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SPACE SYNTAX ANALYSIS AT THE CHACOAN OUTLIER OF GUADALUPE

Ruth M. Van Dyke

Space syntax analysis is a popular method for investigating social processes by quantifying the relationships among architectural spaces. Identification of spatial patterns is straightforward, but interpretation is less so. In this study, segregated spatial patterns were assumed to indicate the presence of social inequality. A space syntax analysis was conducted for Guadalupe Ruin, an excavated, outlying Chacoan great house with three well-dated construction episodes. The study investigated great house function and social context. Results seemed contradictory until room function and pueblo layout were incorporated into the interpretation. The great house can be understood as an group of separate but equal household units accessible primarily through the roof and plaza. Analyzed as a discrete entity, Guadalupe Ruin appears to have been a domestic building rather than an administrative or ceremonial facility. However, topographic restrictions and other differences with the surrounding community of small sites need to be explored through an expanded study at the community level. Comparison of the Guadalupe study with other great house space syntax analyses supports the recognition that Chacoan great houses varied considerably across time and space.

El análisis del sintaxis del espacio es un método de moda para investigar procesos sociales. El análisis cuantifica la organización espacial y arquitectónica. La identificación de diseños espaciales es fácil, pero la interpretación es difícil. En este estudio, los diseños espaciales segregados fueron asumidos para indicar un contexto social de desigualdad. Un análisis del sintaxis del espacio fue conducido para la gran casa de Guadalupe. Esta ruina excavada es periférica de Chaco Canyon y manifesta tres episodios de la construcción. El estudio investigó la función y el contexto social de la gran casa. Los resultados se parecían contradictorios hasta que la función y la organizacíon del edificio fueron incorporadas en la interpretación. La gran casa representa uno grupo de unidades domésticas separades pero iguales. Por lo general, las entradas son de la azotea o de la plaza. A solas, la ruina de Guadalupe aparece haber sido una casa doméstica más bien que un edificio administrativo o ceremonial. Sin embargo, las restricciones topográficas y otras diferencias con la comunidad circundante necesitan ser exploradas con un estudio ampliado. La comparación del estudio de Guadalupe con otros análisis del sintaxis del espacio indica que las gran casas de Chaco variaron considerablemente a través de tiempo y de espacio.

Space syntax analysis is a set of techniques for quantifying and comparing access patterns in built spaces. The techniques, developed by Bill Hillier and colleagues at University College, London, are explicated in Hillier and Hanson's (1984) *The Social Logic of Space*, as well as in a number of other publications (Hillier 1985, 1989, 1996; Hillier et al. 1976, 1987a, 1987b; Orhun et al. 1995). Space syntax analysis is attractive to archaeologists because it offers an uncomplicated way to quantify spatial relationships that can be used to interpret or infer social interaction. The techniques, based on graph theory, can be applied to single buildings or to entire settlements.

Researchers seeking to extract aspects of social organization from architectural remains have employed space syntax or its variants in diverse areas of the Old World (Banning 1996; Banning and Byrd 1989; Bonanno et al. 1990; Fairclough 1992; Foster 1989; Laurence 1994:115–121; Plimpton and Hassan 1987; Smith 1996:79–84, 243–258, 304–309), Mesoamerica (Hopkins 1987), and South America (Moore 1992). Space syntax recently has become a popular means of architectural analysis in the American Southwest (Bradley 1992:94–95, 1993:29–32; Bustard 1996; Cooper 1995; Ferguson 1996; Potter 1998; Shapiro 1997).

In this study, space syntax techniques are applied at the Chaco Anasazi outlier of Guadalupe Ruin. The quantitative results of the analysis are straightforward, but their interpretation is less so, because space syntax analysis discerns spatial rather than social

Ruth M. Van Dyke ■ Department of Anthropology, California State University, Fullerton, CA 92834

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relationships. Examination of the results in conjunction with room function and pueblo layout yields useful insights into social configurations at Guadalupe Ruin. When compared with space syntax analyses for other Chacoan sites, the results contribute to a picture of diversity within the Chacoan world. Potential challenges for applying the space syntax technique in non-Western, archaeological settings also are discussed.

Spatial Measures and Social Contexts

Two of the most useful quantitative measures in the suite of space syntax techniques are symmetry/asymmetry and distributedness/nondistributedness (Hillier and Hanson 1984:82–142). The former assesses overall accessibility among spaces within the structure, and the latter measures the extent to which access is subject to hierarchical control. In a symmetrical arrangement, spaces in a structure are equally accessible to one another. In an asymmetrical arrangement, some spaces are accessible only by passing through other spaces. Distributed configurations occur when multiple routes of access exist among spaces, so that no single space determines access to the others. Nondistributed configurations occur when there is only one possible route from one space to another. Asymmetry and nondistributedness characterize spatial segregation, in which some spaces are less accessible than others and movement is hierarchically controlled. Symmetry and distributedness, in contrast, characterize spatial integration, in which all spaces are equally accessible and movement is diffuse.

Hillier and Hanson (1984:18–22) use Durkheimian notions of social organization to interpret the results of spatial analysis. They associate spatial segregation with mechanical social solidarity, and spatial integration with organic social solidarity. These theoretical links are assumed rather than demonstrated, however. Use of space syntax techniques need not lead to Durkheimian interpretations.

