The Built Environment: Spatial and Social Interaction

at

Pot Creek Pueblo, New Mexico

by

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Abstract

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This dissertation develops a new archaeological approach for analysing social interaction through the built environment of ancient communities by amalgamating various theoretical approaches, three-dimensional computer modelling, and spatial analysis. I apply this approach to Pot Creek Pueblo, New Mexico, which grew from several individual ‘unit pueblos’ into a Period III village with large, multi-storied buildings, during the period A.D. 1270 - 1320. I explain how spatial environments arranged inhabitants’ movements and social encounters, while creating and reinforcing social organizational structures. Previous research on architecture at Pot Creek has primarily relied on functional and ritual perspectives; in contrast, I delve into ways that the inhabitants of Pot Creek used buildings and site development to produce, maintain, and reproduce social structures.

To understand these issues, I use theories from environment-behaviour studies and urban planning with an emphasis on non-verbal, visual communication in spatial settings. I examine visual pathways between plazas during the morphological development of the village. The findings show that the buildings of Pot Creek were carefully constructed and situated to manipulate visual and social interaction. From the earliest occupation the plazas did not permit intervisibility with one another, and developed an increasing sense of
enclosure throughout the occupation sequence. Private and public spaces were carefully orchestrated allowing differing levels of social interaction. I also examine visual taskscapes surrounding corn grinding to understand how the built environment structured the social interaction of teaching and learning. I found that distinct differences in the built environment brought to light different patterns of social interaction for female corn grinders. Participation and learning would have varied widely between enclosed grinding rooms and open-sided ramadas where corn meal production took place.

The results offer insight into how people in the past socially interacted within the confines of their spatial environment, as built environments provide non-verbal cues to structure behaviour, even during mundane tasks such as grinding corn. This research has allowed me to think and see the spatial environment in a humanized way, to ‘see’ from a perspective of past village occupants and could be applied to varying site scales and geographic regions.
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Chapter 1

The Built Environment: Structuring Spatial and Social Interaction

Introduction

We live and interact in a world that has been modified by the existence of built structures, where the very presence of buildings is so pervasive that we may be unaware of the influence that buildings have upon our daily lives. The design of buildings and the placement of those buildings within a settlement have the ability to influence how we interact with others in a very fundamental way. Buildings are situated within a spatial environment in a manner to create areas that are publicly accessible and others that are restricted. The placement of buildings acts to structure social interaction by partitioning space into areas that enable or prevent interaction from occurring. Organization of architectural space plays a part in structuring visually accessible spaces and the consequent social interaction occurs as the built environment promotes or inhibits interaction among inhabitants through the placement of walls, buildings, and associated open spaces and provides a background to everyday life (Gutman 1972; Hillier 1999; Hillier and Hanson 1984; Rapoport 1969; 1980; 1982). Who and what we see are important factors in our ability to interact with others, both in the present and the past. Power differences can emerge through the control of space, material resources, time, and labour, and become routine
through daily and periodic action (Hendon 2010). Spatiality contributes to people’s understanding of their identities and their relations with others. The subdivision of social space into public and private areas affects individuals’ mental states and experiences, regulates their behaviour, and superimposes long-lasting social structures onto human societies (Madanipour 2003). In this research, I attempt to understand the complex interrelationships between the built environment and social interaction in the community of Pot Creek Pueblo, New Mexico.

Pot Creek Pueblo dates to the Pueblo III Period, A.D. 1150-1350 in the Northern Rio Grande region of New Mexico and was characterized by experimentation and change in both the structure of the built environment and social interactions that occurred within those communities. New systems of economic organization, socio-political structures, and architectural patterns resulted from changing population demographics (Crown 1991; Crown and Kohler 1994; Cordell 1994). Architectural alterations to the configuration of buildings, plazas, and ritual spaces created new ways for social interactions to occur within the settlements, and established spatial layouts that had varying degrees of access, control, and privacy. Pot Creek Pueblo, located at the northernmost extremity of the Northern Rio Grande region, expanded from a community of several two-room structures to multiple, large roomblocks surrounding plaza areas within a 70-year period that ended about A.D. 1320. Extensive archaeological research at Pot Creek has focused upon chronology, agricultural practices, population dynamics, households, moieties, village aggregation, abandonment processes, and ritual practices (Adler 1994; 1995; 1996a; 1996b; 1996c; Arbolino 2001; Crown 1990; 1991; Crown and Kohler 1994; Fowles 2004; 2009; Fowles et. al. 2007; Herold 1968; Holschlag 1975; Jeançon 1929; Wendorf and Reed, Erik 1955; Wetherington 1968; Woosley 1980; 1986). Yet, little research has been conducted on the role that the
buildings and plaza areas performed in the development and maintenance of the social behaviour of everyday life within the community.

