities might well have been easily persuaded to participate. After all, most surveying on the plateau would have been a process of shared spatial and social participation across large distances. The process of surveying, or hauling in timbers for buildings for that matter (see Snygg & Windes 1998 image as figure 103), could have been a core value of the religion. So if a small group of priests from somewhere, perhaps not even Chaco, had the idea to explore new expression of this large-scale religious practice, it may have been more of a self-fulfilling than primarily politically motivated phenomenon. Alternate interpretations are possible regarding what happened toward the end of the project.

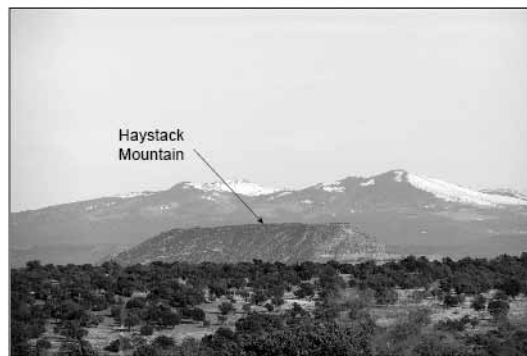
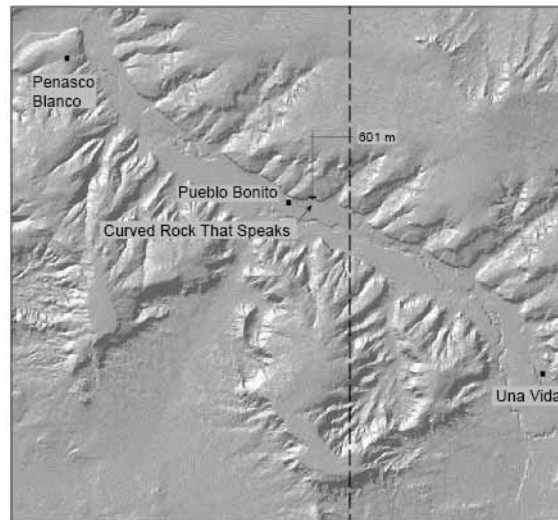
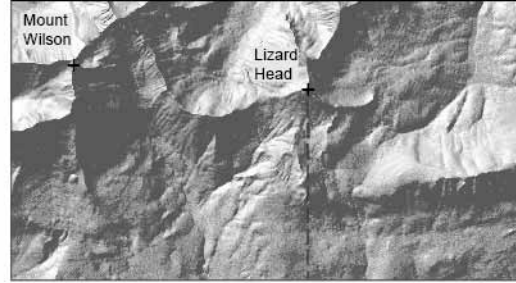
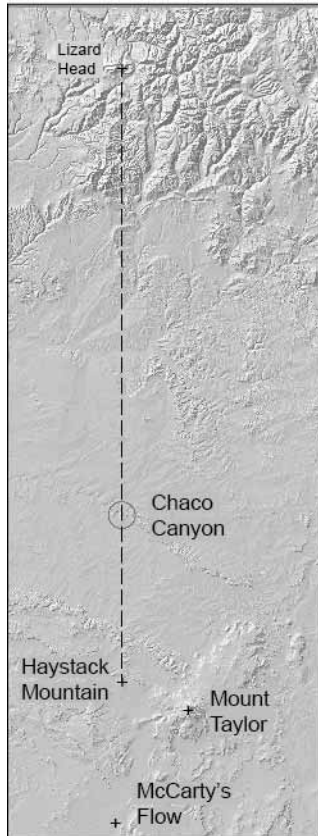
The design analysis of this chapter maps the way a relatively complete framework of survey points was seemingly laid out prior to the construction of the largest great kiva, five new great houses and their great kivas and the formalization of two of the three preexisting canyon great house sites. Because of the short period, a few decades in the mid-11th century during which these buildings came into being, and the way they are integrated with each other via the framework, it very much appears as if most if not all of the surveyed points were conceptualized and executed as part of a relatively unified design “whole”. The scheme might well have been understood prior to beginning the massive construction of new great kivas and great houses. In terms of social space, this idea obviously contradicts any notion that particular great houses were initiated by territorially competitive groups, thereby accounting for the conventional im-

pression of relatively independent, informally located pieces of architecture—even including the Pueblo Alto – Tsin Kletsin pair.

Establishing the Lizard Head meridian

Two landscape realities might well have stimulated the first design ideas about a re-formation focused at Chaco. First may have been the possible centuries old history of the first meridian from Mount Wilson that organized the first Chaco triad. Second may have been an increased ritual practice at the Curved Rock That Speaks in relation to the three PI great houses. It is not impossible that spiritual power had been religiously understood to flow from this greatest mountain in the Wilson Group down to 29SJ423 where it split, as it were, to West and East sides of the original Chaco triangle. Thus the power that invigorated performance at the Curved Rock That Speaks may have been controlled by Middle priests on the canyon rim at 29SJ423—apex of the triangle--people who traditionally may have represented Chaco in the larger formalized triadic plateau. Increased ritual at the Curved Rock That Speaks in the 800's could have caused people to begin to question the efficacy of spiritual power at this topographically central place, subordinate to the increasingly ambiguous meaning of 29SJ423 (both in its internal Chaco context, and in its relation to the other half and middle of the plateau).

Given this context, priests from somewhere in the East who might well have known Mount Wilson first hand would also have been aware of the unique feature a short distance to the east, today called “Lizard Head”, see again images of figure 62. Is it possible, they might have asked each other, that Lizard Head coincidentally aligned as an accurate meridian with the Curved Rock That Speaks, just as McCarty's Flow did in the original formulation? To answer this question a survey might have been organized to prolong the longitude of Lizard Head down to the canyon, discovering whether the creators had placed these two unique natural features on a common meridian. As seen in figure 64, the first part of their work revealed, to their probable disappointment, that Lizard Head's meridian misses the Curved Rock That Speaks by about 601 meters to the east, an overly inaccurate deviation their expertise would have clearly understood. Their response at this stage in the religious exercise, or perhaps even before beginning, may have been to envision the possibility of a third element, an also unique natural feature as southern pole to Lizard Head, a coincidental relationship analogous to Wilson's “bipolar” partner McCarty's Flow.



Haystack Mountain with Mount Taylor in background

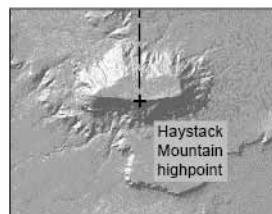


Figure 64. Prolongation of Lizard Head meridian to Haystack Mountain.

Thus, a continued prolongation south of the canyon might have eventually discovered the very accurate cardinal coincidence with the high point of a modest, but symmetrical butte today called “Haystack Mountain”. Its azimuth from Lizard Head is $180^{\circ} 2' 39''$, a deviation of about 0.044° (among the more accurate of alignments evaluated in Chapter 2) which at the distance of 275.249 km is off about 211 meters. The butte sits immediately west of Mount Taylor, as also seen in figure 64, with all of its

previously described involvement in landscape framing. Haystack Mountain actually lies on the northern edge of and visually connected to the Zuni-Bandera lava field, of which McCarty's Flow is a prominent element. Haystack's location is much more adjacent to Ancestral Pueblo populations, in this case in the Red Mesa Valley (see Kantner 1999, Van Dyke 1999), than the hypothetical early southern pole of the Wilson meridian, 61.133 km to the southwest. While no Puebloan archaeology has been thus far recorded on top of Haystack, and only a small wooden cross stands on the actual BM high point, the quite precise coincidence of the butte point to Lizard Head, proximity to Mount Taylor, cardinality of southern face, and surrounding view of

many Red Mesa Valley communities—perhaps involved in the survey process-- might all have persuaded participants of the religiosity of this feature.

The reader, however, is not asked at this early juncture in the design analysis of the Chaco build out to necessarily buy the argument of a possible religious importance of Haystack Mountain. This will ultimately depend upon understanding the design logic of multiple additional pieces of the landscape structure dependent upon the high point of the butte.

The search for natural cross axes congruent with the new meridian: Chaco East X

Imagine being part of the survey party on the high point of Haystack Mountain, having become convinced, after some discussion and/or praying, that this natural feature had spirit-given (coincidental) power. They had just discovered a new meridian, perhaps a symbolic homologue to Mount Wilson – McCarty’s Flow. Recognizing the religious implications of replacing the early power of the Wilson meridian, and leaving the question of integration with the Curved Rock That Speaks on the back burner for the time, the question might have arisen of whether this new *axis mundi* was also coincident with some pair of cross axes, not unlike the then ancient coincidences of multiple axes at Canyon de Chelly, and Kin Bineola. The fact that Kin Bineola X’s three intersecting axes do not have a proper vertical, and was located some distance from the Wilson meridian, might well have also entered into the design discussion. Particularly in the minds of the Red Mesa Valley participants, also might have been the religious presence of Hosta Butte to the West of Haystack, a kind of paired unique feature to Mount Taylor in this eastern re-formation. These two “SW” and “SE” mountains are the most prominently visible in these directions from canyon rims at Chaco. What if, surveyors might have asked, these two features, together with two to the north (“NW” and “NE”) intersected coincidentally with the new Lizard Head meridian—perhaps actually in Chaco Canyon?

The organizational breadth of the radical re-formation might now have picked up steam. Two groups of surveyor-priests and participants could have been organized to discover how two new lines from Mount Taylor and Hosta Butte, together with two northern points, might (or might not) coincidentally intersect with the newly established meridian. Chimney Rock’s involvement with Kin Bineola X, perhaps part of a partial replacement of its early Chaco importance, its cognitive location NE of Chaco, and as a probable ancient shamanistic source,

might have made it a logical design choice to pair up with Hosta Butte. The new NW point terminating the opposite cross diagonal from Mount Taylor might also have been immediately evident, though less as a unique natural feature than a kind of geographical representative of the important previous socio-cultural contributions, of people from the Mesa Verde area (especially on the Mesa and around Grass Mesa). This is the high point of the mesa, the location of the present day lookout tower, on the north rim with a full view of the Moctezuma Valley below—not unlike Haystack’s overview of the Red Mesa Valley. Both of these sites are illustrated in figure 65.

These two separate surveys would not have been prolongations like that from Lizard Head cardinally south to Haystack. Rather, the processes would have begun with a string of approximate intervisible stations (among adjacent threesomes) running the distance between end points of the two cross axes. As described again in more detail in the Appendix II, these straightening techniques had hypothetically already been used for some time across the plateau. Not unlike the profile from Mount Wilson to McCarty’s Flow shown in figure 33, new cross axes lines are even shorter and might have involved relatively few interim station points.

After this work, perhaps taking only a few weeks or so (see simulation exercise also in the Appendix II) participants would have discovered that no good natural coincidental intersection exists between the three lines in question. The mathematically determined intersection of the two cross axes lies about 792 m east of the Lizard Head meridian, as shown in figure 66. Thus religious and social power from these four “intercardinal” points focuses roughly a similar

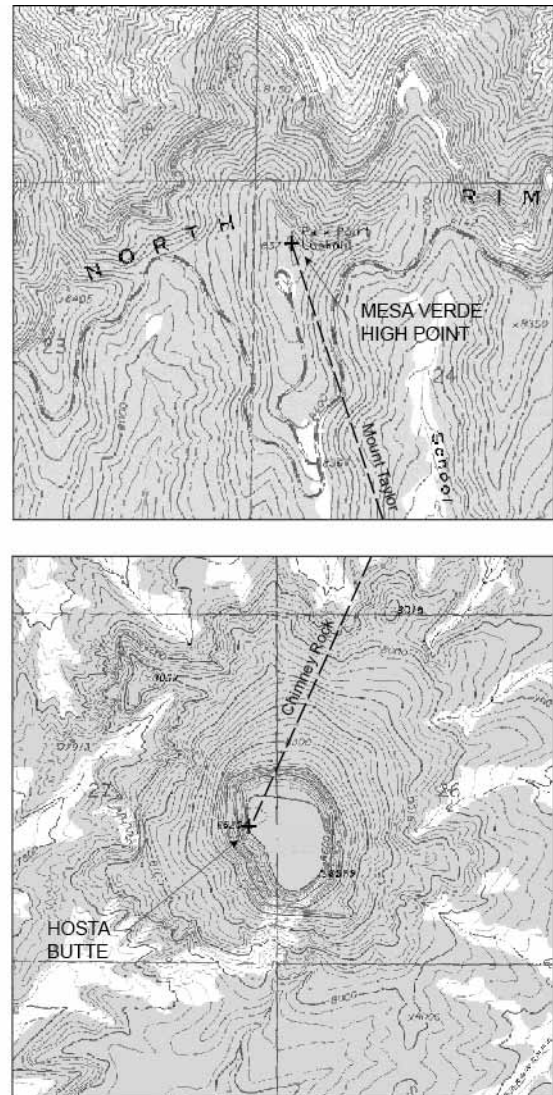


Figure 65. USGS Bench Mark points on Mesa Verde and Hosta Butte.

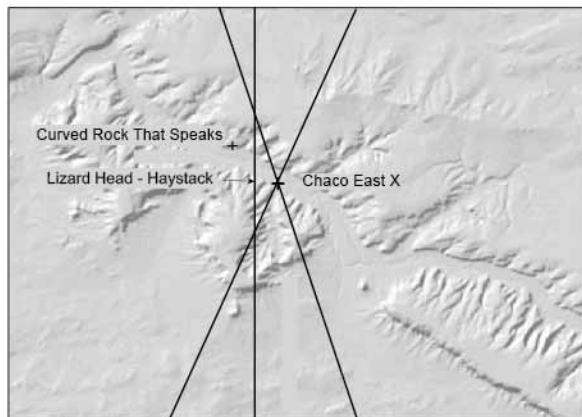
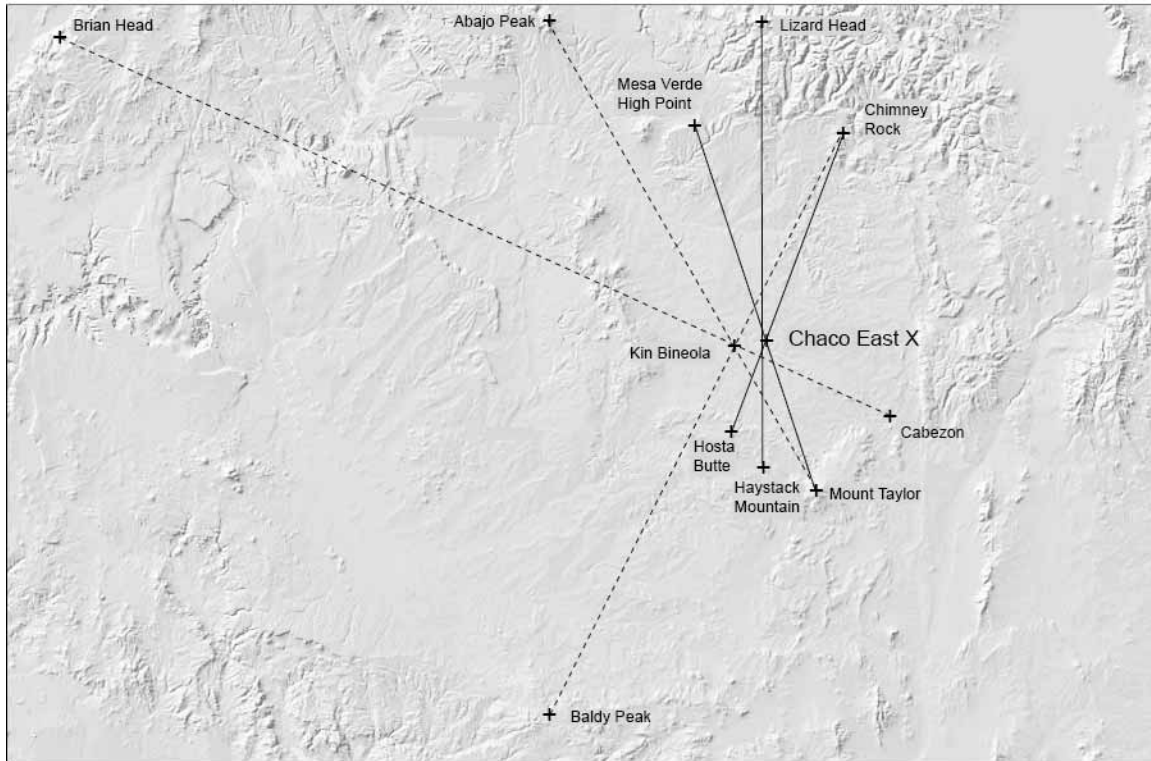


Figure 66. Location of Chaco East X with respect to Lizard Head - Haystack Mountain meridian.

distance on one side of the new meridian as that to the Curved Rock That Speaks performance focus on the other, 601 m.

Continuing their thinking in the religious design mode, as it were, an image may have evolved of two balancing focal points in the canyon, one on either side of the Lizard Head meridian. Ideally, both western and eastern points could have been conceived to be a powerful intersection point, not only of cross axes, but of some sort of a still largely north-south vertical, connecting not unlike the Lizard Head -Haystack axis, to sacred features in the Wilson Group. The southern pole of these two balancing axes ideally would also be Haystack Mountain. In this scenario, there might not have been a desire to compete with the older Wilson meridian to

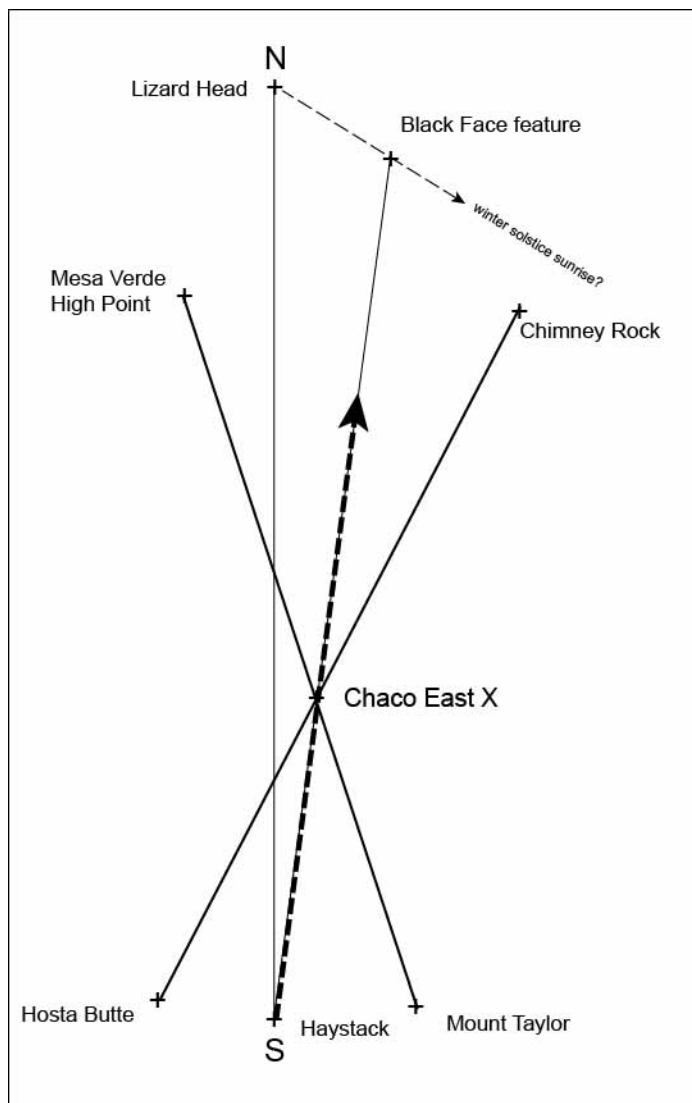


Figure 67. Coincidental prolongation of Haystack Mountain - Chaco East X line to Black Face feature.

Black Face feature shown in figure 62. The precise line from this feature to the Haystack high point misses the calculated Chaco East X by about 44 m (0.023° average deviation of two angles from both ends of the line). The overall line is 273.800 km in length. In terms of design analysis logic, one now can count two highly accurate coincidental patterns that possibly began to form the religious power of Haystack Mountain: the meridian from Lizard Head, and the slightly canted vertical through Chaco East X and the Black Face feature, perhaps as a kind of eastern element in a Wilson Group trio with Mount Wilson and Lizard Head.

The logical next survey, perhaps incrementally over time like many formalizing Ancestral Pueblo practices of this period--both in the landscape and soon in architecture—might have

McCarty's Flow by establishing some new accurate north-south to line with the Curved Rock That Speaks, running only a little less than one kilometer west of Haystack. If these two new vertical lines were laid out from the common base of Haystack, up to some point east of Lizard Head, on the one side, and up to Mount Wilson itself on the other, would they not provide the desired dual power to balance the Lizard Head meridian?

Thus the first move in this design concept might have been to create an accurate line from Haystack to the newly positioned Chaco East X. With this azimuth laid out, it could have been projected north up to the Wilson Group. Figure 67 diagrams the very accurate coincidental relationship between Haystack, the intersection point of Mount Taylor – MVHP and Hosta Butte – Chimney Rock (Chaco East X) and the

been an opposite new canted vertical from Haystack to the West. Here the point in the Wilson Group would have had to have been Mount Wilson itself, as diagramed in figure 68. The creation of other intersecting lines for a balancing “Chaco West X” would have to follow, a reversal of the process that discovered the coincidence of the three axes of Chaco East X. First laying out interim points very much like the example in figure 33, the line from the Mount Wilson peak to the Haystack point revealed that it actually passed between the early Pueblo Bonito roomblock crescent, and the Curved Rock That Speaks. If the communities building Pueblo Bonito had priestly duties at the Curved Rock That Speaks, the newly drawn line from Mount Wilson to Haystack might well have presented logical problems for the larger religious consensus. The Pueblo Bonito – Curved Rock That Speaks combo (great house + largest great “kiva”) was possibly already the ritual center of the canyon.

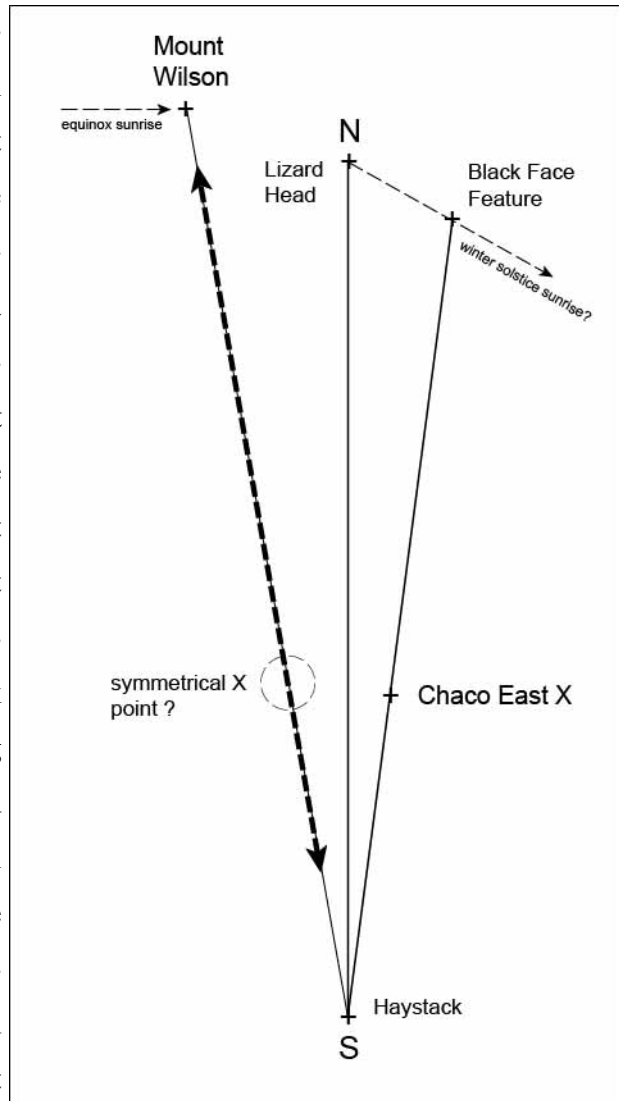


Figure 68. Logical opposed axis from Haystack Mountain to Mount Wilson.

The imbalance here might have been clearly felt. While attempting to create an ultimate Curved Rock That Speaks link to the Lizard Head - Haystack meridian—via a balancing Chaco West X—they discover that this new West line unduly emphasizes the existing great house-greatest of “kiva” relationship by passing through the small space between the pair. How was this to be overcome? The Wilson – Haystack line, however, passes a few hundred meters to the west of the Lizard Head meridian. Could this provide the necessary formal balance if a truly powerful Chaco West X could be created--mitigating the coincidental association with Pueblo Bonito and the acoustic plaza discovered when first laying out the potential vertical to Wilson?

Adjusting the original Chaco triangle to create Chaco West X

Proceeding with the their larger Haystack based concept, priest-surveyors might have considered finding two lines to intersect with Wilson – Haystack to further convince people of the power of some balancing X point west of the Lizard Head meridian (the role of Pueblo Bonito notwithstanding). The successful (in part coincidentally remarkable) Chaco East X had already involved the four most logical natural features at the corners of the re-forming Chacoan side of the plateau, and the Black Face feature. If adherents to the religious aspects of the original Chacoan cross at Kin Bineola were still active at this site, it may be possible that their influence was felt in this quest for a balancing cross intersection point west of the Curved Rock That Speaks. Thrown into the mix could also have been people at the West canyon site of Peñaasco Blanco (associated with 29SJ423), sensitive perhaps to what was happening to their earlier prominence of being at the vertex of the original triangle with Kin Bineola X and Shabik'eschee.

The design logic might have been to replace the two lines and their intersection point (the vertex at 29SJ423) with a similar construct whose intersect would be on the Wilson – Haystack axis at a point just west of the canyon center, a balancing Chaco West X. This revised triangle might keep Kin Bineola X as its western base point, thereby facilitating some religious continuity in this piece of the new Chaco frame. The original triangle, see again figure 38, might have been conceptualized as pivoting clockwise from a fixed Kin Bineola X, creating both a new eastern base point to replace Shabik'eschee and a new ChacoWest X point closer to the canyon center. The base of this rotated triangle might have been struck first as a line originating from the Sipapu. After all, the coincidental Sipapu – Chicoma – Truchas line could have been one of the two lines that positioned the original vertex at 29SJ423. While a Sipapu line is shifting here from vertex to base, the essential geometric relationship between these two elements of an equilateral triangle may have provided some symbolic continuity to the change.

Design evidence of this shifted base lies in the very accurate alignment from the Sipapu through Kin Bineola X, actually striking the Kin Bineola great house's large partner to the SE of the canyon, Pueblo Pintado, figure 69. The total line is 372.472 km. While this line was not included in the probability exercises of Chapter 4, the high likelihood that some number of

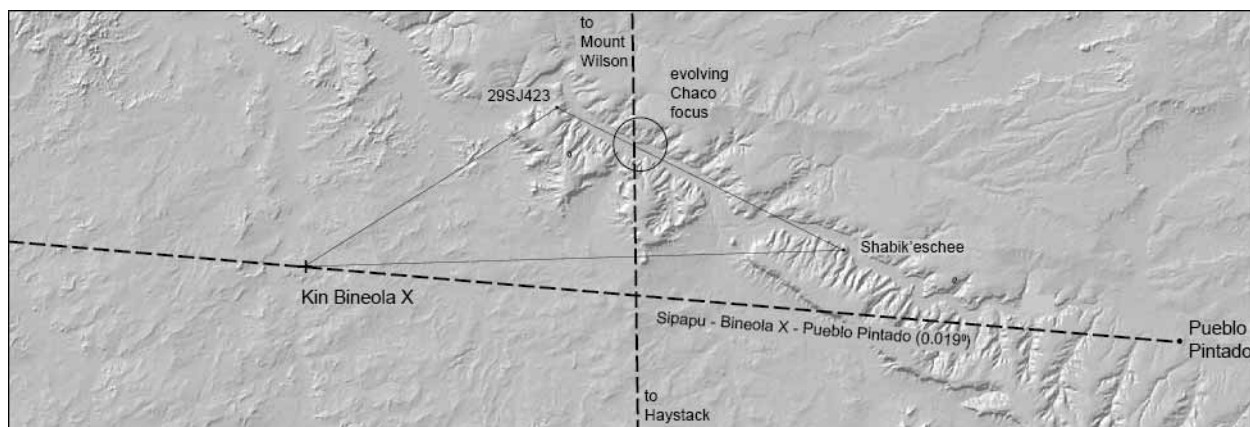


Figure 69. Sipapu - Kin Bineola X line as base for revising original Chaco triangle.

other Sipapu lines were designed, adds positive consideration of this axial symmetry of Chaco Canyon's two flanking great houses. But Pueblo Pintado was not necessarily built at this time, nor for that matter had Kin Bineola's PI roomblocks been radically enlarged and formalized. Nor was Pueblo Pintado the new East base point of a rotated Chaco triangle. This point needed to be close to the same distance from the new vertex as was Kin Bineola X. Another consideration might have been the possibility for the azimuth from east base point to emulate the original canyon axis from 29SJ423 through the Curved Rock That Speaks to Shabik'eschee.

Enter the possible participation of people from the West part of the plateau. If communities associated with 29SJ423 and Kin Bineola, both religiously part of a reformation of West components of the new Chaco layout, were active in rotating the triangle, then the possible West focus of Ganado might have participated in this portion of the process; or they might have been more instrumental, given the possibility that the West landscape had been more highly framed in the PI period prior to the Chaco build out. The logic of thinking in this vein is the somewhat unfinished SW/NE axis of the Ganado cross (figure 48) that may have terminated at the BMIII site of Tohatchi, also on the Ship Rock axis as Middle. The Humphrey's Peak – Ganado – Tohatchi line orients generally toward Chaco Canyon. If accurately extended (see list of alignment accuracies in Appendix II), it comes very close to the second great house in the East Chaco community, "560" (Pintado being the other), figure 70. More interesting, however, in terms of triangle redesign, is the point at which the Ganado line intersects with the Sipapu – Kin Bineola X base. Could this intersection, "Pintado X", have been created as the eastern base point opposite Kin Bineola X? Pintado X is located up on the rim of Chaco (Chacra) Mesa with no readily apparent feature elaboration, just as is the case with Kin Bineola X. The azi-

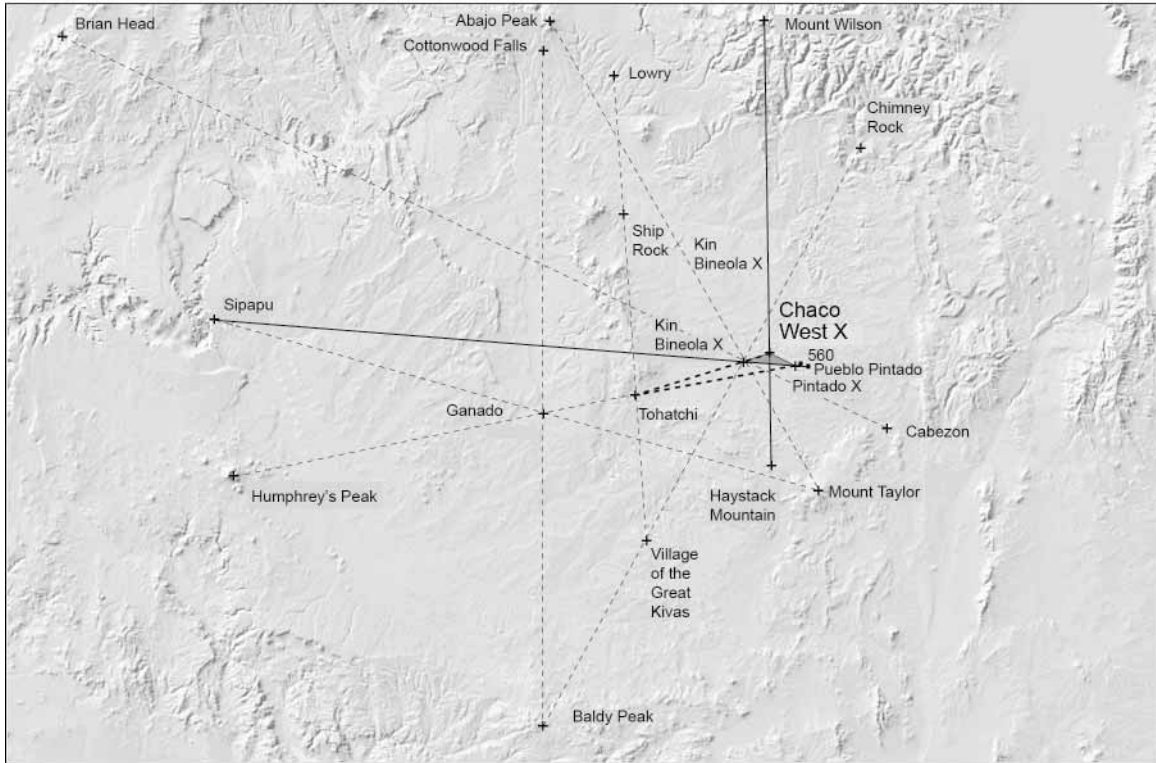


Figure 70. Prolongation of two lines from Tohatchi to create corners of new Chaco triangle with Chaco West X at apex.

mouth from Pintado X to the emerging Canyon center is very similar to the original eastern ray of the original triangle.

Given the possibility of numerous community priests participating in the establishment of both the Sipapu base and the power from the Humphrey's Peak – Ganado – Tohatchi alignment, how would they then have determined the vertex point of the new triangle on the Wilson – Haystack line at the canyon center? Could they have corded off or measured the actual distances from Kin Bineola X and Pintado X to an equidistant point at the canyon center? And was this measured point coincidentally also on the Wilson – Haystack axis, at accuracies similar to the three lines of Chaco East X? Probably not, given the apparent general lack of interest in measuring distances of linear features whether as landscape line or great house wall (more on this in the next chapter). Measuring line lengths is quite different than creating angular bisects such as discussed in the orientations of great kivas at Lowry and VGK (see again figure 52).

One design solution to positioning the new Chaco West X, more by alignments among natural and where possible coincidental features than purely mathematical measure *per se* (the general shape of a isosceles triangle notwithstanding), might have been to consider a partnered

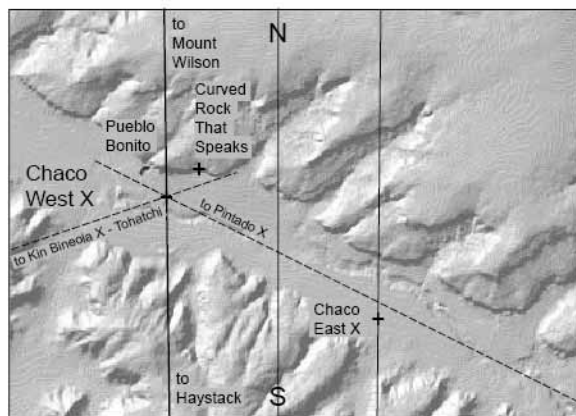
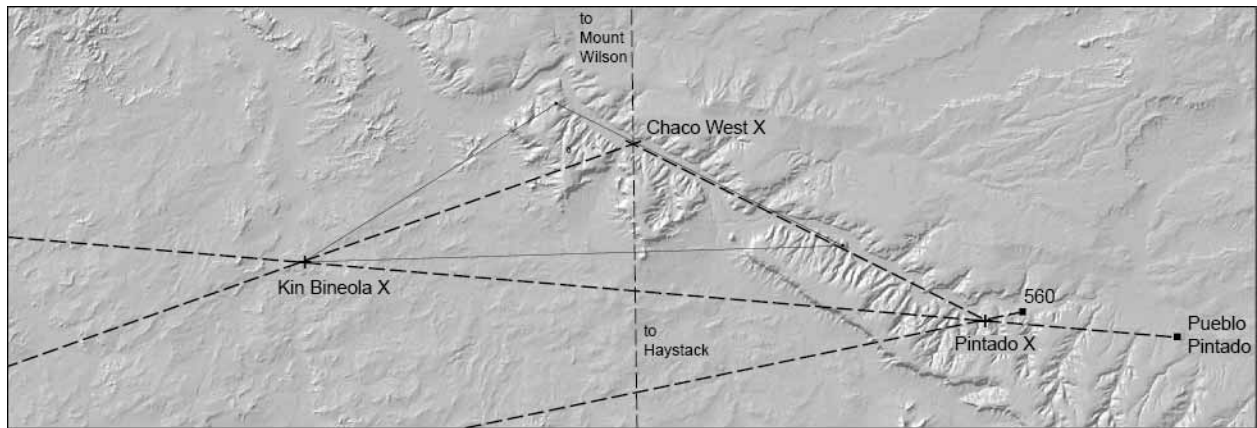


Figure 71. Enlarged maps of creation of revised triangle and opposed Chaco West X.

line from Tohatchi—the original terminus of the Humphrey’s Peak-Ganado line--as symbolically appropriate to create the new X point in the canyon, shunting Middle (Ship Rock) power as it were not only to Pintado X on the east of the base, but through the western Kin Bineola X and the new X point as well (figures 70 and 71). The line from Tohatchi through Kin Bineola X, when prolonged to the NE intersects with Wilson – Haystack just to the north of the Chaco Wash at the canyon center (in this simulation, the line is made almost precise at around 0.002°). The azimuth from this point, Chaco West X, to Pintado X is $243^\circ 28' 31.8''$ compared to that from 29SJ423 to Shabik’eschee as $243^\circ 36' 41.8''$ (the first eastern ray of the triangle and primary canyon axis through the Curved Rock That Speaks). The lengths of the two rays of the new triangle from Chaco West X are roughly similar (18.716 km and 17.273 km), surveyors again perhaps placing less emphasis on measured lengths than azimuths and angles. Like the Haystack point and Chaco East X, the new survey point Chaco West X near the canyon center cannot yet be fully understood in terms of evaluating what it provides to the complete design layout of classic Chaco.

The ultimate great house of Pueblo Pintado might well have been built some decades

later than the landscape layout of Chaco West X. Nevertheless, discussion of its eventual architectural plan perhaps provides another piece of evidence for a paired relationship with Kin Bineola. The design possibility here is the conceptualization of a landscape or great house pattern as something that can be replicated at other sites and even other scales, again “homologues”. In this vein, fairly strong evidence—at least from an experienced designer’s perspective-- has already been presented that the plan of the great house at Village of the Great Kivas was a knock off of that at Lowry Ruin. Even azimuths from one of these poles of the Ship Rock Middle axis were reproduced at the opposite end. Pueblo Pintado, not unlike VGK, forms the terminus of a major axis and pairs up with Kin Bineola (X), in locations that flank

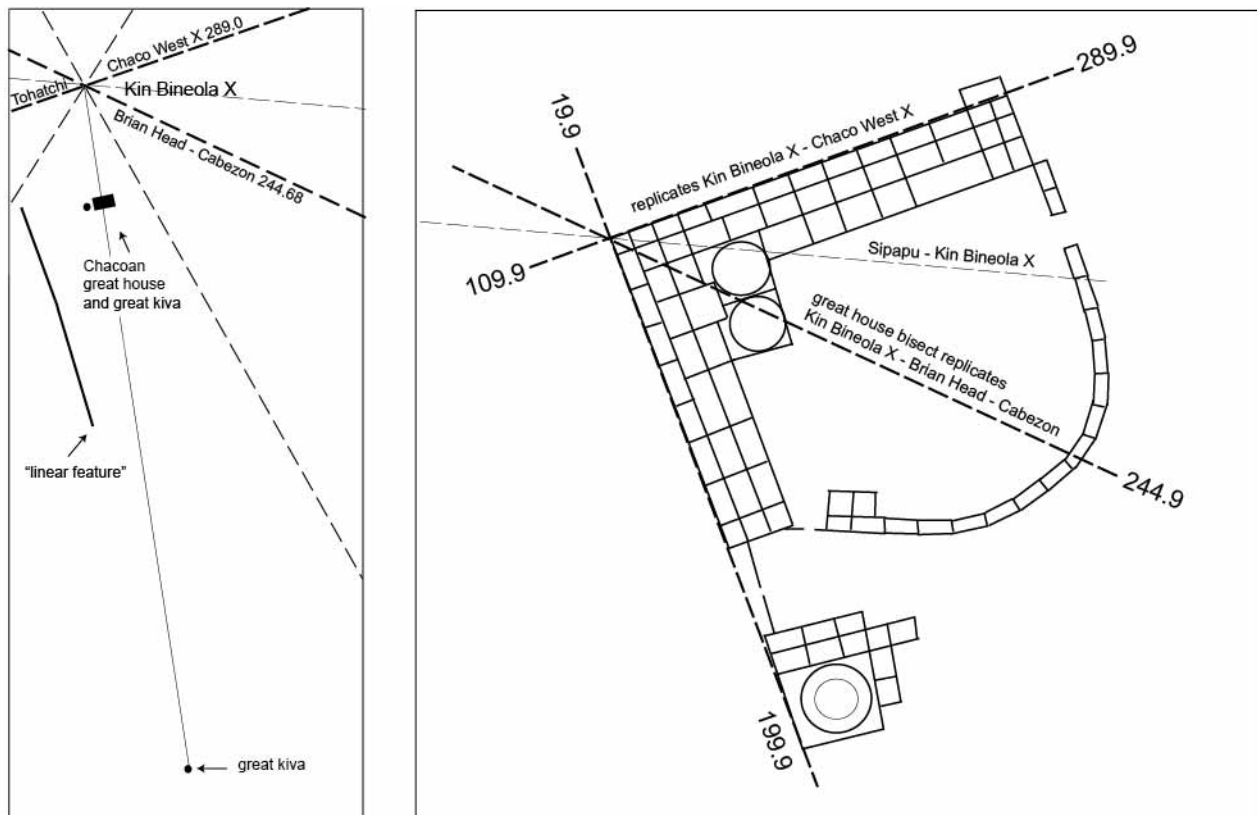


Figure 72. Homologies of large scale alignments and wall orientations between Kin Bineola X and Pueblo Pintado.

opposite SE and SW directions south of the canyon (possible large-scale lines that might have intersected the Sipapu axis and located Pintado longitudinally do exist, but are not discussed in the present volume). Most interesting in the present context is the way the plan layout of Pintado appears to emulate, not the later great house remodel at Kin Bineola (as in the Ship Rock pair), but aspects of Kin Bineola’s cross and especially of its role in setting up Chaco West X.

The measured azimuth of Pueblo Pintado's north wall is 289.9° (counterclockwise from north), while the azimuth from Kin Bineola X to the new Chaco West X is $289^\circ 00' 56.8''$. The front wall of the eventual great house expansion at Kin Bineola creates a possible alignment, not to Chaco but to Ganado (see figure 84), perhaps in recognition of the importance of this West focus in surveying the new landscape frame. So if at Pintado, the north wall expressed Kin Bineola X's relation to the Chaco center, a second possible analogue exists in the bisect of plan's NW right angle. This angle measures 244.9° , which compares very closely to the orientation of one of Kin Bineola's three axes, that from Brian Head to Cabezon; the azimuth from the common intersection point at Kin Bineola X (about 60 m from each of the three lines) to Cabezon is $244^\circ 40' 59.3''$, or about 244.7° . In the Pintado plan, the bisect comes close to intersecting with the tangent point of the two central enclosed kivas. Pueblo Pintado's west wall does not have an immediate referent in the map of Kin Bineola X, save for a similar orientation to the "linear feature" of the larger Kin Bineola site. It could have been that the west wall simply completed the 90° relationship with the north wall, so as to establish the bisect to Cabezon. Pueblo Pintado is the closest major great house to Cabezon, much larger than visually adjacent (less than ten km) Guadalupe. One of the previously tested Sipapu lines runs through the Kin Ya'a great kiva to Guadalupe. More examples of transferring azimuth and angular relationships from one site to another will be illustrated in the layouts of the major formalized great houses in the canyon center (positioned by the landscape frame).

Axial unification and bringing power to the Rock That Speaks

At this stage in the evolving design scheme, ritual participants--as much communal representatives as priest specialists perhaps--would have accurately understood the coincidental meridian from Lizard Head to Haystack Mountain and two intersection or "X" points on the West and East sides of the *axis mundi* within less than 2,000 meters of each other at the center of the canyon. The big design question at this point could have been how to connect the power of the two X points, created by distant features in the plateau landscape, with the power of the Lizard Head meridian and especially the traditional ritual focus at the Curved Rock That Speaks. The not-to-scale conceptual diagram of figure 73 suggests how designer-priests might have wondered whether, not unlike the ancient De Chelly or Kin Bineola coincidental Xs, the lines from Chaco West X to Black Face, and that from Chaco East X to Mount Wilson might possibly

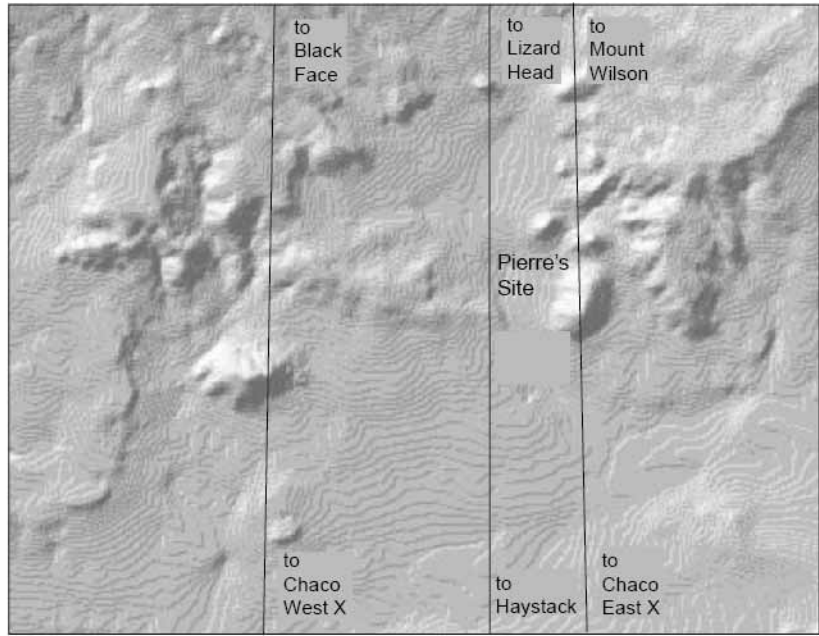
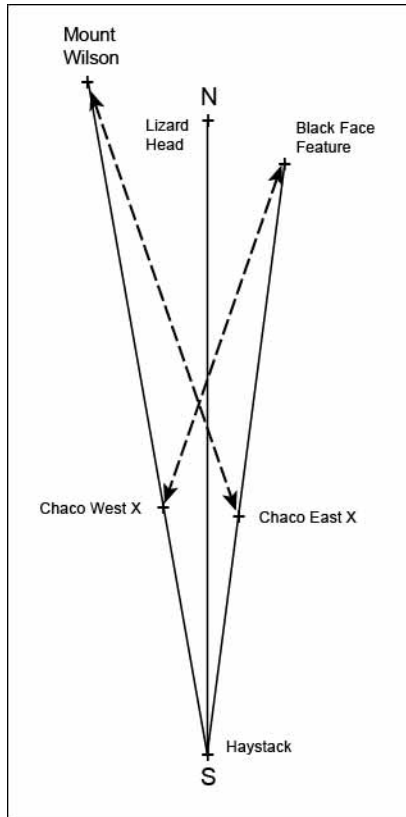


Figure 73. Pierre's Butte in relation to cross axis lines from two X points in Chaco Canyon.

have intersected somewhere close to or on the Lizard Head meridian. If they had surveyed these two canted lines earlier they might well have realized that their intersection lies very inaccurately kilometers west of the station points used to lay out the meridian. Thus there was no “spirit-given” point of unification from which some slight diagonal, perhaps, might be brought into the canyon at the Curved Rock That Speaks--conducting *all* of the spiritual power from *all* of the major distant plateau points of the ultimate frame to this (ancient) natural amphitheater.

