COMPARATIVE ANALYSIS OF CHACOAN GREAT HOUSES

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0 Abstract

The great houses in and near Chaco Canyon, New Mexico, have intrigued researchers for over a century. Built between the mid-A.D. 800s to the mid-1100s, the massive structures have distinctive masonry styles and formal site plans unlike those of later Pueblo buildings. At first believed to be heavily populated villages, great houses are now interpreted as redistribution or ceremonial centres with little domestic use. Their occurrence is used to define the Chacoan interaction sphere and its role in the development of complexity in the arid U.S. Southwest. By emphasizing movement possibilities, the space syntax approach developed by the Unit for Architectural Studies can help to characterise Chacoan architecture and to evaluate existing models of Chacoan society.

Justified access graphs were derived for great houses according to the construction stages identified by Lekson (1986) in Great Pueblo Architecture of Chaco Canyon, New Mexico. Ruins by definition are incomplete buildings, lacking critical access features. Moreover the archaeological work varied in quantity and quality. Published floor plans had to be checked against room descriptions and more recent investigations. Only seven great houses had sufficient known features to use as a basis for access graphs: Pueblo Bonito, Chetro Ketl, Pueblo del Arroyo, Pueblo Alto, Kin Kletso, Salmon Ruin and West Aztec Ruin. Relative Asymmetry and R-Ringiness values were calculated using the Network software developed by Kazukumi Ikegami.

Twenty-eight justified access graphs were drawn for parts of seven great houses. More diversity than consistency is apparent from individual great house floor plans, but certain spatial characteristics emerge. Access patterns tend to be highly asymmetric and non-distributed, becoming deeper over time. Yet the occasional presence of rings, allowing alternate routes within a building, differs from earlier and later Pueblo building forms. The importance of connectivity is marked by the occasional use of doorways in corners as well as in the center of walls. While east and west wings are sometimes interpreted as equivalent parts, the known access patterns differ between and within east and west wings even during comparable time periods. Seen from the perspective of the floor plan, the examples of Chacoan architecture suggest differentiation both within and among great houses.

Despite the frustrations of working with incomplete sets, the space syntax approach helps to illuminate Chacoan architecture, if only to question some interpretations of great house function such as dwellings or warehouses. The closed appearance of the Chaco Canyon houses and their increasingly asymmetrical and non-distributed plans would indicate that strong boundary control was more important than facilitating entry and social interaction. The lack of openness presents an anomaly with the

roads, interpreted as promoting communication. The emphasis on configuration helps to balance the reliance on external characteristics to attribute all great houses as belonging to the Chacoan interaction sphere. While some archaeologists have argued that the Chaco phenomenon was even a proto-state, the variability indicated by access graphs echoes what is known of Pueblo factionalism.

1 Introduction

Located in a remote, barren part of the U.S. Southwest, the great houses in and near Chaco Canyon, New Mexico, have intrigued travellers and researchers for over a century. Interpretations have ranged from thriving egalitarian villages to elite residences to redistribution or ceremonial centres with little domestic use. By emphasising movement possibilities, the space syntax approach developed by the Unit for Architectural Studies can help to characterise Chacoan architecture and to reevaluate existing models of Chacoan society.

2 The problem of Chacoan great houses

Built between the mid-A.D. 800s to the mid-1100s by the ancestral Pueblo Indians (or Anasazi), the massive, multi-story structures have distinctive masonry styles and formal site plans unlike those of later Pueblo buildings. Indeed early explorers believed them to be the work of the Indians of central Mexico. The typical site plan includes a multi-story core unit of roomblocks, flanked by perpendicular wings which are joined by an arc of rooms. Great houses were only one aspect of the Chacoan built environment, coexisting with small house sites, great kivas, roads and other features (Lekson et al., 1988; Vivian, 1990). They were started soon after the population shifted around A.D. 750 from the mesa tops to the Chaco Canyon floor and used above-ground structures instead of semi-subterranean pithouses. Chaco Canyon was at its peak from about 1075 to 1115, a time of good weather conditions; population estimates range from 2,000 to 10,000, with most favoring the more conservative figures (Judge, 1991). About a century after the great building boom of 1030 and coinciding with the start of a 50-year-long drought in the San Juan Basin, Chaco Canyon was being abandoned, with only a brief reoccupation by people from Mesa Verde during the thirteenth century.