Foucault (1977:170–177, 195–209, 1982:239–256) and others (Lefebvre 1989) have demonstrated that built environments are an integral part of struggles for social power, which is often manifested through control of movement. For example, in an Ambo chief's kraal (Hillier and Hanson 1984:163–168), the personal space of the kraal head is the most difficult to reach. It is reasonable to assume that spatially segregated, asymmetrical, nondistributed configurations should characterize built environments that are an interactive part of the creation or recursive reinforcement of social inequalities.

There is little agreement as to the social contexts within which the imposing architecture of the Chaco Anasazi was constructed (see Sebastian [1992:82–97] and Vivian [1990:391–419] for good overviews). Because a reflexive relationship exists between social processes and the built environment (Bourdieu 1971; Giddens 1984:143–158), a space syntax analysis of Chacoan structures should be able to provide useful insights into Chacoan social processes.

Chacoan Great Houses

Massive great houses built of core-and-veneer masonry are characteristic of the Chaco Phenomenon of the American Southwest between ca. A.D. 900–1130 (Judge 1989; Lekson 1991; Vivian 1990:167–492). Approximately 75 great houses similar to those found in Chaco Canyon are known from throughout the San Juan Basin of northwestern New Mexico and adjacent areas (Figure 1) (Fowler et al. 1987; Marshall et al. 1979:331–339; Powers et al. 1983:241–341). Great houses often are associated with communities of small sites, great kivas, road segments, and other features. Great houses varied across time and space in terms of their purposes and the social contexts within which they were constructed. Some probably functioned as habitations (Lekson 1984:271; Powers et al. 1983:341; Schelberg 1984:8; Sebastian 1992; Vivian 1990:418–490), although in Chaco Canyon, featureless rooms and a paucity of burials have served as fodder to argue habitation could not have been their only purpose (Lekson 1984:270; Windes 1984). Other suggested great house functions include administration (Lekson 1984:272; Powers et al. 1983:341; Schelberg 1984:17; Wilcox 1993:81–86), storage (Lekson 1984:271; Marshall et al. 1979:337; Powers et al. 1983:341), settings for community rituals (Judge 1989:234–249; Marshall et al. 1979:337; Stein and Lekson 1992; Toll 1985:192–196, 369–490; Van Dyke 1999), or various combinations of the above. Some explanations are predicated upon a social context characterized by inequality (Judge 1989:239–240; Mathien 1993:43–51; Powers et al. 1983:341; Schelberg 1984:8–18; Sebastian 1992:104–141; Van Dyke 1999; Wilcox 1993:79–88). Other arguments assert that Chacoan