So what might have been the solution? The best clues come from the location of the two most prominent “outlier” sites in the area, which actually are not community foci like most; no great kivas or great houses surrounded by domestic sites here. Twin Angels, on the south rim of the Kutz Canyon is only a few hundred meters north of the point where the Chaco West X – Black Face line crosses the Lizard Head meridian. The Pierre’s Site complex, for its part sits only a couple of hundred meters south of the point where the Chaco East X- Mount Wilson line crosses the meridian. This precise diagonal to Mount Wilson actually runs less than 10 meters east of the two room blocks on Pierre’s Butte itself.

From a conceptual design perspective, how could power from either of these two intersection points on the meridian—taken perhaps as more potentially powerful than the intersec-

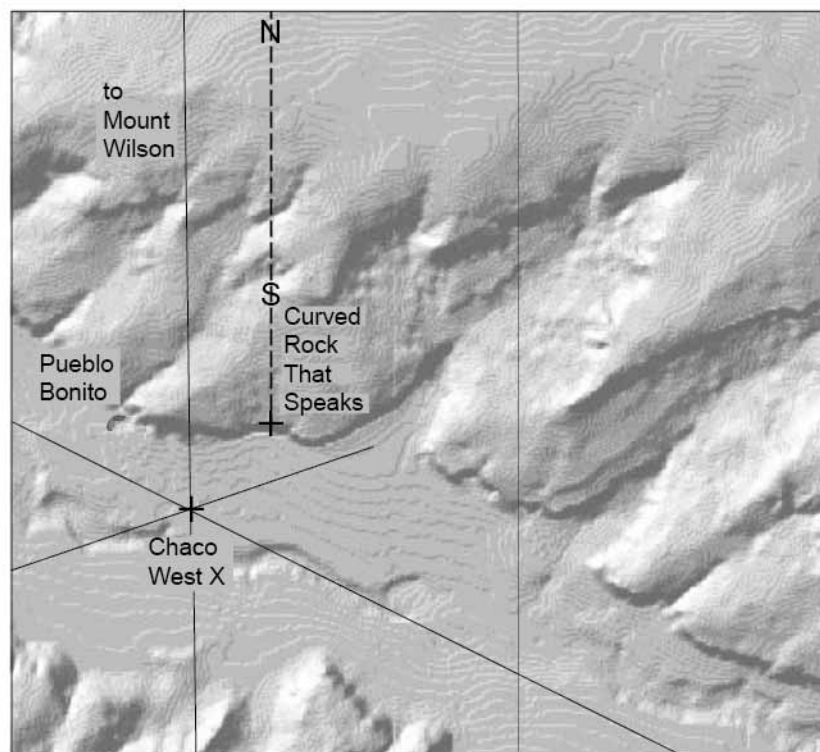
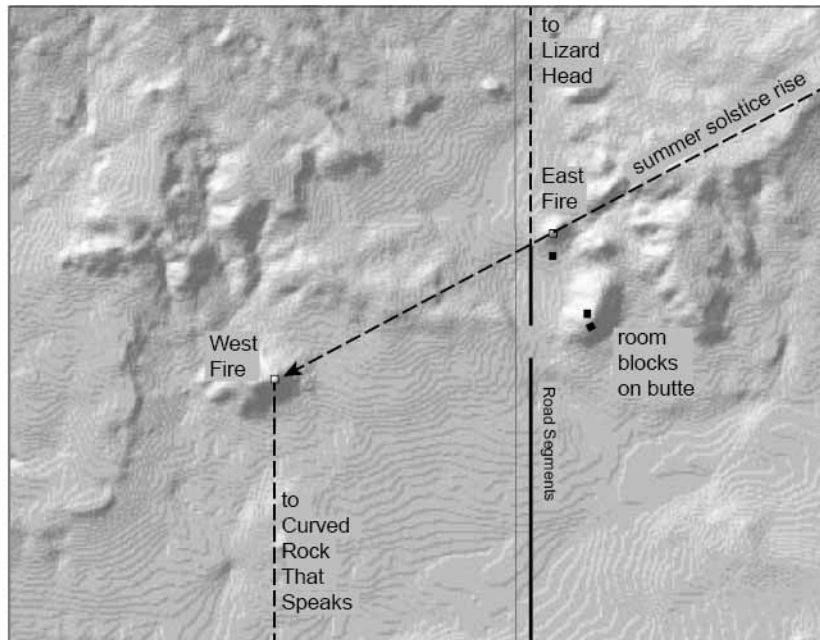


Figure 74. Summer solstice shunt from Lizard Head to Curved Rock That Speaks meridians.

mini-meridian (road) is only about 46 meters from the mathematical Lizard Head-Haystack line (0.021°). The actual slight angle of the meridian is again coincidentally very accurate, i.e. a deviation of 0.043° from Haystack (an angle of $000\ 02'\ 34.0''$).

tion point of the two X axes several kilometers west—be connected to the Curved Rock That Speaks in the canyon, an understood longitudinal distance of about 600 meters west of the Lizard Head meridian? It is clear that the Pierre's Site complex of features, as best documented in Powers et. al. 1983, was the choice over the landscape in the Twin Angels area. Most interesting in this respect is the location of the largest of the small room blocks at Pierre which sits at the base of the butte just to the west, figure 74. The precise Lizard Head-Haystack meridian passes less than one hundred meters to the west of this lower room block. More accurate still is the location of the Great North Road segment (about which much more will be discussed in Chapter 8) at Pierre which here runs very cardinally north-south. This constructed

We know that after the cardinal segment at Pierre, the North Road runs south on a slight diagonal to the west down to the canyon center, accommodating the 600 meter inaccuracy between the Lizard Head meridian and the Curved Rock That Speaks. The road, however, was built in the early 1100's after the new formalized great houses had been constructed (Kincaid 1983). Thus the road could not have been the initial component of the survey scheme to connect meridian power to the center of the canyon and especially to the Curved Rock That Speaks.

Two additional and unusual site features at Pierre may have been the key to delivering spirit power from meridian to central ritual plaza. An eastern fire feature, "El Faro", sits atop a smaller butte directly north above the largest room block. Because of three adjacent rooms, the survey (Power et. al. 1983) couldn't definitely say whether the fire hearth here was for signaling or domestic use. It is located, however, on the very high point of the smaller butte, with three small rooms running down the slope to the south. On another small butte to the southwest of El Faro, is located a large 3x3 meter "signaling hearth" with no adjacent structures. Since many of the room block structures were built later at the time of Great Road construction, it could be that these two signaling features constituted the initial ritual rationale for the Pierre complex. Given that the two fire hearths are about 600 meters apart, longitudinally, and that the western hearth's longitude of $107^{\circ} 57' 23''$ is very close to the center point of the Curved Rock That Speaks amphitheater at $107^{\circ} 57' 26.6''$, this could be a kind of "spiritual shunt" that at certain times connected meridian flow from Lizard Head to a surveyed mini-meridian down to the central ritual plaza.

The azimuth between western and eastern hearths is $298^{\circ} 10' 52''$, about two degrees from summer solstice sunrise at this latitude. While no actual observations have yet been made to better define this possibility, the hearth features could have been a timing element in switching Lizard Head meridian flow at Pierre to the Curved Rock That Speaks meridian. The date should be just before or after actual solstice, perhaps setting up actual ritual events in the canyon. While the fire hearths may have been part of some larger scale signaling from Pierre, the primary ritual efficacy might have been the lighting of the two fires in unison as the sun rose to the east. Not only might spiritual power from Lizard Head have been conducted to the Curved Rock That Speaks meridian, but the effect could have been symbolically heightened by the integration of rays of the solstice sunrise.

Canyon survey points and lines as framework for major great kivas and houses

The layout of the shunt between the Lizard Head and Curved Rock That Speaks meridians, together with the cross axis intersection point as Chaco East X and the revised triangle apex as Chaco West X –actually only four survey points in all—provides the key survey “benchmarks” by which the five new great houses and largest of great kivas, the singular Casa Rincoñada, are positioned. While no probabilistic test has yet been devised to capture this total layout, a not inconsiderable formal design logic exists in this survey process. The ability of the formalized framework to explain both the location and orientation of the largest and singular great kiva and five new great houses, along with remodeled aspects of Pueblo Bonito and Una Vida, should provide considerable additional evidence of overall design intent--that begins in the large scale landscape and culminates in monumental architecture.

7. Locating New Great Houses / Casa Rincoñada and Orienting Monumental Walls

Given the survey layout diagramed in the previous chapter, it seems likely that implications for new great houses and their locations were becoming apparent as the design of the large scale ritual process played out. Could they have held off creating new architecture until they obtained a certain closure of the landscape scheme? When the major construction phase begins in earnest around 1020 A.D. (Powers et. al. 1983:250), it is not impossible that builders at any particular site knew what was being or going to be erected at the other sites. It is not inconceivable that survey related ritual activities by different socio-religious groups were taking place at many sites, perhaps from the time when their location had been determined by the new formal landscape frame. This radical view runs counter to intuitions that imagine more politically individual or territorial choices initiating these very large religiously purposed buildings. Thus a certain theoretical impasse appears, one between a new understanding of cultural landscape history--particularly in the organizational potential of large scale ritual formalization--and conventional histories of designed, formal architecture.

An architectural history perspective on “monumental” great houses

It is during the 11th century that Pueblo Ancestors laid out for the first time precise, massive straight walls as part of roomblock distribution in their non-domestic, ceremonially related great houses in Chaco Canyon. The first formal monumental architecture, beyond the constrained but still highly formal great kiva circles and within an already ancient Ancestral Pueblo region provides an exceptional opportunity to think about a natural history of “architecture” in the more conventional, formalistic sense of the word. In late Basketmaker periods (around 700 A.D.) when people lived only in organic pit houses and stored goods in pit structures as well, their graphic geometry of smaller artifacts clearly illustrates a capacity for design, figure 75. This capacity continues to be limited to smaller artifacts for an additional 300 years, even though people are building precise circular great kivas and living in seemingly more architectural, yet still organic surface structures called “pueblos”. What is it, then, that initiates this

interest in geometry at a monumental architectural scale at this particular time? Are Chacoan great houses temples in the making?

The earliest ideas about an evolution of architectural form distinguished simple shelters providing basic function from pyramids and temples serving primarily religious purposes. Raglan's (1964) classic volume on the "temple and the house" radically dissolved this distinction. His purpose was not to track any sort of evolution between the two poles, however, but to show that primitive huts could also deliver a powerful religious effect, as illustrated in the Warao and Navajo, for example.

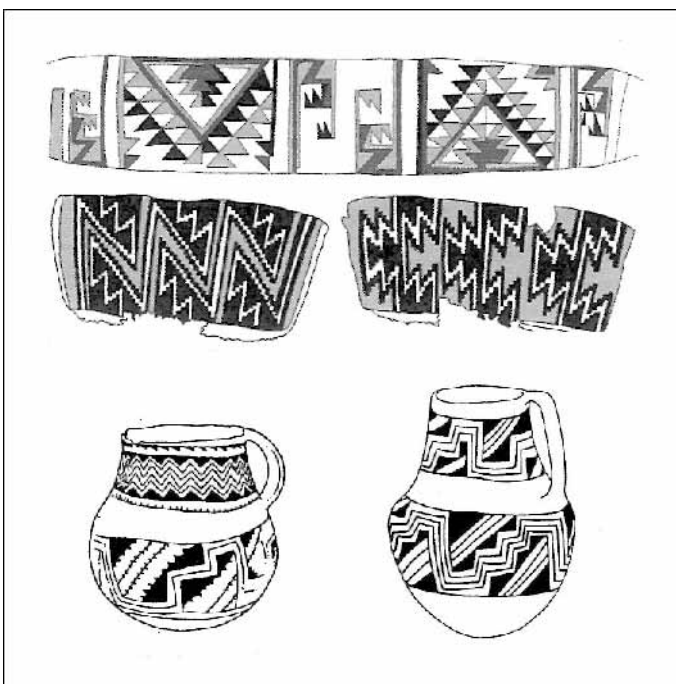


Figure 75. Non-architectural Ancestral Pueblo geometric design: woven bands from Basketmaker periods before 600 A.D. (above, Kelly Hays-Gilpin 2004: 104); early and late pottery from Chaco Canyon 900 A.D. - 1200 A.D. (below, Jernigan 1982:393).

Eliade's (1959) writing on sacred space, while more derived from monumental designed architecture than primitive huts, appears to contain an evolutionary dimension. Societies in the past were more driven by the energies of making contact with spiritual power, as in the "sacred", than in "profane" spaces and societies today. Nevertheless, Eliade's primary interest was in the ritual opposition between sacred and profane spaces and religious experiences that needed to be effective within a particular, mostly architectural setting. The profane, dangerous periphery was always opposed to a structured, religiously powerful sacred center with its *axis mundi* (manifested both vertically and horizontally). Thus Eliade said little about an evolution of form itself from the sacred to settings which had in effect neither sacred nor profane space, i.e. that they were not used ritually to articulate contact with spirits. What does it mean socially when people come to live for the most part in settings which are not religiously or ritually defined? One can speak of these kinds of meanings as "rhetorical" (as distinct to religiously "ritualistic"), given their intent to influence, educate, or differentiate, usually with an underlying territoriality at building, urban, or landscape scales.

Recognizing evidence in many ethnographic accounts of landscape use, a very small number of architectural historians have recognized that sacred space exists beyond the scale of temple experience or architecture. Rykwert (1976) investigated the Eliadian structuralist idea in the religious bases of the founding of Rome, as well as large scale parallels in other societies including the primitive. Rykwert's model suggests an almost Jungian archetypal notion of expression in most traditional societies, whether historic, prehistoric, or ethnographic. The basic patterns of "Eliadian" structures in cities or villages are not dissimilar to those found in huts and temples. Missing here too, however, is an evaluation of a separate, rhetorical component as a distinct means of social power in Roman architecture and city layout. The triumphal architecture, parades of returning conquering Caesars, and ultimately many of the events in the coliseum setting (McCormick 1986) are almost pure rhetoric with a strong real and symbolic territorial underpinning. The intent is to impress and persuade, a source of power quite different from that experienced in sacred ritual settings whose primary purpose is to make contact with the gods.

But what about the largest scale of all, the known landscape or heavenly cosmos, representations of which in both ethnographic and historical societies take the form of seemingly "Eliadian" center structures? Here the sacred-profane opposition may break down, at least in the landscape, according to Smith's critique (1972). Observing a more ethnographic reality in primitive cultures, the periphery is usually the most sacred. This is where the gods live, as in good ethnographic accounts of larger scale, sacred landscape practice extensively described earlier in this volume. Vincent Scully (1989), the architectural historian most recognized, perhaps, for discourse about sacred architecture and landscape, describes the dance plazas of the historic pueblo ritually integrating the surrounding sacred mountains. Influenced perhaps by his earlier work on the way temples in the Classical World orient to landscape features (1962), he sees landscape spatial patterns as more of an extension of architecturally framed dance in pueblo plazas.

The assumption that the largest of ritually framed landscapes are derived from temple or primitive hut architecture, or created more fundamentally by myth as in Eliade or even Ortiz, is of course presently challenged by arguing for a technical ability of traditional societies to survey geometric patterns at scales far beyond immediate viewsheds—a radical, but nonetheless logical extension of scale, in effect, of the formal ritual layouts of huts. In this sense, large

scale ritual frameworks designed in the landscape might possibly have come first, or at least before origin myth and more formalized temple architecture. Theorizing in this vein, the author (2009) revised Scully's notion of *extension* of geometry from temple to landscape feature. While the orientations of the four most recognized Minoan "palaces" on Crete do extend, or orient to significant natural features (only one of which is identified in Scully) these are secondary to a preexisting wholly natural landscape framework. Most importantly, the palaces were initially located by *intension*, as it were, derivations from the older, symbolic, geometric pattern laid out among most prominent natural features of the island. Thus the first design, in the pro-

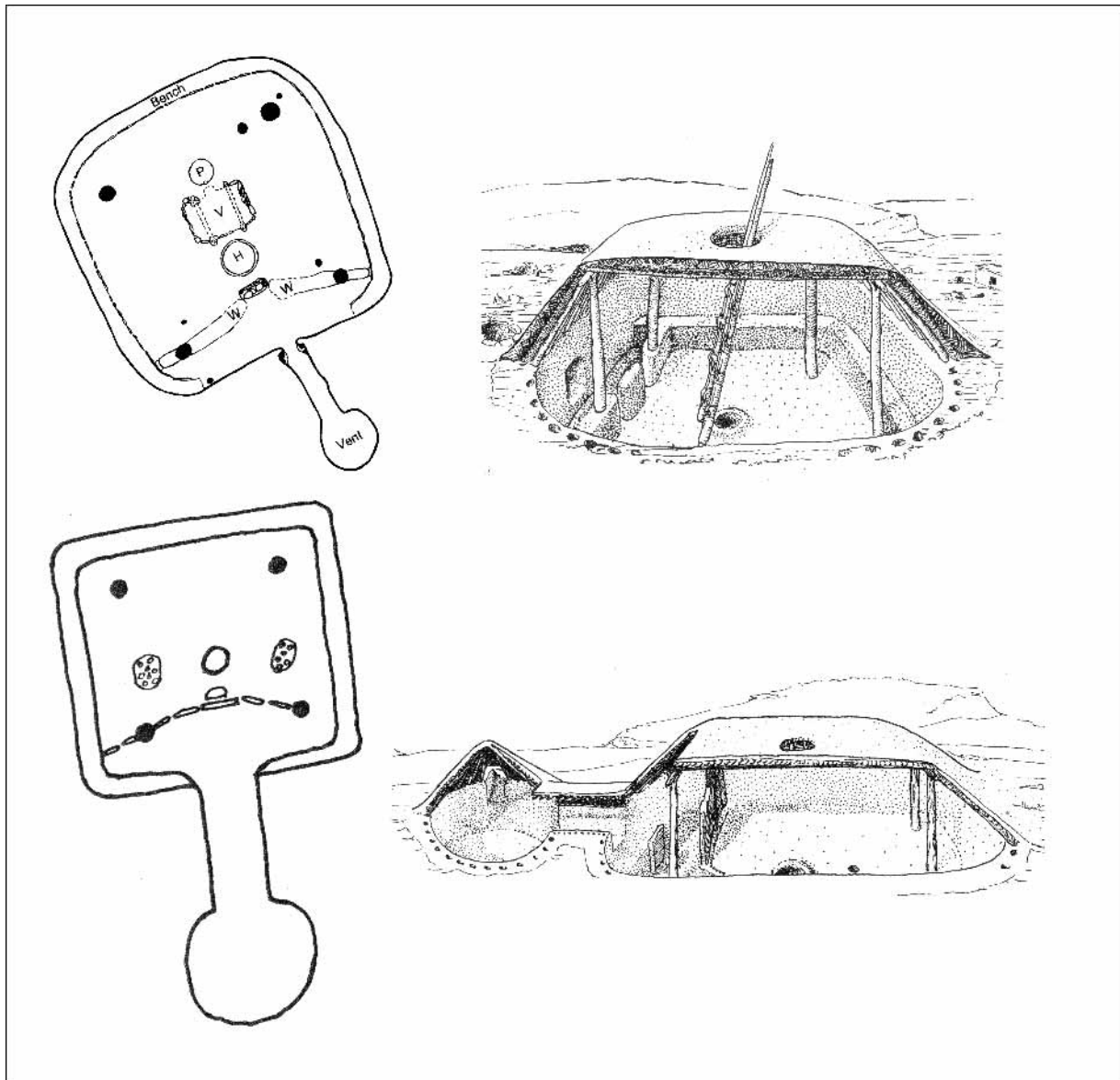


Figure 76. Basketmaker pithouses from La Plata area (above, Earl Morris 1939); from Chaco Canyon (below, Frank Roberts Jr. 1929).

cess of creating architectural settings occurred in the landscape, rather than on the actual site.

Summarizing the architecture mentioned in previous chapters, for hundreds of years prior to about 700 A.D. each Basketmaker family lived in its own pit house as illustrated in figure 76. Corn growing, hunting and gathering families and community groups are relatively settled, but would move because of drought or other ecological exigencies. While the relationship between sacred dwelling and larger symbolic landscape is ethnographically unknown in this period, some shaman mediated cosmos like the Warao or Navajo has been hypothesized.

Around 800 – 900 AD Anasazi families begin building small, more or less rectilinear above ground “pueblo” storage structures in an informal arc around the still circular pit houses, return to figure 54. This domestic example is adjacent to the highly formalized early great kiva of Grass Mesa (Brisbin 1988). Early archaeologists in the SW, influenced by extant historical pueblos, laid out their temporal classification system based in part on this change in domestic building form, i.e. “Basketmaker” to “Pueblo”. The ecological emphasis is on greater settlement permanence, increasing crop surplus along with population growth, and functionality of storage.

The first clusters of rectilinear storage rooms are not consciously laid out, cognitively imagined designs, compared again to the rich evidence of graphic skills as shown in figure 75 (now more in pottery rather than baskets and weavings), or in formally designed great kivas. As described in Chapter 5, during Pueblo I periods in Chaco Canyon larger clusters of room blocks emerged at three foci in the later part of 800 A.D.; new great kivas were built north of two of these. Yet, again, no other great kivas or formalized great houses are constructed in the canyon until the early 1000’s. How would architectural historians explain this incredibly abrupt formalization that occurs not only in the siting of these huge new monuments, but in the apparently symbolic orientations of massive “great walls”, often multiple variations in one structure? In the absence of understanding a preexisting ritual layout in the greater landscape and Chaco Canyon, one might conclude that some itinerant Central American priest/architect suddenly showed up and somehow persuaded half a dozen or so separate social entities (each comprised of multiple internal groups) to more or less contemporaneously spend enormous resources building structures the likes of which had never been seen before.

Architecturalization of the meridian: Pueblo Alto and Tsin Kletsin

One returns to the most obvious and widely accepted example of Ancestral Pueblo surveying at Chaco Canyon, i.e. the very short cardinal north-south relationship between Pueblo Alto on the north rim and Tsin Kletsin on south rim, their plaza centers some 3.730 km meters apart. The fact that the architectural forms on each end are within a degree of being perpendicular (cardinally west-east) to this mini-meridian is also not lost in this conventional wisdom. As accepted as these designed relationships are, there is limited research understanding of what the design means, aside from a broad symbolic reference to cardinal directions, *per se*, or of a generalized interest in dualism in SW societies. These quiet assumptions, however, carry no specific explanation why the buildings are actually located where they are in either the local or large scale landscape. Furthermore, this lack of linkage to location and even orientation meaning may have promoted a disinterest in finding equally formal design relationships that may locate and better explain architectural aspects of other new great houses and Casa Rincoñada as well.

If Ancestral Pueblo surveyor-priests had laid out the Pierre Site to channel power to the Curved Rock That Speaks meridian, the meaning of these two new structures on the north and south rim of the canyon could have been a symbolic re-creation, or homologue, of the Lizard Head – Haystack meridian, figure 77. The center of the Pueblo Alto plaza has a longitude of $107^{\circ} 57' 26.6''$, while the west fire hearth point taken from the Power's et. al. (1983) map is about $107^{\circ} 57' 23''$. The point presently being used for the center of the amphitheater wall of The Rock That Speaks is $107^{\circ} 57' 26.6''$, the same as Pueblo Alto (no actual survey point is known on the tangent point of the amphitheater wall, but the meridian line from Alto's plaza center visually works quite well). In this view, Pueblo Alto might have been the place where the original power of Lizard Head was made more ritually manifest before the final flow to the Curved Rock That Speaks. This may explain the unusual amount of ritual ceremony that occurred at Pueblo Alto (Windes 1987). The ultimate lack of a great kiva associated with this "entry" location into the canyon may be due to its conception as a kind of re-energizing conductor of power to the ultimate focus at the amphitheater. The Curved Rock That Speaks may have been the greatest of all Chacoan "kivas", and a smaller, (architectural) kiva on top could have been antithetical.

The north-south cardinal power function of Pueblo Alto may have had its complement in a west- east line that actually positioned Alto on its primary axis (from the Pierre Site). Not unlike the early founding of Chaco, and particularly 29SJ423, a symbolically similar “sunray” may have been surveyed from the Sipapu emergence point in the Grand Canyon, one of a number of probabilistically not random lines from this source. The precise 346.185 km line from the natural Sipapu point to the center of Pueblo Alto’s plaza misses the Chacoan outlier structure just below White House in Canyon De Chelly by about 65 meters (0.023°). If the survey had started at the Sipapu, running a line to Chaco’s north rim above the Curved Rock That Speaks, then the somewhat coincidental White House cave feature might have been discovered and the overall line subsequently adjusted slightly to the present Pueblo Alto location.

The miniaturization of a large scale ritual *axis mundi* like Lizard Head - Haystack represents another radical departure of new built form from centuries of modest architectural interests

and their subordination to the formalized landscape (the great houses at Lowry and Village of the Great Kivas, built about the same time, do not symbolize or expressively replicate significant natural features, though they clearly speak to the Ship Rock vertical). Does the eventual architectural form of Pueblo Alto actually represent Lizard Head, even though it may have been *just* funneling spiritual flow down to the central plaza? In this perspective, the line to the Sipapu might have been laid directly from a chosen Pueblo Alto point on the mini-meridian—the architecture, as it were, coming first. Surveyors then found a relatively unique feature in Can-

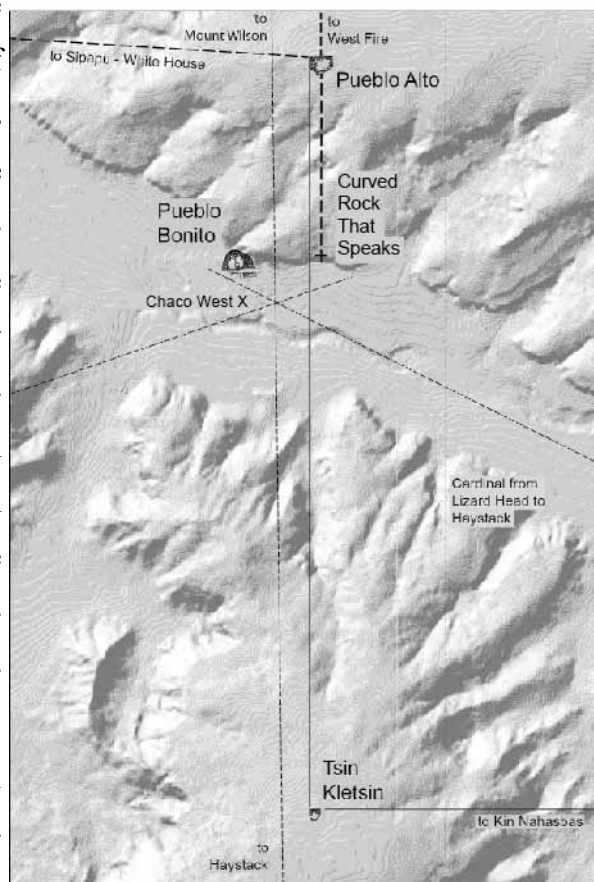
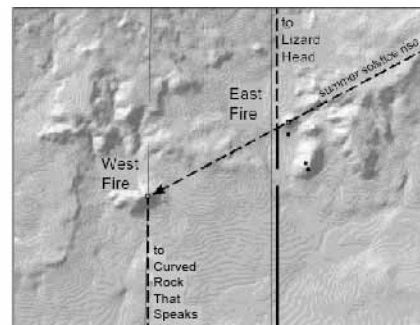


Figure 77. Determination of Pueblo Alto and Tsin Kletsin locations.

yon De Chelly coincidentally on this line to serve as a ritual connector to possible traditions of an ancient cross focus in shamanistic times.

The idea that Lizard Head's power stopped at Pueblo Alto and the Curved Rock That Speaks, may be evident in a closer look at how this great house actually aligns with Tsin Kletsin. The plaza centers do not align, alleviating perhaps any contradiction of the southbound power's ultimate destination. It stops at the amphitheater. Instead, a separate small scale canyon meridian was apparently designed to align the west walls of the two rim structures. Symbolically the 50 meters or so difference from Pueblo Alto's center line and its west wall could have been understood as adequately separating the two "mini-meridians", the one from Pierre's west fire hearth being the longer and most important. An angular variation of 50 meters at the distance between the two rim great houses is about 0.77° , compared to most surveyed lines of the major expansion being well under 0.075° .

Tsin Kletsin's position as "Haystack Mountain" on this west wall line could have been determined more locally by a cardinal west-east line from the earlier established Kin Nahasbas great kiva. This point, the reader will recall, possibly replaced Shabik'eschee as the eastern entity in relation to the early great kiva at Peñasco Blanco and Curved Rock That Speaks/Pueblo Bonito in the middle. The monolithic north wall of the Tsin Kletsin plaza, facing Pueblo Alto, is about 0.3 of one arc second (9 m) off an identical latitude. This accuracy would only come from using solar determinants of due west from Kin Nahasbas, not laying out a great circle perpendicular (which would deviate much more from a celestial west-east).

The author's theodolite measurement of great house wall orientations records the major west-east wall of Pueblo Alto being about 0.85° from true cardinal, and Tsin Kletsin's is almost identical at 0.83° , making both within one degree of being perpendicular to the north-south alignment between the two. Without significant further research into the layout accuracy of the architecture itself, compared to large scale landscape geometry, it is difficult to presently speculate whether these deviations from cardinal west-east might be intentional or just the product of a lessor working accuracy within the architectural medium of the time. As evaluated in more detailed drawings not presently illustrated, the NW corners of the two great houses in question seem to be designed as 90° . This reinforces the use of their west walls as the aligning features between north and south rims. The walls of Pueblo Alto's eventual east wing are not perpendicular, off 2.9 and 4.0 degrees, variations common in the new Chacoan great houses.

Hungo Pavi as “Keeper of Chaco East X”: symbolically understanding early great walls

Following the design analysis portions of this volume, by the time of the first monumental great walls (presumably in Chaco Canyon), the greater tripartite religious landscape had been surveyed for at least two to three hundred years. But the first great wall does not occur at any of the first stirrings of this build out, Peñasco Blanco, Pueblo Bonito (or the Curved Rock That Speaks), or Una Vida. It may have been built as part of an entirely new great house, Hungo Pavi, particularly in its relationships to the west walls being laid out at Pueblo Alto and Tsin Kletsin. While precise dating of the major Chaco structures is difficult (Lekson 2007), especially since most have not been thoroughly excavated and construction processes at each site occurred over long time periods often by different groups of people (Hudson 1972), it is possible that the best candidate for this major departure into potentially rhetorical and seemingly self-interested formal architecture may been at this site a little over three kilometers east of the canyon’s focus at the Curved Rock That Speaks. Four of the five new great houses (five including Tsin Kletsin) and Casa Rincoñada are clearly related to the canyon center of the Curved Rock That Speaks and close to Chaco West X, as is the remodeling of Pueblo Bonito. Both Una Vida and Peñasco Blanco are remodeled at the preexisting West and East sites at the extremes of the PI linear core. Only one of the new structures of the first decades of the 11th century deviates from these locational patterns, Hungo Pavi.

What was so important about this possibly first formalized great house’s location and religious purpose that lead to the creation of an entirely new design feature? It has been suggested that the establishment of Chaco East X had followed the discovery of the cardinal relationship between Lizard Head and Haystack Mountain. As a scaling down and perhaps somewhat political replacement for the original Kin Bineola X which helped found Chaco, Chaco East X now might have involved populations around Mesa Verde (the Mesa Verde High Point) to the north, and Hosta Butte to the south. The Kin Bineola eastern cross axial points of Chimney Rock and Mount Taylor also help position Chaco East X. Could this involvement, particularly with the Mesa Verde area that had early on first experimented with architectural form in both dwelling and perhaps great kivas, have helped precipitate the new great house expression in its framework context?

As drawn in figure 78, Hungo Pavi great house sits cardinally quite precisely east of the intersection point of Chaco East X. The location of the great house 1,065 meters away may

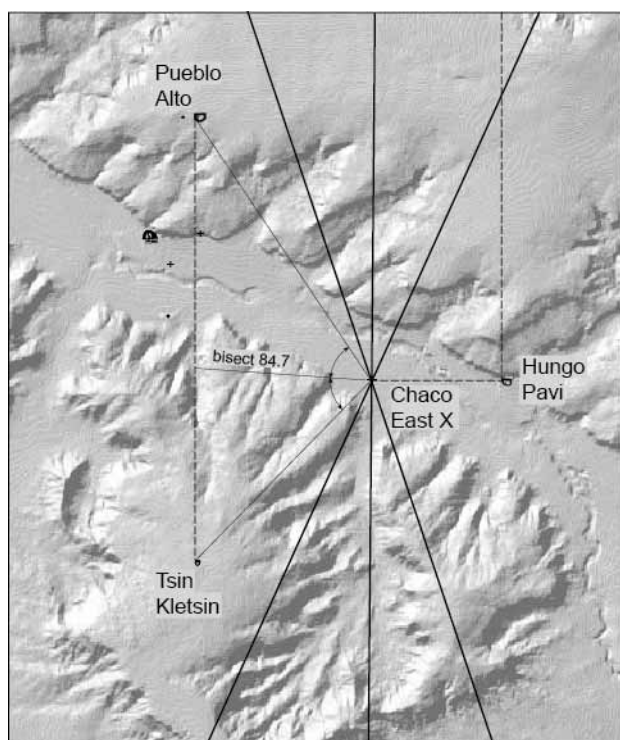
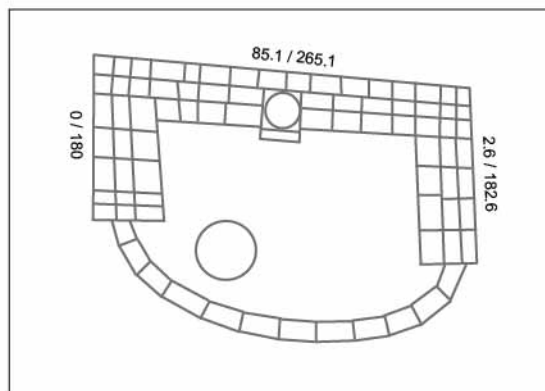


Figure 78. Positioning of Hungo Pavi due east of Chaco East X, perpendicular west wall; north wall orientation as homologue to bisect of angle to Pueblo Alto - Tsin Kletsin meridian.



have followed the pattern of nesting great houses against the canyon's north wall, as occurs at the Curved Rock That Speaks, Pueblo Bonito, and Una Vida. Like the Kin Bineola site, there is no known archaeological feature associated with the Chaco East X point, though no remote sensing has been conducted. In terms of accuracy, the intersection area is about about 150 m across, determined by the amount of angular deviation perhaps typical for Ancestral Pueblo surveying, roughly within about 0.06° deviation (visual acuity again is 0.017°). The latitude of Chaco East X was set identical to that of the central small kiva embedded in the major west-east roomblock of Hungo Pavi, a kind of reverse test of the relationship between the two. As the reader has seen, and will continue to see, the Chaco East X point used is very accurate in its participation in multiple large scale patterns.

At first look, the most obviously designed elements of Hungo Pavi are the long, precise straight walls, and formal manner in which the two end wings, together with the longitudinal or longest room block form an "E" shape (front walls to enclose these courtyards came later). The triadic E form recognizes a seemingly central feature in the main block like the small integrated kiva at Hungo Pavi. Some great houses, however, have no central feature, especially in early stages of their construction (Lekson 1984). Though Lekson would perhaps hesitate to point to any specific sequence of features, it is possible that the main longitudinal block of rooms at

Hungo Pavi may have been one of the first departures, somewhere between 945 AD and 1020 AD, from the undisciplined arcs of the first three great houses. Lekson suggests that its wing walls might have been built in the later part of the sequence (2007: 32-36). Of first importance, therefore, might have been the meaning of the ninety-five meter straight back wall of the first room block.

In spite of not being seen from the front or great kiva side of the emerging ceremonial site, was the two or three story wall primarily a rhetorical, monumental expression of status? While the three largest central Chacoan structures could have been linked with West, Middle and East ritual groups from the large scale ritual landscape, could other ritual groups have had authority over other foci of the landscape framework? Did potential or actual competitive political dimensions exist between these groups, resulting in desires to build bigger and more prestigious great houses? Does this explain one of the most remarkable aspects of Chaco, i.e. that many of the hundreds of great house rooms were apparently never used?

While the competitive notion makes sense from a simple, almost contemporary rhetorical perspective, it really doesn't explain why Hungo Pavi designers would have made the first step of building a formalized straight wall rather than just creating a bigger arc cluster of rooms. Furthermore, if the location of the structure had in fact been determined by *intension* in relation to the religiously vital cross intersection point, after considerable allied efforts of priest surveyors from distant areas, what would the building of a great wall mean in this context? Given the possibility that Ancestral Pueblo landscape frameworks consist of symbols defined as precisely oriented straight lines, why wouldn't great walls do likewise? The question follows as to what might have been symbolically intended? Two possibilities have been previously explored in the literature, limited as it is. Both the author and a NOAA team lead by the artist/ archaeoastronomer Anna Sofaer (coincidentally about the same time in the early 1980's) took theodolite sun shot readings of the orientations of Chacoan great walls. Hungo Pavi's great wall azimuth was calculated as 85° 6' (Doxtater) and 85° 14' (Sofaer 1997) west of north.

While both researchers sought to understand some symbolic meaning of these orientations, their hypotheses differ. The present author (1991), for his part, suggested that the walls and their orientations primarily expressed alliances, possibly pointing to other great house sites in or around the canyon. Sofaer, working with astronomers, saw the walls as connecting primarily to rise and setting points of the sun and moon (1997). Her hypothesis followed earlier

work discovering remarkable astronomical interpretations of the “Sun Dagger”, a placement of rock slabs on Chaco Canyon’s Fajada Butte that cast light patterns on a carved spiral form to mark solar and lunar cycles (Sofaer, et. al. 1982).

While some of Sofaer et.al.’s great wall azimuth data seemed to also be pointing to the sun and moon, as popularized in the film *Mystery of Chaco Canyon* (Sofaer 1999), others seem less convincing. These interpretations (like those of the author) were largely inconclusive because of the lack of tests against random phenomena. Her team’s measured front wall azimuth of the formalized Pueblo Bonito, for example, is less than one degree from being cardinal east-west, in a supposed equinox expression. Hungo Pavi, for its part, at almost a full five degrees off cardinal is also included as an equinox or cardinal expression (Sofaer 1997). No evaluation is published at either great house as to how sight lines and the “mask” (the way in which topography alters the azimuth of an equinox sunrise for example) relate to building locations.

A much more precise interpretation of the orientation of Hungo Pavi’s monumental north wall relates to the cross intersection point cardinal west of the great house. Hypothetically, one of the goals of Chacoan ritual elaboration in the late tenth and early eleventh century, again, was to integrate Chaco East X with meridian power. And the most perceptually powerful new *axis mundi* symbolism in the new scheme might well have been the replication of Lizard Head – Haystack as a scaled down axis between the west walls of Pueblo Alto and Tsin Kletzin on opposite sides of the canyon rims. Thus it could have been that these two rim points were laid integral to conceptualizing the new “keeper” of the Chaco East X point. So how might have integration between the two taken place? Hungo Pavi’s oddly off “cardinal” orientation accurately mimics the bisect of the angle from Chaco East X to the two great houses on the rims. Hungo Pavi’s measured azimuth is again $85^{\circ} 06'$. The calculated bisect from Chaco East X to the west wing wall points of Pueblo Alto and Tsin Kletzin is $84^{\circ} 54'$, off about twelve arc minutes. The technical process of accurately transferring the bisect azimuth from Chaco East X to the Hungo Pavi great wall a kilometer away could have used lengths of cords to capture the angle, but accuracy would depend upon the ability to relate the measured angle to a constant north direction.

Thus the orientation of one of the first monumental “great walls” may have been used to symbolically express an integration of the new Chaco East X, for all of its religious landscape and socio-political meaning, to the new Lizard Head – Haystack ritual structures at the canyon

center. This meaning of Hungo Pavi's north wall is given serious reinforcement in its relationship to the great house's west wall that faces Chaco East X. This appears to be the most accurately north-south oriented exterior great house wall in the canyon (Pueblo Bonito's divides its plan). Thus Hungo Pavi's north wall points directly to an accurate meridian--its west wall-- as it creates the great house's NW corner, perhaps more fully expressing Chaco East X's bisect to the also west wall meridian between Pueblo Alto and Tsin Kletsin. This form of homologue has been illustrated before in the way that Kin Bineola X may have been symbolically expressed in the orientations of Pueblo Pintado's north wall and the building's bisect of the angle between monumental north and west walls.

Pueblo del Arroyo and Chetro Ketl: terminating the axes of West Chaco X

Compared to Chaco East X and Hungo Pavi, as a design pattern the Chaco West X point has greater involvement in the center, lying as it does close to the Curved Rock That Speaks and Pueblo Bonito. The creation of the east X possibly followed long held beliefs about coincidence between meridians and cross axes and may have been largely separate surveying experiences from the creation of the west X point as a reorientation of Chaco's early ritual triangle (also strongly involving Kin Bineola and its adjacent cross X point). Some resolution and even integration of the two points may have been expressed in the location and wall orientations of Pueblo del Arroyo and Chetro Ketl. The reader will see a similar pattern of an X point and "keeper" paired up at some distance with large West and East great houses at the later complex of Aztec.

First, the two hypothesized axes through Chaco West X appear to have been used to locate the two completely new great houses in the canyon at its center. As seen in the figure 79, the precise lines run to the central, enclosed small kivas of the major wall roomblocks, possible founding points for the structures. This is clearest in the case of Pueblo del Arroyo where the line runs quite accurately to the small center kiva between the west and east wall. Even at Chetro Ketl, the axis from Tohatchi and Kin Bineola X is quite accurately aligned with the three small kivas in the center of the middle or "E" part of the principal room block.

The distances from each of the points shown in figure 79 to the Chaco West X point are almost exactly the same, 556 and 558 meters. It may be that Chetro Ketl's location on its axis, and distance to the X point, was determined first. Before any of its monumental walls were

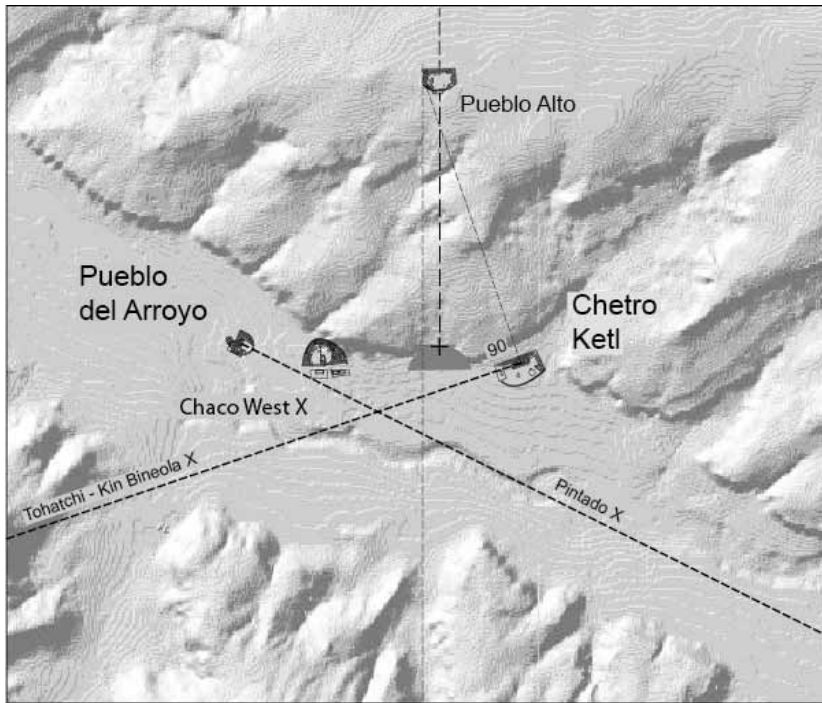
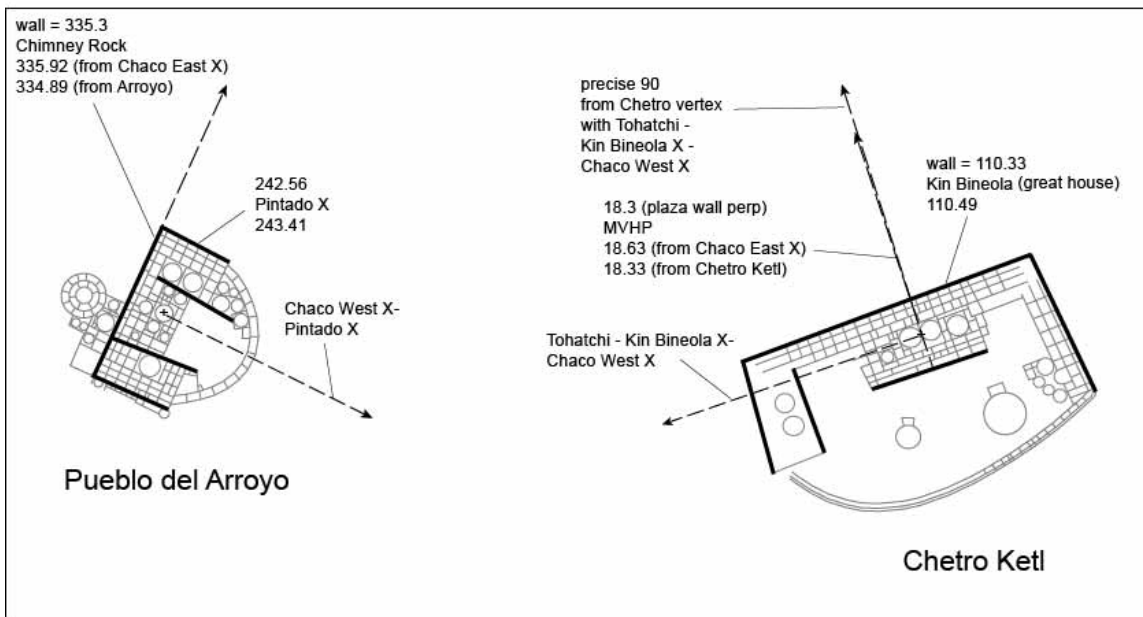


Figure 79. Positioning and wall orientation symbolism of Pueblo del Arroyo and Chetro Ketl with respect to Chaco West X and Chaco East X.



laid out, an approximately perpendicular line from the west wall point on Pueblo Alto (same latitude as center of New Alto and point used in Hungo Pavi's bisect expression) might have been laid out down to intersect with the Tohatchi – Kin Bineola X axis. Adjusting the 90° angle between this axis and Alto's previously positioned west wall point could have determined Chetro Ketl's initial layout point. This location also follows the Bonito and Hungo Pavi pat-

tern of being up against the canyon's north wall. Pueblo del Arroyo, however, for obvious reasons of geometric religious symmetry, could have been located by measuring the same Chetro Ketl – West Chaco X distance on its axis from Pueblo Pintado X. The site relationship of terminating an axis, rather than “keeping” it as with Hungo Pavi, must have had carried somewhat different implications of ritual power. Great houses at both “560” and Pueblo Pintado also appear to terminate large scale axes.