While much more is known about Chaco Canyon and its region than would have been thought possible by the explorers of a century ago, the great houses remain enigmatic. Among others, Mindeleff (1891) noted that the ancient ruins and the houses of contemporary Pueblos had similar architectural details but different plans. Explanation through ethnographic examples is further complicated by the changes known to have occurred in Pueblo subsistence and ritual (Dozier, 1965). There is little possibility to determine function through historical information, although great houses figure in stories by Navajos and contemporary Pueblos (Windes, 1987). Archaeological interpretation through associated artifacts like ceramics is limited as few great houses have been excavated, and most of those before many excavation and dating techniques were developed. In any case, the discard patterns recovered by archaeologists do not necessarily reflect the use by the original inhabitants (Schiffer, 1985).

Given the lack of information from other sources, description and interpretation of the great houses have been derived from traditional approaches to architecture: build-

ing characteristics such as the core-veneer walls; changing styles in masonry (or veneer) (Hawley, 1938); units of measurement (Hudson, 1972); the size, formal site layout, and the changing shapes of the structures (Judge, 1991; Lekson, 1986). Because many outliers are not excavated and great house definition has been based on the small and not necessarily representative sample of the great houses excavated in Chaco Canyon itself, the relative size and shape of the great houses are emphasised in defining Chacoan communities as consisting of a "big bump" together with clusters of unit houses, "small bumps," and a great kiva (Lekson, 1991; Powers et al., 1983). The presence of "big bumps" is used to indicate the extent of the Chacoan tradition or interaction sphere, which some now interpret as having spread over most of the Anasazi world, the plateau area of Arizona, New Mexico, Utah, and Colorado.

Early explanations of great houses were coloured by the perception of contemporary Pueblo villages as largely egalitarian societies. In 1877, the photographer William Henry Jackson drew a reconstruction of Pueblo Bonito as a thriving community. His account was used by Lewis Morgan (1965), who suggested in his 1881 work on Indian house types that the patterns of doorways and partitions reflected family groups. The excavators of the two largest great houses, Pueblo Bonito (Judd, 1964) and Chetro Ketl (Hewett, 1936), persisted in interpreting them as heavily-populated apartment complexes.

Anomalies like the paucity of burials and the presence of elite goods caused a reevaluation of the role of great houses during the extensive research programme of the Chaco Centre. It emphasised a redistribution model, with a managerial elite living in the great houses and controlling goods stored in the now-empty suites (Judge, 1979; Lekson, 1986). Chaco Canyon would have a ceremonial role, integrating a regional system through pilgrimages and other ritual events. The lack of consensus on the function of great houses points out the need for a better understanding of the buildings themselves. That might be facilitated by the use of space syntax, with its emphasis on movement possibilities.

3 Applying Space Syntax to Chacoan great houses

Ruins by definition are incomplete buildings, lacking critical access features. Only seven great houses had sufficient features known through excavation to use as a basis for access graphs (Cooper, 1995). Five are in Chaco Canyon itself: Pueblo Bonito (Judd, 1964), Chetro Ketl (Hewett, 1936; Lekson, 1983), Pueblo del Arroyo (Judd, 1959), Pueblo Alto (Windes, 1987), and Kin Kletso (Vivian and Mathews, 1965). Two are outliers to the north: Salmon Ruin (Irwin-Williams and Shelley, 1980) and West Aztec Ruin (Morris, 1919, 1921, 1928).

Generalisation upon the basis of incomplete data is a task that offers no marked appeal. It is as if one walked stumblingly in the twilight, apprehensive of pitfalls in the dimly seen terrain ahead. Earl Morris (1928, page 417)

Deriving justified access graphs for archaeological cases presents special challenges: prehistoric remodeling, problems of preservation and stabilisation, as well as poor record keeping. Sorting out the extensive remodellings has been much discussed in Chacoan literature, most completely by Lekson (1986). A common pattern appears

to be the superimposition of a circular kiva only accessible from the rooftop into the space once occupied by four rectangular rooms, cutting off the direct access route between the plaza and the back rooms. Blocking doors with masonry was a common Pueblo practice marking seasonal use (Mindeleff, 1891). Blocked doors are frequently reported for Pueblo Bonito, Chetro Ketl, and the other great houses. In some cases, the masonry matches that of the wall, so some doors may have been used only during construction and blocked at the completion of the project, such as the back row of Pueblo Bonito (Judd, 1964).