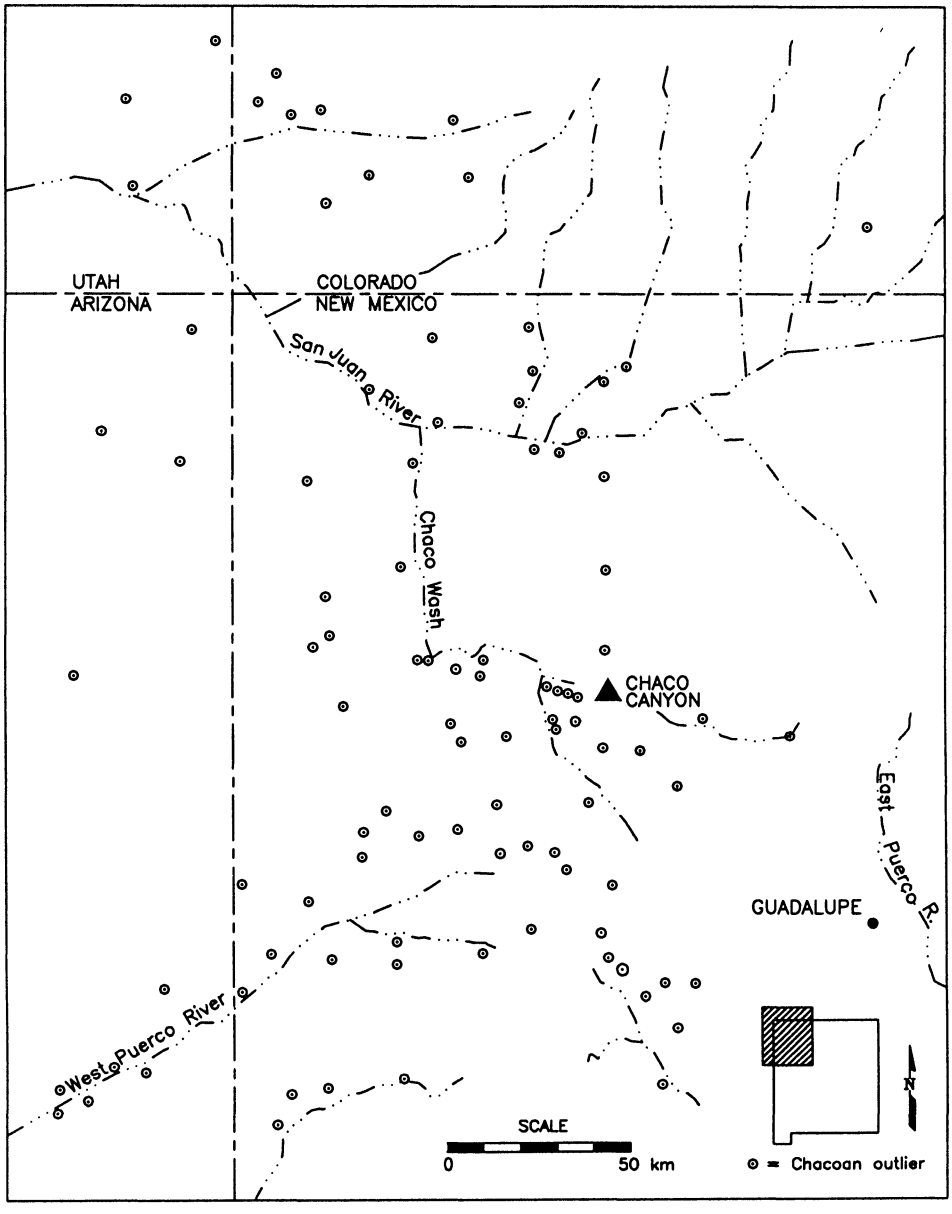

Figure 1. Location of Guadalupe Ruin and contemporaneous Chacoan outliers in the San Juan Basin, New Mexico (based on data from Fowler et al. 1987; Marshall et al. 1979; and Powers et al. 1983).

social organization was essentially egalitarian (Toll 1985:502–508; Vivian 1989, 1990:472–490).

Great houses found across the San Juan Basin and in adjacent areas should not be viewed as one homogenous entity, as they were undoubtedly constructed for diverse functions in a variety of social contexts. Space syntax analysis should assist in deciding among the potential explanations in particular cases. For example, spatially segregated, asymmetrical, nondistributed patterns at a great house would suggest the structure functioned within a context of social inequality; that is, the structure is more likely to have served as an elite residence or facility rather than as a public meeting place or egalitarian domicile. Guadalupe Ruin, an excavated Chacoan great house with three well-dated construction episodes, is an ideal candidate for a space syntax study designed to investigate local social configurations.

The Guadalupe Ruin Study

Guadalupe Ruin (LA 2757) is located on the far eastern side of the San Juan Basin in the East Rio Puerco valley, approximately 90 km (54 mi) southeast of Chaco Canyon. The single-storied structure contains approximately 30 rooms and is perched atop a butte overlooking Tapia Canyon to the south. A cluster of approximately 30 small community sites is located approximately 50m below at the base of the butte. These are part of a larger community of over 200 Pueblo I-III sites within a 44 km^2 surrounding area (Washburn 1974:315–316). Judge (1989:236–237) postulates Guadalupe may have been built as a Chacoan outpost to control the distribution of turquoise obtained from the Cerillos mines; however, Sebastian (1992:95) considers this unlikely, given that the mines are another 104 km distant from the site. Guadalupe Ruin and the surrounding community were investigated during the 1970s by the Rio Puerco Valley Archaeological Project under the direction of Cynthia Irwin-Williams. Much of the data recovered exist in the form of unpublished manuscripts and theses authored by Irwin-Williams' students. Guadalupe Ruin was partially excavated by Pippin (1987) and stabilized by Baker (1984); all data from Guadalupe used in this paper are based on their published accounts. A few minor changes in nomenclature have been made for the sake of clarity or brevity, and these are noted where they occur.

Guadalupe Ruin is dated by means of dendrochronology, archaeomagnetism, architectural styles, stratigraphy, and ceramic seriation (Pippin 1987:92–128). A number of discrete construction episodes are identified at the great house. These are organized by Pippin into the Early Chaco (A.D. 918–1050), Late Chaco (A.D. 1050–1130), and San Juan/Mesa Verde (A.D. 1130–1300) phases, respectively (Figure 2). Although there is a single cutting date of A.D. 918 from the structure (Bannister et al. 1970:53), a cluster of five tree-ring dates at around A.D. 960 suggests the latter date is a more accurate indication of initial construction. Below, I retain Pippin's nomenclature but substitute the more likely dates of A.D. 960–1050 for the Early Chaco phase. Pippin presents a detailed description of Guadalupe Ruin masonry styles and techniques. In most cases, the masonry is very similar to that described for Chaco Canyon great houses by Lekson (1984:18–19), so Lekson's widely used terminology is employed here.

Construction Phases

The Early Chaco structure consisted of a nine-room, linear pueblo positioned on the highest part of the mesa (Figure 2a; Pippin 1987:100–105). It was constructed of simple tabular sandstone masonry similar to Type I masonry defined in Chaco Canyon. Most walls were laid on basalt cobble foundations. Two room-size classes—large rooms averaging 13 m^2 in size, and small rooms averaging 8 m^2 in size—were present. Doorways connected Room 18W to Room 19W and Room 20W to Room 21W. Doorways connecting Room 22W with the plaza and Rooms 24W and 25W were sealed by the end of the Early Chaco phase. Pippin (1987:101) interprets entryway and room-size patterns to indicate that the structure was subdivided into room suites consisting of three pairs of large habitation or activity rooms (Rooms 18W–19W, 20W–21W, and 22W–24W) each associated with one small storage room at the east end of the roomblock (Rooms 25W, 26W, and 27W). An unexcavated kiva (Room 3W) also may date from this era.