In addition to the apparent power of the site itself terminating an axis, the monumental wall orientations of Pueblo del Arroyo and Chetro Ketl may have been used symbolically to do other religious work, revealing a considerable complexity to these “buildings”. Chetro Ketl's huge north wall at 110.33° in the SW quadrant very accurately points not to the Kin Bineola X point on which, together with Tohatchi, the great house may have been founded, but to the Kin Bineola great house which in short order becomes as large as the ultimate size of Alto, del Arroyo, and Una Vida. The azimuth from the Chetro foundation point to the great kiva immediately adjacent to the great house at Kin Bineola is $110^\circ 44' 42.9''$ (about 110.74°). This relationship between Chetro Ketl (its major wall orientation) and Kin Bineola great house has also been noted by Sofaer and will be discussed in more detail below. Also elaborated is the fact that there is no geological or engineering explanation for the wide variation of wall orientations, and general lack of design interest in 90° angles where they meet. Thus given the likelihood of symbolic meaning, what is the best explanation in the present context for the other major wall orientations at Chetro Ketl and Pueblo del Arroyo?

Again, Chetro Ketl's north wall is quite accurate to the Kin Bineola great house, about 18.010 km away. Because of this orientation perhaps, Chetro Ketl's wall is not accurately (about two degrees off) perpendicular to the originating line to Pueblo Alto's west wall point. Thus one might evaluate the orientation of the interior south wall of the central room block seen prominently from within the eventual plaza. Curiously, as formally related to the massive back wall as a contemporary designer might think logical, it is off two degrees. These builders of such precise linear walls would certainly have had the ability to run these two walls accurately parallel, had they been so inclined. At 108.3° , the interior plaza wall could be pointing instead to Kin Bineola X ($108^\circ 54' 31.3''$ or 108.91°) which again lies some 600 meters NW of the great house. Yet if this were the design intent, the orientations of Chetro Ketl's walls are in an illogical reversed posture compared to these two Kin Bineola points.

Alternatively, the perpendicular to Chetro's plaza wall, 18.3° , when extended northward, has a very close affinity to the azimuth from Chetro to the Mesa Verde High Point, 18.33° , the natural feature terminus of the NW-SE axis of Chaco East X (this line actually terminates quite accurately farther north at the small outlier structure of Escalante in the Moctezuma valley—no great kiva). Thus is it possible that Chetro Ketl, in addition to bringing in power from Ganado and Tohachi, used its interior wall to pick an axial component of East Chaco X? This would amount to a fusion of sorts of the two Chaco X's at the center. Chetro Ketl has at least three other wall features whose orientations remain to be interpreted.

Pueblo del Arroyo's big wall orients at an azimuth of 335.3° , which again is not perpendicular to its founding axis to Chaco West X and Pueblo Pintado X (about 333.7°), not unlike Chetro Ketl about two degrees off in this regard. Reflecting on what Chetro Ketl's plaza wall may have been doing, the azimuth to Chimney Rock, the NE natural feature of Chaco East X, is $334^\circ 54' 00''$ or 334.9° . While accuracies of wall orientations will be discussed in more detail in the concluding exercise of this chapter, a variation of 0.40° between measured wall orientation and azimuth is relatively accurate. Del Arroyo has an additional four possibly symbolic wing walls, none of which are perpendicular to its major back wall.

The ritual importance of uniting the two new Chaco X points at the centralizing focus around the Curved Rock That Speaks will have its analogue in the later layout of Aztec. At Chaco, if wall orientations of the new Chetro Ketl and Pueblo del Arroyo can someday be recognized as having been symbolically associated with the two northern features of the Chaco East X, then one would begin to sense a certain power asymmetry between the West and East entities at the canyon center. Compare the linkage of the larger structure of Chetro Ketl (East) with that of Pueblo del Arroyo (West). The East group of sodalities and ritual associations is connected to the large Kin Bineola great house and X, Tohatchi on the Middle axis, Ganado, Humphrey's Peak, and even the Sipapu; additionally it might also pick up associations with Mount Taylor and the rich region around Mesa Verde. Arroyo, for its part as West, counts only the Pueblo Pintado X communities of "560" and Pueblo Pintado great house, together with the axial associations with Chimney Rock and Hosta Butte.

Meanings of Peñasco Blanco and Una Vida additions

Should this asymmetry discussion also be extended to the extensive additions to early West and

East great houses in the canyon, Pueblo Peñasco and Una Vida? While Chetro Ketl has a larger plan layout than Pueblo del Arroyo, the western entity of Peñasco Blanco becomes larger than the early eastern great house of Una Vida. Did ritual groups using these two early great houses associate logically with the new West and East architecture at the center? If so, then how would Peñasco Blanco's position on the original Mount Wilson meridian, and its long term relationship with 29SJ423 add to the importance of Pueblo del Arroyo and the West? It is interesting perhaps that there is no formalization, or building of monumental, symbolically orientated walls among the large additions at Peñasco Blanco. Is it because its site location on the Wilson meridian and link to 29SJ423 is so strong that no new associations could be added?

Una Vida, on the other hand, as an East entity moved hypothetically from Shabik'eschee in the late PI, perhaps had much less to contribute to the East group in the center at Chetro Ketl, save for its alignment relationship with the Curved Rock That Speaks and Peñasco Blanco. Peñasco Blanco's position on the westernmost of the now two large scale canyon meridians, Lizard Head – Haystack as most recently added, may have stimulated a design search for additional and related meaning at Peñasco Blanco's traditional “bipolar” partner Una Vida.

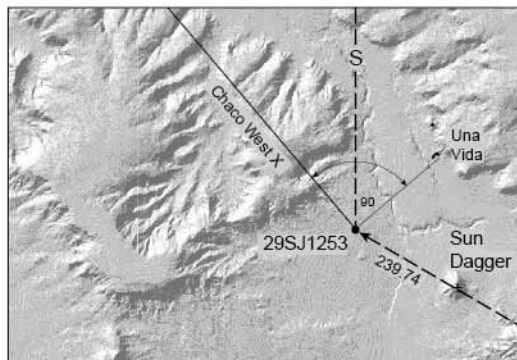
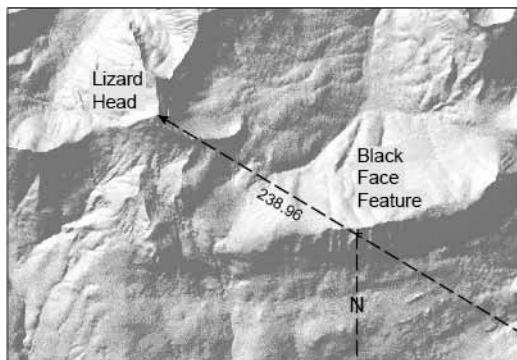


Figure 80. Relation of Black Face meridian to 29SJ1253 great kiva, the Fajada Butte Sun Dagger, and remodeled Una Vida.

While a meridian line from the third Wilson Group feature of Black Face might have been prolonged south prior to the formalization of Una Vida in the 11th century, it may, nonetheless, have been the primary symbolism behind its major monumental wall at this later time.

Evidence of a Black Face feature meridian lies, as the reader will see, not only in the layout of a formalized Una Vida, but in the location of the isolated (no associated great house or room blocks) great kiva 29SJ1253 shown in figure 80. The bearing from this great kiva to the Black Face feature is $359^{\circ} 58' 44.1''$ or a meridian deviation of 0.021° . Priests doing this survey, as noted previously, may also have observed the coincidental alignment of the front or south facing point of Liz-

ard Head, the Black Face feature, and the winter solstice sunrise at this latitude, about 121.04° in the SE quadrant. Down in the canyon 's south entrance, a point on the meridian might have been chosen to emulate—another pattern transfer from one site to another—the winter solstice sunrise angle to the most prominent natural feature of Chaco Canyon, Fajada Butte. It is not just the butte itself but the remarkable ritual timing feature of the Sun Dagger that replicates the Lizard Head – Black Face feature angle. The azimuth from 29SJ1253 to the Sun Dagger (Sofaer et. al. 1982) device near the top of Fajada Butte is 120.26° . In this scenario the winter solstice sunrise line from a point on the Black Face meridian might have been struck to a point near the summit of Fajada Butte; here the Sun Dagger feature was created. Not unrelated to the possible summer solstice “shunt” symbolism at the Pierre Site, at winter solstice power flowed from Lizard Head to Black Face, down to the canyon and 29SJ1253 and over to Fajada Butte. Symbolically, Fajada Butte could have been the natural southern terminal feature of the third meridian, along with McCarty’s Flow and Haystack Mountain. Because of Mount Wilson’s association with Abajo Peak, its ritual time would have been equinox. Did the three different ritual times play into the power relationships between West, Middle and East entities in the canyon?

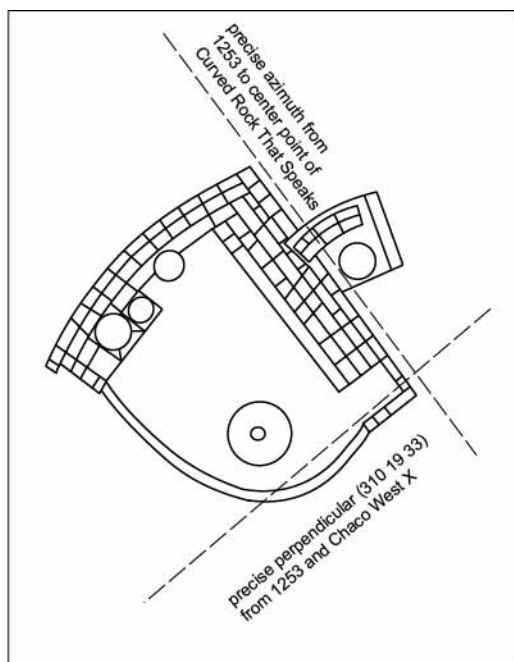


Figure 81. Formalized plan of Una Vida and possible orientation symbolism of major wall.

Una Vidas formalized architecture essentially keeps the PI arc of the earliest roomblock, but creates a larger expressly linear block running NW-SE, figure 81. The orientation of this outside monumental wall is measured as 35.43° looking to the NW quadrant and the center of the canyon. Curiously, the long plaza facing wall is not quite parallel to the back wall and the two most interior walls seem to be a very subtle bisect of the two outside walls (at least as determined by measuring published great house plans). The orientations of the linear room block walls, all of which are less than a degree off 35.43° , do not readily align with any major point at the canyon center, nor a feature out the southeast landscape.

If Una Vida’s formalized ritual role had been involved in the establishment of the Black Face meridi-

an and the 29SJ1253 great kiva, just across the canyon, then one might look for a homologue of this relationship in the great house's new straight walls. Not unlike the pattern transfer between VGK and Lowry, Pueblo Pintado, Pueblo Alto – Tsin Kletsin and Hungo Pavi, one examines the large-scale alignment components at 29SJ1253, seeking their expression in the revised Una Vida design. The azimuth from 29SJ1253 to the center point on the amphitheater wall of the Curved Rock That Speaks is $36^{\circ} 33' 24.9''$. While this orientation is less than one degree off the measurement of Una Vida's back wall, it appears to be most identical with the two interior most walls of the formal roomblock. Coincidentally, though off about three degrees, the two locations of 29SJ1253 and Una Vida (both located independently of each other) form a rough perpendicular to 29SJ1253's azimuth to the Curved Rock That Speaks.

Formal integration of Casa Rincoñada, New Alto and Pueblo Bonito

Pueblo Alto, the natural form of the Curved Rock That Speaks, Tsin Kletzin, Pueblo Bonito's formalization, Casa Rincoñada and New Alto are all cardinally oriented, creating a possible Middle complex perhaps ritually distinct from the functions of Pueblo del Arroyo (West) and Chetro Ketl (East). Symbolically, the location of Casa Rincoñada and lack of associated great house or room block across the wash from the emerging greatest of great houses seems more religiously and perhaps politically vital to the final landscape/architecture scheme focusing on the canyon center.

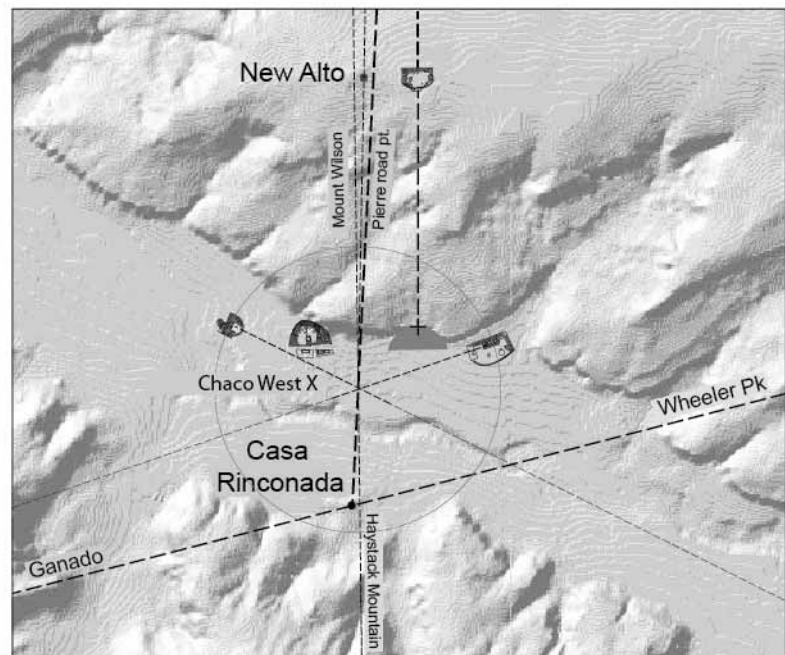
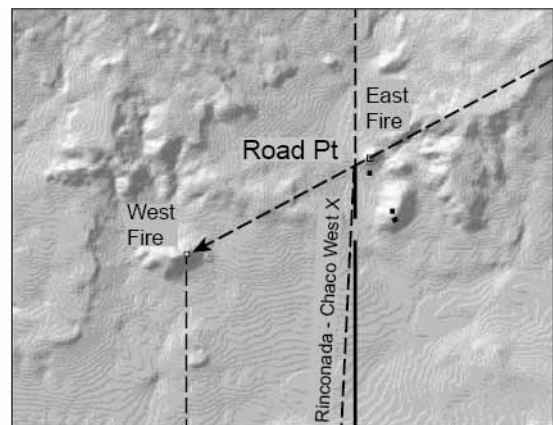
In longitude, the new largest of canyon kivas sits between the already probably long lived Curved Rock That Speaks/Pueblo Bonito pair, an initial apparent mediation between the two Middle religious sites. While the amphitheater and its great house may have ritually functioned for close to two hundred years or so by this time, the new infusion of the Lizard Head - Haystack meridian, and its homologue of Pueblo Alto and Tsin Kletsin might have set up a certain imbalance, or perhaps potential dominance of the canyon Middle pair. Did Pueblo Bonito's role need clarification? How did the formalization of this ultimately greatest piece of architecture relate to its still totally natural complement, the large ritual plaza with its new Lizard Head connections? How did the architecturalized component of the Curved Rock That Speaks, i.e. Pueblo Alto, play off against or with the huge project of turning Pueblo Bonito into the biggest monument of all? From the perspective of pilgrims using the the canyon

floor, the two new great houses and major formalization of the third may have begun to overwhelm the natural amphitheater—just as it does today in the way Chaco’s (west) focus is interpreted to visitors.

Some solution to this possible conundrum may involve the fact that pilgrims participated in extensive ceremony, including feasting at Pueblo Alto that may have linked to ritual sequels actually down in the amphitheater plaza. It is not clear of course from which direction these people came from, only perhaps that a visit to Pueblo Alto might have been important to initiate some ultimate experience in the canyon. It also not unlikely that the primary Chaco pilgrimage ritual expressed a kind of “union” of spirits from distant natural places with humans, as described in cultures elsewhere by Bordieu (1977), perhaps together with an opposite yearly ceremony focused on distant community or dwelling sites as “occupation” (see Doxtater 1984). The channeled power from the two fire hearths at the Pierre Site, flowing down to Pueblo Alto might have been primarily an initiating experience for this fusion between spirits and humans.

The location of Casa Rinconada suggests a second complementary route--whether for spirits or pilgrims--coming into the canyon from the Pierre Site. In this case the construction of the circular form of the great kiva could have expressed a more specific terminus where most powerful spirits and humans come into contact--the tra-

Figure 82. Laying out Casa Rinconada by prolonging Pierre road point through Chaco West X; position of New Alto with respect to Mount Wilson and Pierre road point lines.



ditional experience in Historical Pueblo ceremonial kivas. The logic of a second alignment “path” into the canyon, also related to the entry architecture of the north rim, will be discussed further in regard to the Great North Road in the following chapter. However conceptualized, the design evidence of a separate survey line to position Casa Rincoñada, particularly after the next chapter, should be convincing.

Returning to the layout map of components at the Pierre Site, the most powerful point might likely have been where the north-south cardinal section of road, on the Lizard Head – Haystack Mountain meridian, is most east-west cardinally perpendicular to “El Faro” or the east fire hearth. Prolonging a line from this point down precisely through the mathematical point of Chaco West X, one discovers that it slices through Casa Rincoñada less than a meter from its center point. Thus the possibility appears of conceptualized direct line, overly accurate as it is, from the Pierre Site into the canyon that runs to the immediate west of Pueblo Alto to the new ultimate great kiva.

What stopped this prolongation from Pierre? Was Rincoñada’s location on the line determined by the modest rise above the canyon floor affording a view and perhaps associated expression of height and importance in comparison to the great houses on the ground plane across the wash? Or was this an occasion to more formally relate the new Chaco center with the older Ganado focus on the western side of the plateau. While such a construct, like other alignments, might well be random, mathematically the line from the Ganado point to the highest mountain in the east, Wheeler Peak, has a fairly accurate deviation of about 0.027° from Casa Rincoñada. Of all the formalized points in Chaco Canyon this alignment with two possibly very powerful distant points, west and east, works best with the “master” great kiva at the heart of the center. If designed, some coincidence would have been necessary, given the limited distance in the canyon the great kiva could have been located south of Chaco West X. The survey could have involved a trial and error prolongation from Ganado through the Chaco center, but from a design perspective doing seems to be an illogical duplication of the way the Tohatchi (and closely associated Ganado) line through Kin Bineola X might have been used to reorient the early Chaco triangle with Chaco West X as its new apex.

Casa Rincoñada’s location was apparently not created as a bisecting point between the Chaco West X – Pierre Road Pt. line and the new south entrance of Pueblo Bonito to the west and the center point of the Curved Rock That Speaks to the east; this is over a full degree from

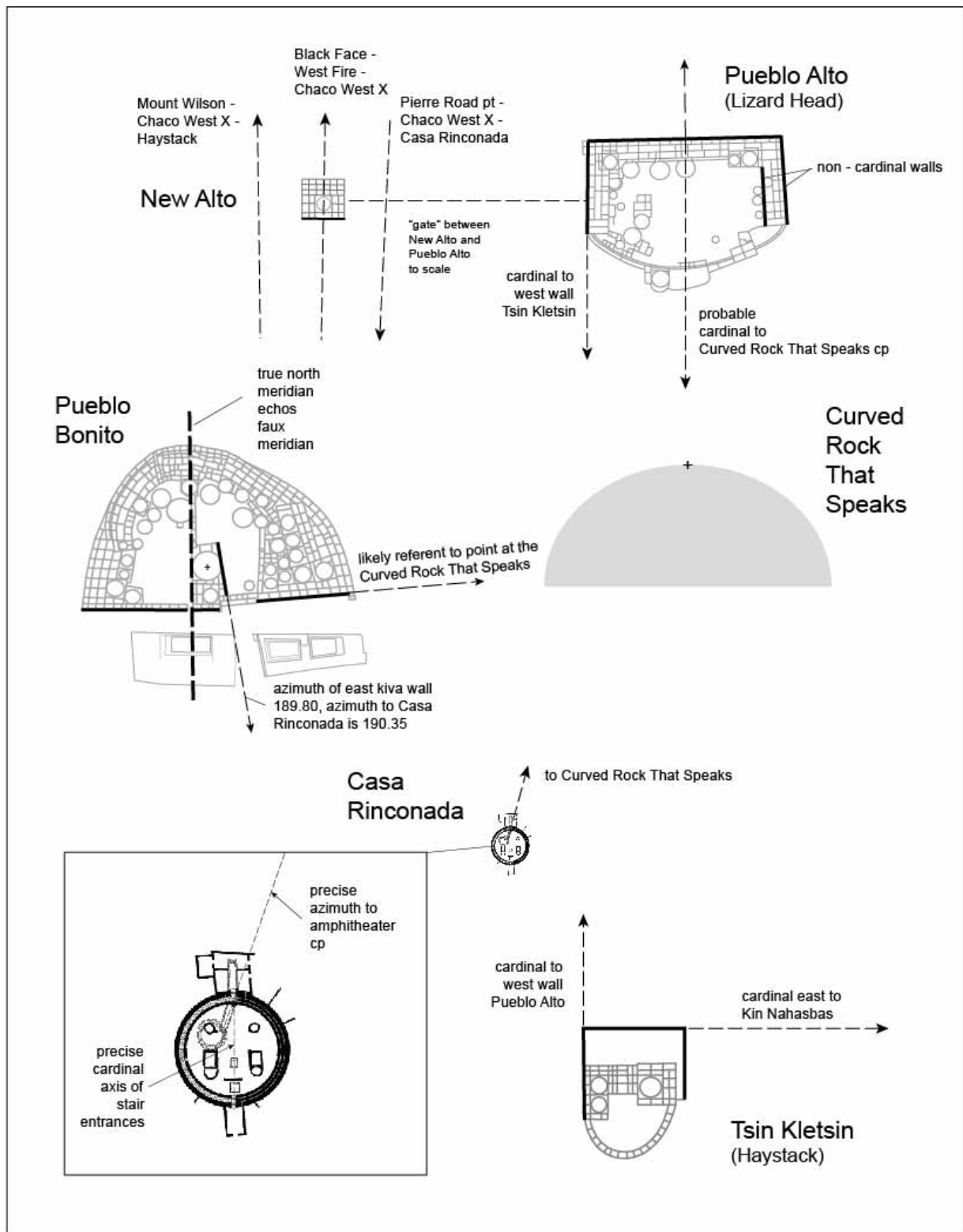


Figure 83. Cardinally oriented or "Middle" structures.

being precise even though perceptually from Rincoñada's position, it has a relatively equal relationship to Bonito and the amphitheater with respect to the Chaco West X - Pierre Road Pt.axis.

While Casa Rincoñada was built in the last half of the 11th century (Vivian & Reiter 1960), New Alto, the small formal block built adjacent to Pueblo Alto shown in figure 83, has been dated as 1110-1140 (Chaco Archives). Yet there is much in this very symmetrical feature that speaks not only to an integration with somewhat earlier large scale landscape layout, but also specifically to the possible second "sunray" from the Pierre Site to Chaco West X and Casa Rincoñada. Sometimes lumped together with other small late (less than) great houses, i.e. Casa Chiquita or Kin Kletso, New Alto as well has been referred to as a kind of annex to its adjacent large great house, Pueblo Alto. Particularly in New Alto's case, this assumption really doesn't follow design logic from either a planning or architectural sense.

Why would a great house like Pueblo Alto, with ample space in its linear room blocks to accommodate a relatively small number of additional rooms, build an "annex" 216 meters from the main structure? In terms of task-performance efficiency of moving items back and forth, storage capacity, or being within in the range of voice communication, this doesn't make sense. Thus one returns to symbolism and ritual function. Given the possible vertical meaning of Pueblo Alto in regard to both its central axis to the Curved Rock That Speaks and its role in organizing the homologue of Lizard Head – Haystack Mountain, could New Alto have had a related *axis mundi* meaning? The center kiva of the small formal structure has a longitude of 107° 57' 35.2", errors of reading GPS devices or Google Earth notwithstanding. A vertical relationship of New Alto with Casa Rincoñada has been mentioned in Sofaer (1997), but no precise professionally surveyed data is provided. Using readily available GPS locations, Casa Rincoñada's center point longitude is quite close at 107° 57' 36.9". But the hypothetical Chaco West X, 107° 57' 36.0" is a bit closer to that of New Alto, off 0.8" rather than 1.7". These figures, however, must be taken as only very provisional at the much smaller scales at the canyon center, given the potential for ready reference GPS points to be off 3-4 meters. At a distance of 1.199 km apart, a 0.8" deviation is about 24 meters or 1.14°, not at all accurate compared to larger scale layouts or even some within the canyon, e.g. most using Chaco West X. Given that the New Alto structure is only about 20 meters wide in the east-west dimension there is an obvious need to measure these relationships more precisely. It is this author's opinion that if the

Chacoan priests intended to align New Alto north-south to either Chaco West X or Casa Rincoñada, they could have done it much closer than 24 meters. At the present, however, the best indication of vertical alignment is to Chaco West X, not Casa Rincoñada. This makes sense in that the line that locates Casa Rincoñada might have been the slight diagonal up to the El Faro road point at the Pierre Site, a construct that appears to contribute dramatically to the great north road layout (contemporaneous perhaps with New Alto).

Apart from New Alto's possible meridian relationship to Chaco West X, its position also, and perhaps more importantly expresses the two most important northerly seeking lines of this seemingly all important survey point at the canyon center (West X). The reader will recall how the slight diagonal from Haystack Mountain up to Mount Wilson could have been the initial line on which Chaco West X was eventually located (with Tohatchi – Kin Bineola X). With the addition of the Pierre Road Pt. - Chaco West X - Casa Rincoñada line, we now have two slight diagonals running within 20-30 meters on each side of New Alto, again figure 83. This could have created a symbolic balance related to the symmetrical New Alto architecture and enclosed small kiva. It could have been almost a replication of the relation of Haystack to the three Wilson Group natural features, one ray to Mount Wilson, a vertical element (New Alto's parallel to Pueblo Alto and the Lizard meridian), and a line to the easternmost of the three northern mountain features. Yet, as thus far laid out, the eastern axis does not yet run to the Black Face feature, but only to the Pierre Road Point.

In terms of latitude, New Alto lies quite accurately (again present measurement limitations notwithstanding) due west of the point on Pueblo Alto's west wall used for the hypothetical bisect layout from Chaco East X, as replicated in Hungo Pavi's major wall. Thus there might have been a designed 90° relationship of the New Alto – Pueblo Alto axis to the Lizard Head – Haystack Mountain homologue down to Tsin Kletsin. Just how precisely the building orientation of New Alto works geometrically with this relationship to Pueblo Alto remains to be seen. The small structure has a generally accepted cardinal orientation, as recorded in archaeological drawings. Neither Sofaer's group, nor the author, recorded sunshot measurements of New Alto while up on the north rim documenting Pueblo Alto's close to east-west orientation (88.9° by author).

While New Alto might have replicated aspects of the founding role of Haystack Mountain in the Lizard Head inspired layout that precipitated the new Chaco frame, the small formal

structure on the north rim, though, does not originate the three lines up to the Wilson Group. This logically would have been the symbolic role of Chaco West X, perhaps as closely associated with Casa Rincoñada. At this scaled down version of the landscape master layout, New Alto might have expressed the way the new Chaco center effectively mediates these ritual lines as they pass through the canyon on their way north.

Finally, in terms of building location and “great” wall orientation, although Pueblo Bonito’s original position is maintained in extensive formalization, what can one say about its new massive wall features? Most obvious are the two very cardinal constructions, the north-south middle element that cleanly divides the huge structure in two, and the west-east front of the western half of the arc, again figure 83. Given the good possibility that Pueblo Bonito had long been ritually linked with the major ritual that took place at the Curved Rock That Speaks, it makes symbolic sense to interpret its new interior *axis mundi*, not so much as a sign of equinox timing as Sofaer (1997) suggests (there are no known related observation features), but as a clear homologue for the vertical axis that runs from the west fire hearth at the Pierre Site down through Pueblo Alto to the amphitheater plaza. Thus the essence of Pueblo Bonito’s internal meridian could have been Lizard Head as ultimate spiritual source for the Middle role of its ritual participants.

What then was symbolically perpendicular to the Lizard Head meridian, a possible reason for the front west wall? Could this have expressed the western line to the Sipapu, and the aligned White House in Canyon de Chelly that positioned Pueblo Alto on its faux Lizard Head axis? Bonito’s front eastern wall angles slightly to the NE toward the Curved Rock That Speaks plaza. Was this an auditory point in the amphitheater where ritual participants communicated with the spirits? Pueblo Bonito’s eastern “half” is larger, and along with the construction of the main great kiva on this side of the internal meridian wall suggest a greater importance to things to its east, i.e. its pairing up with the Curved Rock That Speaks.

Pueblo Bonito’s fourth wall feature, on the east side of its central great kiva, appears to link this possibly biased eastern ritual function to Casa Rincoñada across the wash. This relationship, evidenced not only by the wall’s accurate orientation (189.8 wall and 190.35 azimuth to Rincoñada) but the cut between the mound features south of Pueblo Bonito has been commented on by others (Stein et. al. 1997). While Casa Rincoñada’s principal axis is accurately north south, replicating good cardinals in both Pueblo Bonito and west fire hearth-Pueblo Alto-

Curved Rock That Speaks, figure 83 shows a strangely asymmetrical diagonal running from an interior circular form to the north main entrance. The center line of this diagonal feature works well as an axis to the center point of the Curved Rock That Speaks amphitheater (as best determined graphically).

With the exception of the late New Alto, the cardinally oriented form of Pueblo Alto, Tsin Kletsin, Pueblo Bonito, Casa Rincoñada, and probably the natural amphitheater feature of the Curved Rock That Speaks all organize through location and wall orientations to create a possibly integrated Middle function at the new canyon center. The most “middle” of the Middle was probably Casa Rincoñada located as it is between the architecturalized Lizard Head meridians of Pueblo Bonito and Pueblo Alto/Curved Rock That Speaks. This role could have been strengthened with its direct path to the El Faro related road point at the Pierre Site, and the actual Lizard Head – Haystack Mountain meridian. New Alto may have created a kind of gate with Pueblo Alto through which the path runs. Most important socio-politically, could have been the way Casa Rincoñada, with its separate Middle location on a rise, expressed a certain dominance over the extreme new formalized architectural definitions on the north side of the wash. Even the natural largest of great kivas (the amphitheater) is directly aligned with the prominent architectural features on the north and south rims and perceptually dwarfed by the massive Pueblo Bonito. At the height of the big build-out one may even ask whether Casa Rincoñada, with its seemingly more egalitarian oppositional meaning—albeit with fewer participants perhaps—replaced the possibly centuries old ritual function of the Curved Rock That Speaks?

PROBABILITY TEST: GREAT HOUSE WALLS AS ASTRONOMY OR LANDSCAPE INTEGRATION?

Given the two alternative reasons for the symbolic meaning of great wall orientations—astronomical (Sofaer 1997) and landscape frame (Doxtater 1991)—it is possible to test both in terms of probabilities of being random. Theoretically and ethnographically, *both* alignments to sacred mountains and to astronomically determined points are important in traditional ritual. Spatial frameworks incorporating most unique natural features most likely contribute uniquely, while not at all dismissing complementary and also unique temporal uses of the movements of the sun, moon and stars. This is clearly evident in this volume’s discussion of key, often coin-

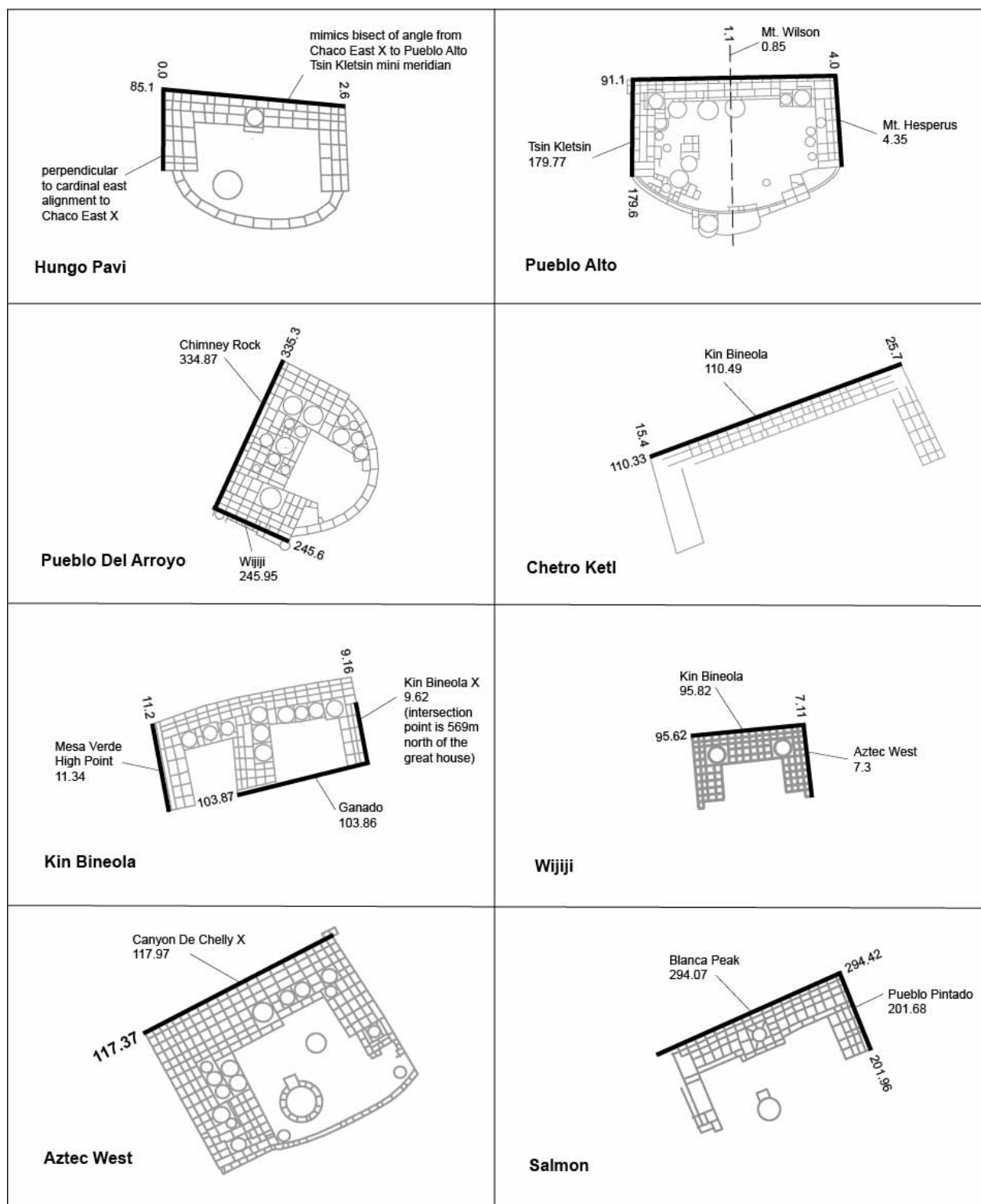
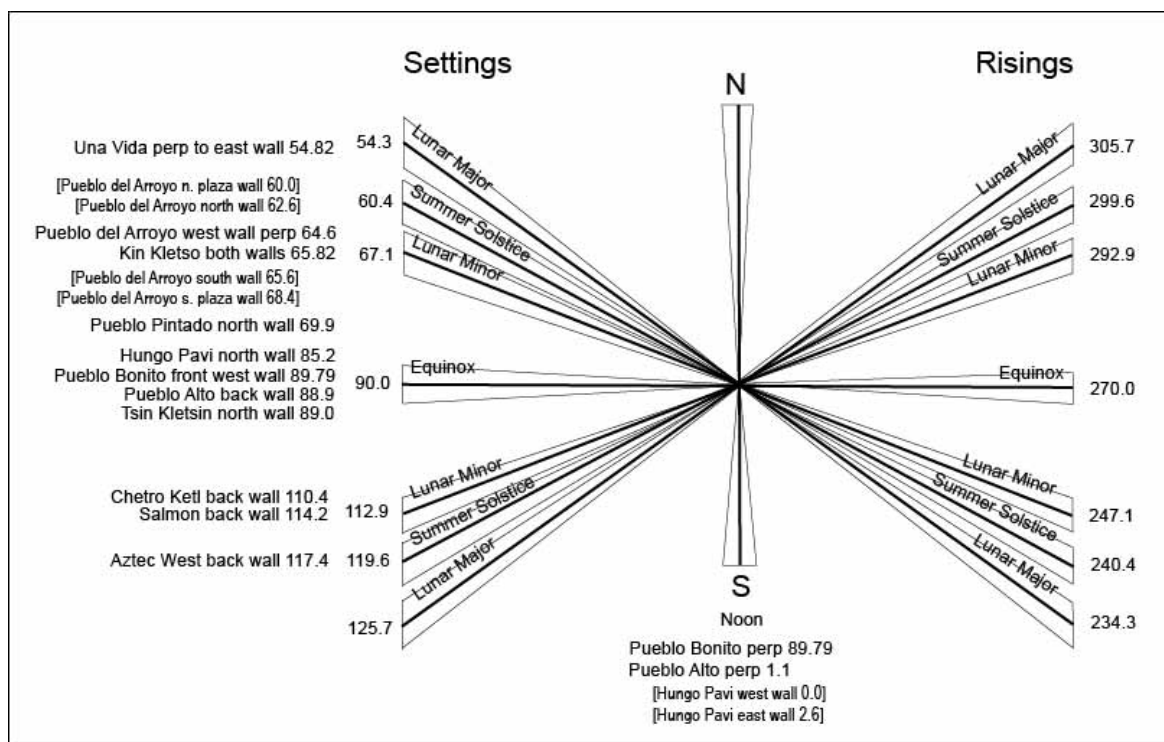


Figure 84. Eight Chacoan “E” great house plans used in the analysis; bold lines show alignments of wall orientations with distant points (excepting Hungo Pavi).

cidental, large scale layouts, e.g. a solstice line from the Sipapu to Comb Ridge, the equinox relationship between Abajo Peak and Mount Wilson, the power “shunt” at the Pierre’s Site, or possibly solstice relationships between Lizard Head and the Black Face feature and analog from 29SJ1253 great kiva to the Sun Dagger on Fajada Butte.

For purposes of this exercise, only the eight more formal E shaped Chacoan great houses, like Hungo Pavi, are included, as shown in figure 84. The most striking aspects of these structures are the angles at which wing walls attach to the main, longitudinal walls. Certainly priest surveyors with the likely ability to conduct extremely precise large scale alignments would have had the technical skill to attach wing walls at precise 90° angles. Walls are not angled simply to accommodate topography. If builders could construct a technically straight back wall from 60 - 140 m long, then it is extremely unlikely that some ground condition in wing wall directions would cause virtually all of the corner angles to deviate. Of the sixteen corners in question, none comes closer than 0.42° from being precisely perpendicular, ranging from 87.9° to 97.5°. The corners of the smallest great house Wijiji, seeming the most formally and possibly last in the canyon to be laid out, actually vary by over a degree; one is 0.42° and the other 1.49°. While an obvious “perpendicular” constraint of all great houses exists within a maximum deviation of 7.5°, one can hypothesize that if the long back walls were symbolically oriented, so were the wings. The plan of the building, therefore, may have been designed less as a precise geometric form, than as a sequence of expressions of somewhat independent symbolic orientations or meanings. Builders did not precisely relate the lengths of the walls to any plan formality. Wing wall lengths are not any constant ratio to back wall lengths. The two outside wing walls, for their part, while within a meter or two of being equal, were clearly not measured to be identical in length.

Let us first examine the astronomical hypothesis that walls orient to rise/set points of the sun and moon cycles. Besides the three exterior wall orientations, Sofaer includes the possibility of a perpendicular to the longitudinal wall, a possible “facing” axis to the great house. What are the odds, then that of thirty-two orientations (4x8), some number will point within a range of defined deviation to the eight orientations given in Sofaer (1997), Fig. 85 She maintains that either the major wall or a perpendicular align in six of the great E houses of the present study. The range of deviation permitted by Sofaer runs from the mentioned 4.8° of Hungo Pavi to 1.1° of Pueblo Alto’s cardinal. Kin Bineola and Wijiji have no proposed astronomical features in



her

Figure 85. Associations of great wall (major and perpendicular) orientations of largest Chacoan great houses with lunar and solar risings and settings, and cardinal axes; from Sofaer 1997. [brackets indicate additional associated walls by author]

analysis (omitted in figure 85). Sofaer does not include the orientations of the sixteen wing walls (eight great houses of the present study), but if included using a maximum deviation of 2.8° (the highest excluding Hungo Pavi's 4.8°), she could have added five additional features that align astronomically, for a total of ten.

One can test the simple probabilities of thirty-two constructed walls orienting within 2.8° of sixteen astronomical orientations by using lottery calculators (cumulative binomial probabilities). Thinking of astronomical orientations as lines on a 360° disk, the "player" scores a hit (builds an oriented wall) when the orientation comes within 2.8° on either side of a precise astronomical direction, a total 5.6° arc (actual observation and topography masking disregarded). Considering both directions of a particular alignment, or a total arc of 11.2° , this number can be multiplied by the eight different orientations to give the total arc area of 89.6° which will produce a winner. These odds are 360° divided by 89.6° or one in 4.02. Using the probability calculator (<http://stattrek.com/Tables/Binomial.aspx>) one can determine the odds of the existing situation where sixteen wall orientations--throwing the dice sixteen times so to speak--hit five winners (Sofaer's major walls and perpendiculars). The answer here is 0.180 or

about a one in 5.6 probability of duplicating the existing pattern by chance. Adding the sixteen wing walls that create ten hits in thirty-two wall orientations, gives a rate of 0.110 or about one in 9.1.

One can now test the second hypothesis, i.e. that walls primarily orient to built or natural features in the landscape (excluding purely analogic expression like Hungo Pavi's north wall for present purposes). This list includes the two coincidental cross X intersection points at Kin Bineola and Canyon de Chelly, their natural features of Brian Head, Humphrey's Peak, Abajo Peak, Baldy Peak, Blanca Peak, Chimney Rock and Mount Taylor, in addition to Chaco East X and its two new natural axes points, Hosta Butte and the Mesa Verde High Point (Chaco West X and the importance of Lizard Head and Black Face were not understood at the time of this exercise). The Sipapu, Mount Wilson, and Cabezon round out the natural list along with Hesperus Peak (one of the four Navajo cosmic points). The total number of natural points, including intersections is sixteen. For the built components of the list, included are all of the major Chacoan great houses: Pueblo Alto, Peñasco Blanco, Una Vida, Hungo Pavi, Wiji, Chetro Ketl, Pueblo Arroyo, Pueblo Bonito, Tsin Kletsin in the canyon, Kin Bineola and Pueblo Pintado flanking the canyon to the SW and SE respectively, and the late structures of Salmon and Aztec West up north in area of present day Farmington, NM. The final list also logically includes Casa Rinconada and what may have been largest pre-Chacoan great kiva site of Ganado with possibly five of the large ceremonial features.

This list creates thirty-one points on the distant landscape as potential symbolic orientations to the four features of each great house. The number can be reduced to thirty, given the impossibility of a great house feature orienting to itself. The choice of the angular deviation of a wall or perpendicular (to the precise distant point) to use in the test is determined by which deviation produces the best likelihood of intentional design. A smaller deviation number reduces the number of "hits" in the exercise, and vice versa. For the given list of thirty distant points, the best deviation number for the thirty-two great wall features of the E houses is 0.60° , a figure about five times more accurate than the astronomical test. This number is multiplied by two to again accommodate an azimuth falling on either side of a distant point, giving an arc of 1.2° . Multiplying this number by the thirty points provides a total of 36° of possible hits of 360° . The odds then, of any one feature coinciding with a distant point is 0.10, or one in ten. But since each wall points in two directions (that are not paired up as in the astronomical), the odds of any

wall hitting a distant point is two times as great or 0.20, one in five. Turning to the probability calculator, what is the likelihood that building thirty-two features each with a 0.20 odds, will orient within 0.60° , of fourteen distant points (the actual case as shown in figure 86)? Eight of these points are great houses or Ganado, and six are mountains or a natural intersection point. This probability is 0.0013, about 1 in 720. Large scale surveyed patterns, therefore, are eighty times more likely to have been the symbolic, designed basis for great house wall orientation than astronomical phenomena.

How would this comparison change if the allowed deviations of the astronomical orientations were much closer to landscape lines? Priest surveyors should have been able to work within a similar range for both. In the present case the accuracy of lines to distant points in the landscape is much easier to ascertain than some unknown actual sighting of astronomical phenomena which must include a topographic section of the landscape features involved. One doesn't know at present even if relatively accurate sightings from great house sites are possible within the canyon, or whether larger scale observations could have been made on the canyon rim and transferred down to great house sites below. If they did this, however, they would seem to have been much less accurate than the transfer of the mentioned bisect of the Chaco East X angle to Hungo Pavi's back wall.