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The presence or absence of entrances is not always known, especially as door sills are frequently not at floor level. Doorway definition can be debated (Mindeleff, 1891; Lekson, 1986), as smaller openings, suitable only for crawling, could also have been used for access between rooms. Although many assume that hatchways connected different stories, the evidence from Chacoan ceilings suggests that this was not necessarily the case, even allowing for likelier preservation of ceilings without hatchways. Morris (1919) noted only three hatchways in the sixteen intact ceilings recovered at Aztec West, and Judd (1959), four known hatchways at Pueblo del Arroyo. Erosion destroyed upper stories with their evidence of connections. While Judd (1964) and others point out that the upper stories and rooftops were commonly used for daily activities by Puebloan people, maps present only the ground level (although not consistently so). Early explorers created more gaps: by 1887, every sealed door in the outer walls of Pueblo Bonito had been reopened by treasure hunters, as shown in photographs by Mindeleff (Judd 1964). Twentieth-century ruin stabilisation may have removed some doorways, as during the rebuilding of collapsed walls at Chetro Ketl (Lekson 1983).

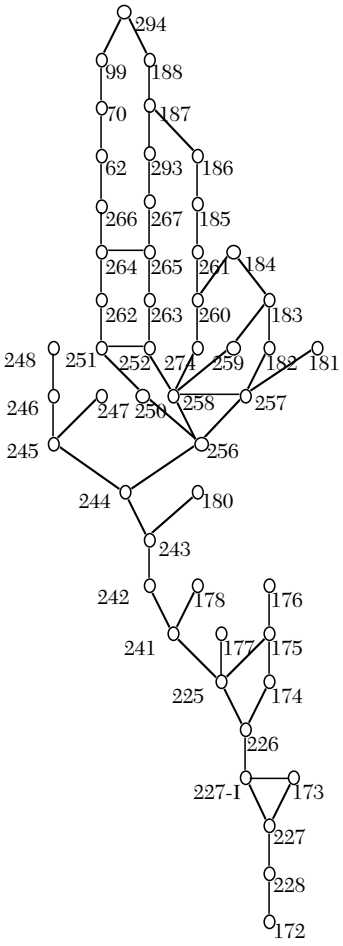


Figure 1. Access graph for Pueblo Bonito, Stage VI, east wing, ground floor

Moreover the archaeological work varied in quantity and quality. Most of the great houses were tested before the development of modern recovery and reporting techniques; the work at Pueblo Alto (Windes, 1987) is an indication of how much was missed by earlier researchers. Published floor plans had to be checked against room descriptions and more recent investigations. Occasionally, a room description for Pueblo Bonito (Judd, 1964) or Pueblo del Arroyo (Judd, 1959) will not include a doorway noted for the adjoining room. The ground plan of Pueblo Bonito includes rooms actually on the second level, so a casual look at the maps can be misleading, implying more contemporaneity than would have been the case. Even though much information was available for upper rooms, especially in the southeast part of Pueblo Bonito, no map reconstructing those rooms was published.

Given all the limitations of the data, only twenty-eight justified access graphs were drawn, usually from the perspective of the carrier or open space. They included sets of rooms and other defined spaces like plazas and rooftops, according to construction stages mostly as defined by Lekson (1986). While the ground plan of Pueblo Bonito is often epitomised as evidence for Chacoan planning ability, construction stages remain evident, showing a process of accretion and frequent remodellings. In the graphs, dotted lines were substituted for solid ones when linkages are assumed but not confirmed. In some cases, the graphs include rooms that were built during earlier phases but were used with the new rooms. Many potential connections remain unknown and so were not included in the graphs. Relative Asymmetry and R-

Ringiness values were calculated using the Network software developed by Kazukumi Ikegami.

4 General Chacoan Space Syntax patterns

More diversity rather than consistency is apparent from individual Chacoan floor plans, but certain characteristics emerge. Access patterns tend to be asymmetric and non-distributed, with occasional rings, and differ between east and west wings as well as with the core.

4.1 Trend to icreasing asymmetry

The first predominant tendency within Chacoan great houses is for segregated, asymmetric sets of spaces with great depth. Out of 26 mean RRA values calculated, 20 were above 1.0, considered to be more segregating (Hillier and Hanson, 1984), and only 3 were in the 0.4 to 0.6 range defined to be strongly integrated. The access graphs tend to show branching patterns, where each space monopolises access to the next, indicating social differentiation and specialisation, especially if the depth is great. The accumulation of more rooms in the front of roomblocks and in upper stories created more depth, somewhat compensated by the removal from active use of some of the deeper spaces when doorways were blocked.