During the Late Chaco phase, an L-shaped addition was constructed on the west end of the existing roomblock (Figure 2b; Pippin 1987:105–114). In its Late Chaco configuration, the great house contained 12 habitation rooms (Rooms 12W–22W and 24W), 9 storage rooms (Rooms 7W–8W, 10W–11W, and 25W–29W), 1 room of unknown function (Room 6W) and 3 round ceremonial rooms or kivas (Rooms 2W, 3W, and 4W). Late Chaco rooms were built of core-and-veneer masonry resembling Types II and III at Chaco (Lekson 1984:18–19). Walls were laid on foundations of adobe and small basalt cobbles. Rectangular habitation rooms had centrally placed, T-shaped doorways opening to the south; most other rooms appear to have had roof entries. Small square storage rooms averaged 10 m^2 in area, and small circular kivas averaged 17 m^2 in area. Room 6W was unusually large, with an area of approximately 50 m^2. A partial retaining wall extended along the south side of the pueblo. Pippin suggests the structure may have been accessed from the west by means of ladders or steps (Pippin 1987:108). The rooms were organized in a manner similar to that seen in the Early Chaco phase. Three pairs of habitation rooms were added and may have been associated with the four storage rooms in the west wing (Pippin (1987:112). This layout mirrored the Early Chaco construction in the eastern half of the structure, which

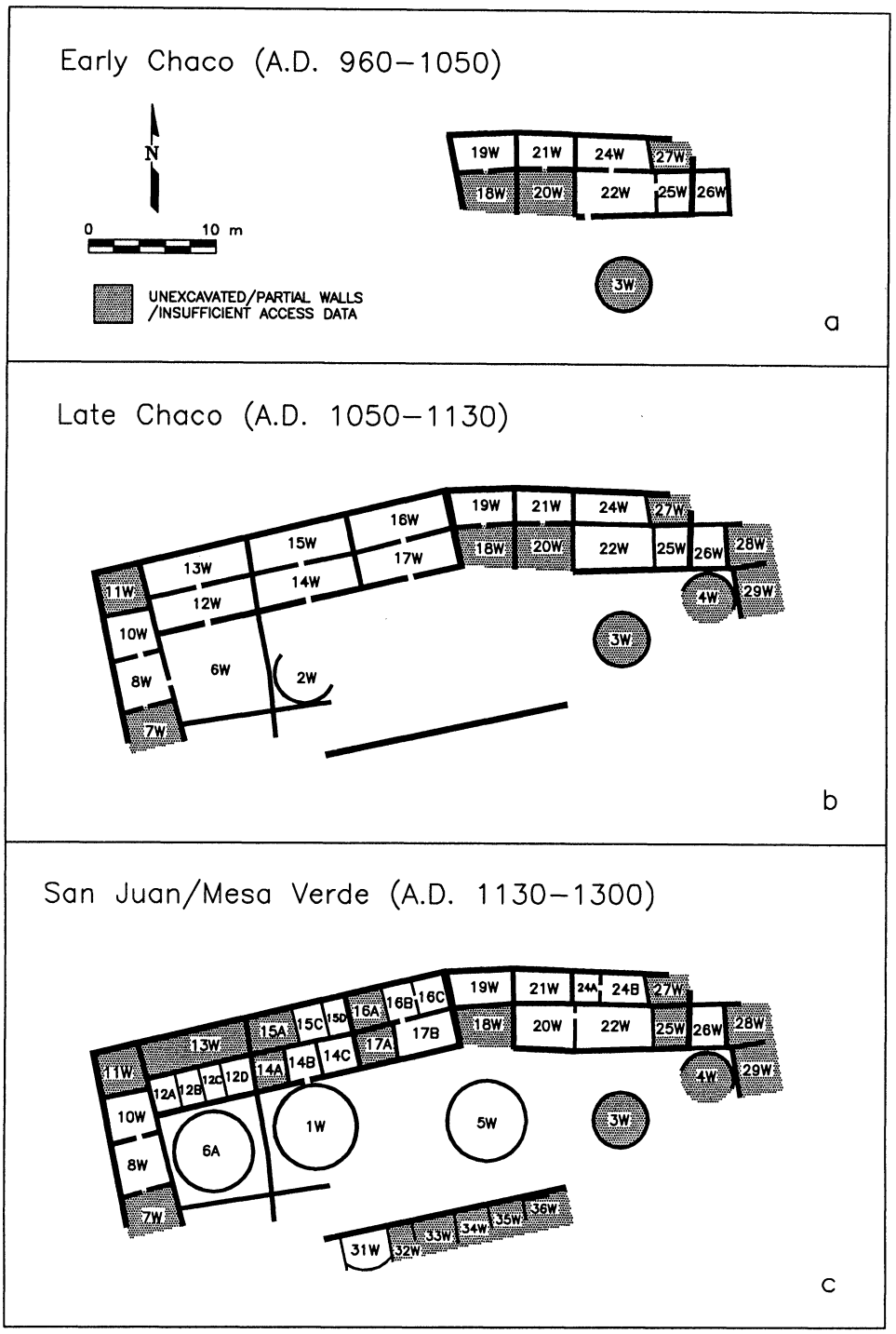

Figure 2. Three construction phases at Guadalupe Ruin (after Pippin 1987:Figures 48 and 52).

now took on a symmetrical appearance.

The San Juan/Mesa Verde phase of construction is associated with non-Chacoan masonry styles and carbon-painted ceramics. Although some new construction (Rooms 31W–36W) took place during this phase, many existing rooms were modified or subdivided by foundationless partitions built of small sandstone blocks and occasional basalt cobbles set

in abundant mortar (Figure 2c; Pippin 1987:114–128). A total of 43 rooms were present. The phase was characterized by small rooms averaging 5 m^2 in size and large, Mesa Verde style kivas with pilasters. Most entries were by way of roof hatches. Pippin uses floor features and assemblages to identify six habitation rooms (Rooms 8W, 14B, 17B, 18W, 20W, and 21W), 14 storage rooms (Rooms 7W, 10W, 11W, 12A–D, 16C, 24B, and 25W–29W), five kivas (Rooms 1W, 3W, 4W, 5W, and 6A), and one D-shaped ceremonial room. The functions of 17 additional rooms are indeterminate, because not all rooms were fully excavated.