NOT YET A TEMPLE

The brief probability exercise above certainly does not do justice to this volume's full range of ideas hypothesizing a much richer symbolic potential among formal architectural elements--created by Ancestral Pueblo ritual sodalities and their communities. Yet clearly, the more similar and more integrated, even subordinated, formalized architecture is to previously formalized ritual patterns founded in the large-scale landscape, the less one sees these buildings as all powerful locations of gods, the public access to which is controlled by hierarchies of priests and other theocratic figures. Chacoan great houses emerge somewhat innocently, perhaps, in a context of large scale ritual design and practice focused on great kiva ceremonial nodes. They do so with a clear expression of the distinction between and subordination to their great kivas, undoubtedly seen as thresholds for the direct communication between humans and spirits who live in the most powerful natural places at some distance. Even though at smaller scales of social organization perhaps, kiva forms become embedded in the evolving architecture of great hous-

es, nevertheless, at the largest scale of the great house itself, the kiva most often sits alone in its privileged position. But in terms of cognitive, formal plan intentions--even of the largest and most formalized of the great houses--one can find no consistent geometric relationship between the location of the great kiva and the shape of the three or more monumental walls of these largest of buildings. At the scale of Chaco Canyon itself, the largest great kiva, Casa Rincoñada, again, has no surrounding great house, strongly suggesting its dominant ritual and social relationship to all of the great houses. How the nevertheless architectural Casa Rincoñada relates to the possibly greatest (and most natural) of "kivas", the Curved Rock That Speaks, however, remains an open question of continuing provocation in the next chapter.

All in all, one senses that the massive building that started in the late 900's and early 1000's, really during only about a hundred years or so, might be associated with Chaco's demise. In terms of the creation of large scale, formal ritual processes that might even have begun with the great kiva in the 500's, and founded the ultimate layout of Chaco Canyon, a rough span of 500 years, all this architecture at the end begins to look suspicious. Eventually researchers will need to sort out the distinctions, if possible, between the social bases of ritual associated with more singular great kivas, and those operating in the massive architectural settings of largest Chacoan great houses. In spite of the obvious religious exuberance of form, still functional may have been alliances between distant communities or tribes for purposes of marriage and other exchange and facilitation of the movement of people during times of ecological contingencies like drought. For an earlier period of time, however, the primary expense of making sacred geometry might well have been in the process of surveying landscape patterns themselves. While these were likely collaborative efforts of allied groups, not unlike the staged construction processes of great houses, the latter, together with the efforts to bring in timbers from distant high places, might have begun to clearly overshadow the landscape based, religious surveying processes of positioning sites.

Herein may have grown the seeds for undue competition between dualistically or triadically organized great house entities. The possibility that many of the oriented great walls of these structures carried strong, permanent associations to the particular groups who built them, an emerging rhetoric beyond their monumental scale may have unduly fueled the competitive portion of the delicate opposition between landscape spiritual collective (great kiva) and self-interested clan or alliance (great house). When one notices that the pair of great houses that

flank Pueblo Bonito and the Curved Rock That Speaks, i.e. Arroyo as West and Chetro Ketl as East, are measurably unequal in number of rooms, then perhaps the balanced, landscape based system is beginning to strain. Yet it is still expression based on patterns of large scale ritual, not fundamentally territorial signage where the landscape has essentially disappeared as a ritually integrated opposition, leaving temples to express the power of an elite group in control of access to the gods. The reader is invited to compare detailed research into the religious function of the central Aztec pyramid at Tenotichlan provided in Broda et.al.(1987). A clear sense exists that the gods no longer live in the mountains, but exist, among other things, as tiny statues that can be manipulated and even kept in centralized urban religious edifices, including pyramids.

8. The Plateau Frame Beyond Chaco

With all that was happening with the new Chaco, both in terms of landscape frame and radical architecturalization, what was going on at the many smaller ceremonial foci across the Southern Colorado Plateau? The two well used extensive surveys of these “outliers” by Marshall et. al. (1979), and Powers et.al. (1983) still provide the best yet description of general site layouts including roads, architecture, pottery, provisional dating and other vital archaeological evidence. Missing, of course, from the present volume’s perspective, is why or how these sites were located, particularly those with great kivas. While multifaceted tables begin to paint a picture of an outlier whole with relationships to each other and to Chaco, there is no analysis of possible integration with an accurate, surveyed landscape frame at the scale of plateau landscape. The following examples are not an attempt to provide any definitive “proof” in this direction, but to provide examples of the kind of new work that needs to be added to better understand “outliers”. Formalized elements of two outliers, Lowry Ruin and Village of the Great Kivas, have already been discussed in Chapter 4. The late Chacoan complex at Aztec, while certainly no typical small outlier, will be seen in this chapter as perhaps the best example of the way the plateau frame (and integrated architecture) outside of Chaco is also being formally designed or redesigned.

“OUTLIERS”

Kin Ya’a and Muddy Water

The Kin Ya’a site is best known for its unique great house tower and as the apparent terminus for the major south (west) prehistoric road from Chaco Canyon. For these and other reasons spelled out in Marshall et. al. 1979:207 and Powers et.al. 1983:202, the people who built these features were clearly connected to or influenced by those who were laying out and building the new Chaco center. Of course they may in fact have been the same people, in that Chaco wasn’t a permanent population focus, but pilgrimage destination probably built by these same visitors. This being said, there may be surveyed aspects of Kin Ya’a that suggest a certain independence

from the new Chaco scheme including formalized peripheral relationships to other sites outside of the canyon.

Using the Powers et.al. site drawing as base in figure 86, one can analyze a possible rationale for the formal site axis created by the intersection points of the prehistoric road segments that not only connect with the road from the canyon to the north, but also direct the flow of the site to somewhere to the SW. Having looked carefully at the road segments that make up the long southern roads out of the canyon (from Kincaide 1983), it is clear that their longest lengths do not constitute any precisely linear surveyed alignment, though smaller pieces may be relatively straight. What may be more interesting is the way roads are used fairly accurately and even symbolically at or near built sites, just as a segment of the North Road at the Pierre Site is quite cardinal precisely on the Lizard Head meridian. Thus considering Kin Ya'a, why does the larger road *from* Chaco split in two, creating a trapezoidal domain that includes the great kiva and great house.

The symbolic function of Hosta Butte, only a little over twelve kilometers to the SW, has been previously described as the possible SW pole of one of the two cross axes of Chaco East X. But Kin Ya'a is not positioned on this line, even though it appears to be the termination of the south Chaco road running in this general direction. It is not impossible that Kin Ya'a was founded or positioned in the landscape in the late PI or early PII period, or in any event prior to the big Chaco scheme and the layout of Chaco East X. If this were the case, then Hosta Butte might well have been more of a local focus of natural spiritual power. What might have been known about larger scale frames at the time was the coincidental phenomenon of Kin Bineola X, important to the triangular creation of earliest Chaco. One of its three axes, again, runs from Baldy Peak to Chimney Rock (with the base of the Ship Rock vertical, VGK, on this line), and is only twenty kilometers or so from Kin Ya'a.

Looking more closely then, at the northern and southern points of the Kin Ya'a road defined domain, they appear to align not only with a high point of nearby Hosta Butte, but down to Baldy Peak as well. Thus, prior to the big scheme focused in Chaco, perhaps, Kin Ya'a might have received its ritual power by connecting more primarily--via Hosta Butte--with the base of the West vertical or *axis mundi* (Ganado and Cottonwood Falls) and its earlier Chaco line through Kin Bineola X and Chimney Rock. In effect, then, the South Chaco road, with regard to Kin Ya'a, is less of a centrifugal distributor *from* Chaco Canyon, than a centripetal path

to an earlier laid out foci well connected to the largest scale earlier plateau frame.

Noticeably, the alignment from Baldy Peak through Hosta Butte comes closest to the isolated great kiva at Kin Ya'a, which might be earlier than the great house with its tower located across the ceremonial domain near the intersection of the two eastern road segments. While there are analysis problems in determining which point on the flat featureless top of Hosta Butte (a mid-point is presently used unlike the clear high point on Haystack Mountain), surveyors might have created a possible "x" point on the Kin Ya'a site near the great kiva and prior to the construction of roads and great house. The quite accurate alignment of the straight road segment to the west of the domain area is one possible indication of such. It orients quite accurately to Ganado, making sense given its central focus function on the hypothetical West vertical, whose base of Baldy Peak, again, might have been the prime mover for Kin Ya'a's major site orientation. This Ganado road, however, is not a good cardinal, off close to two degrees. Ganado, therefore, might not have been an originating intersection line an "x" point of Kin Ya'a.

One of the lines originating at the Sipapu, as described in the analysis in Chapter 4, actually hits the great kiva (about 13 m from the the GPS center point) near the western road's intersection of the domain, as it runs to the great kiva at the Guadalupe outlier. While there is a certain logic of including Cabezon, the eastern feature of one of Kin Bineola X's axes and visually adjacent to Guadalupe, it is difficult to suggest which of the two outlier sites aligned with the Sipapu might have come first. One of the future research issues should be a more precise determination the intersecting line that located Kin Ya'a on the Baldy Peak – Hosta Butte axis. The orientation of the tower great house at 227.9° to the SE might eventually play into this inquiry, e.g. perhaps something in the direction of Mount Taylor, but as yet cannot be associated with any large scale azimuth.

Only seven and a half kilometers NW of Kin Ya'a lies the Muddy Water community, complete with great kiva and three great house features. First of all, if great kivas and their communities were located via a relationship to the large-scale landscape frame, wouldn't the close proximity to a seemingly important Kin Ya'a be ritually illogical? Again, social space in the Ancestral Pueblo landscape may have had a territorial component in shamanistic Basket-maker periods, but in the centuries of possible ritual structure that followed, symbolic integration would have been the key. And if one looks at the multitudinous religious entities that ap-

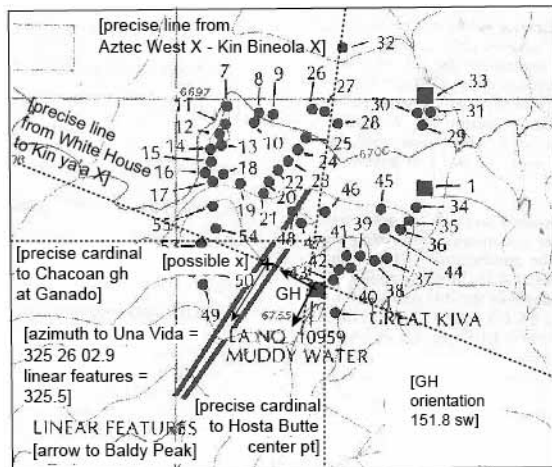
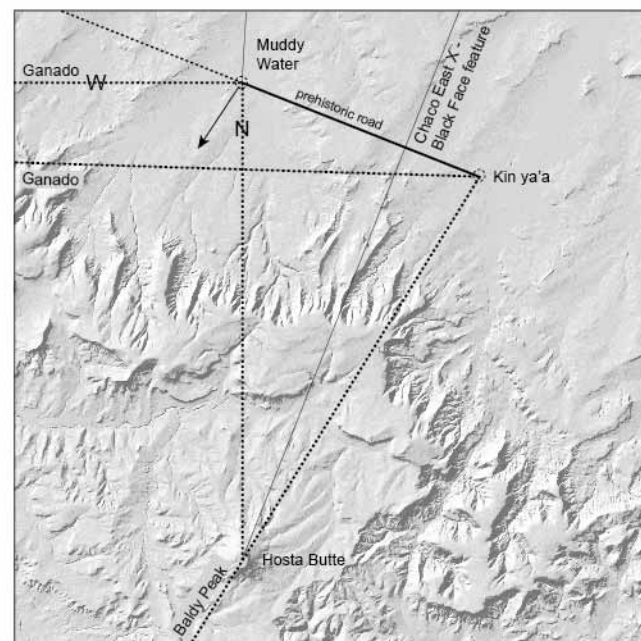
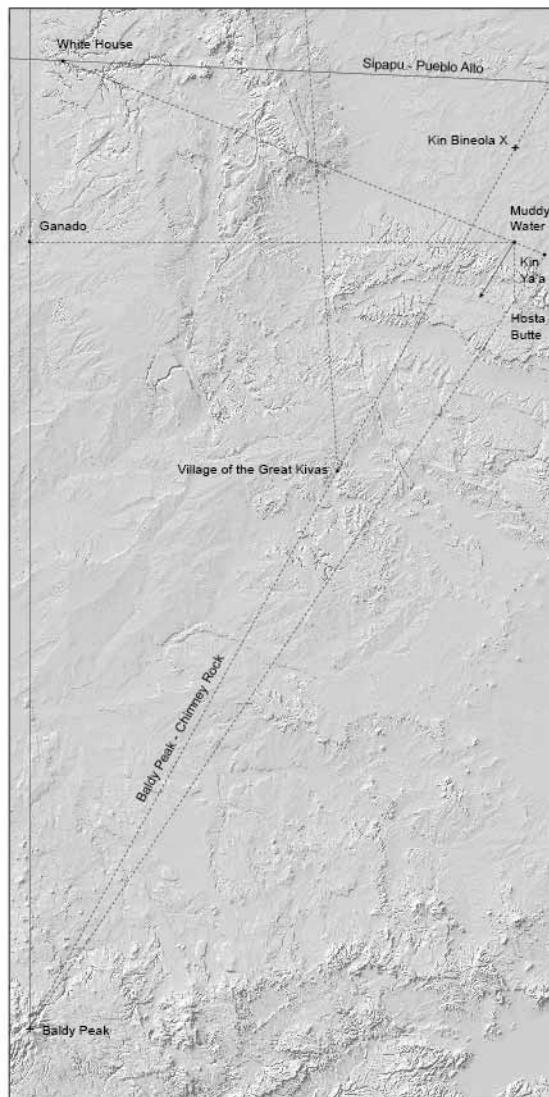
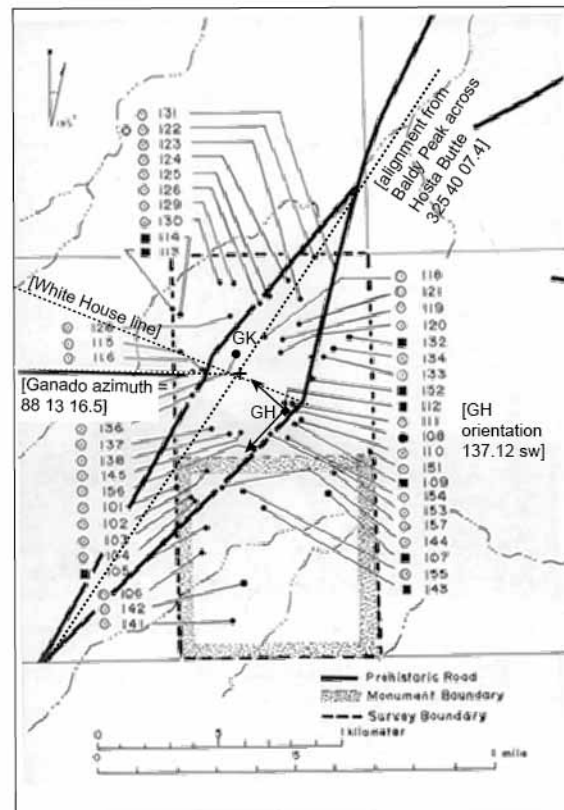


Figure 86. Possible alignments superimposed over Marshall et. al. 1979 drawings of Muddy Water and Kin Ya'a (above, brackets added).



pear to have been relatively peacefully integrated in the close quarters of Chaco Canyon, maintaining good religiously based social relationships between Muddy Water and Kin Ya'a doesn't seem that unusual. But how might they have been connected?

The most immediately intriguing component of a possible Muddy Water site design is its duality or symmetry organized most prominently by a tight pair of roads (325.5° to the NE) that may have pointed to the southern entrance of Chaco Canyon (azimuth to Una Vida is $325^\circ 26' 03''$, 29SJ1253 is $325^\circ 54' 52''$, and Fajada Butte is $324^\circ 00' 41.7''$). The line between two of the great houses in the eastern side of the Muddy Water community seems to be similar to this orientation. The orientation of the great house immediately adjacent to the great kiva is about 331.8° (the author's measure), similar to the dual road axis, but off several degrees. Like many aspects in Ancestral Pueblo religious layouts Muddy Water is triadic in both dimensions, first the two sides and middle domain created by the dual road reinforced by the linearity of domestic small site organization, and second the three great houses along the perpendicular complimentary axis (at least by the two flanking great house structures).

Curiously, the Chaco pointing dual road feature was built not on that side of the site to the NE as centrifugal thinking would imagine, but clearly expressing somewhere in the opposite SW direction, not unlike Kin Ya'a's possible orientation to Hosta Butte and Baldy Peak. As diagramed in figure 86, two cardinal lines, one from the south, the other from the west, intersect close to the great kiva/great house area. The one from the center point northward from Hosta Butte is most precise, actually running between the great kiva and great house, located about 135 m apart. The eastward seeking cardinal from the Ganado (later great house) point runs about 250 meters north of the southernmost Muddy Water great house. Recalling how elements at Lowry and VGK oriented to Baldy Peak, one realizes that the dual road feature also is somewhat close (three degrees) to the azimuth to this southern pole of the West vertical, $328^\circ 14' 20.6''$ (from Baldy Peak to Muddy Water). Yet roads at great kiva/great house sites can apparently be quite precise, as seen at the Pierre Site and the Mount Wilson oriented feature that connects the two great houses at Lowry Ruins. Only a precise professional survey of the Muddy Water dual roads artifact can better answer the question of their symbolic design. They are, however, located in the direction of Baldy Peak, with related side lines to Hosta Butte and Ganado, perhaps all also important to Kin Ya'a.

If the Baldy Peak, Hosta Butte and Ganado threesome were the primary rationale for

Muddy Water site design, then the two cardinals would have been sufficient to locate the nucleus of great kiva and house. Two other accurate lines run through this site, and although any alignment might be a random event, they should at least be documented as part of the analysis. Most interesting perhaps, is the line from the interim point, White House, on the Sipapu – Pueblo Alto axis, to the ceremonial center at Kin Ya’a. It comes close to hitting the great kiva related great house at Muddy Water. There would have had to have been some coincidence for this to be a designed line playing some role in the positioning of Muddy Water. If, on the other hand both White House and Muddy Water were earlier, then this line might have positioned Kin Ya’a on a Baldy Peak – Hosta Butte axis; Guadalupe would then have been created in part by a Sipapu – Kin Ya’a prolongation.

The second very accurate line into the Muddy Water focus comes from the Aztec complex center point through Kin Bineola X. Since it is unlikely that the late Aztec point organizing such a huge site was created by an axis from a small outlier community, this line seems most probably random. The only way the line would work as a coincidental piece to founding Muddy Water, along with the two cardinals, is if an Aztec point were known earlier than the architectural construction, i.e. as part of the late PI-early PII total new landscape frame laid out largely as a whole. The foundation of the Aztec center point, along with its integrated architecture and ritual relation to Chaco, concludes this chapter.

It might have been that because of their common large scale integration to the SW portions of the plateau frame, Muddy Water and Kin Ya’a were something of paired ritual foci and associated communities. While Kantner’s early paper (1997) concluded that the Chacoan prehistoric roads in this area did *not* facilitate exchange between adjacent foci, *per se*, site location and feature orientation (including immediate road segments) related to the landscape frame might well have linked communities together.

Standing Rock

In the map of existing alignments of all periods that concluded the probability analysis of Chapter 2 (figure 31) a certain intensity of lines run from Comb Ridge features down to southern points in the eastern or Chacoan part of the possibly triadic plateau. Symbolically, these suggest oppositions between the northern area of one hemisphere to the southern part of the other. Thus one of the more interesting, possible founding lines for the great kiva and community of

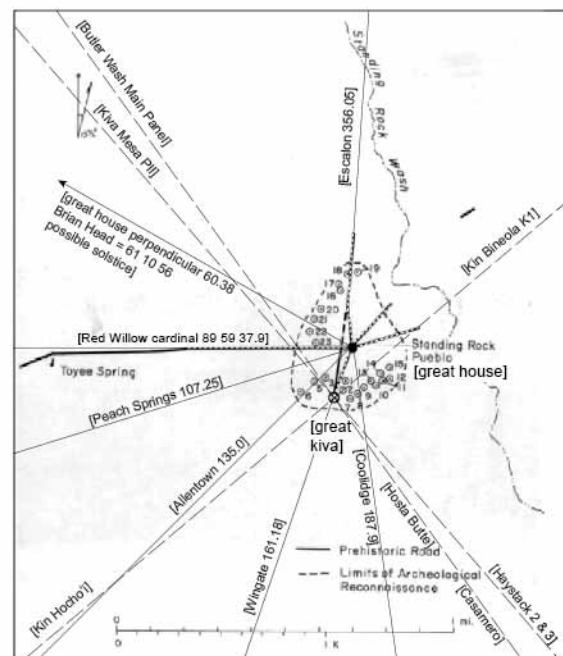
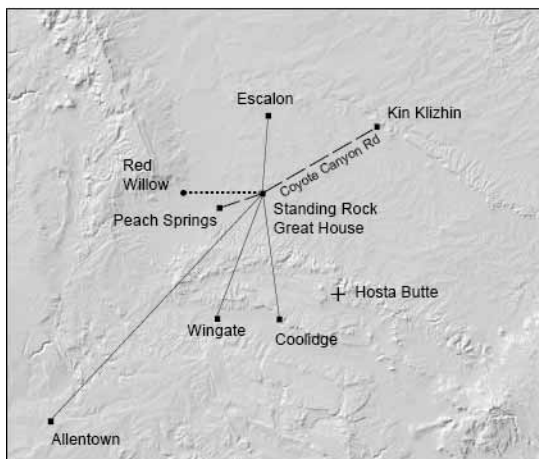
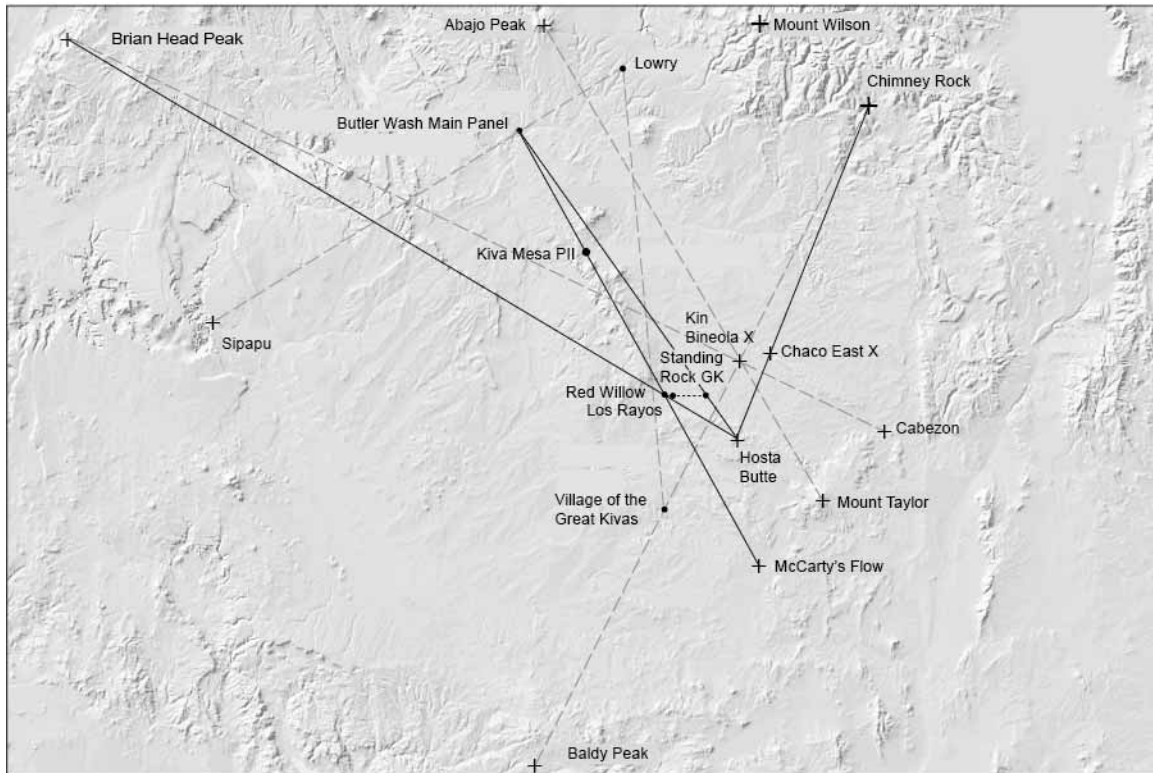


Figure 87. Possible alignments associated with Standing Rock complex; lines and destinations on Marshall et. al. 1979 drawing (lower right, additions in brackets).

Standing Rock is its alignment with the Butler Wash Main Panel (perhaps the most important ritual location on the Sipapu – Lowry alignment) and Hosta Butte. Inspecting the base layout of Standing Rock taken from Powers et. al. 1983:214, figure 87, nothing in the orientations of

the later road segments or great house reinforce the line from the Butler Wash Main Panel. Transferring the published map location to digital USGS quads, the center of the great kiva, however, located some 300 meters south of the radial road focus point, lies about 10 meters from the 193.136 km line (using the center point of Hosta Butte).

The line from the Butler Wash Main Panel to McCarty's Flow at the base of the Wilson meridian was, if understood, a powerful connection between the north and south poles of West and East sides of the plateau. On it are located the multi-faceted Kiva Mesa focus, and the great kiva site of Red Willow, though the latter isn't very accurate at 0.129° (still under the 0.15° limit of the probability exercise of Chapter 2). A line from Brian Head connects Red Willow to Hosta Butte (0.036°), and the possible axis from the Main Panel and the Standing Rock great kiva. Some credence of a relationship between Red Willow and Standing Rock, both on lines from the Butler Wash Main Panel, appears in the cardinal relationship between the two. It is very precise when using the road focal point at Standing Rock ($89^\circ 59' 37.9''$), which corresponds with the start point of the initial segment of the road west of the site to Toy-ee Spring. In terms of the latitude of the Standing Rock great kiva, $35^\circ 49' 32.2''$, it lies pretty much due east of both Red Willow, $35^\circ 49' 41.1''$ (aligns quite precisely with the road focus), and Los Rayos, $35^\circ 49' 24''$, the singular great kiva seemingly paired up just 2.521 km east of Red Willow. If this possible design layout created cardinally related great kiva sites on the two major lines from the Butler Wash Main Panel, the Red Willow site would have been pinned down first, then a cardinal east laid out as the second line to position Standing Rock.

After being hypothetically positioned by *intension* (lines originating at distant points in the larger frame), the focused road pattern appears to be acting to the contrary more as an *extension* feature, i.e. origination from the road center and great house out to nearby communities. Six road segments comprise the site center, five of which run to the great house, and one that veers off to the great kiva. Relatively accurate azimuth associations—again map and map transfer errors notwithstanding--can be found for all six as illustrated in figure 87. The longest segment is the above mentioned cardinal to the Red Willow/Los Rayos pair. While three of the road segments lie on the side of the great house in the direction of the referent, like Red Willow, oddly enough three others were laid out on the NE side of the great house opposite from the aligned distant communities. Although some of these other outlier sites lie some distance away, e.g. 93.244 km to Allentown, all are in the general SW quadrant of the East half of the

plateau. It may be possible to set up a probability exercise to determine the likelihood of some outlier site in the area matching the orientation of all road features at Standing Rock, within a stipulated accuracy.

Curiously, with all the radiating roads, none aligns with the often mentioned longer Coyote Canyon road between Standing Rock and Kin Klizhin, the small great house without a great kiva just a few kilometers west of the Chaco center. Other lines within the accuracies of the probability exercise of the last chapter also involve the isolated Standing Rock great kiva: Kiva Mesa PII – Haystack 2 & 3, and Kin Hocho'l – Kin Bineola K1 (at the great house). These lines may be more likely to be random, since they do not include important natural features which may have been necessary components to founding/locating great kiva foci. Finally, the orientation of the Standing Rock great house of 29.62° toward the NE (author's measurement) carries as yet little strong associational evidence. The only thing that one can presently note is that its perpendicular of 60.38° is similar to the azimuth to Brian Head ($61^\circ 10' 56''$). If this were a design, it would link to Red Willow's partner position on the Brian Head – Hosta Butte line. Standing Rock's great house has a relatively formal classic "D" shape with a large, straight back wall and arc formed front. Given the indicators of symbolic wall orientation in other larger great houses, the Standing Rock structure as well merits further investigation.

EXTENSION OF THE WILSON MERIDIAN

Cerro Moctezuma and Paquime

The largest sites outside of the new Chaco center are certainly Aztec, up in the San Juan River area, and Paquime down in today's Chihuahua, Northern Mexico. While the latter is not necessarily Chacoan in time or architectural characteristics, Lekson's volume (1999) on the "Chaco" meridian links these two poles with the Chaco center by virtue of their cardinal alignment, among other things. Chaco was first, then Aztec, and finally Paquime. In terms of the surveying accuracy in the present design analysis, these three sites are only very loosely aligned within about two full degrees. Lekson does not involve significant natural features in his meridian, while mentioning the fact that Paquime's kiva like structure on Cerro Moctezuma, described earlier, is quite accurately cardinal south from Peñasco Blanco.

Referring back to the probability exercise at the end of Chapter 3, it appears quite likely that an important part of the Ancestral Pueblo plateau layout was the meridian, not from Chaco

per se, but from Mount Wilson: on it, again, are Mount Wilson, Aztec, Pueblo Peñasco, 29SJ423, Andrews, McCarty's Flow and Cerro Moctezuma. Symbolic expression of the total meridian, including the late or post Chaco Cerro Moctezuma, appears to exist in the great kiva orientations at the north and south poles of the Middle axis from Lowry to Village of the Great Kivas. As diagramed previously in figure 52, the classic Chaco period kiva orientations might be bisects of the angles to the two pairs of West and East meridian features, i.e. Abajo Peak and Mount Wilson in the north, and Baldy Peak and Cerro Moctezuma to the south. If this design interpretation were someday better confirmed, it would mean that the extension of the Wilson meridian down to Cerro Moctezuma occurred during the last decades of the 11th century, perhaps as part of the impending move to Aztec, and before the urban layout of Paquime.

If it was also true that a triadic plateau structure had existed for several centuries prior to the new Chaco scheme, why connect the Ship Rock plateau Middle axis with an extension of the Wilson meridian? Is it possible that the new Lizard Head inspired Chaco center had diminished the East integration with the traditional triadic plateau, including the Ganado and Ship Rock ax-

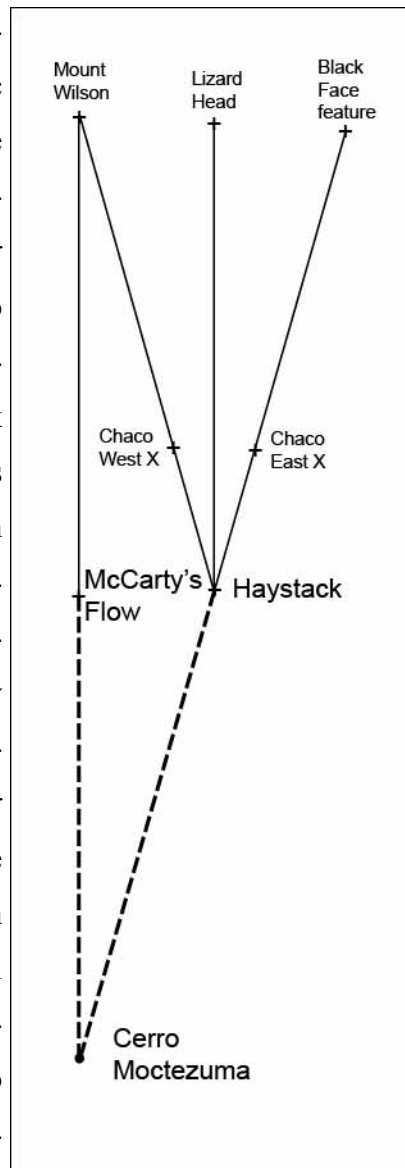
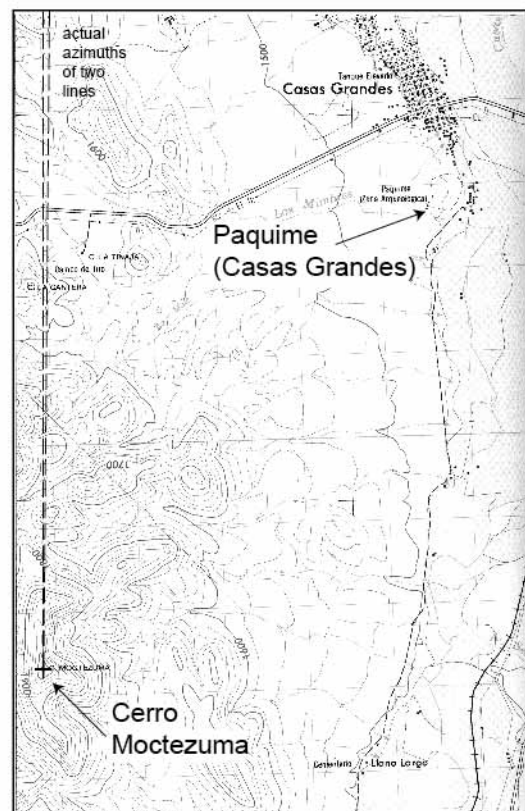


Figure 88. Prolongation of Mount Wilson meridian and Chaco East X - Haystack to create intersection at Cerro Moctezuma (angles in left diagram are exaggerated for graphic purposes).



es? Did the West contingent, even within the new Chaco—possibly including Pueblo del Arroyo, Peñasco Blanco and Kin Bineola—feel the need to invigorate the founding role of the Wilson meridian, contextual as it had been to the larger plateau frame?

Cerro Moctezuma's position, as illustrated in figure 88, is the intersection of southerly prolongations of the Wilson meridian and the Black Face feature – Chaco East X line. Cerro Moctezuma is 498.032 km from McCarty's Flow, and the longitudes of the two points are $107^{\circ} 59' 48.4''$ and $108^{\circ} 00' 03.0''$ respectively (angular deviation from cardinal of 0.045°). As an extension of the Chaco East X – Haystack Mountain line, Cerro Moctezuma is off about 158 m at the distance of 558.991 km. The accuracy of this diagonal, 0.016° is just below visual acuity. These lines intersect coincidentally on this modest mountain seen directly west from Paquime.

Thus it is not impossible that Cerro Moctezuma, perhaps including some early built feature on its summit, primarily expressed a somewhat traditionalist religious perspective about Mount Wilson, one perhaps seen as a more legitimate East meridian, than Lizard Head, in context with the larger triadic plateau. Its primary meaning might therefore have been symbolic *within* the system, rather than representing some new social or economic association with people farther to the south.

Replicating the Chaco landscape/architecture scheme at Aztec

Just as surveyor priests developed a landscape scheme to re-create Chaco, a not dissimilar design concept might have founded Aztec as well. Yet prior to this survey process, their first decision could have been an intention to place the center of the new complex somewhere directly on the Wilson meridian, a clear reemphasis of the traditional East vertical at the plateau scale. Again, could this have been competitive with or at least an alternative to the Lizard Head energy behind the new Chaco? Then, as had been the case in the Chaco layout, the next step may have been finding a new northern East X to replace or augment the cross axes intersection point in the canyon kept hypothetically by Hungo Pavi.

Particularly important may have been how to replace the modest Mesa Verde High Point (NW) and Chimney Rock (NE) as ends of new cross axes. Thinking at an even larger scale than Chaco East X, two earlier known lines might have been re-surveyed: first, the line from Mount Peale down through the major early great kiva focus of Grass Mesa and on to Cabazon, Kin Bineola X's SE feature (see map in figure 59). While considering Mount Peale, per-

haps, as the new NW feature, the line seeking to create an Aztec East X would only have to be re-surveyed from Grass Mesa southward to Cabezon. The other cross axis could have been the long, possibly ancient shamanistic line from Blanca Peak to Humphrey's Peak (see map in figure 15). This axis could have incorporated the early west side of the plateau via linkage with the Canyon de Chelly frame including Brian Head, Mount Taylor, Baldy Peak, Abajo Peak, and the Grand Canyon Sipapu.

Once the intersecting point of these two lines was established, the next design element could have sought to connect the X point with some third axis running symbolically south to north. Perhaps having some knowledge of the prolongation of Haystack – Chaco East X that discovered the coincidence with the Black Face feature, surveyors might have known that the new Aztec (Totah) X lay in the vicinity of this line. In resurveying the eastern ray of the triad from Haystack, they would have been amazed at the intersecting coincidence of these three lines, essentially a duplication of the coincidence of Chaco East X. The mathematical line from Haystack to Black Face (154.594 km) only misses the precise Aztec East X point (from the initial two lines) by about 8 meters. Thus both Chaco East X and the new Aztec East X are coincidentally aligned very accurately with Haystack – Black Face feature. This line misses the precise cross axes intersection point of Chaco East X by about 44 meters (average deviation of 0.022° or close to visual acuity). This latter range of accuracy is likely closer to the limit of surveyors' skills than the overly precise 8 m at Aztec East X.

An extremely intriguing piece of evidence for an Aztec East X survey point may lie in the fact that it is also coincidental with the intersection of the two Navajo large-scale axes illustrated earlier in figure 6. The two mathematically determined intersection points for Grass Mesa – Cabezon and Humphrey's Peak – Blanca Peak (Ancestral Pueblo), and Hesperus Peak – Mount Taylor and Humphrey's Peak – Blanca Peak (Navajo) are latitudes: $36^\circ 44' 55.0''$, and $36^\circ 44' 55.4''$; and longitudes: $107^\circ 56' 03.9''$, and $107^\circ 56' 01.5''$ (respectively). Given that the Navajo originally first moved into the Ancestral Pueblo plateau area in the vicinity of Aztec and the San Juan River in the 1500's or so, is it possible that they knew of Aztec East X and adopted one of the preexisting Aztec East X axes but weren't taken with the late emphasis of Grass Mesa and Cabezon. Instead they first chose the more prominent SE feature of Mount Taylor. Perhaps with some surveying help from Ancestral Pueblo priests still knowledgeable of these traditions, they might have prolonged a line from Mount Taylor through the X point to

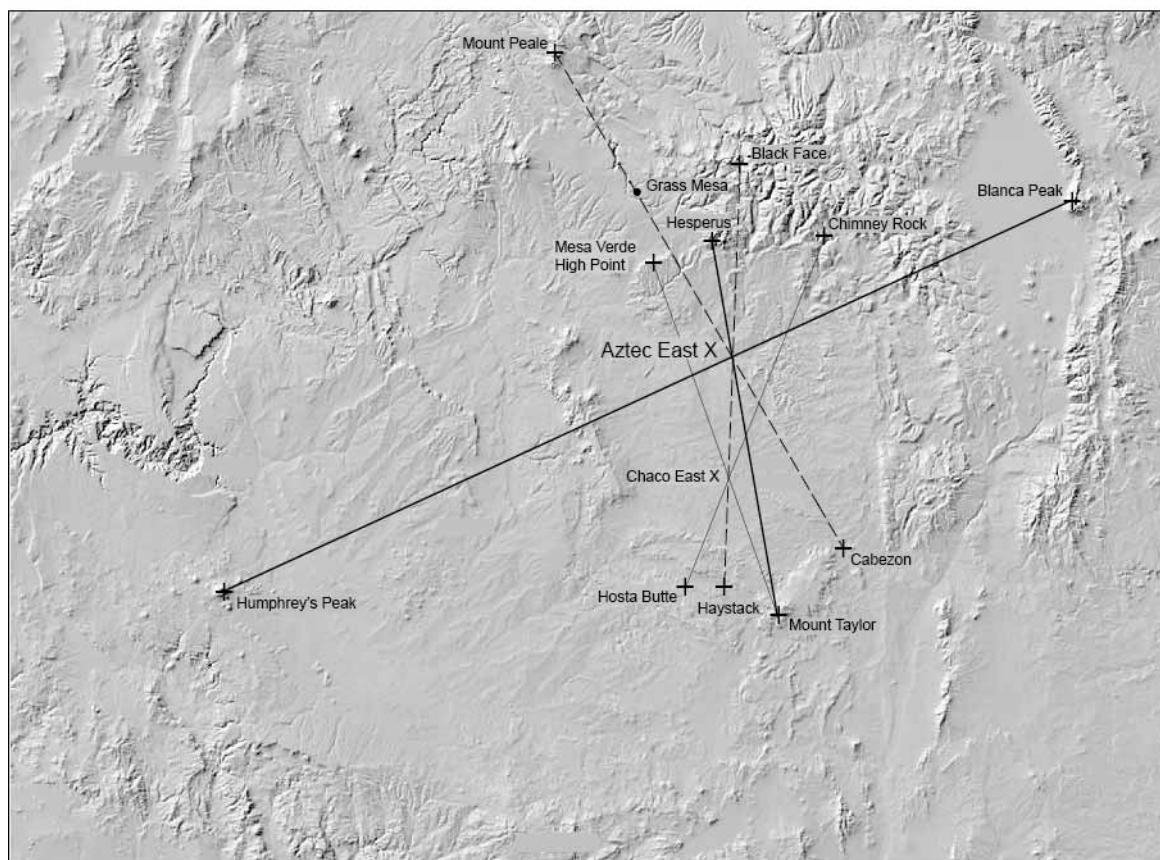
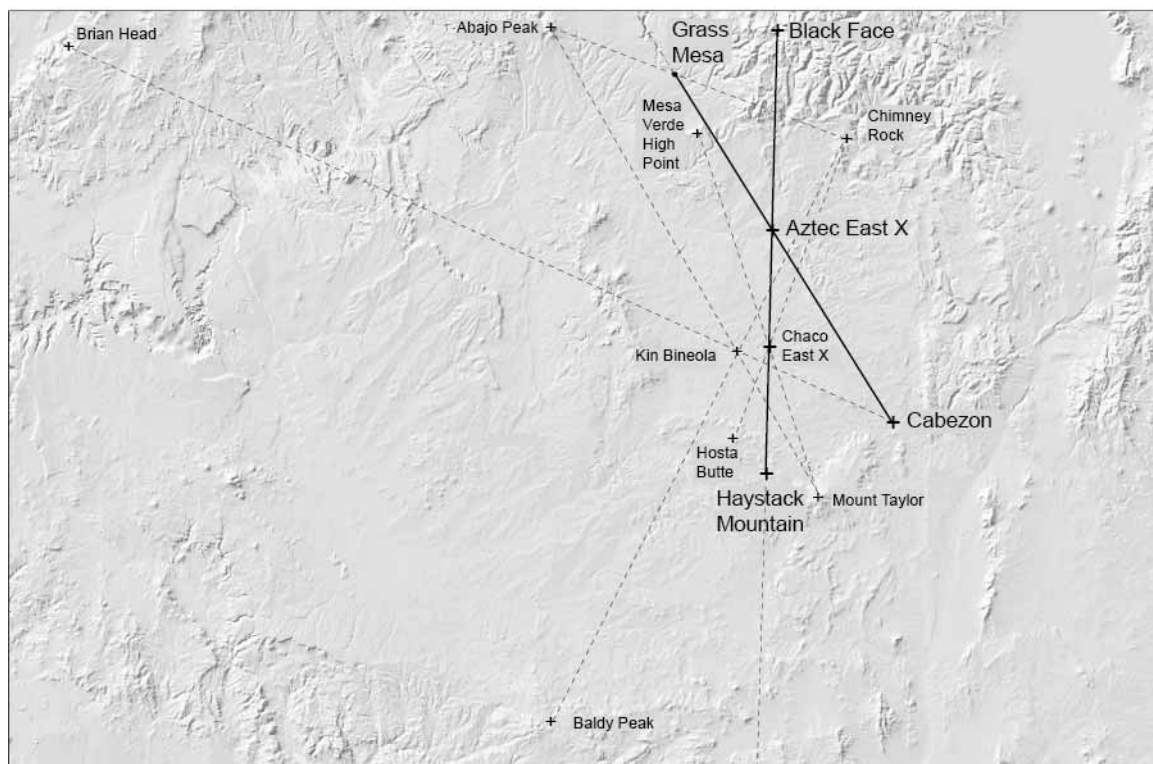


Figure 89. First determination of Aztec East X (above), subsequent addition of “Navajo” axis from Mount Taylor to Hesperus Peak.

discover a coincidentally aligned mountain to the north, Hesperus Peak.

The author has visited this Aztec East X survey point in the company of a BLM archaeologist. Like the X points at Kin Bineola and in Chaco, there are no immediately noteworthy natural or archaeological features present. Again, none of these sites has been investigated with excavation or subsurface sensing technology.

A possible second piece of evidence for Aztec East X is the location, plan and orientation of the first major great house built in this area north of Chaco Canyon, figure 90. Returning to the discussion of Hungo Pavi, one of the first formalized great houses in the Chaco remodel, it lies due east of Chaco East X, has a perpendicular north-south west wall, and long back wall that emulates the bisect from the X point to Pueblo Alto and Tsin Kletsin. The Salmon great house is located to the west of the Aztec East X point, 9.836 km, considerably farther than its apparent prototype Hungo Pavi (evident in plan comparisons recognized by archaeologists). Why wouldn't Salmon have been closer, if its primary ritual role had been linked to the new northern X point? At Chaco, again, the East X point and Hungo Pavi are located between the Curved Rock That Speaks and the PI eastern entity of Una Vida. At Aztec, there is neither a preexisting ceremonial feature to the east of the Wilson meridian, nor traditional north face of the canyon to influence the location of the new "keeper" great house.

The primary determinants that do agree with Hungo Pavi, may have been: first, a linear association with Aztec East X; and second, a connection with the previously determined principal vertical axis of Aztec accomplished in Chaco with Pavi's back wall orientation link to Pueblo Alto – Tsin Kletsin; and third a separation between the "keeper" location and the center itself, maintaining a spatial balance between the two East and West X's. Salmon's position satisfies all three of these prerequisites. It is the association with the principal Wilson vertical that moves the site almost 10 km from the X point. While seemingly violating the need to spatially separate East X from West X (predetermined to be somewhere on the meridian) by being close to the vertical itself, its distance south from Aztec satisfies the separation requirement. These design considerations seem to reflect back on some possible initial goal of organizing the new center on the Wilson meridian and not relating primarily to an East X. In this regard Salmon is not built exactly on any X point, as is the case at Hungo Pavi, recognizing its eventual relation to the actual center at "Aztec West X".