The extreme example of great depth characterising later Chacoan architecture is the southeast corner of Pueblo Bonito (built 1075-1085), a complex maze that can only be graphed in part [Figures 1 & 2]. Admired for its fine stonework, the Stage VI addition has unusual access features: series of broad doorways, masonry steps, tunnels, and seven known diagonal doorways. While internal access may have been facilitated, any direct route from the plaza was obliterated in later remodellings, so one would have had to go over the rooftops. The most integrated space on the ground floor is Room 256 which has doors in all four walls and controls access to six rings in the back rows. Room 256 shares a door with Room 258, the only ground floor one to have a diagonal doorway, and with the unusually large Room 244, which leads to a series of rooms whose doorways provide a line of sight. The second storey of the east wing additions is a subset with much depth, especially for such a small physical area. A tree diagram predominates, although some rooms in the area are hyper-connected with doors not only in all four walls but in the corners as well.

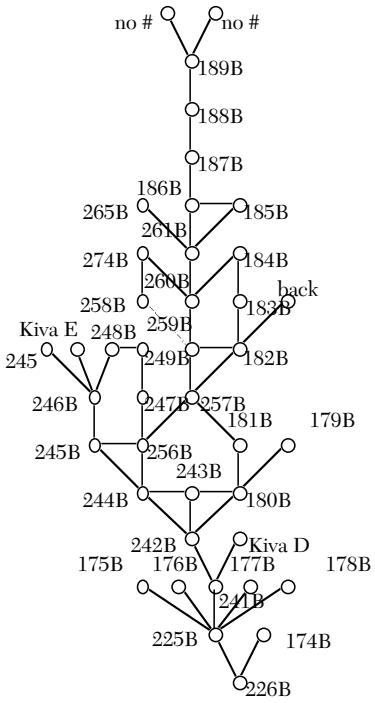
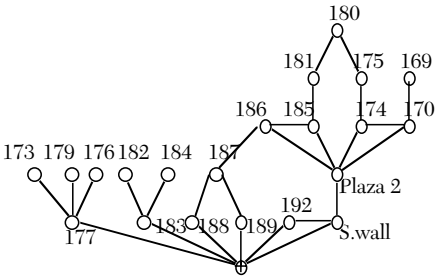


Figure 2. Access graph for Pueblo Bonito, Stage VI, east wing, second story

The closed appearance of great houses known for later phases, with increasingly asymmetrical and non-distributed plans, would indicate that strong boundary control was more important than facilitating entry. The closed aspect of the great houses was hardly conducive to social interaction. While the ruins are now open to sunlight, pathfinding in the multi-storey buildings would have been difficult. The forbidding appearance of great houses presents an anomaly with the roads, interpreted as facilitating communication. Roads converge on Pueblo Alto, yet modifications during Stage IV (1080-1100) made its interior less accessible from the roads. Access to a second plaza area, to the east of the great house, and connectivity decreased for the east wing [Figuree 3 and 4].



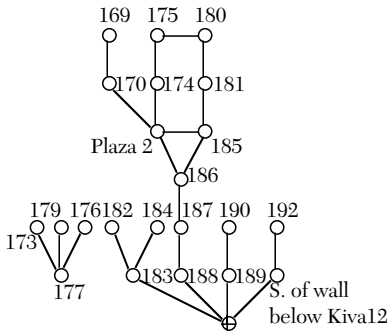


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Figure 3: Access graph for Pueblo Alto, Stage III, east wing

Figure 4. Access graph for Pueblo Alto, Stage IV or V, east wing

4.2 *Presence of distribution within the structure*

Reinforcing the highly segregated nature of the Chacoan examples, the great houses tend to be non-distributed, with little or no possibility of alternate routes to reach a particular space. Yet the occasional presence of rings within the great houses contrasts with earlier and later Puebloan forms, and even the coeval small houses, where the basic pattern is to have a front room backed with one or two smaller rooms. Examples found at Pueblo Bonito IA (920-935) [Figure 5] and Una Vida IIA (930-950) show lateral connections as well. While rings often indicate greater social interaction when their depth is shallow, many of the Chacoan examples tend to be deep on an otherwise branching pattern, as in the examples from Pueblo Bonito Stage VI.