Great House Function and Social Context

Pippin considers habitation to have been the primary function of Guadalupe Ruin throughout its occupation, and there is no reason to disagree with this assessment. Domestic occupation is demonstrated by the presence of floor features such as hearths and mealing bins, and, during the San Juan/Mesa Verde phase, by a substantial volume of household trash (Pippin 1987:34, 108, 113, 128, 195–197).

Although people appear to have been living at Guadalupe Ruin throughout its occupation, the great house is architecturally quite different from the surrounding community sites (Pippin 1987:10). Guadalupe Ruin was built of sandstone on an adobe and basalt foundation, and Late Chaco phase construction employed the core-and-veneer technique. In contrast, all but one of the community sites were built of simple walls made of expediently available basalt cobbles.

These differences indicate Guadalupe Ruin represents something more than a simple habitation site. Was the great house built by outsiders from Chaco Canyon who were trying to establish a local presence or authority? Pippin (1987:188, 193–194) argues against this explanation, using additional lines of material evidence to argue that Guadalupe was constructed by locals. Was the great house the residence of local community members of particular importance, who controlled resources or ritual activities, for example? Here the evidence is ambiguous, as architectural differences between the great house and small sites are not echoed by other material remains (Pippin 1987:10). If Guadalupe Ruin functioned as a public storage or ritual facility, did everyone in the community have access to the structure and the activities hosted here?

Through space syntax analysis, it should be possible to evaluate these questions and examine changes across the three phases of occupation. If the Guadalupe great house functioned within a context of social inequality as the residence of important persons or as a locus of exclusionary storage or ritual, the structure should exhibit a spatially segregated configuration characterized by asymmetry and nondistributedness. Some areas of the structure should be less accessible to than others, and movement should be superordinately controlled. The reverse also should hold; if the great house functioned as a public, community space within a society characterized by equal access to status and resources, the structure should exhibit a spatially integrated configuration indicated by symmetry and distributedness.

The Analysis

To quantify a structure's symmetry/asymmetry and distributedness/ nondistributedness, a justified permeability graph first is constructed. All the spaces or rooms in the structure are illustrated as nodes linked by paths of access drawn from the central entrance, or carrier space, to all successively accessible spaces. The resulting graph depicts the number of levels between the carrier space and the deepest space in the structure. Then, a depth value is assigned to each space based on its shortest route of access from the carrier space. Spaces that are one room away from the carrier space receive a value of 1, spaces that are two rooms away receive a value of 2, and so on. The sum of the depth values is divided by the total number of spaces (k) less the original carrier space to yield the mean depth (MD) of the system. Once the mean depth is known, relative asymmetry (RA) is calculated as 2(MD-1)/k-2. This produces a value between 0 and 1. The closer the RA value is to 1, the more asymmetry is present. However, the RA value can vary greatly depending on the size of the structure. The real relative asymmetry (RRA) value is a measure designed to compensate for size differences. The RRA is calculated by dividing the RA by a constant listed by Hillier and Hanson (1984:112). RRA values can be either greater than or less than 1, but higher values indicate more asymmetry. Distributed configurations exhibit ringy access graph patterns, and nondistributed spaces exhibit hierarchical or branching patterns. Distributedness is quantified as relative ringiness, which is calculated by dividing the total number of rings on