Given the meanings of Pavi's symbolic walls, how does one interpret the 114.42° (to

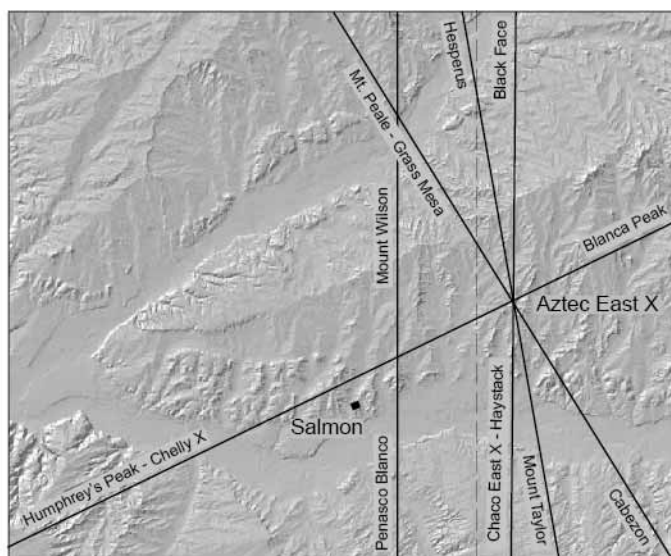
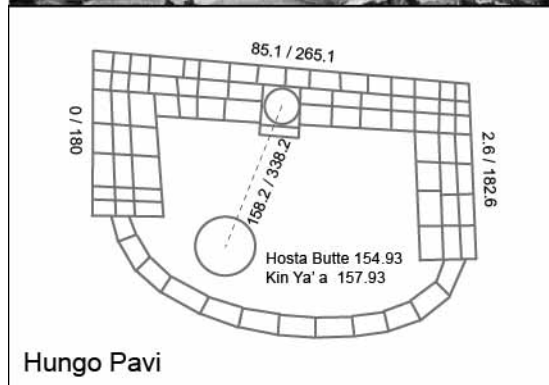
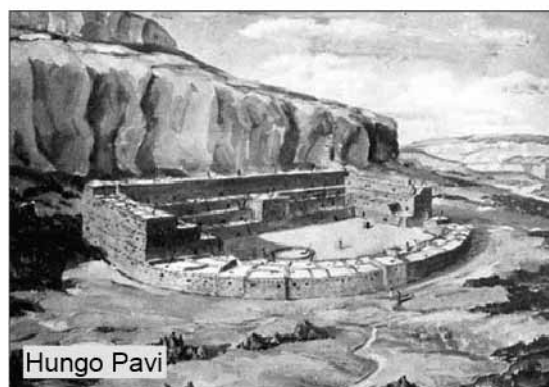
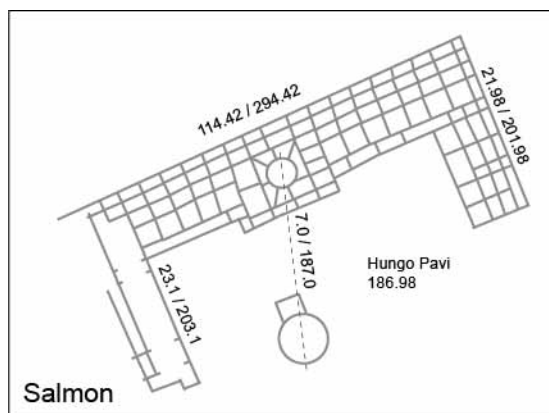


Figure 90. Location of Salmon as "keeper" of Aztec East X (above right); similarity of Salmon plan to Hungo Pavi, "keeper" of Chaco East X.

the SW) orientation of Salmon's monumental north wall? Was it a homologue as well, i.e. a transfer of a principal direction to its X point? The azimuth from Aztec East X to Humphrey's Peak (and the coincidental common point if surveyed at Canyon de Chelly) is 113.66° (113.78° to Canyon de Chelly point). This variation is somewhat over the 0.60° range used in the wall orientation probability exercise of the last chapter. Salmon's east wing wall is off over two degrees from being perpendicular to its back wall, and has no clear association either as an orientation from its site or as a homologue from Aztec East X.

Salmon's location, as the first northern great house, perhaps again expressed a unifica-

tion of not only the large scale cross axes of Aztec East X and the Wilson meridian, but an ancient shamanistic focus at Canyon de Chelly that might have become part of a more formal West half of the plateau. Why then, would the Aztec location, and its ensuing immensity of architectural construction, have been necessary? The most obvious reason might have been to simply emulate the process and layout at Chaco. There, an East X point and associated early formalized great house exists at one area of the canyon, while the actual center is organized around a West X point associated with the primary meridian of Lizard Head. Furthermore, hypothetically, there had been a tradition of a triangular layout that created the organizational focus, first at 29SJ423, and later at Chaco West X. Up north, given the religious importance of the Humphrey's Peak – Blanca Peak “base” line to Salmon, the new northern triangle might have been conceptualized less as a roughly equilateral shape than a “right” one. With Aztec East X as primary angle (actually $82^{\circ} 54' 17''$), and the intersection near Salmon as adjacent angle on the base, the logical third and most northerly angle would be the new Aztec West X vertex and location for a great house focus to rival that at Chaco.

Thus the Aztec West X focus would not only lie directly on the Wilson meridian, and the perhaps traditional Mount Peale – Grass Mesa – Cabezon axis, but collect power from the duality of Aztec East X and Chaco East X via the Haystack – Black Face feature line. Coincidentally, the intersection of the Wilson meridian and the Mount Peale – Cabezon axis is very buildable, and close to the Animas River.

Aztec West X and its great house emulation of Chaco West X

After seeing purely geometric evidence of several religiously powerful “X” points, without any architectural feature to clearly mark them, at Aztec one finally bears witness to a new “triwall” kiva created perhaps just for this purpose. The center triwall kiva of the site, seen in figure 91, lies very accurately on both the Wilson meridian as measured from Peñasco Blanco (an overly accurate average deviation of 0.0052° or off about 9 meters), and the Mount Peale – Cabezon axis as measured from Grass Mesa (average deviation 0.037° or off about 77 meters). Reflecting on the role of Chaco West X in its new layout, figure 79, the parallel design thinking is striking. But at Aztec, instead of a Casa Rincoñada associating strongly with a north axis through the X point, between West and East great houses, a new kiva triwall feature is constructed precisely on the West X point itself.

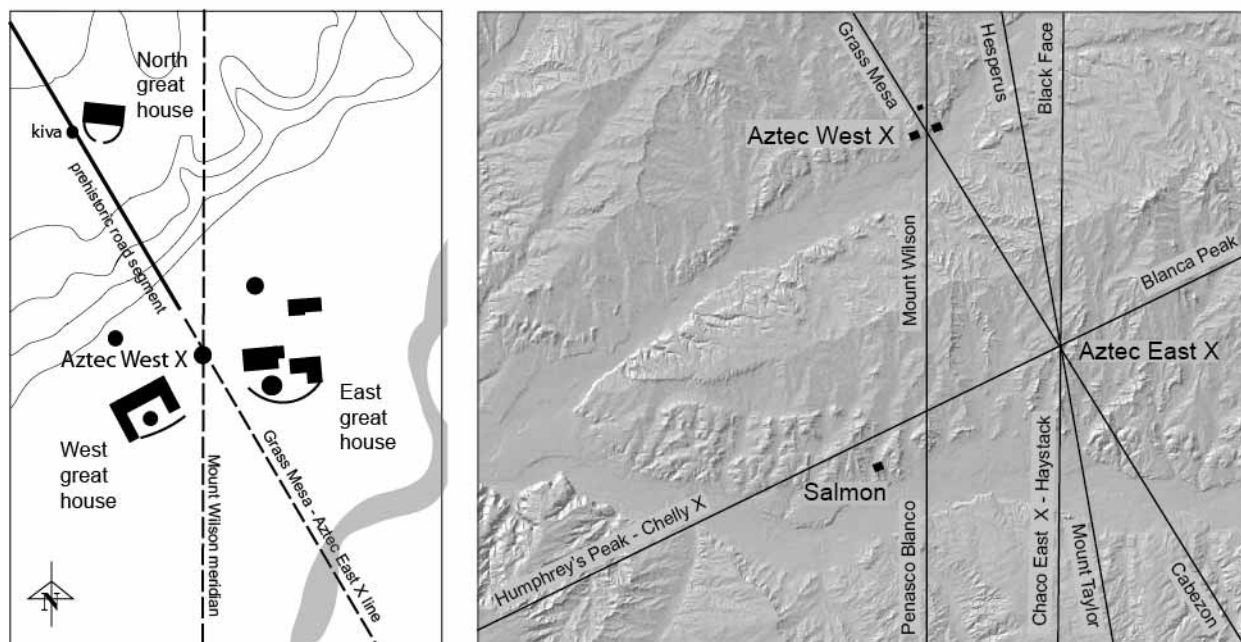


Figure 91. Creation of Aztec West X and emulation of great house positioning at Chaco West X.

At Chaco, the role of Pueblo Bonito had perhaps always been something of a legacy from the simple PI layout, where it primarily served the Curved Rock That Speaks acoustic phenomenon, mediating between early Peñasco Blanco and Una Vida. With the new Lizard Head meridian and Pierre shunt to Pueblo Alto, and integrated homologue with Tsin Kletsin, the Middle role of Bonito may have been something of a more traditional than truly ritually integrated entity in the new scheme, this in spite of, or even because of its immense eventual size and numerous rebuilding efforts, especially on its eastern half. At Aztec, a Pueblo Bonito great house may not have been considered essential to the new northern scheme--only West and East great houses flanking the X point--which in most other aspects is almost a carbon copy of Chaco.

Together with the West X layout on the Animas River margin, Aztec also replicates Pueblo Alto in the construction of the Aztec North great house and kiva on the rim above (much additional construction occurs later on this shelf to the east but does not appear to be integrated into the initial center scheme). Like Pueblo Alto, Aztec North has the primary road feature(s) of the entire West X complex. Similarly, this great house acts as an apparent threshold for humans or spirits traveling from somewhere in the NW down to the West X point (and perhaps beyond to Aztec East X, though again no architectural feature is presently known at this point). Ritually, given the position of both Aztec West X and Salmon in relation to the

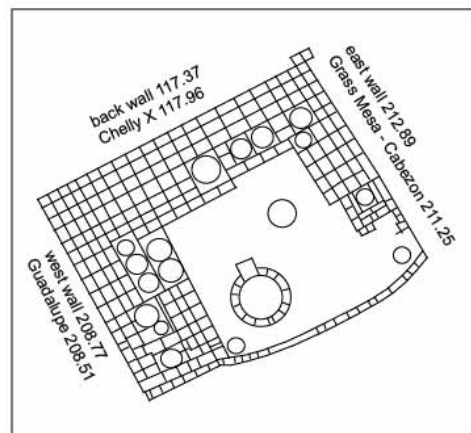
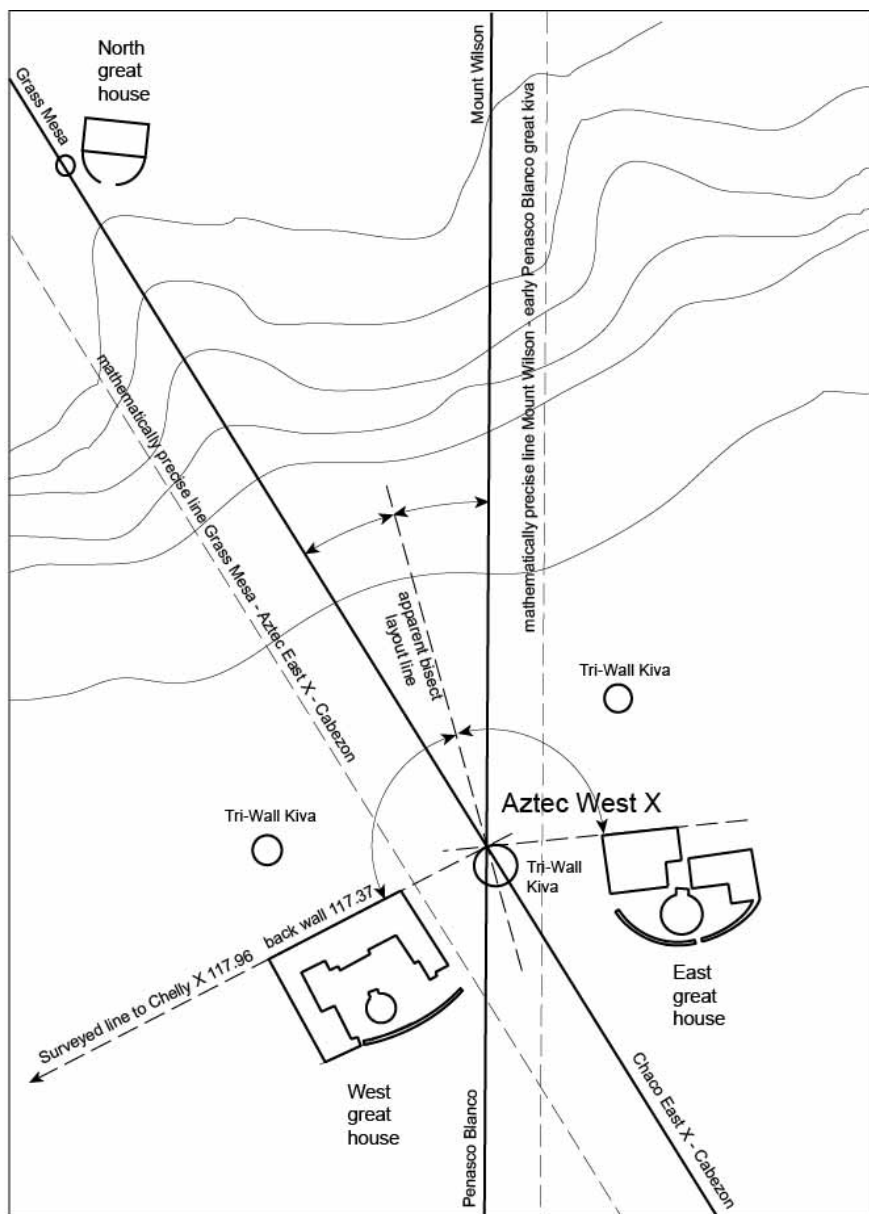


Figure 92. Apparent bisect of Grass Mesa - Mount Wilson angle as determinant for orientation of East great house at Aztec; enlarged plan of West great house.

Wilson meridian, why isn't the road expression of pilgrimage on this axis? What was it about Mount Peale- Grass Mesa - Cabezon, or perhaps Aztec East X that appears to have created more religious strength than Mount Wilson? One possible answer, is that the Canyon de Chelly axis as base for the new triangle with its key angle at East X may have been more important than what Mount Wilson meant at this time. In this sense the new Aztec complex may have been less intent on championing the traditional Wilson meridian, in a competitive, though still integrated manner, than directly connecting to Canyon de Chelly with its latter associations with the plateau West. At the same time it is also not impossible that some component in the increasingly complex plat-

eau frame may have sought a return to an ancestral Grass Mesa and related San Juan region.

The present partially restored Aztec West great house is the focus the visitor center experience. The orientation of its major back wall was measured some time ago by the author, including over fifty other great house structures on the plateau; no data for the unrestored Aztec East structure was collected at that time. The orientation of Aztec West is 117.37° to the SW, which seems to reinforce an interpretation of Salmon's major wall to a less ancient survey point in Canyon de Chelly on the Humphrey's Peak – Blanca Peak line (also the coincidental point for two other axes and the perpendicular to Sipapu). The azimuth from Aztec West X to the Canyon de Chelly point is 117.98° . Interestingly enough, the builders of Aztec West apparently did not choose to create a homologue of the Humphrey's Peak – Blanca Peak line by using the orientation of the line itself as it passes through Aztec East X, i.e. 113.78° . Again, several examples of this kind transfer of orientation from one site to another have been suggested, e.g. Hundo Pavi and Pueblo Pintado. Perhaps the founding of the huge Aztec West great house was seen of such importance that a line from Aztec West X to the Canyon de Chelly point was specially surveyed to not only orient the new monument, but further invigorate West X itself.

The northeast corner of Aztec West may have been of particular importance in that it expressed not only the Canyon de Chelly line but perhaps the principal axis to Aztec North and beyond. The orientation of the great house's east wall is 32.89° to the NW, while the azimuth from Aztec West X to Grass Mesa is 30.95° . This deviation of almost two degrees, however, is not really close to the range used in the probability exercise in Chapter 7. It is also true that the location of Aztec North, its adjacent road, and great kiva are not precisely established compared to a GPS position of Aztec West. This great house might have been laid out a few years after the establishment of the West X point, and its east wall could have been orientated more specifically in some way to Aztec North features.

Emulating the orientation of Aztec East's major or back wall from Stein and McKenna drawings (1988), one can tentatively comment on the apparent relationship between west and east wall orientations and the bisect of the angle between the two major Aztec West axes, see again figure 92. If this were an intentional design element, it would associate the west great house with Mount Peale-Cabazon and the east great house with the Wilson meridian. In this sense Aztec East is more like Pueblo Bonito in its relation to the central (Lizard Head) meridi-

an; in both we see a large interior great kiva and an expressed interior duality of west and east room block components, thus adding an interesting footnote to the apparent absence of a large Middle great house at Aztec. Yet according to the cited survey drawings, Aztec East's west wall does not appear to be parallel to the Wilson meridian.

In spite of a certain amount of design analysis, no geometric, possible intentional pattern can be found for the location of the two triwall kivas in the NW and NE quadrants of the Aztec site. This includes both relationships to other adjacent built features and to distant landscape or great kiva points. Formally, they seem paired up as "northern" components immediately linked to their respective West and East great houses. To a certain extent this replicates the only triwall kiva in Chaco Canyon at Pueblo del Arroyo. Here the kiva feature, see again figure 79, was attached directly to Arroyo's major back wall. If the triwall design was created to express an X point--much less as spaces for major ritual than geometric expressions of their capacity to organize, focus, or "center"--then why are they attached to great houses?

One scenario, the absence of more detailed archaeological data notwithstanding, could begin with the creation of the triwall form as an expression of the Aztec West point. Social groups involved with Pueblo del Arroyo might have been, via their common West religious definition, associated with the apparent re-definition of the Wilson meridian as a new West element--both within the Lizard Head - Haystack triad, and in relation to Canyon de Chelly and West at the plateau scale. The triwall element at Pueblo del Arroyo might therefore have been added as a sign of these associations. This may have been additionally multivocal in that Pueblo del Arroyo's axis could have been created by one of the triangle lines of Chaco West X. Thus there would have been a certain unification of the two West X points through the mediating act of building the triwall as an attachment on Pueblo del Arroyo's north wall.

Would it follow then, that the two Aztec great houses would feel the symbolic need to replicate Pueblo del Arroyo's role by respectively adding triwall kivas just north of their major back walls? In this case, a kind of legitimization of new Aztec religious practice may have been felt by creating these homologues of the "mother" West great house at the Chaco West X center--whose constituency might logically have included Kin Bineola as the early Chaco West, Peñasco Blanco as the PI West and probable survey point for Aztec's relationship to the Wilson meridian, and even people from the West hemisphere of plateau.

The Great North Road as ritual integrator of Aztec and Chaco

The following design analysis of the best known Chaco road reveals that this is a highly formal, most likely surveyed integration between the two center foci of Chaco West X and Aztec West X. Yet the scheme is no simple line between the two, and its change in course, when precisely analyzed, should logically be an understandable part of the overall schematic formality and ritual practice within and between the two centers.

Archaeologists agree that the prehistoric north road--in places a dualistic pair of features at others even quadripartite with two pairs running parallel--is a wholly symbolic construct facilitating some sort of religious practice between Pueblo Alto on the north rim of Chaco Canyon's center and the Aztec complex. Its general north-south alignment, as an apparent *axis mundi*, helps confirm this accepted definition. The south road from Chaco as discussed earlier in this chapter, on the other hand, angles considerably to the southwest, connecting only smaller outlier sites particularly the Kin Ya'a "terminus". The South road thus receives less interpretative interest. But to all who have looked closely at the pieces of built roadways, north and south, e.g. attaching lat/long positions to Kincaid's (1983) mapped sections and checking for consistent overlaps of alignments with Geopatterns software, these roads were apparently not surveyed along their entire seemingly straight lengths. Sofaer (et.al. 1989:3) summarizes the route of the north road thusly:

"From there (Pueblo Alto) the road runs 13 degrees to the east of north for 3 km to Escavada Wash. It then heads within 1/2 percent of true north for 16km, where it articulates with Pierre's Complex, an unusual cluster of small buildings on knobs and pinnacles. The road then heads close to 2 degrees east of north for 31 km and ends at Kutz Canyon. It appears to terminate at three small, isolated sites, and a stairway recently located by the Solstice Project (Marshall and Sofaer, 1988) that descends from the Kutz Canyon escarpment to the canyon floor."

Copeland (2012), an archaeologist with the BLM in Farmington, NM (Aztec area) and their expert on prehistoric roads, has recently added information about the layout and ritual use of the North Road, in conclusion suggesting cautiously that the symbolic reason for vagaries of its less than precise cardinal layout might be a general similarity to the cant of the Milky Way from this location. Most interesting in this work, perhaps, is the additional mapping of diversely oriented road segments and documentation of the ritual breaking of pots that occurred along

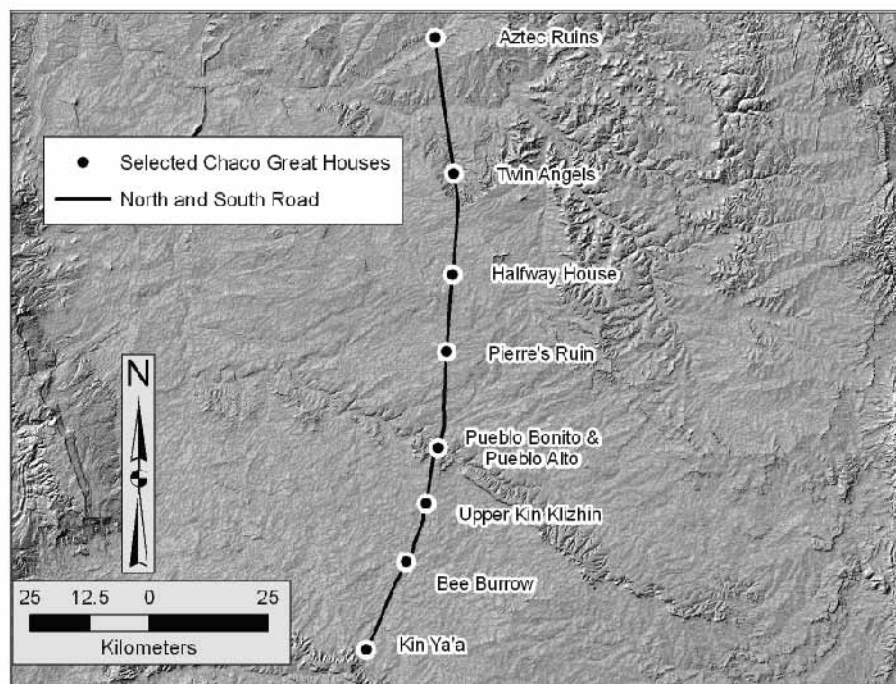


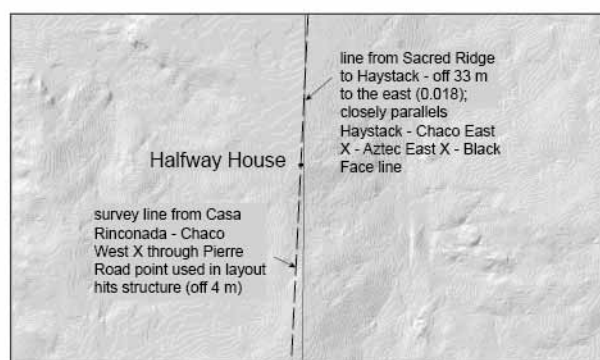
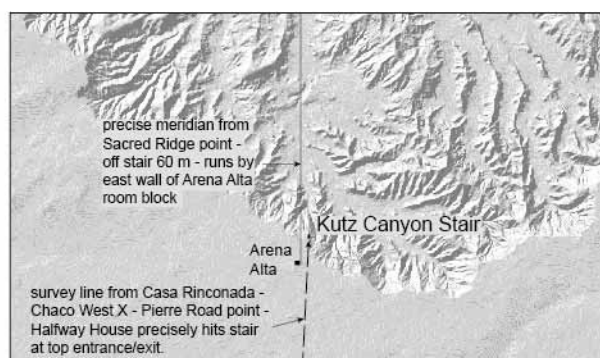
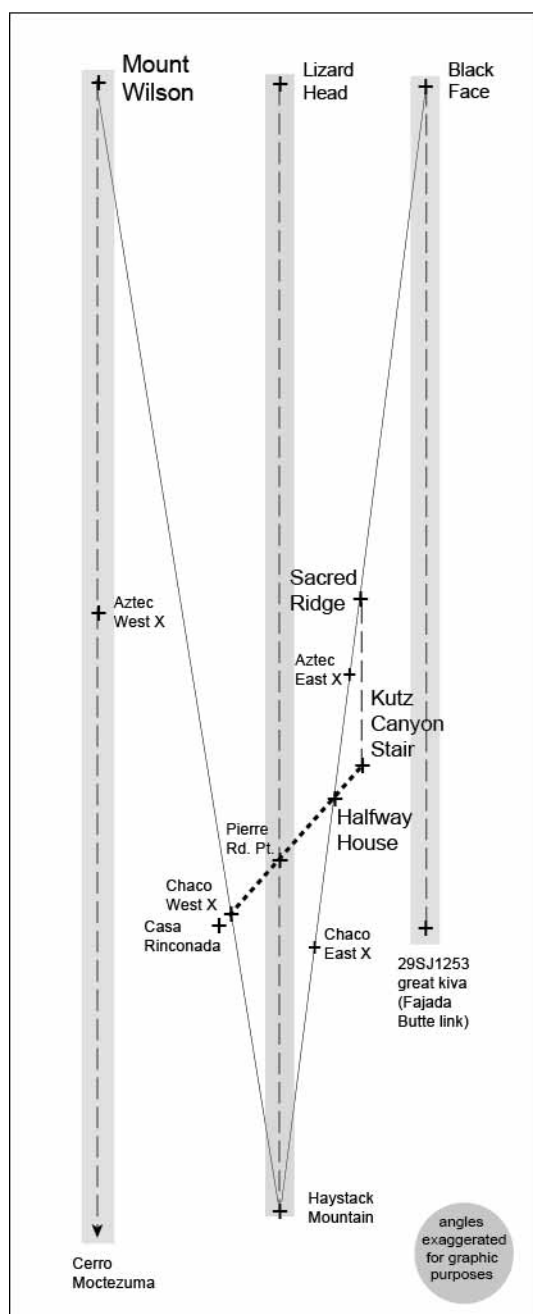
Figure 93. Illustration of North and South Roads to Chaco Canyon as drawn by Copeland (2012).

these avenues. The linear scatters of sherds are so extensive that they have become a greater indicator of roadway than actual constructed berm features themselves. Scatters cannot of course be discerned at the scale of Copeland's map, figure 93, but the reader can make out the change in route direction between Halfway House and

Twin Angels. Yet there is little discourse about any specific point where the road makes any particularly dramatic turn. This is primarily because the road structures have not been precisely mapped and subjected to any larger scale design analysis of their relationships. Interestingly enough, in the area where Copeland shows the change in route on his large scale map, Sofaer et. al. (1989) discovered a prehistoric approach and stairway leading from the Kutz Canyon rim down to its floor. Because this is not a Chacoan house structure, Copeland omits it from his map. Yet he is aware of a possible roomblock site, called "Arena Alta", in the sand mounds right adjacent to the stair approach (personal conversation); he provided a map of this site for the present work.

The author (2002) suggested that a surveyed line of pilgrimage entry to the canyon ran from Pierre's Butte through the "gate" between Pueblo Alto and New Alto on the North Rim, and down to Casa Rincoñada. It was recognized that the top of Pierre's Butte formed a relatively accurate meridian with Haystack, prior to discovering the principal spiritual role of Lizard Head and its precise meridian relation to other Pierre features. The outlier sites of Halfway House and Twin Angels did not calculate to be accurately part of the line from the room block area on the top of Pierre's Butte to Rincoñada. When recently adding the Kutz Stair (using the

point on the rim of the canyon where the stair approach begins) to the Chaco West X scheme that is now seen to organize the line from Rincoñada to the Pierre Road Point (at El Faro), a much clearer pattern began to emerge. Not only was the Kutz Canyon stair positioned as the northernmost feature of the line from or to Rincoñada, via Chaco West X, but the small road related feature of Halfway House also lies accurately on this line. Thus a very accurate alignment of five features—Casa Rincoñada-Chaco West X-Pierre Road-Halfway House-Kutz Stair-- not only unifies all of the best known segments of the North Road except for Twin An-



94. Extremely precise alignment of major North Road features Kutz Canyon Stair and Halfway House as probable prolongation from Casa Rinconada - Chaco West X - Pierre Road point.

gels, actually veering off almost three full degrees E of N to Kutz Canyon, but provides another validating piece to X point (Chaco West) hypotheses.

Thus the divergent variations in road segment orientations have masked the remarkable precision by which the road *features* themselves were probably first laid out contemporaneously with the development of the Aztec landscape scheme or perhaps its great house infill. The actual road segments may relate more to subsequent usage by non-surveyor ritual participants. Recalling that the Chaco West X point may have been determined by the mathematical intersection of Wilson – Haystack and Tohatchi-Kin Bineola X, it is extremely improbable that as a random phenomenon it would participate so accurately with the principal ritual road line into Chaco. This line consists of eleven separate three point alignments (see list in Appendix II). Errors in GPS readings and map transfers notwithstanding, the lowest average deviation of the eleven (taken from both ends) is 0.0002° and the highest is 0.011° , while the average of the eleven is 0.005° (visual acuity again is 0.017°). Considering the 52.050 km length of the line, the greatest distance any three-point line would be off its interim point, is about 2-3 meters; or, all lines clearly hit their features, pretty much dead center.

This likely evidence of Ancestral Pueblo surveying abilities aside, it seems understandable why Casa Rincoñada-Chaco West X ran to the Pierre Road point on the Lizard Head meridian, but why does this axis continue very precisely to the mysterious stair feature that disappears into Kutz Canyon, and what was the role of Halfway House on this line? If long held suppositions that the North Road ran from Chaco all the way to Aztec are true, now considering the features of Casa Rincoñada – Kutz Stair alignment, straight as an arrow, then why would the way to Aztec make an abrupt almost ten degree turn to the west at the stair point? Curiously there is no well documented road segment between the stair and Aztec—the direct alignment runs mostly in the canyon wash—including at the primary non-community outlier site that appears to connect the two, Twin Angels. Nevertheless, two large-scale landscape considerations may have played into a pilgrimage role for the Twin Angels room block with two enclosed kivas perched rather precariously on a rim outcrop overlooking Kutz Canyon. Perhaps most important was its adjacency to the Lizard Head – Haystack meridian which passes about 123 meters west of the structure. Was this another “keeper” relationship not that unlike Hungo Pavi and Salmon where structures were located off associated axes? Logically, a small structure like Twin Angels couldn’t be directly on the Lizard Head meridian, competing

with all that the Pierre Site and the shunt to Pueblo Alto – Curved Rock That Speaks may have done.

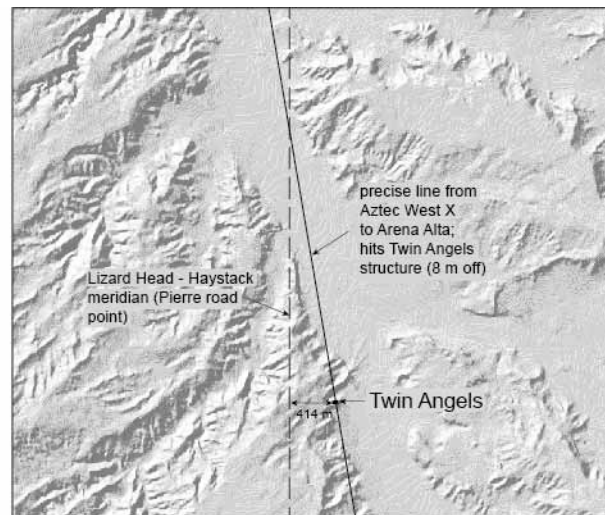
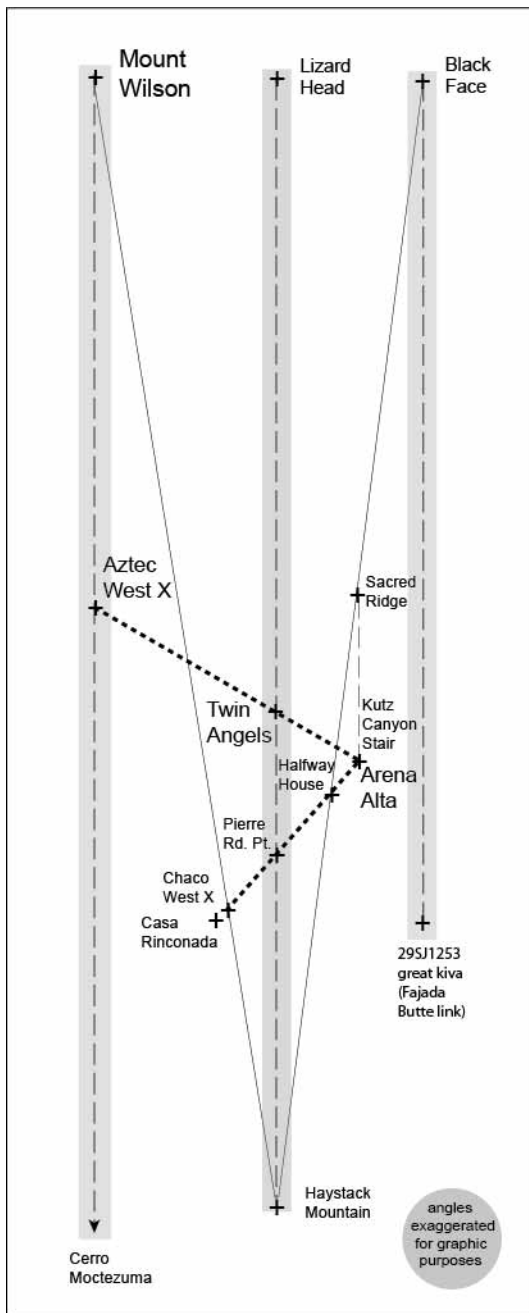


Figure 95. Location of Twin Angels on separate survey line from Aztec West X to Arena Alta.

The other positioning line at Twin Angels, however, appears to be almost as precise as the alignment between Casa Rincoñada – Kutz Stair features, though with only one interim feature. About 340 meters to the southwest of the Kutz Stair is the unexcavated road related room block buried in the sand, Arena Alta. The mathematical line from this point to Aztec West X

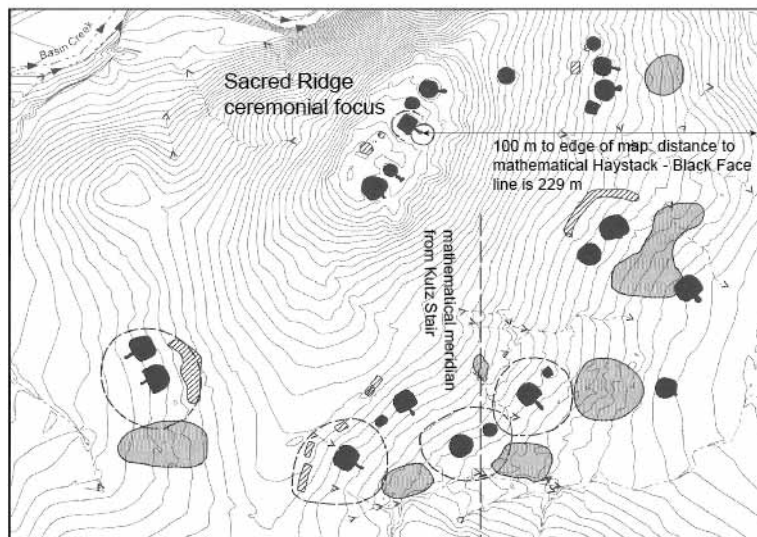
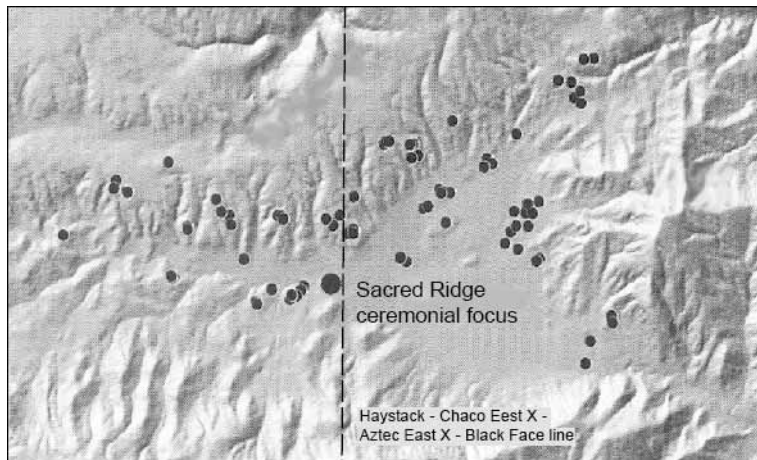
(central triwall kiva) actually hits the small Twin Angels structure (average deviation of 0.044° at 35.510km). It is worth mentioning that the location of Twin Angels accurately on an Aztec – Arena Alta line might be compared with probabilities of random point alignments by creating a fairly large test box (10-15 km square) around the site location. Only one random point would be placed in each test set, since there are no Chacoan outlier communities or other road related structures (like Twin Angels) in this part of the Aztec/Kutz Canyon area. How many sets would it take to find one similarly positioned in relation to both the Lizard Head meridian and the Aztec West X – Arena Alta line? Thus given the impressive surveying of the Chaco West X road to the Kutz Stair (including Casa Rincoñada), one might well be inclined to see Twin Angel's position on the road segment from Aztec West X as an equally intentional design act, rather than coincidence.

In terms of design logic, if both lines from the two center West X points from Chaco and Aztec were surveyed, why do they not connect at a common point where the turn is made? More specifically, are they likely to be separate symbolic and ritual artifacts, yet clearly integrated into one North Road? An archaeologically determined dating of road related features may be critical here, though beyond this writer's expertise. Working primarily from the present perspective of design analysis, however, there seems to be good initial evidence that the new Lizard Head landscape scheme, including Chaco West X, was laid out prior to the location and great wall constructions of the new great houses. In the latter part of the 11th century, the second path to the Pierre complex (separate from the initial cardinal line from the west fire hearth to Pueblo Alto and Curved Rock That Speaks) was then laid out with Casa Rincoñada as its new focus to the south. From the provisional dating presently available in the literature, Casa Rincoñada was built prior to the road related structures at both the Pierre Site and Halfway House. Therefore it would appear that Halfway House, as an extension of the ritual path from Chaco West X (and Rincoñada) to the Pierre Road Point was built later, or that the ritual path originally stopped at the Lizard Head meridian next to El Faro.

Alternatively, however, depending on the dating of the Kutz Stair, the initial route from Casa Rincoñada might have passed through the Pierre Road Point, and terminated at the Kutz Stair, leaving the architectural structures at Halfway House and the Pierre Site to be built later. This possibility arises with the design recognition of two separate North Road segments, one to Chaco West X and other to Aztec West X. There may be two interpretations of what happens

at the Kutz Stair / Arena Alta junction: one that the line simply changes course, and the other that the Aztec West X path joins a second coming in from northeast, i.e. an as yet unknown extension of the Chaco West X line through Pierre Road Pt. While it is possible that such an extension of the Chaco West X portion of the North Road was laid out at the time of the Aztec expansion, it was clearly of some significant ritual purpose to create the Kutz Stair feature markedly to the east of the Lizard Head meridian, this purpose might possibly have earlier played into the creation of Casa Rincoñada itself. What is so important about the Kutz Stair's position to the northeast, in either case?

From personal conversation and a subsequent blog from Steve Lekson discussing a populous 800's site farther north as an additional point on his loosely cardinal "Chaco Meridian" combination, this early PI site in the "Ridges Basin" (preliminary report in Potter & Chuiyka 2007) appears to be of major importance, along with other early northern foci such as Grass Mesa (see again discussion in Chapter 5). The ceremonial focus of the community, shown in figure 96, a modest rise in the basin called "Sacred Ridge", lies about 239 meters west from the highly coincidental line from Haystack to the Black Face feature (including Chaco East X, Aztec



East X and the Navajo cross intersection point). It is not being suggested here that Sacred Ridge may have

Figure 96. Relation of Sacred Ridge community (above) and ceremonial focus (below) to Haystack Mountain - Black Face line and meridian from Kutz Stair (base drawings from Potter and Chuiyka 2007).

been positioned on this line, or even on any other during the early formalization of the plateau

framework, but that later surveyors of the Chaco and Aztec schemes might have well understood the adjacency of the new schemes with what may have been a still important ancestral site.

Whenever the Chaco West X – Kutz Stair axis was laid out, its northeast direction beyond the Lizard Head point at Pierre, must have been symbolically significant, otherwise the complementary ritual route from Aztec West X would have come directly in to Pierre. Just as Aztec's primary ritual axis by the Aztec North great house runs to the X point on the Haystack – Black Face feature line, so too may thinking about the Casa Rincoñada line have involved some consideration of the remarkable power of Chaco East X / Aztec East X line running by the then ancestral Sacred Ridge ceremonial focus. It is not impossible that the Kutz Stair was located, first on an extension of the Chaco West X line through the Pierre Road Point, and second on a meridian prolonged south from Sacred Ridge. The longitude of Sacred Ridge is $107^{\circ} 55' 56.4''$ and the Kutz Stair is $107^{\circ} 55' 54.4''$, or very accurately cardinal. It is clear from a drawing supplied by Copeland that the layout of the stair, including the prehistoric approach, while not at all precisely linear, is much more cardinal, taken as a whole, than anything veering 10 degrees to the NW and Aztec. Furthermore, in the actual stair itself, the northernmost, seemingly straight segment points about 25° in a NE direction (no apparent connection with any point used in this volume). Without better topographic information, and/or a landscape design analysis, it is premature to say that the stair/approach feature was laid out to take advantage of one of the best natural grades into the canyon. From the USGS topo alone, this seems unlikely, i.e. that there doesn't seem to be any clear coincidence to accessibility stair function and its position on the Chaco West X – Pierre Road point line (and perhaps the meridian from Sacred Ridge as well).

The role of Halfway House may someday also be seen as also relating to either Sacred Ridge or the dual East X (Chaco and Aztec) axis that runs through the center of that early community. The Black Face feature – Haystack – Cerro Moctezuma line runs about 165 meters (average deviation of 0.071°) east of the Halfway House block structure. While being very accurately on the Casa Rincoñada – Kutz Stair line, Halfway House might play another more a “keeper” role with respect to the major East axis; it lies a similar distance as Twin Angels is off the Middle axis (Lizard Head meridian). Unlike the larger keeper distances at Hungo Pavi and Salmon, the deviations at Twin Angels and Halfway House could also simply be errors in sur-

veying, given their accuracies well within the range of the probability exercise in Chapter 2. If the two road related sites were intentionally located off the major lines running close to them, some priestly sleight of hand might have been necessary, since in both cases, surveyors would have known where the big natural feature lines intersect with the road lines (in the vicinity of the structures).

Given the dualistic and quadripartite road features that occur between the Kutz Stair and the Pierre Site, together with the separate designs of the Chaco West X and Aztec West X legs of the overall North Road, and the ambiguity of where the stair points, it seems not impossible that two or more ritual groups of participants met at the Arena Alta / Kutz Stair area, then traveled down together to the first major Chaco threshold at Pierre, and then on to the canyon. The location of the stair on the Chaco West X axis farther east from the Lizard Head meridian, speaks strongest for some separate religious meaning or group from the East side of the Chaco scheme. This might have been a purely symbolic emphasis of Chaco's traditional East definition at the plateau scale, with the same or related participants as laid out Casa Rincoñada, and perhaps much of the Chaco scheme itself. Yet the simple stairway seems an odd expression of "East" *per se*, given the overzealous architecture built at Chaco and Aztec.

From a formalistic design perspective, seen in figure 97, it makes most sense to see the journey to the Kutz Stair, well east of the Lizard Head axis, as a means of balancing the power of Aztec with its reformed West expression, including Grass Mesa and Mount Wilson. When the North Road was laid out, it is possible that an ancestral Sacred Ridge was conceived of as an East compliment to a contemporaneous ancestral Grass Mesa. If this were the case, then the ritual trip to Chaco may have begun at Aztec with people worshiping or masquerading ancestors associated both with earliest Chaco and the Wilson meridian, and PI Grass Mesa. Their ritual power would have immediately been moderated not only by crossing by the Lizard Head meridian near Twin Angels, but by terminating the Aztec West X leg at Arena Alta, where they might have been met by other groups worshiping ancestors from the NE. Mixed in a kind of ritual union (see again Doxtater 1991) their arrival at Halfway House reinforced their still East location and its association to the remarkably coincident "great" X axis of the East.