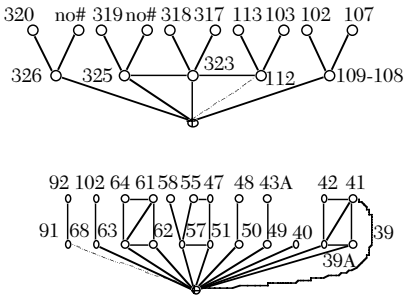


Figure 5. Access graph for Pueblo Bonito, Stage IA, west wing

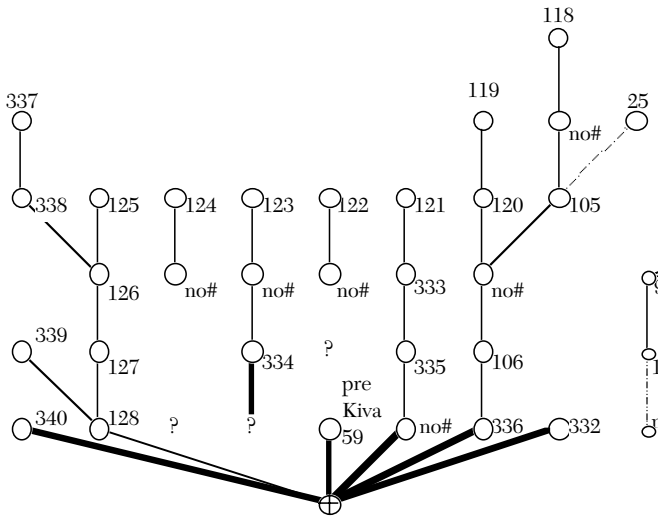
Figure 6. Access graph for Chetro Ketl, Stage II, central part

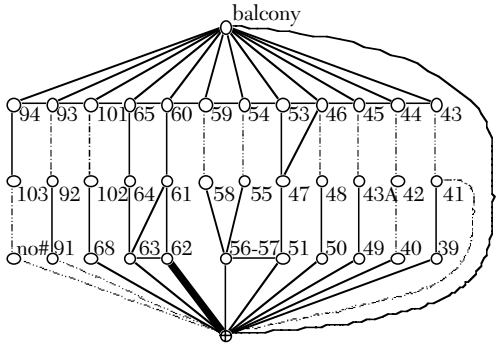
That connectivity was important to the builders is indicated by their use of corner or diagonal doorways, first seen at Chetro Ketl Stage II (1035-1040) with the door from Room 39A to 41 [Figure 6]. Diagonal doorways were most used in the second storyes of the southeastern rooms at Pueblo Bonito Stage VI (1075-1085) [Figure 2], and outlier Aztec West (1100-1150). The doorways' position within the roomblock does not support their archaeoastronomical significance but rather that movement in and around those rooms was an important goal of the builders, especially given the added engineering problems involved in weakening a corner.

Only two examples lack distribution, Pueblo Alto IA and the west wing additions of Pueblo Bonito VI [Figure 7]. But most R-Ringiness values are very low: of the remaining twenty-three examples, sixteen are less than 0.1. The highest are in somewhat anomalous cases, the back rows of Pueblo Bonito II (at 0.34) and Chetro Ketl III (at 0.57) and the central Chetro Ketl IVA (at 0.42) [Figure 8]. Although they provided direct access to the outside, that may have been only to facilitate construction at a time when access from the plaza was complicated by the insertion of kivas into roomblocks. The external doors of the back rows were interpreted as having been closed soon after completion of the additions, leaving a loop that would have been controlled through the interior of the building.

4.3 *Distribution through the open space*

Another characteristic tendency for Chacoan great houses is that sets are usually integrated through the open space. Plazas and roofs have long been recognised as important work areas in Pueblo architecture. Pueblo Bonito had access to the plaza area limited by mounds and arcs of rooms from Stage II and III onwards, and eventually blocked, while the plaza area itself was bisected by roomblocks. The other great houses examined except for blocklike Kin Kletso and the late outlier Salmon Ruin also had arcs delimiting the plaza, thus reinforcing the deep, segregated, asym-