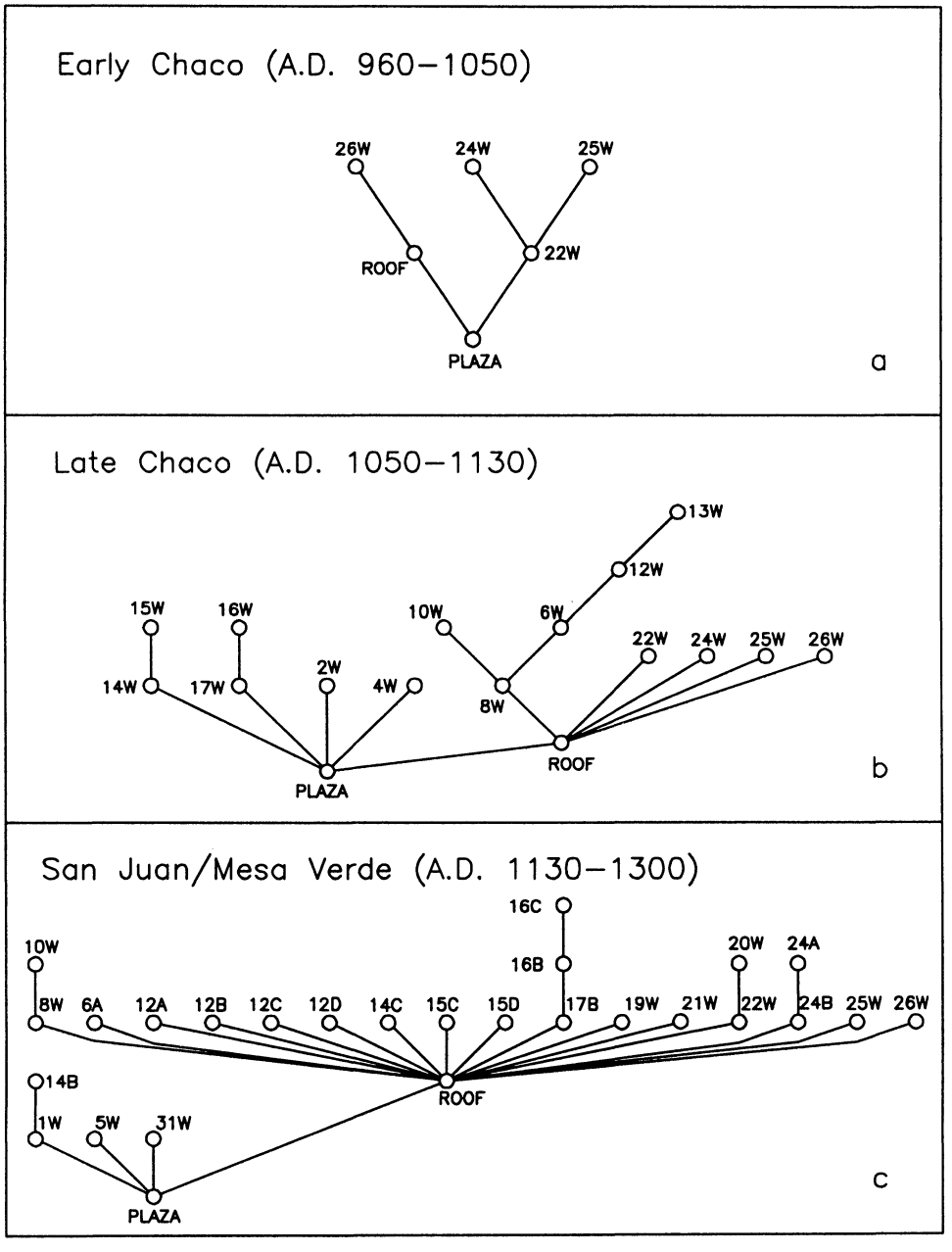

Figure 3. Access graphs for each of the three construction phases.

the graph by 2k-5 (Hillier and Hanson 1984:102, 152–154). This produces a value between 0 and 1. A completely nondistributed configuration has 0 rings, whereas distributed configurations yield values closer to 1.

Access graphs for each of the three construction phases at Guadalupe Ruin are illustrated in Figure 3. To minimize distortion where information is incomplete, unexcavated rooms or rooms without sufficient grounds for assessing access points are eliminated from the analysis (Figure 2). Rooms with partial walls due to poor preservation also are eliminated from consideration. Many rooms are accessible only from the roof (Pippin 1987:103, Table 49). Roof hatch slabs were recovered from the floors of four rooms; however, many rooms are assigned roof

entry based on negative evidence (i.e., the absence of doors in walls) (Pippin 1987:114). Roof entries are not assigned to rooms that contain wall doorways and lack roof hatch slabs; this method may have produced some unavoidable errors on the conservative side. Because the roof logically would have been accessible from the plaza, the plaza is considered the carrier space, and the roof receives a value of 1 in depth and asymmetry estimates.

The number of spaces (k), mean depth (MD), relative asymmetry (RA), real relative asymmetry (RRA), and relative ringiness for each phase are listed in Table 1. The number of spaces (k) increases over time, as new rooms are built and old rooms are subdivided. Guadalupe Ruin is a shallow structure during all periods, with a maximum mean depth (MD) of 2.13 during the Late Chaco period. Most spaces can be accessed from one or two others, usually the roof or an adjacent room. Both real asymmetry (RA) and real relative asymmetry (RRA) decline over time, as more and more spaces within the structure are directly accessible from the roof or plaza. RRA values decrease from .860 during the Early Chaco phase to .423 during the San Juan/Mesa Verde phase. By the San Juan/Mesa Verde phase, the structure consists of a number of small rooms accessible only through the roof. No rings are present in any of the phases, so all phases are assigned relative ringiness values of 0.

Interpretation of Results

Guadalupe Ruin exhibits low measures of asymmetry throughout its occupation. Although the most asymmetry is present during the Early Chaco phase, an RA of .300 is still relatively low, approaching the symmetrical end of Hillier and Hanson's (1984:109) 0 to 1 scale. Symmetry indicates spatial integration and, according to the assumptions of this study, suggests Guadalupe Ruin did *not* function as an elite residence, exclusive ritual facility, or other type of restricted building during any of the occupation phases. However, the structure also exhibits a nondistributed configuration throughout its occupation with an r-ringiness value of 0. This non-ringy, spatially segregated pattern supports the contrasting interpretation that Guadalupe Ruin *did* function in some type of exclusionary capacity.

Symmetry and nondistributedness point in opposing interpretive directions, indicating the relationships among spatial configurations and social processes are more complex than initially assumed in this study. The quantitative and contradictory results of the space syntax analysis cannot be understood in isolation, but they begin to make sense when examined in conjunction with room function and pueblo layout.

Guadalupe Ruin is a shallow structure throughout its occupation with direct access to most rooms from the plaza or the roof. Symmetry increases over time as the number of rooms increase and the pattern of direct roof or plaza access intensifies. As discussed above, Pippin (1987:101–126) assigned habitation, storage, or ceremonial functions to most rooms based on complete or partial excavation. During the Early Chaco phase, the relationship of habitation rooms to storage rooms to kivas in the structure is 6:3:1. During the Late Chaco phase, the relationship expands to 12:9:3. This nearly perfect proportional increase suggests replication of equivalent social units such as households. Following Pippin's (1987:101, 112) assumption that habitation room pairs represent households at Guadalupe, the Early Chaco phase contains three households sharing a single kiva. Occupation doubles during the Late Chaco phase, when six households share three kivas. The pueblo expands through the addition of new households of similar size and access patterns, rather than through additions to the space occupied by existing households. This segmentary replication also is apparent in the pueblo's layout, as Late Chaco construction creates a mirror image of the Early Chaco structure.