At the Pierre Road point, the liminal merger of East and West should logically occur, but because of the fire shunt to the Curved Rock That Speaks meridian, pilgrims remain in the East domain, continuing at a slight angle on down to the faux meridian and Pueblo Alto, where

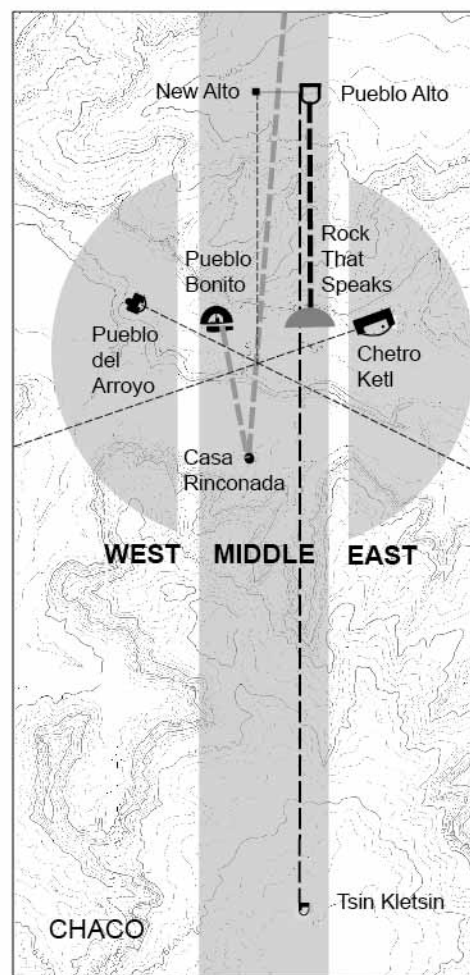
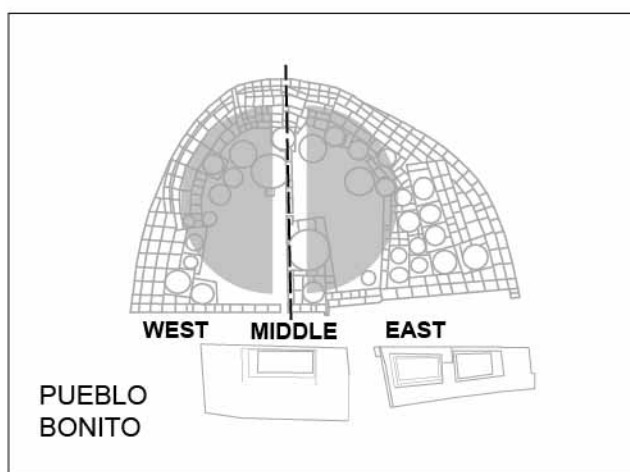
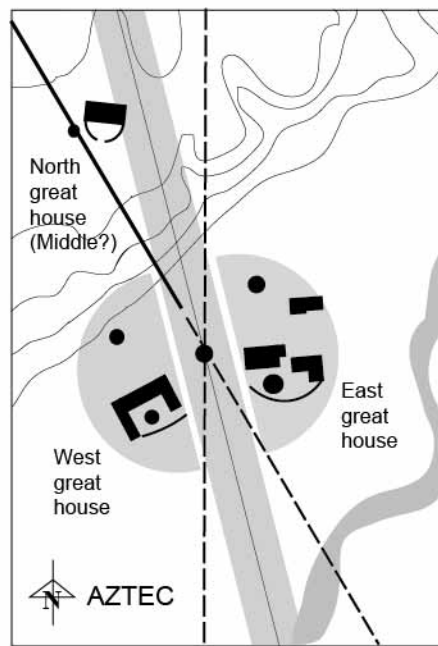
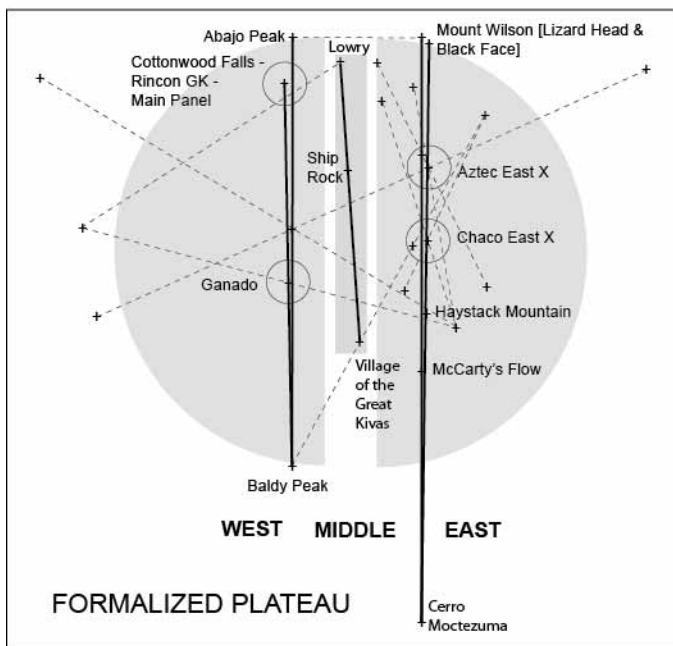


Figure 97. Formalized triadic ritual expression at plateau, center (Chaco and Aztec), and great house scales.

the primary rituals of unification may have taken place, in preparation for ultimate performance at the natural amphitheater. The ritual route went from the central triwall kiva, Aztec West X, down to Chaco West X, architecturally expressed by the terminus of the axis from Kutz Stair at Casa Rincoñada. Since Rincoñada's location and orientation make it one of the Middle elements in central Chaco it may have been used by both groups united initially during the pilgrimage at the Kutz Stair.

9. Toward an Anthropology of Prehistoric Landscape/Architecture Design

There is no academic discipline, or even sub discipline, whose primary goal seeks to understand social and particularly cognitive space. While one would think that “wayfinding”, as our most immediate example of cognitive maps, would constitute a serious research domain within contemporary design and planning, only a couple of now older “how to” books, barely keep the ideas of Lynch (1960) and others alive. The flourishing though still esoteric applications of Space Syntax to wayfinding today are the exception here within their broader interests in the human uses of different morphologies of environment (initiated by Hillier & Hanson 1984). While the seminal work of both Lynch and Hillier & Hanson made copious use of literature about or maps of traditional settings, neither developed any clear distinction between religiously used symbolic/ritual space and other social phenomena better defined as territoriality, both unique forms of cognitive mapping. This is precisely what an anthropology of traditional space needs to do.

Our contemporary 21st century environments are so devoid of formalized, long lived ritual layouts of space, that assumptions of wide spread territoriality, though again not well researched, are largely true. While a contemporary designer might actively pursue symbolic content in the layout of a church or a memorial landscape (e.g. Wasserman 1998) there is little in our academic histories of architecture, planning, or landscape that includes ritual “maps” as it were, especially in the scant course coverage of the prehistoric. The emphasis lies in the built artifact more so than how it can create and participate in ritual practice moving through symbolic thresholds, domains and other elements of structure. This preoccupation with the artifact is largely true as well in archaeology, with the more recent area of “landscape archaeology” just beginning to ask questions about more symbolic landscape contexts (Darvill 1999, Bradley 2000, 2006), though not yet inquiring about possibilities of designed large scale frameworks. We remain some distance from any generally consensual definition of the difference between territorial examples of social space, at all scales, and ritual patterns that are much more formalized, symbolic, complex, participatory, and often integrative. Thus there is precious lit-

tle discourse, in design and planning or anthropology that can yet point to the changing social role of cognitive maps in an evolution of “shamanistic” to surveyed “formalized” large scale landscapes. The present work is hopefully a small step in that direction.

ANCESTRAL PUEBLO EVOLUTION OF FORMALIZED LANDSCAPE RELIGION

The religious effect of alignments among or with prominent natural features

Hypothetically, neither shamanistic landscapes where some non-surveyed “spider web” or “cosmos” anchored on real topographic features is shared by tribes living within, nor ritually surveyed evolutions of such, are territorial. Rather, these symbolic definitions may tend to mitigate competition for resources, at least from within the defined cultural sphere. The spiritual power of the natural landscape constitutes a kind of symbolic capital available for the social and curative purposes of these societies. Given, therefore, that the powerful larger natural setting had most likely been loaded with shamanistic spiritual affect, perhaps for millennia, it is not unreasonable to suggest that at some time, religious specialists began to attribute extra power to coincidental geometric relationships among the most prominent of “god-given” features—mostly alignments and particularly those cardinally orientated. The development of simple but accurate techniques of surveying may not have been driven by any functional purpose, as in modern engineering, but by a desire to create greater religious affect among features in the natural landscape. This is not yet design, but with such tools, and a context of ritual practice as the primary expression of religion, first formalized larger scale geometric artifacts might soon have followed.

Pivotal in some new anthropology of traditional space is the rereading of Ortiz, described in Chapter 1. While generally successful in questioning the kinship/mythology based dualistic structures in lessor organized cultures, Ortiz’s work perhaps more importantly contributed a new appreciation for the spatial structure of a ritual landscape. Yet his interpretation may have fallen short of fully understanding the phenomenological contribution, or originating capacity of space and cognitive mapping itself. He felt that spatial layouts of ritual landscape were essentially secondary, essentially coming from origin myth as a sort of primary social medium. To the contrary, assuming a non-territorial, shared landscape, an “on the ground” native discovery of coincidental, large scale geometry might immediately transcend more lan-

guage based kinship or mythic definitions of social groups, engaging other social entities associated with features some distance from each other. The discourse about when and how ritual sodalities came into being, and how they worked with kinship organization, might really be less complicated than it seems. Most ritual groups in the Ancestral or Historical Pueblos are fundamentally large scale and integrative, rising above kinship definition. This may have been even more the case in a hypothetical prehistoric survey based religion. Most important perhaps, is the idea that sodalities were not invented to ameliorate relatively local scale distribution of kinship power, but to engage more formally in the larger scale landscape that might well have been culturally shared for thousands of years.

Very much in this same vein, the creation of the first formalized piece of ceremonial architecture, the great kiva, could have been part and parcel to the development of survey based design in the larger landscape. Whether the “chicken” as structured landscape preceded these ritual foci as “eggs” or not, *should* be a theoretical question of considerable priority—the folk wisdom of indeterminacy to the contrary. Presently, early PI great kiva sites, with adjacent seemingly domestic structures, are felt to be largely local phenomena, unique and limited in number compared to the basic domestic pattern of small kinship pithouse homesteads scattered about sparsely within a community area. The role of these first specialized ritual settings, probably misnamed “villages”, are not at all clear from the archaeological record. Notably, the number of alignments associated with early great kiva sites, as illustrated in the probability analysis of Chapter 2, is higher than in later periods, suggesting that work needs to be done to not only determine how the sites were used, but perhaps even more importantly, where they were located.

The design analysis of the first two great kiva sites in Chaco Canyon (29SJ423) reveals not only the possible intentional location of the northernmost site on the Mount Wilson – McCarty’s Flow (north-south) cardinal axis, and close to the only large-scale coincidental three-point alignment on the plateau among the Grand Canyon Sipapu-Mount Chicoma-Truchas Peak (west-east) but a relatively good equilateral triangle with 29SJ423 as apex to base points at the coincidental intersection of Kin Bineola X (three large scale axes) to the west, and the second great kiva site of Shabik’eschee east in the canyon. The “cross axes” of Kin Bineola X—perhaps not unlike those of the corner mountains of the shamanistic cosmos—might have been understood by surveying in an effort to find complementary corner axes to the Wilson me-

meridian in the vicinity of Chaco Canyon. The acoustical amphitheater wall called Curved Rock That Speaks sits quite accurately on the eastern ray of the early Chaco triangle whose end points are the two great kiva sites. This formal flanking of the canyon has been briefly commented on by archaeologists, an implicit understanding of some process of larger scale design and formalization.

Most importantly, this hypothetical evolutionary turn of landscape religion may not have begun by people in the canyon, seeking to magnify the religious power of the canyon by “extension” out into the greater spiritual landscape. Rather it could have been the reverse, with early priests or shamans first discovering the cardinal relationship between Abajo Peak – Mount Wilson (west-east) far to the north, and a complementary perpendicular down to the most recent volcanic event called McCarty’s Flow(south from Wilson). Thus the concept of layout was “intension”, i.e. beginning with significant landscape elements on the periphery, and then secondarily channeling that spiritual power to more ritually accessible ceremonial sites, with clustering populations around. The *intension* process of understanding the equinox relation with Abajo Peak, then laying out the meridian from Wilson, positioning the two canyon sites, carrying timber supports some distance, and completing the great kiva form, may have been a new *kind* of religious practice, specifically integrating different social groups associated with the geometry, rather than any more socially or politically motivated religious *extension* to create a “center” at the plateau scale. The design and execution of laying out landscape and related (subordinated) architectural form may have been the most important aspect of these religious acts, perhaps even more so than doing ritual in the kivas once built.

Formalization of triadic ritual framework across a likely previously shamanistic plateau

Interpreting the first “Chaco” layout and location of great kivas more as an early change in religious process, *per se*, than new center with large scale political implications, allows one to think quite differently about change in other parts of the plateau. It is not impossible that the period beginning in late Basketmaker III and running into the PI period (roughly 600 – 800 A.D.) saw a reformulation of basic religious process across much of the plateau. Great Kiva sites appear in all parts of the cultural sphere, though in small number. Most interesting are the geometries that possibly “emerged” from the Sipapu in the Grand Canyon—confluence of the two Colorado Rivers—to found new framework, particularly on the west side of a shamanistic

cosmos with its *axis mundi* (north-south vertical) between Abajo Peak and Mount Baldy. The line from the Sipapu through the southern tip of Comb Ridge (and the main panel of the Butler Wash Rock Art) and up through the Bluff site and to Lowry Ruin may have formalized a northern ritual focus, complementary to a southern focus at Ganado laid out with lines from the Sipapu to Mount Taylor and from Humphrey's Peak to Tohatchi.

Tentative evidence that these new ritual experiences on the western side were designed cognizant of the eastern precedent of Mount Wilson and Chaco appears in the mediating or "Middle" vertical structure laid out on Ship Rock with aligned great kiva sites of Lowry Ruin, Tohatchi and Village of the Great Kivas. While the basic triadic structure of Ancestral Pueblo religion might have been first formalized in the design of the early Chaco layout (vertex and two base points), it may have been inherently more likely in West, Middle and East domains of the traditional shamanistic cosmos itself. This is not to say that its formalization during the new survey integrated ritual practices didn't likely intensify the expressive and social effects of these meanings in emergent sodalities, at all scales of organization, particularly the larger ones.

In the late PI, Chaco itself--perhaps in recognition of the formalizing larger plateau frame and sharper definitions of triadic Pan-Ancestral Pueblo religion--constructs a triad of embellished or new sites with two new great kivas, creating a smaller more visually defined canyon axis. Early non-formalized or organic roomblocks are built at both of ends and adjacent to the Curved Rock That Speaks in the Middle (Pueblo Bonito). This modest Chaco remodel may have more formally expressed its relationship to the emergent plateau frame, since its NW point, Pueblo Peñasco, is sited quite close to 29SJ423, and still on the Mount Wilson meridian, funneling power into the canyon triad as it were. The SE great kiva of Kin Nahasbas and great house of Una Vida, adjacent to Fajada Butte, replace earlier Shabik'eschee. Little in this re-definition, however, speaks to any intention to make Chaco anything more than an Eastern focus, in sync with the plateau frame.

Lizard Head meridian and Curved Rock That Speaks

By the early 11th century, the primary mode of Ancestral Pueblo religion for several hundred years might have been designing and surveying layouts of large scale landscape patterns, together with the integrated building of liminal great kivas and associated pithouse or roomblock structures. In a very real sense, these processes *were* the religion, the motivation of different

groups to participate with each other, and of probably specialized individuals to create new design by which to keep the religious process vital. The PI formalization could have been driven primarily by these forces, almost religion for its own sake, rather than any radical new ecological need to organize at these scales. So too can one begin to see the motivation of different groups of people coming into Chaco in the early 1000's and laying out one of the most highly designed landscape-architectural integrations yet theorized in SW prehistory. Fueling it all may have been in effect a transfer of plateau scale triadic structure to the naturally coincidental positioning of two additional mountain features east of Mount Wilson (in the Wilson Group). If Chaco were to be legitimately perceived as the new pilgrimage center of the entire plateau, a kind of renaissance of its earliest role in the new religious process, it would need the power of "god-given" natural features to make the case.

Only by analyzing classic Chaco from a design perspective can one begins to appreciate the creative religiosity--design and execution--that informed not only the positioning of all new structures, whether great kivas or great houses, but new symbolically oriented monumental wall features in them. Designers of the new scheme perhaps fully recognized the goal of a legitimate triadic plateau pilgrimage center by conceptualizing and laying out most of the scheme as a whole, prior to the construction of architectural components. This part of the process, after all, may have been the most engaging in terms of ritual participation by groups from distant regions.

Core to the scheme might have been the channeling of the Lizard Head meridian at the Pierre Site to a mini-meridian running due south to the Curved Rock That Speaks, correcting the close but not accurate alignment of the ultimate ritual plaza of the amphitheater with the most powerful newly crowned Middle mountain. This positions both Pueblo Alto right on the meridian and Tsin Kletsin aligned with Alto's west wall perhaps as symbolic re-creation of the Lizard Head meridian with Haystack Mountain coincidentally at its base. The design of three lines from Haystack Mountain to the other two northern peaks in the Wilson Group provide west and east scaffolding components of the landscape frame; the west line ran to Mount Wilson and the east to the Black Face feature. A new cross-axes "X" point may have been created in the canyon coincidentally on the Haystack-Black Face line to replace Kin Bineola X. The wall orientations of Hungo Pavi, perhaps the first great house with these monumental features, appear to integrate the Chaco East X point with the Pueblo Alto-Tsin Kletsin mini-meridian.

Then the original Chaco triangle with its western point at Kin Bineola X could have been rotated with a new vertex (Chaco West X) created by a Haystack – Wilson line and lines coming in from Ganado and Tohatchi from the West side and Middle of the plateau. These lines position the new great houses of Chetro Ketl (East) and Pueblo del Arroyo (West). Great wall orientations of new great houses and remodeled existing ones seem understandable in the context of the large scale landscape elements of the new scheme.

The design of the 11th century Chaco scheme seems to follow the *modus operandi* of religious process of the BMIII – PI period, but creates with its ingenuity and scope of participatory process a primary pilgrimage locus on the East side of the plateau. Other imbalances might also have surfaced as different groups began filling in the architectural elements of the canyon center. Spatially, one cannot speak of territorial differences between West, Middle and East great houses, for example, since their locations appear to have been all firmly determined by the initial layout of the landscape scheme. Nevertheless these constituencies began creating this new kind of architecture as much as anything to express huge, oriented walls and perhaps the spatially based sodality process itself, rather than any kind of temple for worship. “Rhetorical” effects, previously suppressed in Ancestral Pueblo building, may have found their voice. Chetro Ketl (East) has a floor plan even larger than Pueblo Bonito, for example, and much larger than that of Pueblo del Arroyo (West).

In this same vein, it is not unlikely that large scale surveying processes were socially more cross-cutting than building architecture in terms of political makeup. While some lines, and possible social constituencies, fell clearly within one of the three symbolic domains of the religion—West, Middle, or East—others were less specific, often necessary for a common underpinning or design logic of the scheme. Compared to the construction of the new great houses over years or even decades, survey participation was less labor intensive and required less design coordination over much shorter periods of time. Quite possibly, therefore, the new rhetorical element of monumental architecture involved a certain competition among constituencies. Particularly important might have been the way formally defined ritual groups sought to maintain their construction crews during the years it took to build such huge structures. All of this increasingly competitive architecture probably intensified political dimensions of the process by which participants identified themselves as members of the West, Middle, or East. Perhaps there had always been at least two ways of belonging: one, by living in an area defined

either at the plateau or “hemisphere” scale and/or having traditionally used a particular natural feature in the system; or two, by being a member of one of the three sodalities *within* a community area. It seems likely that the structural principal of the evolved plateau religion would have become expressed at smallest social scales during the three or four hundred years of landscape formalization prior to the big Chaco build-out.

During the BMIII-PI period, the limitation of architectural form to the simple circular great kiva may have effectively constrained the insipient rhetorical expression of monumental buildings. While the construction of most historical or prehistorical pieces of monumental architecture seems likely to have been preceded by an asymmetrical, territorial control of the site, the new great houses at Chaco were clearly located in the context of large-scale integrative framework—again a process of “intension” compared to “extension” where the building comes first and certain elements orient to landscape features secondarily. And even though, again, any particular great house can be seen more as an assemblage of separate, symbolically oriented monumental walls, than any conceptualized “whole” building meant to impress or persuade, still there was much in their process that may have begun working against the participatory genius of creating formal design frameworks in the landscape.

Casa Rincoñada’s late begin date, after most of the great houses were under construction or completed, may have recognized the subtle rhetorical strain in what had been a comfortable relationship between the natural features of the ritual landscape and simple circular architectural form. This may have been the primary driver of the second ritual axis from the Lizard Head point at the Pierre Site down through Chaco West X, terminating at a slight rise across the Chaco river south from the great houses of Pueblo del Arroyo, Pueblo Bonito, Pueblo Alto, and Chetro Ketl. Also playing into this move may have been the growing size of Pueblo Bonito, and questions about its traditional role of “keeping” the great plaza of the Curved Rock That Speaks. Building the largest great kiva in the canyon on this surveyed site location Casa Rincoñada, partially buried in the earth with no adjacent great house or significant surface roomblock, expressed as much as anything opposition to an architecture on the verge of becoming “style”. The people that performed ritual in Casa Rincoñada’s spatial and religious context in the canyon were quite likely in effect representatives at the highest level of West, Middle, and East.

The move to Aztec

Only a few decades after Casa Rincoñada was built, however, the need was felt to design and execute a second major scheme and new center to the north. At least two things may have powerfully played into this radical addition. First, given the hypothesis about design, surveying, and building as core to practice of the triadic plateau religion, what was the effect as the Chaco scheme became more or less complete? The entire package of what became 11th century Chaco had most probably been so engaging in all the social participation and design it executed, that pilgrims could have felt a diminished purpose for being involved in the finished product. After all, given the absence of written or mythic instructions for ritual practice of this overall complexity, particularly at the largest of scale, what would people have shared? Would they have been content with reuniting with work partners, reminiscing about the laying out of axes, or building? How did journeying to the center change an earlier essence of participation when many, but not all, people were much more actively “being in the landscape” by laying out sacred lines? Here one can glimpse, perhaps, the meaning of many of the prehistoric roads built toward the end of the major construction period in Chaco. Together with the scattering of ceremonial pots along related routes, these experiences could have been latter day reflections on a more essential and even more participatory experience in the landscape, rather than in already built architectural form in the canyon.

Secondly, one can consider the possibility that the architectural and ultimately political imbalance between West and East great houses, along with a felt competition with all the building and rebuilding of Pueblo Bonito at the Middle, eventually stressed the integrative balance of the religious system beyond its limits. The design of Aztec, because of the very accurate location of its center (Aztec West X) triwall kiva appeared to logically revitalize the early Chaco meridian from Mount Wilson to McCarty’s Flow. This axis, as the 6th century impetus for the formalization of the likely shamanistic cosmos on the plateau, had seen its power change and perhaps diminish as the new Chaco scheme centered on its new meridian from Lizard Head. The early Wilson axis had been both Chaco Middle (at the vertex of the triangle) and East component at the formalizing plateau scale. With the Lizard Head scheme, Chaco’s Wilson axis became perhaps less symbolically important at both Chaco and plateau scale, i.e. it may have transitioned to a revised West within the canyon, and lost much of its plateau

significance given Chaco's intention to effectively replace a triadic plateau frame with its scheme on the eastern side.

In a sense, the move north to the San Juan could have been a return of sorts by groups involved in the Chacoan scheme to areas closer to those vacated after the BMIII-PI formalization of the plateau. As discussed in Chapter 5, many of the architectural traits, especially the first organic surface pueblo forms, were from north of the San Juan and may have been brought to Chaco by these people in the late PI or early PII period. There is nothing that design analysis can suggest, however, as to which of the triadic definitions these people might have associated with as they influenced the first three arc room blocks in the canyon--though they likely would have had an ancient reverence for Mount Wilson, as the highest and one of the most visible peaks in the San Juan region. The strongest design evidence rests in the fact that Aztec's unique triwall kivas, one at the very center of the complex, is reproduced on the back wall of Chaco's West great house, Pueblo del Arroyo. Was the creation of a new, but similarly patterned scheme at Aztec a movement among West constituents both within Chaco, and perhaps at the plateau scale as well? Peñasco Blanco, on the Wilson axis and the PI West entity, Kin Bineola, to the southwest of Chaco, and even people from the Ship Rock meridian (Lowry and Village of the Great Kivas) and/or westernmost Chacoan outliers themselves might have felt the need to resurrect the earlier importance of Mount Wilson. The extension of this meridian to Cerro Moctezuma could have been part of this movement.

For whatever socio-political or purely ritualistic reasons Aztec came to be, its layout clearly followed the earlier landscape logic of Lizard Head Chaco. Partially coincidental "X" points, first East then West guide the positioning of the new great houses: Salmon as the "keeper" of Aztec East X, and three structures, West, North and East organized by the central triwall kiva, actually built on the Aztec West X point itself. This new great kiva form might have been specifically designed to express the organizing "X" point. The Aztec scheme's formal tilt to the NW appears to relate primarily to a surveyed line between two of the shamanistic cosmos's corner mountains, Humphrey's Peak and Blanca Peak, and the early Grass Mesa axis involving Mount Peale and Cabezon on which the principal road segment entering the complex from Aztec North lies. Replicative as the Aztec scheme is of Chaco, there is no Middle element comparable to Pueblo Bonito, perhaps because of the lack of any comparable long used natural amphitheater such as the Curved Rock That Speaks. In this, Chaco is still the center

and perhaps partially explains the motivation of people associated with Aztec to make the ultimate pilgrimage to the origin of formalized triadic religion some seventy kilometers to the south.

The great north road as design evidence

In spite of the increasingly self-evident monumentality of the new “great” wall structures at both Chaco and Aztec, the design analysis of Ancestral Pueblo surveying in the layout of the pilgrimage road(s) between the two generates a much more intriguing set of research questions about *the* pivotal feature in the route: a simple stair into Kutz Canyon. To integrate the Aztec West X point, and its complex, to both the Lizard Head meridian and vital points in Chaco like its West X, Casa Rincoñada, and the Curved Rock That Speaks, designer priests could have laid out a direct line to the meridian point at the Pierre Site, adjacent to the fire hearth of El Faro. This they did not do. Instead, they conceptualized and likely laid out two straight lines--one coming from Chaco West X and the other from Aztec West X--the ends of which terminate about 300 meters from each other in the stair area at the south rim of Kutz Canyon. This location lies almost two kilometers east of the Lizard Head meridian, and participates in a very precise line starting with Casa Rincoñada, Chaco West X, the El Faro road point at the Pierre Site, and Halfway House. The northern line, turning about 12.6° from the southern axis to Chaco, perhaps originated from a room block called Arena Alta near the stair, and was straightened to Aztec West X. Twin Angels, very accurately on this northern line sits over a hundred meters off the Lizard Head meridian. Halfway House also sits precisely on the southern line from the stair to Chaco Canyon, but similarly is only adjacent to the passing major line, the highly coincidental Cerro Moctezuma- Haystack-Chaco East X-Aztec East X-Black Face feature axis.

It seems doubtful that designers simply extended the hypothetically earlier Casa Rincoñada line through the Pierre point to the place where it hit Kutz Canyon. Furthermore it doesn't make design sense to survey this extension as a means of locating a stair for people coming through the Kutz Canyon wash from Aztec. Topographically, a best walking route from Aztec probably wouldn't go through the canyon with its rough, changing wash, and steep sides, but would stay to the west of the canyon as modern roads from the Aztec area do. Even if they wanted to use the wash to walk in, there would undoubtedly be several as good as or better places to locate a stair considerably west of both the Lizard Head meridian and the existing stair

location. Given the probable penchant in their religion for landscape formality and the religious importance of a pilgrimage route between the two centers, the existing stair position seems most logically to be the result of the line from Casa Rincoñada being extended from the Pierre Site first, finding an intersection point with a second line from some ritually important place to the north, other than Aztec. A coincidence of this point with the the Kutz Canyon rim may have created additional symbolism. The stair features do not change direction 12.6 degrees at the canyon (toward Aztec West X); the approach is mostly cardinal and stair eventually points more NE. Thus the stair might not have been built as a route for people from Aztec—they came by their own and separate line—but for people or spirits from somewhere in the opposite direction. Whether or not this involves the early regional focus at Sacred Ridge, or not, remains part of the Kutz Stair puzzle.

The design logic of the two part layout of the great north road seems to speak fairly clearly to the fundamental triadic core of their ritual practices, exposing pilgrims in their route to the power of the three northern mountains, Wilson, Lizard Head, and Black Face, and the three lines from the southern vertex at Haystack Mountain, essential in the positioning of the three most important points of the Chaco scheme: the Pierre El Faro point, Chaco East X and Chaco West X. It is quite possible that people from all parts of the plateau came to Aztec, the Pierre Site, or the great road junction at the Kutz Stair to begin their liminal experience, participating as West, Middle, or East groups. The great north road could have served as a highly designed means of linking adherents to the essence of their religion--the triadic landscape framework-- before doing more collective ritual with greater numbers of participants in the canyon, especially at the Curved Rock That Speaks. Given the seemingly clear survey design of the stair location in the East sphere, it seems unlikely that *all* the pilgrims using the great north road to Chaco came from or passed through Aztec first.

Territorialization of landscape ritual and formality

One can see the association of sodalities that may have created Aztec as an attempt to better redefine cultural identity, yet clearly using the tools of integrating frameworks of Ancestral Pueblo ritual practice of the time. Within the relatively short span of about 200 years, however, this verdant area around the San Juan River is radically depopulated, in spite of post-Aztec efforts to maintain ritual practices focused on large urban-like settings (Mesa Verdian sites such

as Sand Canyon, Hovenweep, etc.). Apparently, though much design analysis is lacking, after some 800 years of ritually laying out and using a formalized landscape, Ancestral Pueblo people rather abruptly stopped doing so. Was there a reversion to shared shamanistic practices of the greater landscape? Probably not, since the major landscape features had been redefined for purposes of framework ritual, and its concomitant large scale social organization. Yet many of the new cultural forms of Pueblo people, from the 1300's through historical times, should now be more understandable given the possible framework experience of immediate ancestors. Most significant should be change in the religious use of landscape? Did ritual sodalities still owe their definition and function to distant features in the landscape? What happened to the formal architecture of great kivas and great houses? Were ritual roads still part of their practice? Did pilgrimage still take place, and if so to where?

In the period after the apparent breakup of the plateau framework and before the Spaniards arrived, archaeologists have found many examples of usually short lived true pueblo forms, where community social groups were experimenting with actually living domestically in settings not that dissimilar in size to some of the larger great houses of Chaco or Aztec. From the huge variation in plan layouts that were being tried, it is quite clear, however, that socially and symbolically, these structures were much more like the informal, organic earliest of room blocks of the Ancestral Pueblo, just much larger in scale. While the location of these first true domestic pueblos has not, for the most part, been accurately mapped or analyzed for evidence of any large-scale frame integration, the striking lack of formal features, and really design, in these building layouts may be a good indication of a negative outcome in this regard. The formal "Chacoan" great house elements like monumental walls and their triadic "E" shaped plans were likely part and parcel to the founding location and ritual use of these specialized ceremonial settings. The circular form of great kivas, for their part, perhaps long the primary architectural component of plateau scale ritual, also largely disappear, giving way to community scale plazas for ceremony. Though some squaring off of plaza spaces possibly shows infrequent initial design intent, a thorough design analysis would probably determine that these minimal formal elements happened more for practical construction reasons as the pueblos grew, rather than as religious expression.

Part of the quick building, moving and rebuilding of these true pueblos, might well turn out to be a fundamental spatial response to the breakup of plateau frameworks, for possible rea-

sons of social or political imbalance implicit in the climax of Chaco and Aztec. It is almost as if community groups no longer participating in the essential survey part of the landscape practice-- that somewhat inadvertently created the context for big architecture--opt out of stale ritual that remained, focused as it became primarily on formalized architectural settings. A non-monumental true pueblo, not integrated into the larger landscape should be largely a territorial outcome, a simple aggregation of roomblock forms with little design of formal ritual elements. This author has previously suggested how formalized landscape based societies and religions respond when their large scale frameworks either become politically untenable or unusable because of control by intrusive outside societies (Doxtater 1994). At its extreme, one can hypothesize a shift to a more “local” form of ritual whose integrative functions are confined to more populous, truly residential agglomerations as “villages” or pueblos.

The areas around the true pueblos, whether Prehispanic or Historic (Berninini 2005, Zedeño 1997), can probably be best described as maintained by territorial occupation and control rather than any larger scale ritual exchange. The role of “local” ritual practices emphasizing an opposition between plaza and roomblock may diminish or even eliminate territoriality *within* the residential community. An anthropology of Ancestral and Historical Pueblo social space, with its emphasis on mapped or cognitive patterns, should eventually include significant research done using the mentioned Space Syntax methodology on pueblo forms, e.g Cooper 1995, Fergusen (1996), and Ganns (2003). In this work, the essential territorial (global vs. local) argument of Hillier et. al., however, seems only applicable to these Southwest examples to the degree that they are *not* primarily defined by a symbolic or cultural framework of space, whether as a part of either formalized landscapes or as local ritual. Space Syntax, while ostensibly created out of the full range of traditional morphologies, really seems best applied to modern, territorial uses of space.

How does “local ritual”, or “local cosmology” as coined by Snead and Preucel (1999) among Pueblo people differ from hypothetically earlier formal landscape practices. This is the time, according again to Adams (1991) when the “katsina” cults are introduced with their emphasis on visiting masked dancers. Yet it seems likely that visitation of gods from the significant natural features of the landscape frame might always have played an important part of formalized landscape ritual, and that much of the visitation would have been made by social groups at some distance from each other. The breakup of the framework in the 12th or 13th cen-

tury would have dramatically diminished the latter aspect of visitation—actually laying out or otherwise experiencing first-hand the larger ritual landscape--while at the same time emphasizing or considerably expanding those aspects having to do with the spirits *per se*. Since integration aspects of formalized landscapes are now, or perhaps eventually, reduced to supra-kinship elements *within* the actual pueblo or even between adjacent pueblos of the tribal group, as in the historical Hopi, Zuni and Tewa, visitation by these known and possibly related individuals would not have carried the same social or religious impact. Thus it may have been necessary to disguise what are really local folk as spiritual beings. Again, real alliance visitors are now theoretically absent, leaving spirits as the only category of visitors. In the Historical Pueblos, as described in Chapter 1, these *katsina* (or more generally sodality) groups are associated with radial layouts of landscape, really more “extension” within a now limited geographic and territorial space, than “intension” where ceremonial sites are first located via surveying ritual focused on distant natural features. Not only are locals disguised as visitors from afar, albeit supernatural, but the framework itself is a kind of *representation* of the possible previously all-encompassing framework on the plateau.

Curiously enough, however, and another call for greater design analysis of the Pueblo record overall, when the Tewa chose their two west-east mountains of the foursome around their mother pueblo of San Juan, they chose Mount Chicoma and Truchas Peak. These two, as the reader will recall, participate in the only large scale coincidental three-point alignment among natural features, that running through Canyon de Chelly to the Sipapu, and possibly part of the arrow straight “sunray” described in Navajo tradition. While the Tewa clearly did not survey the intersection point between the cardinal axes of their now more territorial “local cosmos” as a means of positioning their pueblo, nor do the features and paths ritual participants use in the landscape portions of their practices appear to have been formally laid out, the location of the mother pueblo does have a possibly intentional, much larger scale connection to the plateau. The latitude of Catholic Church at San Juan is only about one arc second off that of Casa Rincoñada. This, as well as the connection with the Sipapu sunray, coincides with the Tewa’s emphasis of cardinal, rather than intercardinal axes of their cosmos.

Speculating further in this same vein, if late prehistoric Pueblo groups had coalesced into larger tribes consisting of a group of pueblos, were these people somehow related to those that had been East particularly during the time of the breakup of the Chaco/Aztec schemes?

Did the Hopi pueblos constitute an oppositional West, located on that side of the ancient plateau? After all, their apparent center of Second Mesa lies squarely on one of the possible major axes of plateau prehistory, Humphrey's Peak – Blanca Peak, which passes between two twin villages of Mishongnovi and Shipaulovi (the other village of Second Mesa, Shongopovi lies a few hundred meters to the west) and accurately by the sacred Corn Rock and the Toreva Spring feature, perhaps expressions of some sort of ritual focus for the three mesas. This long line, again perhaps one of the shamanistic intercardinals for their early cosmos, could also have been a major azimuth for the layout of Aztec, and is one of the pair of "corner" mountains claimed by the Navajo. A third tribe consisting of a small number of constituent separate pueblos, the Zuñi, calls itself the "Middle" people. The precise meridian from Ship Rock, the ultimate Middle in the hypothetically earlier plateau frame, runs south 180 km, hitting the present day pueblo of Zuñi, the last of and possibly "mother" to the other fabled lost cities (pueblos) of Cibola. While the meridian hits the village area of dwellings, from the church the azimuth to Ship Rock is 359° 37' 31" (to the NE).

Furthermore, as described in Chapter 1, both the Hopi and Zuñi still make pilgrimage to river confluences, the Sipapu in the Grand Canyon, and the junction of the Zuñi River and Little Colorado respectively. Though these places of emergence are less distant than likely similar practice as part of framework ritual, they remain good examples of religious groups journeying to sacred places outside of their ostensibly territorial tribal areas. Yet, regardless of these ritual memories of large scale ritual practice, little formal social integration seems to occur among the three tribal areas, at least as recorded in historical times. While Ortiz clearly defines actual ritual paths in the Tewa local landscape as cosmos (yet overly formalized in his drawings), because of lack of ethnographic data, one cannot even speculate about the possible formalization in any total Zuñi or Hopi landscape. One knows from early ethnography that the Hopi frequently deposited prayer feathers and visited certain features at distances from their pueblo, but most of these were not observed first hand and apparently never mapped.

Adding a design dimension to cultural anthropology

The present work, above all else, aims to describe how perceptions of larger natural landscape—as shared, phenomenologically real experiences—might in themselves under certain social and cultural circumstances, create formalized changes in the organization of religion. In

preliterate societies, these kinds of landscape meanings and structure may not be secondary reflections of myth or kinship structure, but evolve through the practice of primary ritual in natural physical settings. What this may mean in some prehistoric societies at least, is that conscious, formalized design does not first occur in sacred imitations of domestic architecture, as one might assume, but in surveyed layouts among natural features. So while a formal design analysis of prehistoric architecture may often be left to architectural historians, schooled more in rhetorical effects of style than ritual process, the purpose and meaning of Ancestral Pueblo ceremonial places on the Southern Colorado Plateau remains, for all intents and purposes unanalyzed.

Academics may be prone to quickly dismiss the present work as too ambitious, too overreaching and too lacking in disciplinary detail and support typical in discourse about “archaeological” societies. While not untrue, present goals seek as much to illustrate the *kind* of interdisciplinary work necessary as to definitively prove interesting patterns were actually designed. One must also understand that beginning with good ethnographic and archaeological literature, and then looking for seemingly formal design elements—undiscovered large scale artifacts as it were—will only be the start of a new kind of landscape research process. After some ideal collaboration between architect/landscape architect designers and anthropologists, interesting patterns of formalized landscape need to be subjected to the best comparisons with random geometric phenomena possible. In today’s science, all kinds of images from biological material to natural landscapes are increasingly analyzed by computer applications for the presence of form—from face recognition to terrorist safe houses. Again, the present work falls seriously short in its attempts to utilize this technology. Yet, the probability comparisons embedded in the present chapters should be taken seriously, not as examples of cutting edge design recognition application, but again, of the *kind* of research that needs to be done by significantly larger numbers of people.

A SUMMARY OF PROBABILITY TESTING OF POSSIBLE DESIGN PATTERNS

The presently used Geopatterns software (Appendix I) was created to both accurately describe geometric relations between points on the surface of an ellipsoid earth and compare existing patterns with those created randomly. To avoid the very costly and technically experimental process of writing computer algorithms that would work with no preloaded kinds of form for

which to search, it was assumed that prehistoric design in the landscape would consist at a minimum of simple alignments, right angles, cardinal relationships, and bisected angles. Among landscape points, each of these simple patterns can either occur because of design or random chance. While several computer experts have put together quick applications to show the numbers of random alignments, from three points upward, that can occur at a given level of accuracy and within a defined scale, only two archeologists to date have included comparisons between existing and random patterns in their work (Stahlqvist 2000: cardinal relationships between two points, and Swanson 2003: three point alignments). In both cases, the scale is small, within a viewshed of 10-20 km or less.

Formal design, and its analysis, however, usually consists of understanding the way these simple patterns are organized in some number into much more complex, though logically elegant, layouts. The evolution of three versions of Geopatterns has been driven largely by the need to model more complex pattern combinations that are found among existing archaeological sites, then testing them against the random. As novel as this work is, it has only begun to scratch the surface of understanding what really constitutes a designed landscape layout. Well known attributes of graphic design such as symmetry or different kinds of pattern repetition cannot be presently modeled in Geopatterns. While the desired attention to spatial attributes of ritual, such as axes, thresholds, oppositions, homologues and the like will likely limit the kind of patterns used in formalized landscape, ethnographically this data is not well mapped, another reason the present computer application remains but a first inquiry into this research process.

Nevertheless, a good deal of present work has produced at least some interesting initial results. These have been embedded in the book's text, as much as possible, at places where the discussed possible design patterns are most related to a probability test.

Simple three-point alignments among a total group of great kiva sites (Chapter 2)

1. The first exercise shows the usefulness of a box test area technique, even where strong linear topography exists at smaller scales, by looking at three-point alignments among thirteen great kiva sites in Chaco Canyon. The number of three-point alignments among existing great kivas is only matched twice in 100 random sets of thirteen each, suggesting some design component even with the linear confines of the canyon.
2. The major effort of Chapter 2 uses a single large test box around the entire plateau area

where 61 great kiva sites occur during time periods from Basketmaker III – Pueblo III (500-1300 A.D.). Twenty-one most prominent natural features are kept constant in tests against 100 sets of 61 random points each. At ten levels of accuracy, from 0.015° to 0.15° , the existing number of three-point alignments among the total of 82 points (built plus natural) exceeds the highest random number among any of the 100 sets at accuracies of 0.06° , 0.09° , 0.012° and 0.135° . The number of alignments in the existing at ten different accuracies ranges from 25 to 210. The highest alignment producing set of the 100 is that at 0.105° , whose number (149) is identical to the existing at that same accuracy. Among the five other accuracies, two random sets (of 100) have one more alignment than the existing (0.030° and 0.045°), and two have two more (0.015° and 0.075°). The average number of alignments involving an individual early great kiva site from the BMIII-PI period is 4.15. In the following PII-PIII period, the involvement of the average site is 3.26, possibly suggesting a *greater* tendency to locate great kiva sites by large-scale surveying during the period prior to the major Chaco and Aztec schemes. A list of involvements of all 61 great kiva sites is included, and provides some additional evidence of design importance for those with highest numbers.

Testing the Mount Wilson meridian complex (Chapter 3)

1. A more complex, possibly designed pattern combines alignment with cardinal north-south relationships among seven points, two natural and five kiva or kiva-like sites: Mount Wilson, Peñasco Blanco, 29SJ423, Andrews, McCarty's Flow, and Cerro Moctezuma. Because of the large number of simple three-point alignments and two-point cardinal relationships that these seven points create, the total cannot yet be modeled in the author's software. A reduced model consisting of five three-point alignments at or under 0.054° and five cardinal relationships at or under 0.068° is possible when eliminating the very distant Cerro Moctezuma from the site list. Searching through a much larger number of random sets, than in the exercise in Chapter 2, a comparable random pattern is found in the 44,706th and 95,180th sets of 100,000 trials (0.00002).
2. Rather than use one large test box for the great kiva area of the plateau, a second exercise creates non-overlapping test box areas of different sizes where clusters of great ki-

was occur, again keeping the natural 21 plateau sites constant. The purpose here is to better capture the effect of the cluster of great kivas located in the Chaco Canyon area. In 5,000 sets of 61 points distributed appropriately in nine area boxes, the modeled compound pattern occurs twice in sets 409 and 1,615 (0.0004). This greater frequency of the random, however, must be tempered by the possibility that if the Mount Wilson – McCarty’s Flow meridian was created early in the ritual formalization of the plateau, it would have logically influenced the location of subsequent great kivas. In this regard, a test placing random points in a relatively small test box at Chaco Canyon may be misleading.

Testing the “fan” pattern of lines from the Sipapu (Chapter 4)

The Sipapu point at the confluence of the two Colorado Rivers in the Grand Canyon is involved in fourteen three point alignments (within the accuracy range of 0.150°) that radiate east to natural and great kiva sites across the plateau. Four of these three-point alignments overlap with one additional one to create a five-point alignment: Sipapu-Rincon-Main Panel-Bluff-Lowry. Thus besides the four Sipapu three-pointers in this one five-point line, ten other single three-point alignments exist between the Sipapu and pairs of other plateau sites. One of these is the only naturally coincidental large scale three-point alignment between major natural features: Sipapu-Chicama-Truchas. Setting up one large test box as in Chapters 2 & 3, and eliminating Moctezuma again for similar reasons, a search string of simple patterns can be set up to capture the random involvement probability of the Sipapu in the five-point alignment. Then, finding random sets where the existing pattern is matched, numbers of additional simple three-point alignments with the Sipapu are listed for each set. The accuracy range for the five-point pattern is 0.040° , but for the additional single three-point patterns, the existing range was considered as two high. Thus the existing list of additional three-point patterns was limited to four, besides the five-pointer, with a maximum angular deviation of 0.040° as well. Thus random sets looked for a five-pointer and four additional three-pointer alignments. In 10,000 sets of random points (again with 61 random points and the usual number of fixed natural features) only one set exceeds the existing Sipapu involvement (four in the five-point alignment, and four additional three-pointers), with a

total of nine. Two other random sets match the existing number of Sipapu lines at eight. The probability of a random match is about 0.0003.

Symbolic “great walls”: comparing probabilities of astronomical with landscape meaning (Chapter 7)

The theoretical contrast in prehistoric landscape/architectural relationships, tentatively defined earlier by the author as “intension” and “extension” (Doxtater 2009), can be preliminarily tested as it relates to the large great houses in Chaco Canyon. Sofaer’s (1997) point of view sees the formal, undoubtedly symbolically oriented monumental walls of the great houses as aligning with astronomical rise and set points of the sun at equinox and solstices. Not unlike Scully’s (1962) original work with Greek temples, the relationship between architecture and landscape begins with what is built. The construction can be sited anywhere, for other reasons, but then features are designed to “extend” out to some landscape form and/or astronomical marker. The opposite relationship occurs when a formal landscape pattern positions the building, by “intension”, prior to construction. The present work promotes the idea that symbolic “great” walls primarily carry meanings related to “intension” aspects of the landscape frame--and their religious and social effects--used to found the ritual purpose of the structure.

Using the varying angles of the three large walls of eight “E” shaped great houses, probabilities of pointing to astronomical set and rise positions on the horizon are compared to azimuths of 16 natural features (including “X” or intersection points) together with 15 of the larger Chacoan great house sites and the great kiva Casa Rinconada, including Aztec West, Salmon, Kin Bineola, and Pueblo Pintado outside of the canyon. From the “intension” perspective, the odds of the existing walls aligning as they do by coincidence within the most accurate range of 0.60° is 1 in 720 (0.001). As for the “extension” alternative, using Sofaer’s aligning features of back walls and their perpendiculars, and using her much less accurate measure of angular deviation of 2.8° , the chances of creating the existing number of alignments is only 1 in 5.6 (0.18), and perhaps less with refinement of selected features.