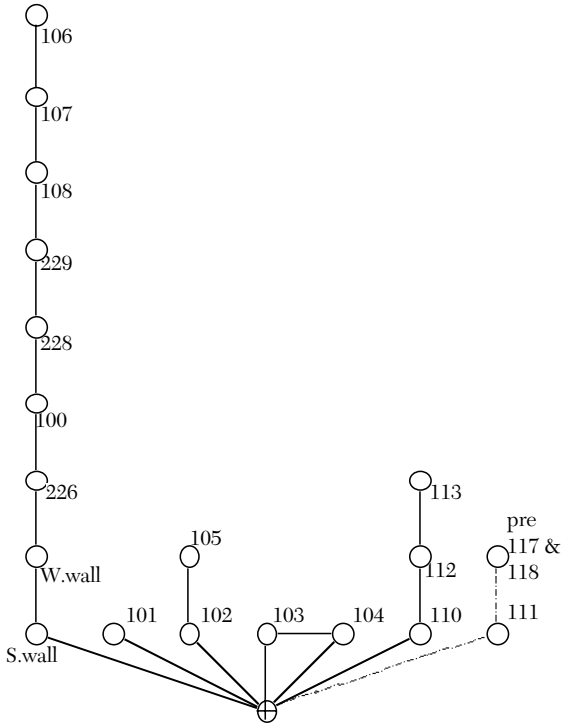


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Figure 7. Access graph for Pueblo Bonito, Stage VI, west wing

Figure 8. Access graph for Chetro Ketl, Stage II, central part, second story

Figure 9. Pueblo Alto, Stage II (1020-1050), west wing

metric nature of the suites themselves. The arcs not only would have complicated physical access, but also cut visual lines of sight for those remaining outside of the structure, turning a previously public space into a more private one.

4.4 Differences between east and west wings

The fourth spatial characteristic of Chacoan great houses is that there are major differences between east and west wings, even during comparable time periods. The wings had been associated by some with the activities of moieties similar to those of contemporary Rio Grande Pueblos (Vivian, 1970). The wings are often described as symmetrical in the geometrical sense (Lekson, 1986), even though they often have unequal length, width and height.

In the rare cases where there have been extensive excavations of both wings, visible access patterns suggest further differences in use. At Pueblo Bonito, the contrasts became apparent in Stage III, and by Stage VI, the east wing [Figures 1and 2) is a

complex maze with some deep rings, with unclear and restricted access from the plaza while the west wing [Figure 7] tends to be more of a simple branching pattern without rings, but more directly accessible from the plaza. At Pueblo Alto, the other great house where a direct comparison with graphs is possible, patterns within the east and west wings differ despite external similarities which are greater than those at Pueblo Bonito and Chetro Ketl. Despite a narrow width, the west wing is highly segregated; adjacent to a major road, part has been interpreted as a warehouse, although the west wing also has the clearest evidence for habitation suites of any excavated Chacoan great house (Windes, 1987) [Figure 9]. While some of the plaza-fronting rooms of the east wing form shallow "dead-end" sets, others are on a deep loop that relates to a second plaza area to the outside of the great house (Figure 3). The implications are that the two wings of Chacoan great houses would have functioned in different ways, whether under a single authority or separate ones.

4.5 Variability of floor plans

Last, but far from least, another characteristic of Chacoan great houses is the high variability of their floor plans. While the great houses are recognised to range in scale, examination of the space syntax patterns for roomblocks indicates that movement patterns differed as well, implying different social relations and functions. Whatever similarities exist appear to be more external than internal. Outward appearances, such as the concept of massive architecture, the shape of the great house itself, the presence of a great kiva, mounds, etc., would be easier to emulate than internal ones which would require knowledge of the original and similar needs. Seen from the perspective of the floor plan, the varied examples of Chacoan architecture suggest differentiation both within and among great houses. The implications are that the Chacoan Phenomenon could not have been a system of political control, but rather more of an interaction sphere. Factionalism has often been documented for historic and contemporary Pueblo Indian communities, and it is suggested by the variety of the Chacoan great houses.

5 Implications of Space Syntax for interpretative scenarios

In the light of a space syntax analysis of great houses, some interpretations of Chacoan society remain problematic. While many refer to aspects of the built environment, they may be limited by the lack of models linking the observable artifact with the abstract concept of social process.

To support the traditional view presented by Judd (1964) and Hewett (1936) of the great houses as apartment compounds or dwellings, one might expect to see an agglomeration of similar units, with differences arising from household size and social status. The deep, segregated nature of later stages in particular argues against household dwellings; at Pueblo Alto, the clearest case of a domestic unit, as indicated by floor features, was in a shallow position.