A pattern of replicating equivalent social units fits with both the symmetrical and the nondistributed results of the space syntax analysis. Symmetry indicates no one household is larger or more important than the others. Nondistributedness indicates a concern with household boundaries—each household is a discrete entity inaccessible from the others except through roofs and plazas.

In the San Juan/Mesa Verde phase, household patterning and replication are not as straightforward. For rooms where function is known, there is a 6:14:6 relationship among habitation, storage, and ceremonial rooms. Given that six ceremonial rooms and at least six habitation rooms are present, a minimum of six households is estimated. The most obvious change from the Chaco phases is the proliferation of storage and ceremonial rooms. Although San Juan/Mesa Verde phase storage rooms can be deep

(Rooms 10W and 16C), most of them are shallow spaces reached directly from the roof (Rooms 12A–D, 24B, 25W, and 26W). Likewise, ceremonial rooms are among the shallowest in the structure, because they can be reached directly from the plaza. Dropping asymmetry values reflect a continuing trend toward shallowness even as subdivision and new construction increase the total room count. These factors, in connection with nondistributedness, suggest continued and perhaps intensified concern with household boundaries.

Household autonomy during the San Juan/Mesa Verde phase also is suggested by a low room/kiva ratio. Steward (1937) considered low kiva/room ratios to indicate household or lineage kiva use, whereas high kiva/room ratios indicate kivas used by larger social groups. At Guadalupe Ruin, the room/kiva ratio is relatively low in the Early Chaco phase (9:1) and decreases through the Late Chaco phase (7.3:1) to reach 6.3:1 in the San Juan/Mesa Verde phase. Similarly, Chaco era small sites and Mesa Verde region post-Chacoan large sites contain an average of 5 to 6 rooms per kiva (Lipe 1989:56; Van Dyke 1998:253–254). By contrast, Chacoan great houses in Chaco Canyon, the San Juan Basin, and adjacent areas contain an average of 15 to 25 rooms per kiva (Lipe 1989:56; Van Dyke 1998:253–254, 305–307). The low room/kiva ratio at Guadalupe suggests a domestic function for the structure and supports a picture of discrete, equivalent households with privacy and storage needs that escalate during the San Juan/Mesa Verde phase.

The spatial configuration of Guadalupe Ruin does not suggest a context of social inequality for any of the occupation phases. Nondistributed patterns of movement in which rooms can be accessed only from roofs and plazas are best explained as the result of separate, equivalent households. Although household spaces are exclusive, no household controls more space than its neighbors. Based on patterns of movement within Guadalupe Ruin, no argument can be made that the people who lived there were of exceptional importance or controlled community resources or activities. However, like most Chacoan great houses, Guadalupe Ruin derives most of its distinctiveness in contrast to the surrounding community. Considered outside of its community context, the space syntax analysis of Guadalupe Ruin neglects to address what may well be the most important aspect of this structure—its vertical position. The great house does not exist in a vacuum but is perched high on a butte above a group of smaller sites. Perhaps Guadalupe Ruin shows little internal evidence of asymmetry because access to the great house was vertically restricted from the rest of the community. The construction of a plaza retaining wall during the Late Chaco phase also suggests restricted access. Given these factors, social inequality could well have played a part in the construction of Guadalupe Ruin after all.

A space syntax analysis at the community level could doubtless provide further insights into this issue. Although differences in slope and elevation are not easily addressed, space syntax analysis can be applied to community layouts (Ferguson 1996; Hillier and Hanson 1984:97–123; Hillier 1996:149–182, 335–368; Potter 1998:139–143). An analysis at this scale could examine movement and open spaces within the community as a whole and could compare Guadalupe Ruin with its neighbors. Because the unpublished Guadalupe community data are not available to the author, this project cannot be undertaken as part of the current study but awaits future investigation.

Comparison with Space Syntax Analysis at Other Chacoan Great Houses

The Guadalupe Ruin study provides a useful contrast with the results of space syntax analyses at other, contemporaneous Chacoan great houses. Cooper (1995) conducted a space syntax analysis of six canyon (Pueblo Bonito, Una Vida, Chetro Ketl, Pueblo Alto, Pueblo del Arroyo, and Kin Kletso) and two outlier (Salmon and Aztec West) great houses. As at Guadalupe, increasing room subdivision characterizes the sites in Cooper's sample. Storage rooms were linked by doorways in long sequences ultimately accessible through the roof or a second story, contributing to increasing asymmetry over time (Cooper 1995:264–279). RRA values for great houses in Cooper's study average .924 for structures contemporaneous with the Early Chaco phase (Cooper 1995:265–266), 1.373 for those from the Late Chaco phase (Cooper 1995:268–269), and 1.547 for those from the San Juan/Mesa Verde phase (Cooper 1995:270). This pattern is in direct contrast to the decreasing RRA values exhibited by the relatively shallow Guadalupe Ruin (Table 1). Like Guadalupe Ruin, however, Cooper's structures exhibit nondistributed configurations in all time peri-

Table 1. Space Syntax Analysis Results for Three Construction Phases at Guadalupe Ruin.