FUTURE RESEARCH

Certainly one can expect much improved computer application beyond that described in Appendix I, to better model and test comparisons between existing and random patterns; and someday interest and resources may entice a group to actually survey a long line using simple prehistoric tools, as simulated in Appendix II. But the most challenging aspects of this kind of inquiry will be the manner of integrating design analysis with both anthropology (ethnography and archaeology) and statistical testing. What do the numbers of the probability exercises above mean? In themselves they range from a random probability of around 0.01 in the first exercise, close to standards of more sophisticated statistical methods in the social sciences, to 0.00001 and less for the second, a chance taken all too willingly every day by people playing one lottery or another. Locating and building a ceremonial structure, of course, isn't quite as everyday as buying a lottery ticket.

While probability numbers seem to be good *indicators* of design intent, future studies in this direction should begin with well-reasoned components in design analysis and anthropology. The six probability exercises included in this volume, may indicate that certain patterns are more likely to have been designed and laid out via large scale surveying—and each of these could be substantially expanded as individual research topics—but as yet they only begin to substantiate the most radical ideas behind this work. For the most part, design analysis alone has produced the seemingly logical sequence of landscape layout that positions architecture and orients its monumental features in classic schemes at Chaco (Lizard Head), and Aztec (Mount Wilson revival). These patterns, for the most part, cannot yet be modeled and tested against random phenomena, before which, additional design analysis at smaller scales would undoubtedly be necessary. There is a good reason why specific patterns, such as the six presently tested, have not been more intensively studied and published as separate pieces, prior to more speculative ideas about how they might combine into plateau frameworks. It is simply because of the limited interdisciplinary research that can presently be brought to bear in largely unfunded work by one person with a design and social anthropology background, but only very modest expertise in archaeology and statistics.

Yet, it is fair to say, the ability of landscape and architectural design to analyze (and create) schematic “wholes” is as much the driver of the present work as are current interdisciplinary

nary limitations of producing publishable research pieces. From a design perspective the classic Chaco and Aztec schemes are seemingly so logical as an expression of precedent Ancestral Pueblo landscape based ritual, that they could not reasonably have been created *de novo* in such a short span in the early 11th century. Theoretically, this design patterning must have had time to mature over centuries rather than a few decades, and at an inclusive plateau scale that explains the commensurate scope of Chacoan influence and participation when its scheme(s) blooms to life. Ultimately, the integration of this theory of large scale plateau design with social anthropology, archaeology, and statistics, should prove just as rewarding in areas around the plateau, as in Chaco Canyon and at Aztec.

In spite of a yet to be integrated process of design analysis, it is envisioned that the present exercise can serve as a call for others to engage in the interdisciplinary discourse necessary to bring the study of large scale landscape ritual—and related architecture—into the academic fold. The best context for this might well be the Ancestral and Historical Pueblo record. With the development of more extensive literature published in reputable journals, one will be able to begin posing questions about the possibility of similar phenomena at certain “stages” of social organization in other cultures, e.g. Central Mexico or Peru, the Ancient Mediterranean, or Scandinavia.

Appendix I: Computer Applications as Essential Design Analysis Tools

To accurately describe alignments of points, as might have been laid out by prehistoric surveyors, one must have software that can quickly calculate positions relative to great circle lines on an ellipsoidal earth surface. A great circle is identical to a meridian plane which passes through the center of the earth in a north-south direction; but a great circle can be taken in any direction relative to the center. Presently (2014) several great circle calculators can be found as freeware. Most are used to calculate the azimuth or direction of an aviation course, along with distances between points on these great circle lines. The most extensive tool listed by Wikipedia (Aug. 10, 2013) is “Moveable Type Scripts” which in addition to azimuth and bearing (direction along an azimuth) also can calculate midpoint, destination points, intersections between courses, distances from great circle lines, closest points to the pole, and rhumb lines. This application, however, is not based on an elliptical shape of the earth. Even back in the early 2000s, when the present work intensified, these applications would not have been nearly sufficient to describe accuracies of points on lines. Even more importantly, they provide only specifically set up calculations, rather than much quicker, more geometrically comprehensive data about relationships between numbers of points on the earth’s surface. The difference in use is like that between considering huge numbers of potential geometrical relationships in the process of developing a design, of a larger urban setting or building for example, and the subsequent specific testing of proposed structural elements by engineers.

Discovering the rationale behind a designed setting, i.e. “design analysis”, is not that dissimilar to the design process itself. In an urban setting or large building, all of the trial and error “sketches” and accompanying design decisions are not readily evident in the final form. Even though the function of some aspects of form may be immediately understandable, far more complex meanings can only be derived from serious evaluation of both infrastructure (engineering) and behavioral uses of form (social science). This is also true in traditional cultures where obvious functions of shelter and the like mask less evident “structuralist” symbolism effective in the social practices of ritual and encompassing religion (e.g. Bordieu 1973, Doxtater 1981, Cunningham 1972, Gossen 1972, Kamau 1976).

Ortiz's contribution to defining cultural space in the Historical Pueblos, in this regard, has been discussed at length in Chapter 1. A related kind of symbolic design and ritual in the precedent Ancestral Pueblo culture, the argument follows, also involved landscape, but at a larger scale rather than temples or settlements. Understanding the logic of these geometric frameworks is certainly more difficult than studying the layered religious meanings of traditional dwellings, where aspects of ritual practice and symbolic meaning often overlap with form necessary to physically support the building. The position of numerous natural and built points in a large-scale landscape, however, obviously offers no such immediate indication of underlying symbolic structure, only a seemingly random maze of geometric patterns--from which one might hopefully discern some subset consisting of understood and/or designed formal relationships. Yet the basic geometric elements of ritual in traditional dwellings will be similar to those of large scale frameworks. Ritual spatial patterns are above all else about formal *relationships* composed of axes *between* opposed domains or elements, thresholds, orientations, and repetitions of such formalized patterns at different scales, or "homologies" (see Doxtater 1984 for a fuller discussion).

What kind of tool, then, is necessary to conduct a design analysis to discover such patterns of formalities among ceremonial sites and important features of the larger landscape? Like design processes generally, one needs to do a lot of trial and error "sketching" of how site locations might have created a landscape pattern for some more complex purpose like ritual. The conventional design tools are primarily pencil and paper, by which geometric form can be explored in plan and section, orthographically or in perspective. Computer based drawing tools such as Sketchup have attempted, with limited success, to match the conventional fluidity or ease of creating design alternatives in hand drawing. Some design schools do not allow students to use computers until they have mastered traditional tools, simple as they are.

Formalized prehistoric landscape symbolism also has the potential for design complexity, and understanding these patterns requires a sort of reverse process of trying many alternatives described mathematically in a computer. An application is needed to be able to quickly calculate alternative geometries, and as much as possible communicate them graphically. Secondly, once complex hypothetical patterns are developed, as in schematic designs, they can then be tested against random phenomena. The continuing process of developing such a tool is essential to this work. Such an application--called "Geopatterns" by the firm that built it—is

the primary theme in Doxtater 2007. Some of this history is condensed below, together with an update on the most recent Geopatterns “3” version.

Geopatterns 2

Early pre-computer attempts to investigate large-scale geometric patterns were extremely limited. When only using physical maps, assessing the accuracy of possible geometric patterns among points in the landscape was difficult if not impossible. Sketching of pattern possibilities did not adequately incorporate the precise realities of site location. At the smallest scale where one can accurately measure site location on a USGS quad, the map is only about 11 kilometers across. Thus, while one can tape numbers of quad maps together to evaluate larger possible geometries with simple straightedges, the process quickly becomes cumbersome and technically inaccurate.

While no readily available software apps existed ten years ago, it was not then a technically difficult application to evaluate single three point alignments. Two of the author’s colleagues with math and optical physics background both relatively easily made such applications to provide azimuths or directions between three points and the degree of alignment accuracy with each other. Using these early tools that described single alignments only, work soon indicated the need to evaluate three additional basic geometric patterns: a simple *bisect*, consisting of a vertex point and three lines from it at equal angles to each other running to three distant points; a *cardinal* relationship between two points either east-west or north-south of each other; and three points in a *ninety* degree or right angle relationship to each other. Eventually the software became too manual and slow to search for such patterns economically. These were more like specific engineering exercises than part of a design analysis. Furthermore, the seemingly largest roadblock to serious consideration of large scale surveying seemed to be shifting from proving the technical ability of the ancients to understand and lay out such patterns (as will be described in Appendix II) to our ability to discern intentionally designed patterns from those created by randomness.

In seeking a more efficient and expanded means of using the computer to describe the four simple patterns mentioned above, more formal combinations of these patterns, and comparisons of these patterns with those created by random points, it seemed logical to attempt to use GIS based applications. Toward this end a young GIS expert at University of Arizona was

hired; he had an excellent track record working with several GIS-using departments including Renewable Natural Resources and the Bureau of Applied Research in Anthropology (BARA). The attempt lasted several months, but in the end we concluded that regardless of the amount of ingenuity, bits and pieces of existing GIS applications just couldn't be put together to do the job. Finally, considering how relatively easy it was for people in math and physics to make the first applications, though much simpler, it seemed logical to try to create a purely math-based

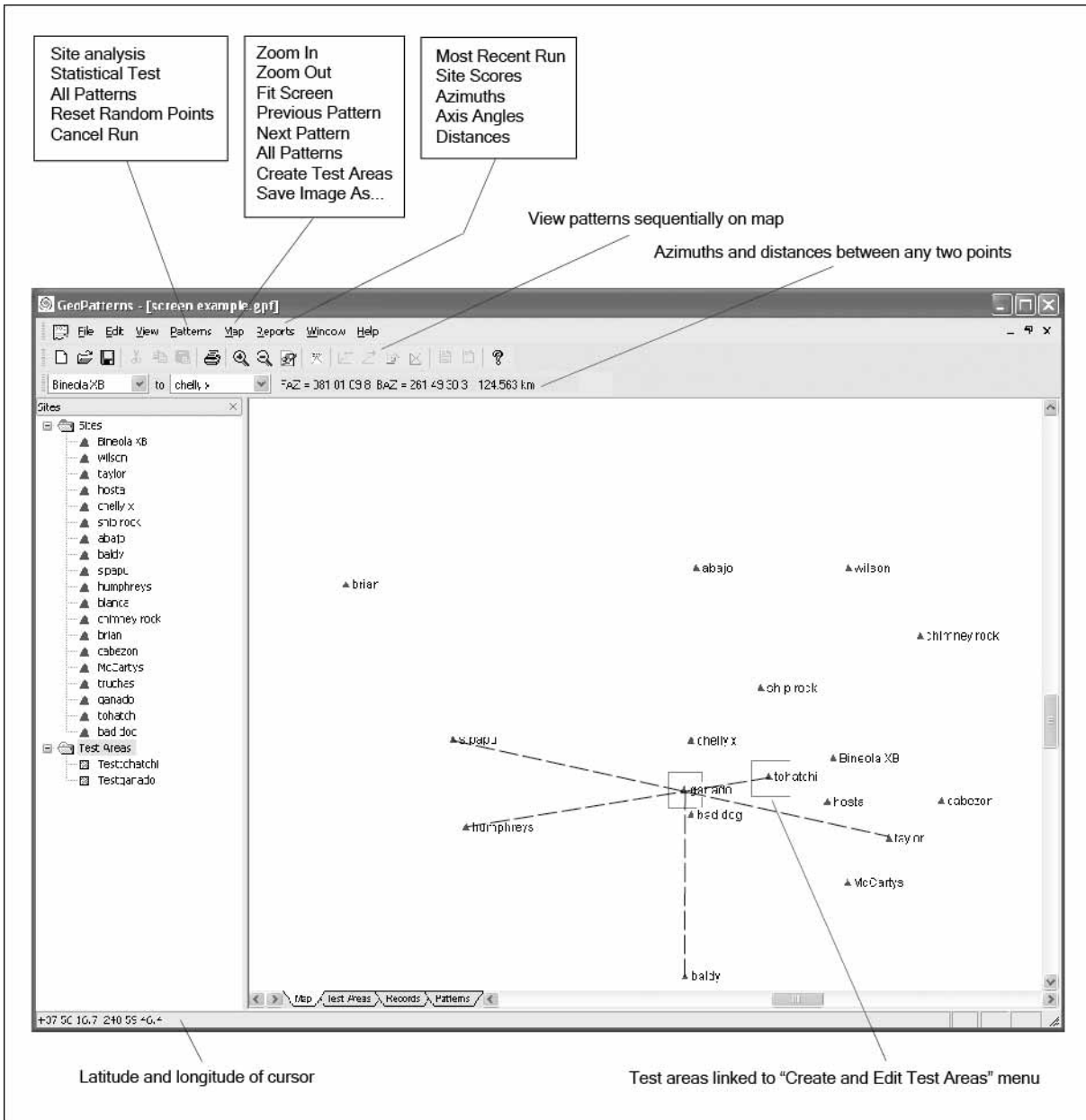


Figure 98. Geopatterns 2 main page.

tool. Enter a small software firm in Seattle (Cross-River Software) with this kind of experience. The first version of Geopatterns essentially expanded the earlier applications by adding bisects, and enhancing the definitions of these geometries with tables and an actual map that illustrated the individual patterns found, scrolled through one by one. It also had an ability to create a test area with random points in it, patterns from which could be compared with existing layouts. Then in 2004, more generous funding from the State of Arizona (Prop 301 or TRIF, technology transfer) enabled a much more extensive version of the application.

The calculations of Geopatterns 2 are based on ellipsoid geometry of the earth and NOAA's interactive applications. Cross-River provided this source to explain its adaptation: "Direct and Inverse Solutions of Geodesics on the Ellipsoid with Application of Nested Equations" from the April 1975 issue of "Survey Review" or see the website http://www.ngs.noaa.gov/PUBS_LIB/inverse.pdf. Geopatterns 2 functions in the following ways. First illustrated in figure 98 is the basic page layout with typical pull down tabs at the top and a split screen below with lists of sites and test areas on the left and the map of site locations on the right. The "Records" tab on the bottom of the page, figure 99, pulls up a spread sheet where the user can enter the names and latitude longitude positions of any number of sites.

Latitude and longitude points entered to tenths of an arc second represent an accuracy of about 3 meters in the Chacoan area. The greatest possibility of accuracy error, however, comes initially of course in map measurement or GPS positioning. In the present work, site locations were measured with a GPS receiver or from USGS 7.5 quadrangle maps where 1 millimeter of measure equals about 25 meters. From these maps one can estimate location down to about a quarter or so of a millimeter or about 5-7 meters. Given the large distances of the patterns investigated, up to several hundred kilometers, these potential process errors, including those of map-making, are probably insignificant. When establishing a site point with a common Garmin 12 GPS receiver, the possible error appears to be within a similarly insignificant range. When testing the author's receiver against known GPS geodetic points in the city of Tucson, the deviation was consistently off in the range of 2-5 meters.

Below the upper row of tabs back on the main page are two pull down lists and windows to find the distance and respective two azimuth angles (reversed) between any two sites listed. At the very left hand bottom of the screen is the latitude/longitude location of the cursor

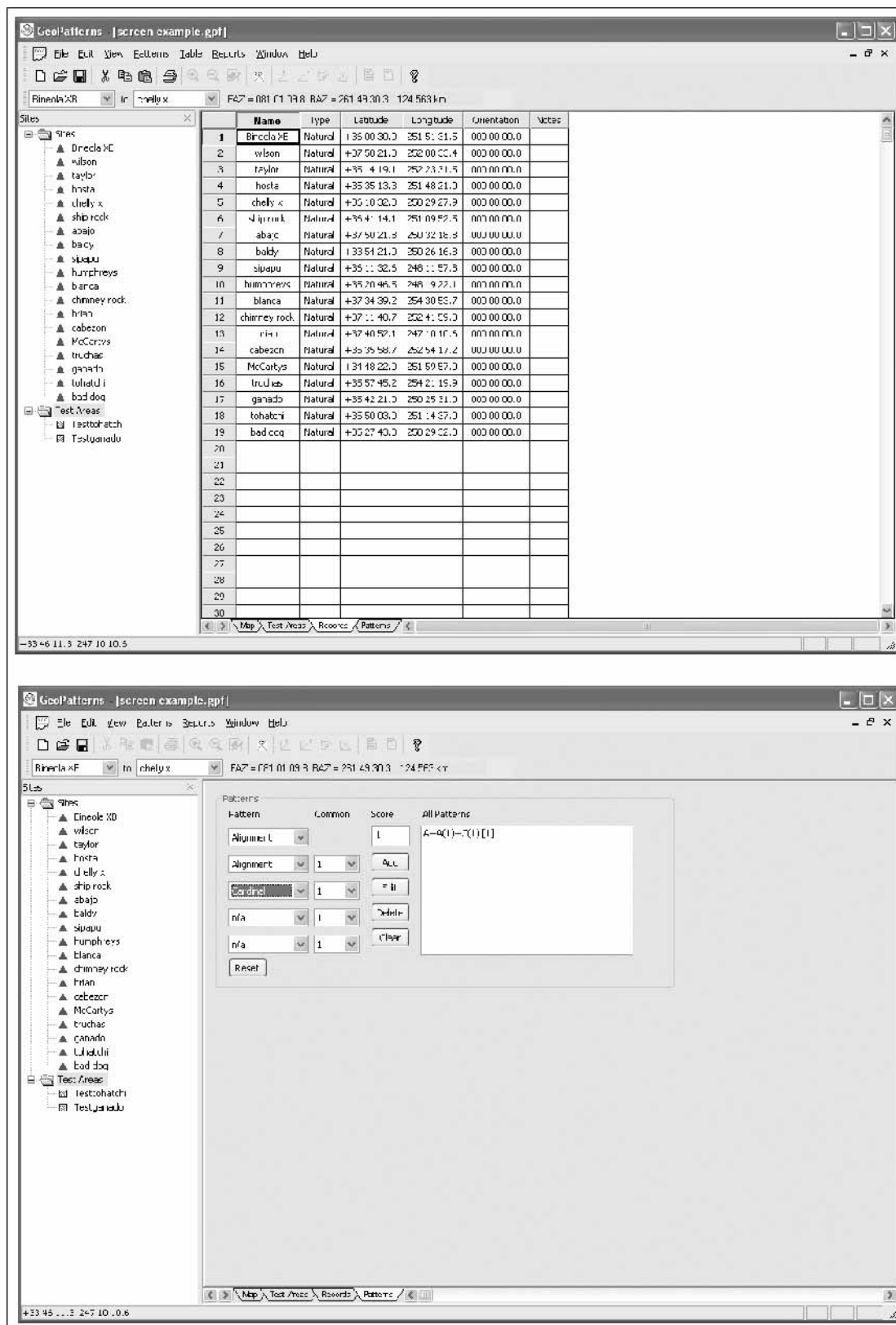


Figure 99. Geopatterns 2 Records page (above), Patterns page (below).

on the map. Prior to searching for patterns or testing against randomness, the user can also find additional basic geometric information. Pulling down the “Reports” tab at the top provides options of “Azimuths” (a list of all sites and the azimuths to all the other sites from each site point), “Axis Angles” (when one of the sites on the main page list is turned on, provides the angles to all pair combinations of the rest of the site list), and “Distances” (the distances between all sites in ascending magnitude).

The lower screen of figure 99 shows the pattern screen as pulled up from the tabs on the lower edge of the main page. The user has the option of searching for each of the four patterns individually, or adding them together in any combination up to five additions. On the Options page, figure 100, the user can ask to only find those patterns at or below a stated accuracy or Pattern Angular Tolerance in degrees. As a means of limiting

The figure consists of two screenshots from the Geopatterns 2 software. The top screenshot is the 'Options' dialog box, and the bottom screenshot is the 'Create and Edit Test Areas' dialog box.

Options Dialog Box:

- Longitude Format:** ☒ 0 to 360, ☐ 180W to 180E
- Distance Units:** ☒ Kilometers, ☐ Meters, ☐ Miles, ☐ Feet
- Earth Ellipsoid:** Major axis (meters): 6378137, Minor axis (meters): 6356752.3141
- Pattern Angular Tolerances (degrees):**
 - Bisect: 0.08, Ninety: 0.08, Alignment: 0.04, Cardinal: 0.34, Eq Angles: 0.06
 - Tolerance for finding intersections: 0.06
 - ☒ Use latitude to determine E-W cardinality
- Bisects:**
 - Minimum ray angle (degrees): 1
 - Minimum length ratio (%): 33
 - ☐ No restrictions
 - ☐ Must include vertex
 - ☒ Must not include vertex
 - ☐ Side ray endpoints only
- Statistical Testing:** ☒ Must include random site from each test area
- Alignments:** ☒ Include midpoint only
- Record limit:** 1000
- Pattern Limit:** 1000
- Random sets:** 10000
- ☒ Display involved points only
- ☒ Display map labels
- ☐ Display random labels
- ☒ Display intersection labels
- ☒ Display report after run

Create and Edit Test Areas Dialog Box:

- Existing Areas:** Testtohatchi, Testganado
- Test Area:**
 - Name: Testtohatchi
 - Associated Site: tohatchi
 - Active: ☐
- Coordinates:**
 - Left-click on the map and drag to create a rectangular test area
 - NW Corner: Longitude 251 04 33.2, Latitude +35 59 23.3
 - SE Corner: Longitude 251 26 58.9, Latitude +35 37 31.2
- Center/Size:**
 - Left-click on the map to specify the center of the selected test area
 - Center: Longitude 251 15 46.0, Latitude +35 48 27.3
 - Dimensions: East-West 33.75, North-South 40.57
- Random Points:**
 - Quantity: 100
 - Generate Points:
-

Figure 100. Geopatterns 2 Options menu (above), test areas set up (below).

some pattern combinations to more formal geometries, also on the Options page the user may limit alignments to their midpoints only (for cross patterns), and constrain bisects where the search must include the vertex, or must not include the vertex, or must include the side ray endpoints only. Bisects can also be limited to a minimum ray angle (degree) and a minimum length ratio between the two side rays. The “Options” tab also allows the user to set the longitude format, distance units, as well as the earth’s ellipsoid (major and minor axes).

Given these definitions of simple patterns and pattern combinations, the user can perform three operations. First is the basic “Site Analysis” which finds all the patterns as defined by options for the list of sites entered on the Record and Map. Results are listed in the Report, with numerical accuracies given for any of the four basic patterns involved in the search. If the user wishes to see the patterns graphically on the Map, one must first turn on one of the sites and then scroll through all the involved patterns of that particular Site Analysis using the buttons on the toolbar (upper edge of main page).

Next, if one wishes to compare patterns created by an existing set of points with those generated randomly, the user pulls down the Create and Edit Test Areas page, as shown in the lower screen of figure 100. Here one can either enter the coordinates of the desired test area, or actually draw it with the cursor directly on the map. Any number of maps may be drawn, and the user has the option of either generating sets of random points, one in each test area, or a set of some number of points within one area. On the Options page the user may require that all or any number of random points of a set participate in a defined pattern or combination pattern. The Options page also allows the user to determine the number of sets of random points created in a run, in addition to limitations of numbers of patterns to be listed in the Report. The use of probability testing, both its abilities and inabilities, is more understandable in the actual surveying analyses discussed in Chapters 2, 3, 4 and 5. Most simply, one first uses Site Analysis to reveal existing patterns among built and natural sites. Then random points are substituted for the built sites, either as individual test areas or some total area where built sites occur; in Options the number of random sets to be searched is set before using the command “Statistical Analysis”. Depending on the complexity of the pattern or combination pattern, a run of 10,000 sets of random points may take only a few minutes.

Geopatterns 3

In 2011 additional funding was obtained to develop a new version of the software, again working with Cross River Software. The quick descriptive features of Geopatterns 2 had provided a ready tool for extensive iterative processes of design analysis. The amount of time one could

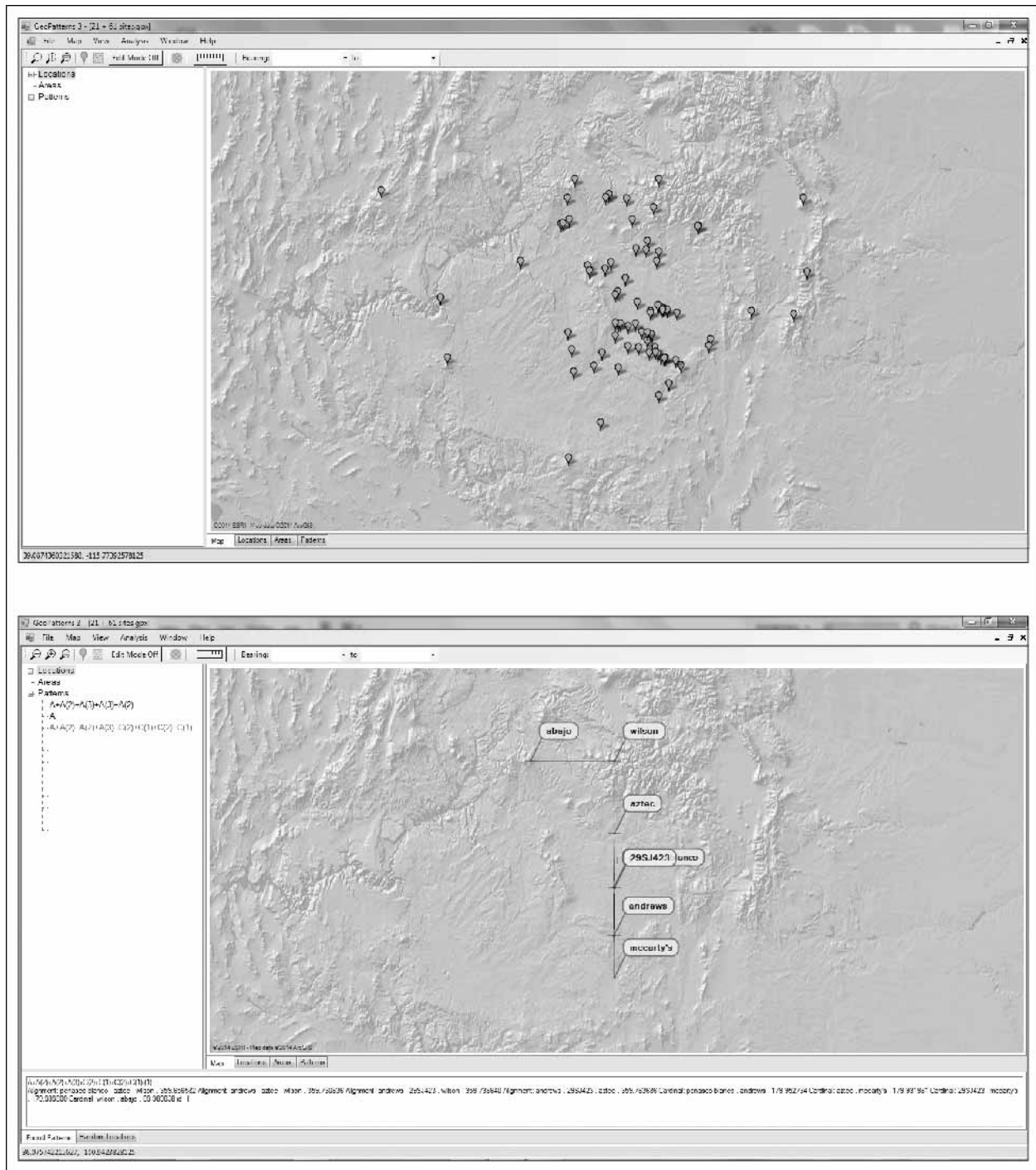


Figure 101. Geopatterns 3 main page (above), example of found complex pattern (below).

spend on searching for meaningful patterns exponentially increased. Yet neither the second or new third version has the ability to “sketch” built into the software, though the consideration of multitudes of pieces of possible cultural layouts has been greatly enhanced. As hypotheses of more organized designs develop they are presently captured more conventionally in Adobe Illustrator.

The primary rationale for Geopattern 3 sought both a better means of testing random patterns and of enhancing some aspects of design processes. Most important among random testing was the Geopatterns 2 limitation of five individual patterns—primarily alignments and cardinals in the present work—that could be combined to model more complex “compounds”. Another goal for the new version, though not realized because of time and money, was an ability to “bracket” particular compounds, connecting them together into increasingly complex layouts. The idea here was to be able to set accuracies and other limiting conditions differently within each bracket. A second accomplished goal allows test area setups where certain features are fixed, e.g. mountains in the present exercises located either inside or outside of test areas emulating the location of existing sites. The primary design analysis enhancement of the third version better graphically links points on the earth and calculated relationships with current digital mapping. Figure 101 shows the new background of fully zoomable ArcGIS (World Shaded Relief) imagery, one choice among several others: Google, Bing, Ovi, Yahoo, and Yandex.

One of the advantages of the third version is the ability to get a good lat/long point from any feature shown on any of these maps. As seen in Chapter 2, some archaeological features are clearly evident on sources like Google Earth. For others, one must continue to get locations from archaeological data bases, usually as marked on USGS topo quads (now digitally available from several sources).

As explained in aspects of the probability exercises of this volume, the new software already has its limitations, primarily in terms of numbers of single patterns that can be added together to model more complex compounds. It is yet difficult to say exactly what numbers can be combined, but looking at the example of the lower screen in figure 101, a “search string” of eight three-point alignments and two-point cardinal relationships—at a particular accuracy—successfully models the compound pattern shown among existing sites. This cannot be done in the previous version. The Mount Wilson layout is compared in Geopatterns 3 to patterns created by large numbers of random sets of points. A number of natural sites remain fixed in these

exercises both within and outside of test areas in which equivalent numbers of random points are generated.

At present, one still needs to use features of Geopatterns 2 together with the new version. While the Geopatterns 3 has the ability to state azimuths and distances between any two points, on the main menu bar of the screen, one must use the older version to see azimuths from any one point to all others on the site records list, and axis angles that show the angles from single points to all others in pairs (the means of calculating the average accuracy of a three-point alignment by averaging the deviation of interim point as seen from each end of the line).

One of the very useful design analysis features that carried forward in the latest version is the ability to quickly scroll through patterns found for search strings. In version 2, after searching in “Site Analysis” and creating a list of found patterns in the report text, the user can return to the map screen and graphically image each found pattern on the list (at whatever accuracy had been set). In Geopatterns 3, the report list also occurs as a text report, but also on the main screen as a variable sized window below the map. Highlighting a particular found pattern on this list shows the geometric layout of the pattern on the map.

Distinguishing designed from random layouts remains a work in progress, and for a person with a design background, one of the most interesting aspects of the work. But one thing is clear. This is no simple process of picking a few points in the landscape that might have geometric relationships. Rather it is a time-consuming, complex process of design analysis and testing, one which relies heavily upon evolving software.

Appendix II: Prehistoric Surveying

The best and most obvious evidence that Ancestral Puebloans designed and surveyed layouts between constructed, and or natural points in the landscape is the geometric relationship between Pueblo Alto and Tsin Kletsin. As seen in Chapter 7, the major (north) walls of the two buildings are within about one degree of being cardinal east-west, and their two west walls are very precisely aligned north and south of each other. This relationship, however, has been so implicitly accepted for some time, including general assumptions of accuracy, that no published work presently identifies actually which features were most important in the prehistoric design. Chapter 7 maintains that the central axis of Pueblo Alto was positioned by a longer cardinal line, not initially to the south rim of the canyon, but between the center of the Curved Rock That Speaks and the western fire signal of the Pierre Site complex.

At a later time, hypothetically, a different cardinal was extended from Alto's west wall down to Tsin Kletsin, as a homologized version of the naturally coincidently meridian from Lizard Head to Haystack Mountain. Apart from this possible symbolism, the relationship between Pueblo Alto and Tsin Kletsin is accepted as having been designed. Some sort of engineering expertise was essential to both establish the direction of south, and to project the line to participating surveyors on the south rim. Did this rely on the same technology used to construct the straight west wall of Pueblo Alto, along with other monumental walls of the great houses in Chaco Canyon? While it is possible that builders might have simply sighted along Alto's west wall, perhaps cardinally oriented and built straight by cord lines—in which case the good accuracy of aligned west walls might have been somewhat accidental--other instruments might have been involved. At issue here is whether a major wall orientation was established first in relation to some more distant point in the landscape or heavens with a surveying instrument, while the actual straightness of the subsequent wall was laid out with string lines.

Larger scale Ancestral Pueblo surveying, while technically more challenging than laying out Tzin Kletsin's position with respect to Pueblo Alto, might likely have had an important religious "dimension". Close to a billion Muslims orient themselves by compass five times a day to Mecca, and had impressive *astrolabe* technology to do so in earlier times. In regards to great

house construction in the period of peak Canyon activity, Wills (2000), describes the probable ritually conceived activities of building, and particularly of obtaining the many timbers needed from distant mountains for roof structures. Overall, multiple groups, with some collective integration, participated at different times in these construction tasks. Several different groups worked on the same great house. The symbolism of bringing an aspect of a distant sacred mountain (the timbers), itself a kind of pilgrimage to the center, fits well with the presently hypothesized religious function of a formalized large scale ritual landscape. Wills emphasizes the corporate basis of this participation by multiple groups, even considering the great size and intuitively competitive individual great house buildings. While a competitive force likely differentiated great house constituencies, the collective principle may have ultimately been dominant.

The transport of large logs is explored further by Syngg & Windes (1998), who see the widths and layouts of “ritual” Ancestral Pueblo roads as being partly determined by the technique and numbers of participants. Their *task performance* depiction of many men carrying these sacred timbers, here included as figure 102, can also be viewed as a significant *symbolic* experience, something not unrelated to Chaco’s primary function of pilgrimage. Symbolic meanings of designed and surveyed portions of prehistoric roads, particularly at ritual focal points, has been discussed at several junctures in this volume.

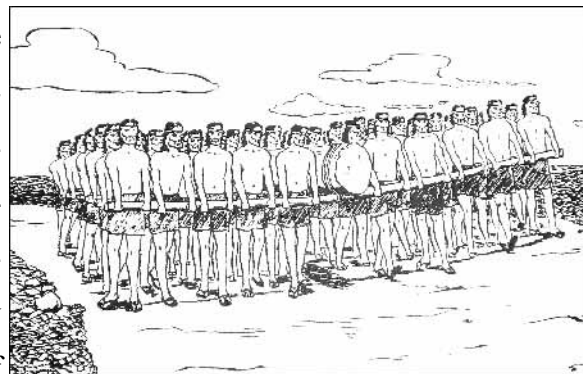


Figure 102. Carrying great kiva pillars from the mountains on Chacoan roads, from Syngg and Windes 1998:10.

Any work on large scale surveying needs to recognize justly critical commentaries by archaeologists or historians about ideas of geometric patterns among features in the landscape e.g. Weinberg (2004), Papadopoulos (2001), Roslund (1999), Williamson & Bellamy (1983), O’Carroll (1979). Typically absent in assertions about designed alignments are accurate descriptions and locations of features, or parts of a features being used in an alignment, and the precise angular deviation of interim points. Also frequently missing are tests of the probability of an existing pattern occurring randomly, as is somewhat more common in archaeoastronomy (Ruggles 1999:161). Few such exercises occur in archaeology; the exception here in the Americas again being Swanson’s (2003) comparison of signal fire locations on Cerro Moctezuma with

random patterns. These apparently designed alignments are much shorter, a few kilometers or so, than the patterns considered in the present volume. Perhaps the most extensive discussion of possible prehistoric surveying in the US Southwest can be found in Lekson's Chapter Four (1999) in his volume on a "Chaco Meridian". He speaks of technical issues including accuracies, citing the work of accomplished archaeoastronomers associated with the National Oceanographic & Atmospheric Administration (NOAA). They testify to a probable prehistoric ability to prolong lines very accurately down to less than two arc minutes of error (0.033°). As mentioned earlier, in the Old World, Romans were about twice this accurate in their alignment of twelve watch towers spaced over a distance of 80 km in Germany (Söderman 1989).

This technology is quite simple. The actual "instrument" used by the Romans might have been threesomes of "range poles" (Gallo 2004:14) aligned across the landscape. In "prolonging" a line, one of the (exterior) poles is moved to an aligned next position and so on. The accuracy of this method depends on the diameter of the poles and their distance apart. Given poles of 0.10 m in diameter, an accuracy of visual acuity or 0.017° can be achieved when the poles are spaced about 300 m.

A field exercise which aligns an interim point between two visible end points

While prolonging points can rely upon sighting down instruments such as range poles, aligning an interim point between two visible end points some distance apart can also be accurately accomplished with a simple instrument using only the unaided eye and basic backsighting techniques. This can be relatively easily demonstrated in the field. Figure 103 shows two tripods (about ten feet tall) each with a plumb line. To align an interim point to a line between two distant points (mountains barely visible in the photo) the vertical cord of the first tripod is aligned with one of the peaks. The second tripod cord, about 25 feet away, is then aligned to these two points. Next, the "backsight" or reverse alignment is checked. By such a process of trial and error, eventually each peak can be aligned with the two tripod lines without having to move one of the tripods. The tripods are then on or very close to the line between the two mountain peaks.

Optical science uses a figure of 0.017° , about one arc minute, to describe the approximate accuracy of the unaided human eye. Under normal sighting conditions, one can clearly

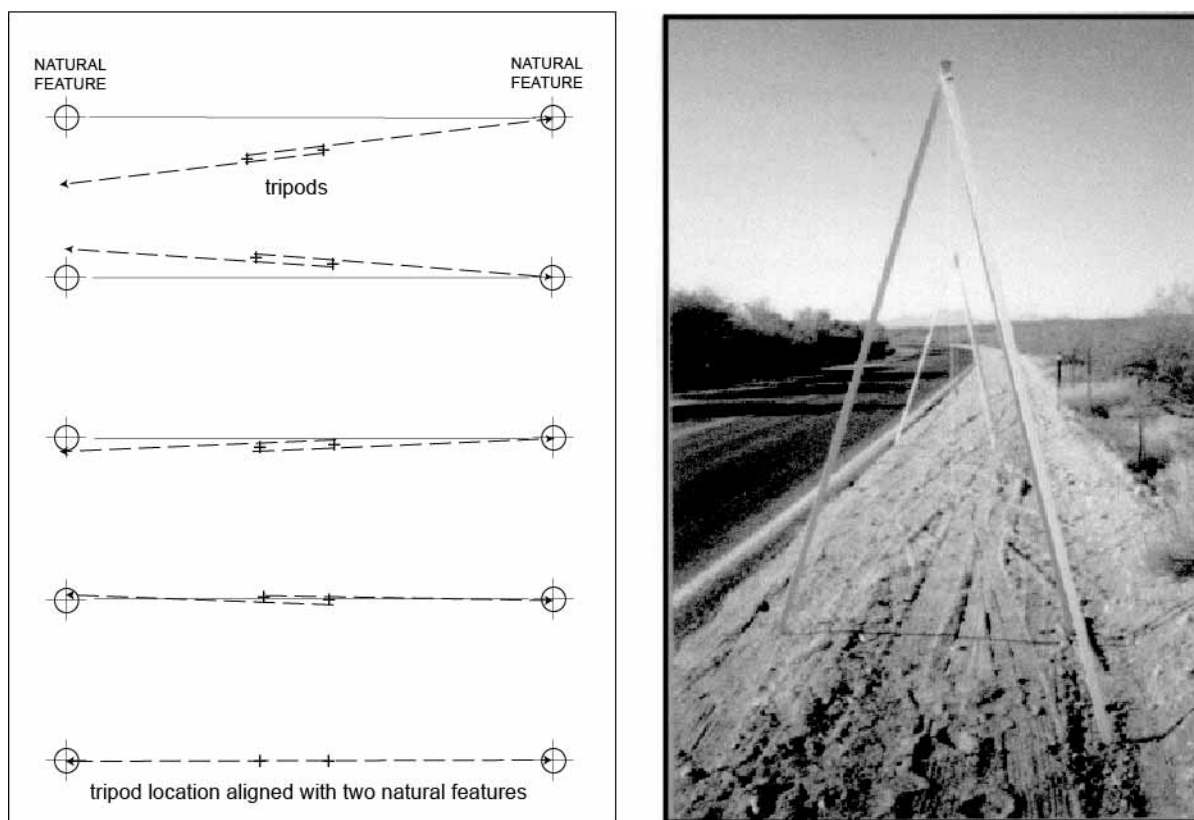


Figure 103. Finding an aligned point between two distant natural features using tall tripods with plumb lines.

see a plumb line cord about 2mm thick from a distance of about 6.75 meters (the cord width equals 0.017° at this distance). Under ideal conditions it should be possible to align a midpoint between two peaks 100 kilometers apart to within about 15 meters, unless closer by chance. Atmospheric refraction and other sighting impairments, and the slight movement of plumb lines by wind can of course influence accuracy.

Three early morning (because of less wind and air pollution) alignments were made between mountain peaks on the visible edges of the Tucson basin. Midpoint locations on potential alignments were chosen for their adjacency to some recognizable feature on a USGS 7.5 minute quad map. After establishing the trial and error position, distance to the known map feature was measured. As in all calculations, determinations of latitude and longitude locations from 7.5 maps contain some margin of error. While figures are carried to the nearest tenth of arc second, about 3 meters of latitude or 2.5 meters of longitude, map making and map measuring errors could be more in the range of 5-10 meters. Differential GPS positioning of sites could produce sub-meter accuracy, but is unnecessary for reasonable accuracy of large scale

patterns. Calculations for this exercise were done with a Mathcad "great circle" or elliptical earth application mentioned in Appendix I.

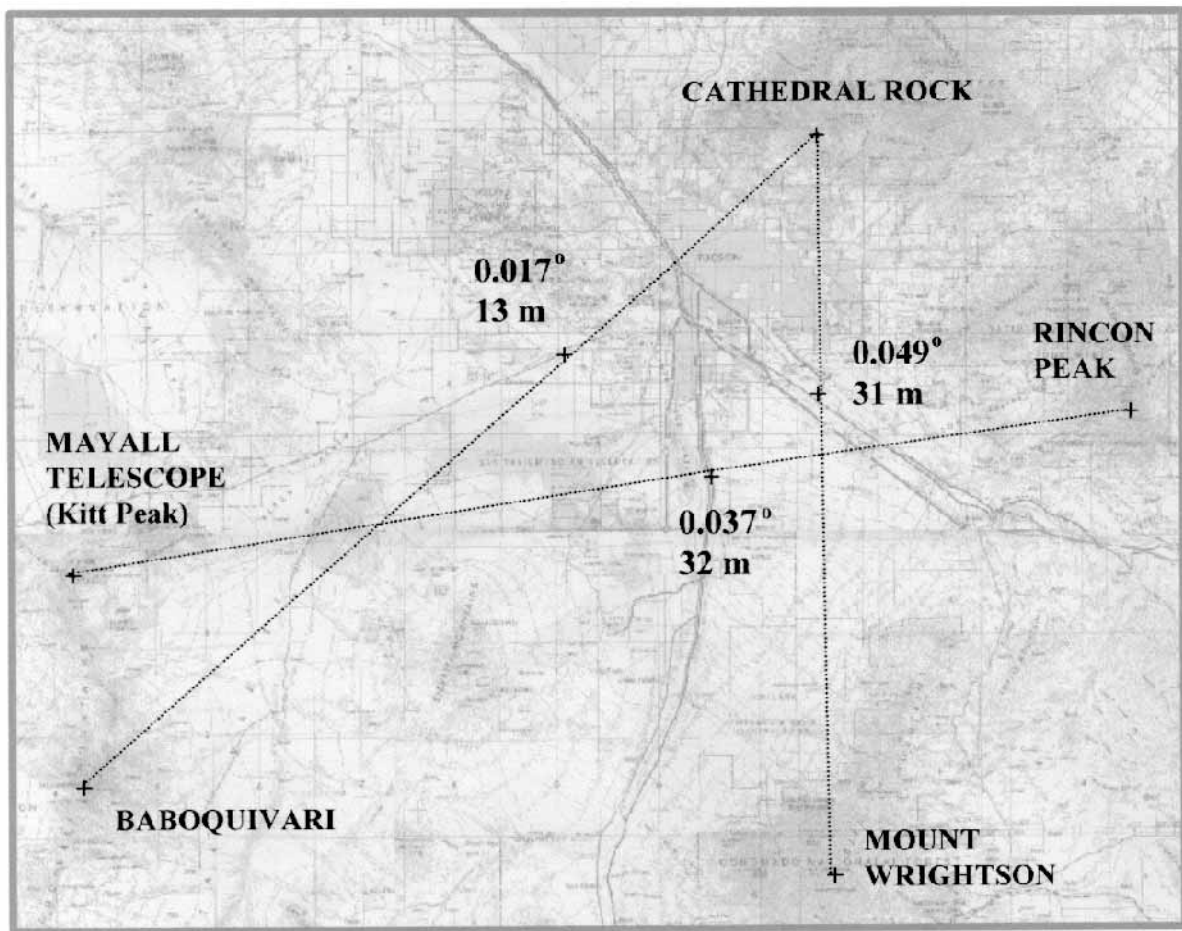


Figure 104. Aligned positions of interim points for three pairs of distant natural features.

The first interim point was found on a best line between the visible southern peak of Cathedral Rock in the Catalina Mountains just north of Tucson and the peak of Mount Wrightson to the south, figure 104. The trial and error backsighting location for an interim point lay about 31 meters off the calculated exact line. For the distances of 30.5 km from the point to Cathedral Rock and 46.1 km to Mount Wrightson (76.6 km overall), the average deviation of the interim point was about 0.049° (taking the average angular deviation of the interim point from the two end points with respect to the ideal line). A point on a second line from the Tohono O'odham "center" of the world, Baboquivari, to Cathedral Rock (overall length 98.6 km) produced a deviation of 13 meters or an average deviation very close to 0.017° . A final point on a line from the Mayall Telescope on Kitt Peak, southwest of Tucson, to Rincon Peak,

measured 32 meters off, or an average deviation of 0.037° (overall length 103.0 km). The use of the white Mayall telescope structure, clearly visible at a distance of about 50km, begins to suggest daytime target sizes, colors and distances.

Field conditions were best for the second two lines. Although all were located early in the morning, the first, Wrightson-Cathedral Rock, occurred midweek when one would expect greater air pollution in the Tucson area (additionally, this interim site lies only a few hundred meters from I-10). The breeze at this site, though slight, blew appreciably steadier than at the others and probably moved the plumb lines more directly perpendicular to the alignment. The author didn't use helpers to steady lines or screen the breeze at any of the sites. The other two points were established on Sunday mornings at desert locations well outside of the built up urban area. Visual pollution conditions were optimal (late May and early June).