The Chaco Centre's redistribution model stressed storage facilities controlled by a managerial elite (Judge, 1979), and the massive blocks with few exterior rooms of the late eleventh-century additions and of the twelfth-century McElmo units are interpreted as storage units (Lekson, 1986). Rooms described as warehouses tend to be difficult of access. While that is an advantage for some types of storage (for

infrequently used items, for highly valued ones), it would not be in a redistribution situation. While the ancient and more recent Pueblo custom is to use back rooms for storage, there is a qualitative difference between rooms that are one or two steps away from the living area, workspaces, and the outside, and rooms that are at greater depth.

The revision of the redistribution model incorporated ceremonial aspects (Judge, 1989). Hillier and Hanson (1984) had found the tendency to synchronise a deep space with a large shallow space to be common in religious buildings such as shrines. The open space in front of a great house and the later plaza areas were large shallow spaces that could have been used by large groups to gather, but the access in later periods was restricted. It is puzzling that at the time when more people are considered to be involved in the Chacoan system, spaces that could accommodate large numbers were being encroached by construction and made harder to access from the outside.

By default, the great houses could be considered as monuments, a common feature of the development of complex societies, which would support scenarios stressing the role of managerial elites (Grebinger, 1973; Sebastian,1992). A space syntax analysis of Late Neolithic Malta (Bonanno et al., 1990) showed a contrast between the high investment in monuments with that for dwellings, and a trend to increasingly deeper structures with harder access; the case has certain parallels to the Chacoan great houses. Their diversity of patterns, even within opposite wings of a single great house, would support competing or sequential hierarchies rather than an overarching global order. Hillier and Hanson (1984) have characterised asymmetry as a more fragile system, because the breakage of one link in a tree-like structure could precipitate the breakage of others rather than be isolated. The Chacoan experiment would prove to be a short-lived event in Southwestern prehistory.

Wilcox (1993) has argued that the diversity of great house architectural features reflects not competing groups, but rather complementary functions for decision-making and site hierarchy in a state-level organisation. The almost total lack of shallow rings in the great houses studied here argues against an administrative or similar public function such as the example of an Ashanti palace (Hillier and Hanson, 1984: 167-175). The ambitious, contradictory and soon-abandoned Northeast Foundation of Pueblo Bonito Stage V is the single best argument against centralised decision-making, although it may have represented an attempt to do so.

As to the relationship between Chaco Canyon and the outliers, Salmon Ruin and West Aztec Ruin appear to be "retro style" at a time when compact McElmo units were being built in and near the Canyon. While the two share similarities with each other and earlier great houses, they too have differing spatial syntax patterns. Again, there does not seem to be an overarching global order.

The excavator of Aztec West mentionned the frustrations of working with Chacoan data: "Generalisation upon the basis of incomplete data is a task that offers no marked appeal. It is as if one walked stumblingly in the twilight, apprehensive of pitfalls in the dimly seen terrain ahead" (Morris, 1928: 417). Despite the limitations of working

with incomplete sets, the space syntax approach helps to illuminate Chacoan architecture, if only to question some interpretations of great house function such as dwellings or warehouses. The closed appearance of the Chaco Canyon houses and their increasingly asymmetrical and non-distributed plans would indicate that strong boundary control was more important than facilitating entry and social interaction. The lack of openness presents an anomaly with the roads, interpreted as promoting communication. The emphasis on configuration helps to balance the reliance on external characteristics to attribute all great houses as belonging to the Chacoan interaction sphere. While some archaeologists have argued that the Chaco phenomenon was even a proto-state, the variability indicated by access graphs echoes what is known of Pueblo factionalism.

6 Conclusions

There are obvious limitations for the archaeologist in using space syntax methods, which have never been intended to be used exclusively, and recent work by Hillier has incorporated more traditional concerns with the size and shape of a building. But the justified access graphs help to visualise and explore complex relationships. While rooms have often been linked in the past to determine suites, their arrangement according to depth, or the number of stages needed to reach a particular step, provides a way to assess their relative importance. The front-to-back room relationships had been easier to grasp than the side-to-side ones which are often part of great house architecture.

Whether the great houses were dwellings, religious structures, administrative centres, warehouses, or combinations of the above, remains an unresolved question. The use of the Hillier space syntax model suggests possibilities rather than provide a definitive tool to determine the function of a building, and ultimately of the societies that created them.

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