Phase	k	MD	RA	RRA	Relative Ringiness
Early Chaco	6	1.60	.300	.860	0
Late Chaco	17	2.13	.150	.615	0
San Juan/Mesa Verde	27	2.08	.086	.448	0

ods. There are occasional rings, but they tend to be deep within the framework where they would not facilitate interaction near the carrier spaces. Depth and asymmetry indicate a concern with boundary control at the expense of access (Cooper 1995:273). The nondistributed arrangement argues against great houses as administrative or other public facilities (Cooper 1995:279). At the same time, these deep, segregated spaces would not have been conducive to domestic use unless occupied by extended families, in which case the arrangement would have provided privacy for each group (Cooper 1995:277).

Beyond these general trends, Cooper (1995:271, 276–277) also observed that the floor plans and access graphs for the six great houses in her study were characterized by diversity rather than any sort of "overarching global plan" (Cooper 1995:279). Given this observation, it is not surprising that the Guadalupe Ruin results do not mirror those obtained by Cooper. The comparison joins a growing body of evidence indicating Chacoan great houses should not be viewed as a members of a homogenous entity; rather, they probably functioned in a variety of capacities across time and space.

Challenges for Using Space Syntax as an Archaeological Tool

As demonstrated in this study, space syntax analysis can be a valuable interpretive tool. However, the special challenges posed by its use in non-Western settings to examine collapsed, abandoned structures merit discussion. Critics of space syntax analysis have asserted that the technique ignores the culturally defined meanings of spaces, treating all spaces equally (Lawrence 1986:331, 1987:53; Leach 1978; Osman and Suliman 1994, 1995:47). A space is only evaluated with respect to its relative position *vis à vis* the others. This can lead to circular reasoning if space syntax is employed to assess a structure's function in the absence of any other lines of information. However, as in the Guadalupe study, archaeologists can and do use other lines of evidence to infer room function and interpret the results of an analysis.

Ideally, all contemporaneous points of access should be identified if space syntax analysis is to yield sound results (Batty 1985:162). This is especially problematic in the pueblo Southwest, where both single and multistoried structures are commonly entered through the roof. Roof entries are difficult to discern in collapsed structures. Occasionally, a shaped stone hatch cover found on a room floor provides an indication that a roof entry was present. More often, a roof entry is assumed when no doorways are located in the room's walls, but the presence of a doorway need not belie the additional presence of a roof hatch. At Guadalupe Ruin, roof entry often was assumed based on negative evidence.

Multiple stories pose a related set of difficulties. Some analysts have proceeded on the assumption that ground-floor rooms provide an accurate proxy for upper stories. However, both ethnographic and archaeological evidence confirm that room configurations and patterns of access at ground-floor level do not necessarily mirror those of upper floors. In contemporary multistoried pueblos, large habitation rooms often occupy the upper stories, and a myriad of small storage rooms constitute the ground floor (Adams 1983:51–53; Mindeleff 1989:103, 223). Within Chaco Canyon, the central roomblock of Chetro Ketl (Lekson 1984:186–187), the southeast corner of Pueblo Bonito (Judd 1964:28), and the south wing of Pueblo del Arroyo (Judd 1959:8–16) contain upper stories that are demonstrably different from ground-floor room configurations.

Although multiple stories were not present at Guadalupe Ruin, roofs were probably an important area of spatial interaction. Roofs and plazas were not merely large pathways but were loci for diverse activities. There is no reason to assume that every member of the community had equal access to every part of a plaza or rooftop at any given time. Despite a dearth of physical boundaries within these spaces, movement within the confines of roofs or plazas might well have been restricted, especially at certain times or during specific events. Ladders could have been moved or removed to alter rooftop accessibility. Shapiro (1997:200) attempted to deal with the issue of rooftop movement at Arroyo Hondo by

assuming it mirrored lateral access patterns in the rooms below, but there is no way to evaluate the accuracy of such a reconstruction. There is insufficient information to incorporate rooftop movement into the Guadalupe Ruin analysis, but if the Late Chaco phase pueblo was accessed from ladders or steps to the roof of the western part of the roomblock, as Pippin (1987:108) suggests, the access graph would show the roof as the carrier space for an even shallower structure.

Summary and Conclusions

A number of important points emerge from this study. Despite the mitigating influence of the above challenges, the space syntax analysis of Guadalupe Ruin successfully provides insights into the social configurations represented by the structure. Analyzed as a discrete entity, Guadalupe Ruin appears to have been a domestic building rather than an administrative or ceremonial facility. Initial assumptions equating asymmetry and nondistributedness with social inequality are too simplistic and, as a consequence, the quantitative results of the analysis are superficially contradictory. When room function and pueblo layout are incorporated into the interpretive mix, however, symmetry and nondistributedness describe a series of shallow but discrete room sets characteristic of separate but equal households. No single household is larger, harder to access, or in control of the space of the others. Comparison of the Guadalupe study with other great house space syntax analyses supports the recognition that Chacoan great houses varied considerably across time and space.

The study failed to resolve why some people in the Guadalupe community lived in a great house and others did not. Perhaps the most important aspects of the social fabric within which Guadalupe Ruin was constructed remain unexplored. The topographic restrictions imposed by the structure's location necessitate that social inequality remain an open question. This issue could be productively addressed through an analytical project focused at the community level.

The presence of a number of challenges for the use of space syntax analysis in abandoned structures does not countermand its interpretive potential. Rather, we should take care to use the techniques appropriately and to critically examine results within the appropriate cultural contexts. Space syntax analysis can be a useful tool for archaeological inquiry, but it is not a "magic bullet" that enables the researcher to instantly extract and understand social processes.

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