The degree of accuracy in these three alignments comes very close to previously mentioned field studies reported by Lekson from his personal conversation with Rolf Sinclair and Anna Sofaer (1999:1180). Their degree of inaccuracy, again, was about 1 meter in 2,000 (2km), or about 0.029° for prolonging or extending a long non-meridian line across the landscape. Thus the figures seem very similar either for interim marks between two end points or for prolonging a line from one point.

Simulating a surveyed line between Humphrey's Peak and Blanca Peak

When it comes to laying out a much longer line between end points not visible from any single interim point processes are naturally more labor intensive, but still could have relied only upon a tripod pairs and plumb bobs. In this case the process could have involved an iterative straightening of multiple three-point segments back and forth sequentially across the full length of the line until a requisite linearity is achieved. To initiate the process, approximate interim points could have been set up on ridges or high points along the full length of the line. It must be possible to view the two adjacent points from each point of the total line. While the technology is still simple backsighting with pairs of tripods at each point, multiple iterations of aligning with sequential threesomes eventually straightens the line. See Lewis (2001:223) for a related diagram and further explanation in a larger context of prehistoric surveying practices.

No testing of this hypothetical process of large scale straightening of lines has been under-

taken in the field. This, of course, would be ideal, but expensive. In the meantime, one can more economically use computer tools to set up a reasonable simulation of how some number of iterative survey stations could establish such a line. The line chosen for the exercise is that adopted by the Navajo for their SW-NE axis, from Humphrey's Peak to Blanca Peak, a distance of 607.582 km. While no evidence points to a Navajo understanding of this line as a straight or surveyed "sunray" like their lore about the larger part of Sipapu-Chicoma-Truchas, one can map its possible involvement in Aztec East X as described in Chapter 8. Furthermore as also mentioned the line runs very close to what might have been the ritual focus of the three Hopi Mesas. This line would have been more difficult to survey than most of the possible lines described in the present work, maybe even more so than prolongations to Cerro Moctezuma. Particularly problematic for Ancestral Puebloan surveyors could have been stretching the straightening process across the Continental Divide.

The following simulation required the use of three computer applications, a digitized version of USGS quads such as Trails.com to determine lat/long locations for points, the Path Profiler add-on with Google Earth to check viewsheds or visibility among threesomes of station points (accounting for the curvature of the earth), and the author's software to determine an equivalent to visual accuracy of any particular backsight measurement. The location of every station point in the iterative process is described in the simulation data.

To get started, high points visible from each of its nearest two neighbors are selected along a rough cognitive line between the two known end points. From Humphrey's Peak, at 12,637 ft, priest surveyors would have had an unobstructed view to the high point of the Chuskas, Roof Butte at 9,783 ft. The two peaks, however, are 263.793 km apart. To facilitate signaling, an interim location, the high point of Black Mountain at 7,467 ft is added in this leg of the simulation. Looking east from Roof Butte, surveyors also had an unobstructed view to various high points on the Continental Divide, about 230-240 km distant. Here too an interim signaling point is added, a highest point in the San Juan River area on Piedra Peak at 8,551 ft. From here surveyors could have gone to the high point on the divide, Summit Peak at 13,301 ft, and then on to Blanca Peak, the eastern terminus and highest of all points at 14,345 ft.

The initial signal/survey points for the trial and error backsighting simulation are shown in figure 105. Many, if not all, of these high points, would likely have long been sacred in their own right prior to any formalization of the religious landscape. Priest surveyors, a crew for

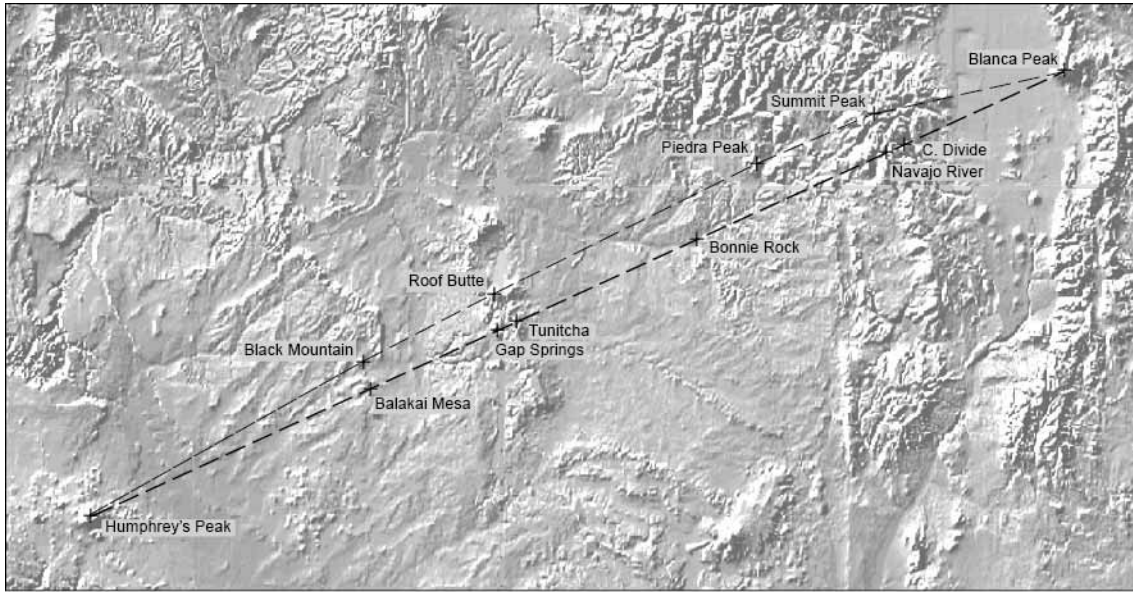


Figure 105. Initial and final survey stations of the simulated survey of a line between Humphrey's Peak and Blanca Peak; initial four interim points are the highest features along an assumed cognitively understood orientation between the two end peaks (note initial bowed condition, i.e. that all points are north of the eventual accurate line).

each peak, would most probably have required the blessings of the gods before ascending to begin work. It is also possible, not unlike hauling timbers from high points to distant ceremonial sites that tribal or communal sodalities (religious groups) along the routes participated in this holy work, infusing an all-important dimension of social integration. Site crews might have been comprised of four or five men, more or less, depending upon the logistics of limited brush clearing at these elevations, fuel supply if signal fires were used, and the provision of food and shelter.

Although archaeologists more informally speak of the use of signal fires by Puebloan Ancestors at larger scales, no published results apparently exist (Lange 2001). Lange has experimented with signal fire communication between “tactical” pueblo sites at distances up to eight miles and briefly discusses such possibilities at larger distances. Others discuss signal fires, but at shorter intervals, e.g. Hayes and Windes 1975; Windes et al. 2000. Swanson, as noted above, also takes up the issue in his work on shorter range signaling platforms in the vicinity of Cerro Moctezuma. He quotes Ellis (1991:60-62) as having ethnographically determined that the maximum daytime visibility of a fire is around 70 km. The maximum viewing distance at night or at sunrise/sunset, however, may be farther. In *Agamemnon*, Aeschylus describes signal fires between Athos and Macistus, 177 kilometers apart. One of the best examples in modern times

is documented naked eye observations of the sun's reflection off of Sputnik, the size of a beach ball, orbiting at 250 km above earth close to its perigee (Hyde Memorial Observatory: www.cloudynights.com). The maximum length used in the present simulation is 179.419 km, the initial distance between Humphrey's Peak and the high point of Black Mountain. The initial distance between Roof Butte and Piedra Peak is 162.137km. Some simple communication code, within the capabilities of the signaling method, would have been necessary between crews.

The use of three different computer applications creates a persuasive simulation of the actual process. Normally, all crews are active simultaneously, either maintaining fixed signals to their two neighbors, or moving their station to align with them. The alternation of these roles eventually straightens the total line. In simulation, one begins with USGS quad map latitude/longitude locations for each survey station point. Then the three points of particular threesomes are checked to see the deviation of the interim point to be moved. Returning to the topo maps, a new trial and error position is located and again checked for alignment. When the interim point is aligned, here within a range close to visual acuity (about $0.005^\circ - 0.020^\circ$), each of the sets of two points between the interim and the two neighbors is checked for visibility in the Path Profiler. If the distance between the two adjacent stations, for example, is 100 km and the deviation of an equidistant interim point is 0.017° , the distance off is about 29.6 meters. Where blockage occurs, the shaded maps of Google Earth provide a means--a good simulation of actual process--of choosing a more visible interim point at which to repeat the process. Figures 106a and 106 b list all of the aligned survey stations required before the line between Humphreys Peak and Blanca Peak became accurately straight. Particularly at early stages of the process or other times when an interim point must be radically moved to maintain visibility, sometimes it seems useful along a particular section of the line to do repeated aligning while other stations remain inactive.

If surveyors had actually laid out this line, once the radical first alignments regularize, they might well have understood the bowed shape of the line, since all interim points moved south when aligned. They could have just continued to align in threesomes and eventually the total line would straighten. But to save labor, they could have moved all the points, eventually only those that are most bowed to the east, some trial and error distance to the south. The simulation performs this movement of bowed positions six times beginning with a move of 3000m

Hump. Pk – Black Mt – Roof Butte – Piedra Pk – Summit Pk – Blanca Pk	
1. Humphreys Peak – Lohali point (36.1372 / 109.8136 / 7,470) – Roof Butte	51. Matthews Pk – Slane K (36.8190 / 107.8698 / 6,706) – Gunsight P
2. <u>Roof Butte – Piedra Peak (37.0787 / 107.4474 / 8,041) – Summit Peak</u>	52. <u>Hump. Pk – Balaki M (36.0375 / 109.9305 / 7,362) – Matthews Pk</u>
3. Piedra Peak – Summit Peak – Blanca Pk (blocked, need 2 points between)	[blocked: need new point between Matthew Pk and Slane Knob]
Piedra Peak – Gunsight Pass (37.2749 / 106.6935 / 12,628) – Conejos Pk	53. Balaki M – Matthews Pk – Tunitcha Mt (36.3687 / 109.0749 / 9,072)
Gunsight Pass – Conejos Pk (37.3078 / 106.5656 / 12,520) – Blanca Pk	54. Balaki M – Matthews Pk (36.3419 / 109.1443 / 9,341) – Tunitcha Mt
4. Roof Butte – Sandoval Pk (37.0570 / 107.3556 / 7,894) – Gunsight Pass	55. Tunitcha Mt – Slane K (36.8144 / 107.8688 / 6,614) – Gunsight Pass
5. <u>Lohali pt – Roof Butte (36.4234 – 109.1127 / 9,232) – Sandoval Pk</u>	56. <u>Gunsight P – Bear Lake – Blanca Pk [aligned]</u>
7. Hump. Pk – Whipperwill Mesa (36.0142 / 110.1110 / 6,604) – Roof Butte	[blocked: need new point between Slane K and Gunsight Pass]
[blocked: three points needed to replace single Roof Butte point]	57. Slane K – C. Divide – (37.2340 / 106.6643 / 12,028) – Gunsight Pass
8. Whipperwill – Matthews Pk (36.3858 / 109.1580 / 9,137) – Roof Butte 3	58. Matthews Pk – Tunitcha (36.3680 / 109.0755 / 9,055) – Slane Knob
9. Matthews Pk – Roof Butte 3 (36.3973 / 109.1283 / 9,127) – Roof Butte 4	59. <u>Hump. Pk – Balaki M (36.0390 / 109.9354 / 7,369) – Matthews Pk</u>
10. Roof Butte 3 – Roof Butte 4 (36.4134 / 109.0869 / 8,871) – Sandoval Pk	60. Balaki M – Matthews Pk – Tunitcha [aligned]
11. Roof Butte 4 – C. Zopilote (37.0717 / 107.2750 / 8,018) – Gunsight Pass	61. Tunitcha – Slane K (36.8130 / 107.8603 / 6,601) – C. Divide
12. C. Zopilote – Gunsight P. (37.2664 / 106.6894 / 12,566) – Conejos Pk	62. <u>C. Divide – Bear Lk (37.2760 / 106.5231 / 12,543) – Blanca Pk</u>
13. <u>Gunsight P. – Conejos Pk. (37.2975 / 106.5727 / 12,844 – Blanca Pk</u>	63. Slane K – C. Divide (37.2227 / 106.6798 / 11,795) – Bear Lake
14. C. Zopilote – Gunsight P. (37.2613 / 106.6856 / 12,156) – Conejos Pk	64. Matthews Pk – Tunitcha (36.3676 / 109.0757 / 9,101) – Slane Knob
15. Roof Butte 3 – Roof Butte 4 – C. Zopilote [aligned]	65. <u>Humphreys Pk – Balaki Mesa – Matthews Pk [aligned]</u>
16. <u>Whipperwill Mesa – Matthew Pk – Roof Butte 3 [aligned]</u>	66. Balaki M – Matthews Pk (36.4818 / 109.1440 / 9,341) – Tunitcha
17. Hump. Pk – First Mesa (35.9677 / 110.1939 / 6,394) – Matthew Pk	67. Tunitcha – Slane Knob (36.8103 / 107.8591 / 6,542) – C. Divide
18. Matthew Pk – Roof Butte 3 – Roof Butte 4 [aligned]	68. <u>C. Divide – Bear Lk (37.2700 / 106.5235 / 12,356) – Blanca Pk</u>
[blocked: point needed between Roof Butte 4 and C. Zopilote]	69. Slane K – C. Divide (37.2179 / 106.6779 / 11,660) – Bear Lake
19. Roof Butte 4 – Hart Mt (36.8714 / 107.8394 / 6,581) – C. Zopilote	70. Matthews Pk – Tunitcha (36.3670 / 109.0759 / 9,104) – Slane Knob
20. <u>C. Zopilote – Gunsight Pass – Conejos Pk [aligned]</u>	71. <u>Humphreys Pk – Balaki Mesa – Matthew Pk [aligned]</u>
21. Gunsight P. – Conejos Pk (37.2923 / 106.5716 / 12,953) – Blanca Pk	72. Balaki M – Matthew Pk (36.3420 / 109.1422 / 9,357) – Tunitcha
[blocked: need additional point between Hart Mt. and C. Zopilote]	
22. Albino Cn (36.9550 / 107.6293 / 7,060) – C. Zopilote – Gunsight Pass	Move “bowed” points approximately 1,500 m south: Matthew Pk (36.3258 /
23. Roof Butte 4 – Hart Mt (36.8837 / 107.8253 / 6,663) – Albino Cn	109.1404 / 8,924) – align Balaki M (36.0288 / 109.9085 / 7,415); blockage
24. Matthews Pk – Roof Butte 3 – Roof Butte 4 [aligned]	requires additional Chuska point - Tunitcha W (36.3468 / 109.0836 / 9,045)
25. <u>Humphreys Pk – First Mesa – Matthews Pk [aligned]</u>	and Tunitcha E (36.3592 / 109.0502 / 9,170); Slane Knob moved to Bonnie
26. First Mesa – Matthews Pk – Roof Butte 3 [aligned]	Rock (36.7986 / 107.8381 / 6,414); C. Divide point is moved less distance
27. Roof Butte 3 – Roof Butte 4 – Hart Mt [aligned]	south, 1,000 m because of bow shape (37.2136 / 106.6817 / 11,877); Bear
28. Hart Mt – Albino Cn (36.9507 / 107.6300 / 7,028) – C. Zopilote	Lake moves approximately 750m (37.2628 / 106.5181 / 11,929).
29. <u>C. Zopilote – Gunsight P (37.2578 / 106.6828 / 12,352) – Conejos Pk</u>	73. C. Divide – Bear Lk (37.2640 / 106.5187 / 11,955) – Blanca Pk
30. Gunsight P – Conejos Pk (37.2878 / 106.5725 / 12,963) – Blanca Pk	74. Tunitcha E – Bonnie Rock (36.8004 / 107.8491 / 6,302) – C. Divide
31. Albino Cn – C. Zopilote (37.0670 / 107.2751 / 7,900) – Gunsight Pass	75. Matthew Pk – Tunitcha W (36.3468 / 109.0835 / 9,045) – Tunitcha E
32. Roof Butte 4 – Hart Mt (36.8789 / 107.8281 / 6,765) – Albino Cn	76. <u>Humphreys Pk – Balaki Mesa – Matthews Pk [aligned]</u>
33. Matthews Pk – Roof Butte 3 – Roof Butte 4 [aligned]	77. Balaki Mesa – Matthews Pk – Tunitcha W [aligned]
34. <u>Humphreys Pk – First Mesa – Matthews Pk [aligned]</u>	78. Tunitcha W – Tunitcha E (36.3594 / 109.0502 / 9,170) – Bonnie Rock
35. First Mesa – Matthews Pk (36.3856 / 109.1580 / 9,137) – Roof Butte 3	79. <u>Bonnie Rk – C. Divide (37.2111 / 106.6732 / 11,936) – Bear Lake</u>
36. Roof Butte 3 – Roof Butte 4 (36.4124 / 109.0885 / 8,973) – Hart Mt	80. C. Divide – Bear Lk (37.2599 / 106.5177 / 11,883) – Blanca Pk
37. Hart Mt – Albino Cn (36.9487 / 107.6238 / 6,923) – C. Zopilote	81. Tunitcha E – Bonnie Rk (36.7991 / 107.8475 / 6,257) – C. Divide
38. <u>C. Zopilote – Gunsight P (37.2548 / 106.6787 / 12,283) – Conejos Pk</u>	82. Matthew Pk – Tunitcha W (36.3469 / 109.0835 / 9,045) – Tunitcha E
39. Gunsight P – Conejos Pk (37.2869 / 106.5625 / 12,753) – Blanca Pk	83. <u>Humphreys Pk – Balaki Mesa – Matthews Pk [aligned]</u>
40. Albino Cn – C. Zopilote (37.0630 / 107.2746 / 7,812) – Gunsight P	84. Balaki M – Matthews Pk (36.3259 / 109.0502 / 8,881) – Tunitcha W
[blocked: Pump Mesa (36.9359 / 107.6594 / 6,923) replaces Albino Cn]	85. Tunitcha W – Tunitcha E (36.3595 / 109.0502 / 9,170) – Bonnie Rock
41. Roof Butte 4 – Hart Mt (36.8757 / 107.8272 / 6,621) – Pump Mesa	86. Bonnie Rk – C. Divide (37.2052 / 106.6791 / 11,913) – Bear Lake
42. Matthews Pk – Roof 3 (36.3970 / 109.1283 / 9,127) – Roof Butte 4	87. <u>C. Divide – Bear Lk (37.2566 / 106.5171 / 11,827) – Blanca Pk</u>
43. <u>Hump. Pk – First Mesa – Matthews Pk [aligned]</u>	
44. First Mesa – Matthews Pk (36.3853 / 109.1580 / 9,121) – Roof Butte 3	Move “bowed” points approximately 750 m south: Matthews Pk (36.3201 /
45. Roof Butte 3 – Roof Butte 4 (36.4120 / 109.0885 / 9,094) – Hart Mt	109.1361 / 8,241); align Balaki M (36.0306 / 109.9118 / 7,303); prolong to new
46. Hart Mt – Pump M (36.9363 / 107.6493 / 6,850) – C. Zopilote	Tunitcha (36.3521 / 109.0479 / 9,150) only one point now necessary here;
47. <u>C. Zopilote – Gunsight P (37.2538 / 106.6692 / 12,316) – Conejos Pk</u>	new Bonnie Rk approx. 750 m south (36.7896 / 107.8319 / 6,385); blockage
48. Gunsight P – Conejos Pk (37.2798 / 106.5759 / 12,703) – Blanca Pk	to C. Divide requires new pt at Chalk Mt (37.1806 / 106.7303 / 11,706); new
49. Pump M – C. Zopilote (37.0578 / 107.2774 / 7,533) – Gunsight Pass	Bear Lake (37.2505 / 106.5140 / 11,686); new C. Divide 750 m south (37.2212
	/ 106.6053 / 11,814)
Move “bowed” points approx. 3,000 meters south: Balaki Mesa (36.0328 /	88. C. Divide – Bear Lake – Blanca Pk [coincidentally aligned]
109.9167 / 7,444) - Matthews Pk (36.3514 / 109.1513 / 9,341) – C. Zopilote	89. Bonnie Rk – Chalk Mt (37.1797 / 106.7257 / 11,506) – C. Divide
(37.0427 / 107.2796 / 7,953) – Slane Knob (36.8227 / 107.8671 / 6,811) –	90. Matthews Pk – Tunitcha (36.3526 / 109.0477 / 9,150) – Bonnie Rock
Gunsight Pass (37.2380 / 106.6782 / 12,051) - Bear Lake (37.2774 / 106.5242 /	91. <u>Humphreys Pk – Balaki Mesa – Matthews Pk [aligned]</u>
12,543)	92. Balaki Mesa – Matthews Pk – Tunitcha [aligned]
50. Gunsight P – Bear Lk (37.2805 / 106.5318 / 12,5318) – Blanca Pk	93. Tunitcha – Bonnie Rk (36.7902 / 107.8425 / 6,362) – Chalk Mt
[view from Slane Knob to Gunsight OK: eliminate C. Zopilote]	94. <u>Chalk Mt – C. Divide (37.2202 / 106.6050 / 11,804) – Bear Lake</u>
	95. C. Divide – Bear Lk (37.2497 / 106.5143 / 11,572) – Blanca Pk
	96. Bonnie Rk – Chalk Mt (37.1793 / 106.7252 / 11,362) – C. Divide
	97. Matthews Pk – Tunitcha (36.3529 / 109.0476 / 9,150) – Bonnie Rock

Figure 106a. List of all survey stations necessary to straighten the initial line between Humphrey’s Peak and Blanca Peak; each of the stations is the result of backsighting among threesomes visible from each other; each listed station and its latitude, longitude, and elevation is the resulting interim point for each aligned threesome.

98. Humphreys Pk – Balaki M – Matthews Pk [aligned]
99. Balaki M – Matthews Pk (36.3203 / 109.1363 / 8,330) – Tunitcha
100. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
101. Chalk Mt – C. Divide (37.2195 / 106.6049 / 11,801) – Bear Lake
[blocked: need new point between Chalk Mt and C. Divide]
102. Chalk Mt – Navajo River (37.2076 / 106.6406 / 11,831) – C. Divide
103. C. Divide – Bear Lk (37.2493 / 106.5133 / 11,519) – Blanca Pk
104. Chalk Mt – Navajo River – C. Divide [aligned]
105. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
106. Balaki M – Matthews Pk (36.3202 / 109.1363 / 8,330) – Tunitcha
107. Humphreys Pk – Balaki Mesa – Matthews Pk [aligned]
108. Matthews Pk – Tunitcha – Bonnie Rock [aligned]
109. Bonnie Rk – Chalk Mt (37.1790 / 106.7242 / 11,266) – Navajo Rv
110. Navajo Rv – C. Divide (37.2193 / 106.6048 / 11,801) – Bear Lake

Move “bowed” points 375 m max south: Balaki Mesa moves 200 m south (36.0291 / 109.9104 / 7,408); Matthews Pk moves to Gap Springs (36.3386 / 109.0733 / 8,973); new Tunitcha (36.3480 / 109.0483 / 9,114); Bonnie Rock moves 300 m south (36.7917 / 107.8295 / 6,411); Chalk Mt moves 200 m south (37.1732 / 106.7331 / 11,086); Navajo Rv moves 180 m south (37.2071 / 106.6372 / 11,821); C. Divide moves 150 m south (37.2179 / 106.6047 / 11,808); Bear Lk moves 120 m south (37.2487 / 106.5125 / 11,453).

111. C. Divide – Bear Lk (37.2482 / 106.5120 / 11,460) – Blanca Pk
112. Chalk Mt – Navajo Rv (37.2085 / 106.6318 / 11,860) – C. Divide
113. Tunitcha – Bonnie Rk (36.7910 / 107.8277 / 6,385) – Chalk Mt
114. Balaki M – Gap Sp (36.3389 / 109.0730 / 8,940) – Tunitcha
115. Humphreys Pk – Balaki M – Gap Springs [aligned]
116. Gap Springs – Tunitcha (36.3481 / 109.0484 / 9,114) – Bonnie Rk
117. Bonnie Rk – Chalk Mt (37.1737 / 106.7333 / 11,086) – Navajo Rv
118. Navajo Rv – C. Divide (37.2175 / 106.6043 / 11,827) – Bear Lake
119. C. Divide – Bear Lk (37.2488 / 106.5087 / 11,493) – Blanca Pk
120. Chalk Mt – Navajo Rv (37.2083 / 106.6314 / 11,860) – C. Divide
121. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
122. Balaki M – Gap Sp (36.3390 / 109.0730 / 8,940) – Tunitcha
123. Humphreys Pk – Balaki Mesa – Gap Springs [aligned]
124. Gap Sp – Tunitcha (36.3482 / 109.0484 / 9,114) – Bonnie Rk
125. Bonnie Rk – Chalk Mt (37.1734 / 106.7331 / 11,086) – Navajo Rv
126. Navajo Rv – C. Divide (37.2173 / 106.6043 / 11,814) – Bear Lk
127. C. Divide – Bear Lk (37.2486 / 106.5087 / 11,493) – Blanca Pk
128. Chalk Mt – Navajo Rv (37.2081 / 106.6314 / 11,860) – C. Divide
129. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
130. Balaki M – Gap Sp (36.3392 / 109.0730 / 8,940) – Tunitcha
131. Hump. Pk – Balaki M (36.0282 / 109.9116 / 7,425) – Gap Sp
132. Gap Sp – Tunitcha (36.3482 / 109.0484 / 9,114) – Bonnie Rk
133. Bonnie Rk – Chalk Mt (37.1674 / 106.7498 / 10,883) – Navajo Rv
134. Navajo Rv – C. Divide (37.2170 / 106.6042 / 11,827) – Bear Lk
135. C. Divide – Bear Lk (37.2484 / 106.5087 / 11,493) – Blanca Pk
136. Chalk Mt – Navajo Rv (37.2078 / 106.6313 / 11,864) – C. Divide
137. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
138. Balaki M – Gap Sp (36.3393 / 109.0730 / 8,940) – Tunitcha
139. Humphreys Pk – Balaki M – Gap Springs [aligned]
140. Gap Sp – Tunitcha (36.3483 / 109.0484 / 9,114) – Bonnie Rk
141. Bonnie Rk – Chalk Mt (37.1674 / 106.7499 / 10,880) – Navajo Rv
142. Navajo Rv – C. Divide (37.2168 / 106.6043 / 11,827) – Bear Lk
143. C. Divide – Bear Lk (37.2482 / 106.5087 / 11,493) – Blanca Pk
144. Chalk Mt – Navajo Rv (37.2076 / 106.6313 / 11,864) – C. Divide
145. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
146. Balaki M – Gap Sp (36.3393 / 109.0730 / 8,940) – Tunitcha
147. Humphreys Pk – Balaki M – Gap Springs [aligned]
148. Gap Sp – Tunitcha (36.3485 / 109.0482 / 9,114) – Bonnie Rk
149. Bonnie Rk – Chalk Mt (37.1671 / 106.7500 / 10,883) – Navajo Rv
150. Navajo Rv – C. Divide (37.2166 / 106.6034 / 11,827) – Bear Lake

Surveyors recognize slight bow to the south for the western portion of the line from Bonnie Rock: move Gap Springs 75 m north (36.3399 / 109.0725 / 8,927) and Tunitcha 75 m north (36.3490 / 109.0481 / 9,137); on eastern portion bow continues to the north necessitating 150 m move south at

Chalk Mt (37.1657 / 106.7508 / 11,112), Navajo Rv (37.2066 / 106.6312 / 11,877), C. Divide (37.2149 / 106.6041 / 11,850), and Bear Lk (37.2475 / 106.5077 / 11,453).

151. C. Divide – Bear Lk (37.2467 / 106.5076 / 11,437) – Blanca Pk
152. Chalk Mt – Navajo Rv (37.2058 / 106.6311 / 11,867) – C. Divide
153. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
154. Balaki M – Gap Sp (36.3400 / 109.0725 / 8,927) – Tunitcha
155. Hump. Pk – Balaki M (36.0287 / 109.9115 / 7,425) – Gap Sp
156. Gap Sp – Tunitcha (36.3491 / 109.0482 / 9,137) – Bonnie Rk
157. Bonnie Rk – Chalk Mt (37.1652 / 106.7507 / 10,830) – Navajo Rv
158. Navajo Rv – C. Divide (37.2148 / 106.6040 / 11,850) – Bear Lake
159. C. Divide – Bear Lk (37.2467 / 106.5075 / 11,437) – Blanca Pk
160. Chalk Mt – Navajo Rv (37.2057 / 106.6311 / 11,867) – C. Divide
161. Tunitcha – Bonnie Rk (36.7911 / 107.8251 / 6,335) – Chalk Mt
162. Balaki M – Gap Sp (36.3401 / 109.0725 / 8,927) – Tunitcha
163. Humphreys Pk – Balaki M – Gap Springs [aligned]
164. Gap Sp – Tunitcha (36.3491 / 109.0482 / 9,137) – Bonnie Rk
165. Bonnie Rk – Chalk Mt (37.1650 / 106.7506 / 10,830) – Navajo Rv
166. Navajo Rv – C. Divide (37.2147 / 106.6040 / 11,850) – Bear Lake
167. C. Divide – Bear Lk (37.2472 / 106.5062 / 11,453) – Blanca Pk
168. Chalk Mt – Navajo Rv (37.2055 / 106.6311 / 11,867) – C. Divide
169. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
170. Balaki M – Gap Sp (36.3402 / 109.0725 / 8,927) – Tunitcha

Points on the western portion of the line to Bonnie Rock are close to being aligned. Still a slight bow north of the line for the four eastern most points. Move 75m south: Chalk Mt (37.1651 / 106.7489 / 11,086), Navajo Rv (37.2055 / 106.6294 / 11,857), C. Divide (37.2137 / 106.6043 / 11,867), Bear Lk (37.2468 / 106.5054 / 11,440).

171. Humphreys Pk – Balaki Mesa – Gap Springs [aligned]
172. Gap Sp – Tunitcha (36.3492 / 109.0482 / 9,137) – Bonnie Rk
173. Bonnie Rk – Chalk Mt (37.1648 / 106.7489 / 11,086) – Navajo Rv
174. Navajo Rv – C. Divide (37.2139 / 106.6042 / 11,857) – Bear Lake
175. C. Divide – Bear Lk (37.2466 / 106.5054 / 11,421) – Blanca Pk
176. Chalk Mt – Navajo Rv (37.2054 / 106.6294 / 11,834) – C. Divide
177. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
178. Balaki M – Gap Sp (36.3403 / 109.0725 / 8,927) – Tunitcha
179. Humphreys Pk – Balaki Mesa – Gap Springs [aligned]
180. Gap Sp – Tunitcha (36.3492 / 109.0482 / 9,137) – Bonnie Rk
181. Bonnie Rk – Chalk Mt (37.1648 / 106.7489 / 11,086) – Navajo Rv
182. Navajo Rv – C. Divide (37.2137 / 106.6042 / 11,867) – Bear Lake

Surveyors recognize continued bow shape of eastern portion of line. Decide to more radically move line to find other (south) side of line. Move these points 450 m south: Chalk Mt (37.1590 / 106.7515 / 11,348), Navajo Rv (37.1937 / 106.6483 / 11,959), C. Divide (37.2110 / 106.5944 / 11,946); Bear Lake is eliminated because of visibility between C. Divide and Blanca Pk.

183. Navajo Rv – C. Divide (37.2120 / 106.5943 / 11,916) – Blanca Pk
184. Bonnie Rk – Chalk Mt – Navajo River [aligned]
185. Gap Sp – Tunitcha – Bonnie Rock [aligned]
186. Humphreys Pk – Balaki M – Gap Springs [aligned]
187. Balaki M – Gap Sp (36.3403 / 109.0725 / 8,927) – Tunitcha
188. Tunitcha – Bonnie Rk (36.7803 / 107.8459 / 6,299) – Chalk Mt
189. Chalk Mt – Navajo River – C. Divide [aligned]
190. Navajo Rv – C. Divide – Blanca Pk [aligned]
191. Bonnie Rk – Chalk Mt (37.1588 / 106.7515 / 11,348) – Navajo Rv
192. Gap Sp – Tunitcha – Bonnie Rock [aligned]
193. Humphreys Pk – Balaki M – Gap Springs [aligned]
194. Balaki M – Gap Springs – Tunitcha [aligned]
195. Tunitcha – Bonnie Rock – Chalk Mt [aligned]
196. Chalk Mt – Navajo River – C. Divide [aligned]
197. Navajo River – C. Divide – Blanca Pk [aligned]
198. Bonnie Rock – Chalk Mt – Navajo River [aligned]
199. Gap Springs – Tunitcha – Bonnie Rock [aligned]
200. Humphreys Pk – Balaki Mesa – Gap Springs [aligned]

Figure 106b. (continuation of list of survey stations in simulation)

and ending with 75m. After the sixth move, the line still has bowed characteristics. The strategy then could have been to try to find the south side of the line, i.e. where most interim points would needed to be moved north instead of south; thus the seventh move is 450m. This, it turns out is close to the final line illustrated also in figure 105.

The number of station points required in the process, not including the locations of temporary interim points as they are being moved to align as a particular threesome with their neighbors, is 251 including the seven shifts where many or all of the points of the line are moved south. The deviations from the precise Humphrey's Peak – Blanca Peak line of the initial highest points are: Black Mountain 2.312° (10,201m north), Roof Butte 2.529° (13,178 m north), Piedra Peak 3.953° (17,640 m north), and Summit Peak 5.687° (17,853 m north). The seven interim points of the final line have deviations from the total line of: Balaki Mesa 0.0009° (3.8m), Gap Springs 0.009° (45.6m), Tunitcha 0.009° (48.1m), Bonnie Rock 0.009 (45.1m), Chalk Mt 0.038° (130m), Navajo River 0.042° (132.8m), and Continental Divide 0.043° (131.3m). Thus a slight bow still remains in the location of the three easternmost station points, this in spite of the fact that the alignment of all final threesomes is close to 0.017° or visual acuity.

There would have had to have been at least nine or ten crews involved at all times during the process. During the 200 iterations shown in figure 106a and 106b, about four can be done at the same time, resulting in 50 periods of activity for each crew. Add to this the eight moves of all sites including the initial layout, to arrive at a total number of move periods of 58. The average time for a move, ranging from large distances initially to many very short ones of 30-60 m in the second half of the process, might be about two days or less. Assuming that each crew had six men, the total effort would be 60 men working about 116 days. Given the possible large scale religious context in which the process would have taken place, this time and effort by cooperating tribal or communal groups can be compared to that of carrying timbers to Chaco Canyon or building great houses and great kivas. In the Basketmaker III period it could have been the primary collective religious "work", even greater in importance than constructing early great kivas at locations determined by this surveying.

LIST OF THREE POINT ALIGNMENT ACCURACIES: average deviation is one half the sum of the two deviations taken from each end of the line; visual acuity of the naked eye is about 0.017°.

	<u>[avg. deviation]</u>	<u>[interim point off]</u>	<u>[length]</u>
<u>Chapter 1</u>			
Sipapu – Mount Chicoma – Truchas Peak	0.019°	39.8 m	555.009 km
<u>[Chelly X cross]</u>			
Humphrey's Peak – Chelly X – Blanca Peak	0.067°	325 m	607.582 km
Brian Head – Chelly X – Mount Taylor	0.078°	342 m	540.800 km
Abajo Peak – Chelly X – Baldy Peak	0.090°	334 m	436.549 km
<u>Chapter 3</u>			
<u>[Kin Bineola X cross]</u>			
Brian Head – Kin Bineola X – Cabezón	0.006°	17.5 m	562.367 km
Baldy Peak – Kin Bineola X – Chimney Rock	0.007°	22.3 m	418.510 km
Abajo Peak – Kin Bineola X – Mount Taylor	0.008°	19.6 m	332.906 km
<u>Chapter 4</u>			
Bad Dog Ridge – Kiva Mesa BM III – Lowry	0.014°	28.7 m	241.350 km
BW Main Panel – Kiva Mesa BM III – McCarty's Flow	0.019°	40.7 m	308.487 km
<u>[Sipapu – Lowry line]</u>			
Sipapu – BW Main Panel – Lowry	0.001°	<1 m	299.695 km
Rincon – Bluff GK – Lowry	0.001°	<1 m	80.059 km
Sipapu – Bluff GK – Lowry	0.035°	62 m	299.695 km
Sipapu – Rincon – Bluff GK	0.036°	16 m	234.284 km
Sipapu – Rincon - Lowry	0.037°	75 m	299.695 km
<u>[Ganado cross]</u>			
Sipapu – Ganado GH – Mount Taylor	0.050°	171 m	393.826 km
Baldy Peak – Ganado GH – Cottonwood Falls GK	0.055°	194 m	407.327 km
Humphrey's Peak – Ganado GH – Tohatchi	0.070°	147 m	270.174 km
<u>[Middle vertical axis]</u>			
Lowry – Ship Rock – Tohatchi	0.027°	47 m	194.774 km
Lowry – Ship Rock – Village of the Great Kivas	0.056°	123 m	265.595 km
Ship Rock – Tohatchi – Village of the Great Kivas	0.068°	96 m	165.748 km

Baldy Peak – Village of Great Kivas – Kin Bineola GK	0.002°	5 m	266.399 km
Baldy Peak – Village of Great Kivas – Chimney Rock	0.062°	201 m	418.510 km

Chapter 5

Three Chaco Foci

Brian Head – Skunk Springs – Kin Bineola GK	0.004°	7 m	457.791 km
Squaw Springs – 29SJ423 – Mount Taylor	0.029°	49 m	151.959 km
Peach Springs – Kin Bineola GK – 29SJ423	0.052°	20 m	57.039 km
Los Rayos – Shabik’eschee – Wheeler Peak	0.053°	105 m	303.359 km
Ackmen N – Squaw Springs – Shabik’eschee	0.072°	126 m	200.437 km
Ackmen S – Squaw Springs – Shabik’eschee	0.075°	131 m	200.270 km
Mount Peale – Ackmen S – Kin Bineola GK	0.092°	204 m	287.092 km
Dalton Pass – Shabik’eschee – Blanca Peak	0.092°	140 m	325.316 km
Mount Peale – Ackmen N – Kin Bineola GK	0.097°	215 m	287.092 km
Tse Bee Kintsoh – Kin Bineola GK – Mount Hesperus	0.120°	195 m	225.336 km
Mitten Rock – Shabik’eschee – Cabezon	0.135°	227 m	199.268 km

Other Foci

[Butler Wash Main Panel – McCarty’s Flow line]

BW Main Panel – Kiva Mesa BMIII – McCarty’s Flow	0.019°	41 m	308.487 km
BW Main Panel – Kiva Mesa BMIII – Red Willow	0.123°	200 m	178.788 km
BW Main Panel – Red Willow – McCarty’s Flow	0.129°	339 m	308.487 km

[Mount Peale – McCarty’s Flow line]

Lowry – Dalton Pass – McCarty’s Flow	0.007°	17 m	319.160 km
Mount Peale – Lowry – Tse Bee Kintsoh	0.052°	128 m	348.792 km
Mount Peale – Dalton Pass – McCarty’s Flow	0.109°	298 m	417.774 km

Rincon – Broken Flute – Coolidge	0.002°	3 m	227.370 km
Cottonwood Falls – Mitten Rock – Tse Bee Kintsoh	0.040°	95 m	271.981 km
Morris 39 – Morris 41 – Hesperus	0.044°	17 m	66.162 km
Coolidge – Haystack – Mount Taylor	0.085°	53 m	72.331 km
Baldy Peak – Squaw Springs – Mount Wilson	0.089°	260 m	458.896 km
Abajo Peak – Grass Mesa – Chimney Rock	0.098°	170 m	203.966 km
Sipapu – Tohatchi – Cabezon	0.101°	346 m	429.827 km
Ship Rock – Morris 39 – Blanca Peak	0.107°	177 m	313.647 km
Abajo Peak – Ship Rock – Tse Bee Kintsoh	0.137°	349 m	293.155 km
Sipapu – Los Rayos – Cabezon	0.140°	488 m	429.827 km

Chapter 6

[Chaco East X]

Hosta Butte – Chaco East X – Chimney Rock	0.002°	4 m	195.561 km
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MVHP – Chaco East X – Mount Taylor	0.010°	20 m	239.194 km
Haystack Mountain – Chaco East X – Black Face	0.023°	44 m	273.800 km

[MVHP – Mount Taylor axis]

Escalante – Chaco East X – Mount Taylor	0.002°	37 m	262.314 km
Haynie West – Morris 33 – Pueblo Alto West Wall Pt.	0.007°	6 m	153.414 km
Haynie West – Morris 33 – Chetro Ketl (dual kiva pt.)	0.008°	7 m	154.505 km
MVHP – Chaco East X – Mount Taylor	0.010°	20 m	239.194 km
Wallace – Chaco East X – San Mateo	0.014°	27 m	238.101 km
Haynie West – Morris 33 – New Alto	0.029°	27 m	153.379 km
MVHP – Chaco East X – San Mateo	0.031°	32 m	226.829 km
Escalante – Chaco East X – San Mateo	0.042°	82 m	249.950 km
Haynie West – Chaco East X – San Mateo	0.051°	96 m	238.572 km
Wallace – Chaco East X – Mount Taylor	0.055°	113 m	250.466 km
Haynie West – MVHP – Wijiji	0.059°	22 m	160.691 km
Escalante – MVHP – Chetro Ketl (dual kiva pt.)	0.066°	46 m	165.885 km
Escalante – MVHP – Pueblo Alto West Wall Pt.	0.068°	47 m	164.794 km
Escalante – MVHP – Mount Taylor	0.080°	59 m	262.314 km
MVHP – Morris 33 – El Rito	0.081°	55 m	229.117 km
Escalante – MVHP – Chaco East X	0.084°	59 m	167.359 km
Morris 33 – Chaco East X – San Mateo	0.090°	155 m	205.319 km
Haynie West – Chaco East X – Mount Taylor	0.091°	187 m	250.936 km
Escalante – MVHP – San Mateo	0.095°	69 m	249.950 km
Escalante – MVHP – New Alto	0.099°	68 m	164.760 km
Ida Jean – Chaco East X – San Mateo	0.122°	230 m	238.804 km
Haynie West – Morris 33 – Mount Taylor	0.126°	127 m	250.936 km
Morris 33 – Chaco East X – Mount Taylor	0.131°	244 m	217.683 km
Wallace – Morris 33 – New Alto	0.146°	131 m	152.910 km
Haynie West – Morris 33 – San Mateo	0.147°	147 m	238.572 km
Ida Jean – Morris 33 – Chaco East X	0.149°	137 m	156.214 km

Tohatchi – Kin Bineola X – Chaco West X	0.002°	1 m	70.058 km
Humphrey's Peak – Ganado GH – 560 GH	0.002°	6 m	362.251 km
Mount Wilson – Chaco West X – Haystack Mountain	0.004°	8 m	275.648 km
Lizard Head – Pierre Road Pt. – Haystack Mountain	0.015°	34 m	275.249 km
Sipapu – Kin Bineola X – Pueblo Pintado GH	0.019°	24 m	372.472 km
Arroyo Pt. – Chaco West X – Pintado X (chapt. 7)	0.091°	2 m	19.272 km

Chapter 7

[Chaco West X]

Casa Rincoñada – Chaco West X – Pierre Road Pt.	0.001°	<1 m	21.019 km
Tohatchi – Kin Bineola X – Chaco West X	0.002°	1 m	70.058 km
Mount Wilson – Chaco West X – Haystack Mountain	0.004°	8 m	275.648 km
Arroyo Pt. – Chaco West X – Pintado X	0.091°	2 m	19.272 km

Sipapu – White House – Pueblo Alto (center pt.)	0.045°	131 m	346.189 km
Ganado GH – Casa Rincoñada – Wheeler Peak	0.045°	144 m	386.179 km

Chapter 8

Muddy Water GK – Kin Bineola X – Aztec West X	0.023°	20 m	126.869 km
Brian Head – Red Willow – Hosta Butte (ct. pt.)	0.036°	60 m	475.363 km
Main Panel – Standing Rock GK – Hosta Butte (ct. pt.)	0.010°	10 m	225.680 km

Cerro Moctezuma – McCarty’s Flow – Penasco Blanco	0.031°	118 m	639.547 km
Cerro Moctezuma – Haystack Mountain – Chaco East X	0.009°	22 m	636.094 km
Cerro Moctezuma – Haystack Mountain – Black Face Pt.	0.010°	62 m	832.791 km

[Aztec East X]

Grass Mesa – Aztec East X – Cabezón	0.001°	<1 m	255.049 km
Humphrey’s Peak – Aztec East X – Blanca Peak	0.001°	2 m	607.582 km
Haystack – Aztec East X – Black Face Pt.	0.003°	8 m	273.800 km
Cerro Moctezuma – Aztec East X – Black Face Pt.	0.010°	35 m	832.791 km
Hesperus Peak – Aztec East X – Mount Taylor	0.036°	68 m	248.600 km

[Aztec West X]

Grass Mesa – Aztec West X – Cabezón	0.001°	1 m	255.049 km
Peñasco Blanco GK – Aztec West X – Mount Wilson	0.036°	33 m	194.953 km

[North Road]

Casa Rincoñada – Chaco West X – Pierre Road Pt.	0.001°	<1 m	21.019 km
Casa Rincoñada – Chaco West X – Kutz Stair (approach)	0.001°	<1 m	52.050 km
Casa Rincoñada – Chaco West X – Halfway House	0.002°	<1 m	37.085 km
Chaco West X – Pierre Road Pt. – Kutz Stair	0.003°	1 m	51.590 km
Casa Rincoñada – Pierre Road Pt. – Kutz Stair	0.003°	1 m	52.050 km
Casa Rincoñada – Halfway House – Kutz Stair	0.006°	2 m	52.050 km
Chaco West X – Pierre Road Pt. – Halfway House	0.008°	3 m	36.625 km
Chaco West X – Halfway House – Kutz Stair	0.008°	3 m	51.590 km
Pierre Road Pt. – Halfway House – Kutz Stair	0.011°	3 m	31.031 km

Haystack Mountain – Halfway House – Sacred Ridge	0.018°	33m	207.570 km
Aztec West X – Twin Angels – Arena Alta (poss. site)	0.103°	19 m	35.455 km

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