My work aims to identify the connections between the increasingly complex spatial system of the built environment and social interaction that occurred within the community by modelling potential visibility among the inhabitants of Pot Creek Pueblo. Every society organizes the essentials of social interaction that can occur between individual members of that society in order to carry out necessary day-to-day activities (Ferguson 1996:2). The buildings had a direct and lasting impact on the structure of social behaviour within the community creating areas that were public and areas that were more private. Buildings are not just passive containers, but active participants in the production and reproduction of social structure and organization in a community. The built environment produced a form of non-verbal communication and afforded opportunities for inhabitants to gain considerable knowledge of their environment through visually connecting with their surroundings.

Through the development and application of a new method, I study the site organization of Pot Creek as it developed over the chronology of the village and model areas of visibility that the built environment afforded and potential areas where social interaction could occur in order to understand social interaction within the Pueblo. I will attempt to address how the built environment of Pot Creek Pueblo, New Mexico influenced social behaviour and interaction among its inhabitants.

The goal of this research is to analyze how the built environment of Pot Creek Pueblo both facilitated and restricted social interaction. I will explore two main questions:

1) How can archaeologists analyze the associations between the built environment and social interaction of past societies?
2) How did the inhabitants of Pot Creek use the built environment to effect social interaction and how did this process contribute to the construction and maintenance of social structures in the community?

In the following sections, I outline the overarching theoretical framework for the study, including how social structures are produced and reproduced in a community. I turn primarily to Anthony Giddens to understand the connections between social structure and agency to gain insight into how space becomes a structuring element that is produced and reproduced through social action.

1.1 Theoretical Framework

The goal of this chapter is to outline a theoretical perspective to link the spatial environment and spatially produced social interaction. The elements of the spatial parameters of the community, time, and social interaction will be integrated into a framework that emphasizes components of social production and reproduction.

Space, cultural beliefs, and social practices have long held interest for anthropologists and archaeologists alike. Anthropological studies in the Southwest have often used ethnographic analogy to aid in the understanding of the built environment and tend to consist of a description of the physical environment and the material correlates regarding social units, such as households (Hill 1970; Kroeber 1917; Lipe 1970; Mindeleff 1891). Yet, the spotlight of attention upon the spatial environment has taken a shift in perspective in recent years towards foregrounding the spatial environment as an active element in the spatial dimensions of culture, rather than treating space as a background element (Low and Lawrence-Zúñiga 2003:1). This shift has been demonstrated in many
disciplines in the social sciences including geography, history, philosophy, and sociology (Ashmore 2002; 2009; Bourdieu 1973; 1977; Giddens 1976; 1979; 1984; Lefebvre 1974; Pred 1981; 1984; 1986; Soja 1996). Within archaeology, scholars have begun to recognize the intimate connection between the spatial environment and the production of social practices (Ferguson 1996; Fisher 2007; 2009; 2014; Fisher and Creekmore 2014; Smith 2009; 2011; Vis 2009; 2013). The major impact resulting from this shift is the idea that all human behaviour is situated within a spatial environment and humans both construct space and human action is formed by spatial forms in the environment.

In order to come to an understanding of how the built environment contributed to social interaction, I will use a theoretical framework resulting from the contributions of several scholars from various disciplines. This approach will embrace “a socialized spatial archaeology” (Ashmore 2002:1173) whereby conceiving of space and place in socially active terms will be the foundation for the theoretical model. I will outline Anthony Giddens’ structuration theory, where the spatial environment of architecture does not only represent society, but is also one of several means of constituting society through physically enabling and constraining social interaction. Henri Lefebvre outlines the ways in which various groups in a society perceive, conceive, and live in space. The time-space geographic stance of Allan Pred and his theory of production of place from space through the historically contingent process of becoming will further strengthen the spatial components that Giddens presents. Finally, the relationships between power and place will contribute to understanding the importance of the politics of space.
1.2 Space and Structuration Theory

The built environment is more than a location for activity, for it is an active manifestation of the organizing principles of a society as it both constrains and enables social interaction and provides a physical form for the production and reproduction of social roles, positions, and identities (Fisher 2007:19). Sociologist Anthony Giddens (1976; 1979; 1982; 1984) has influenced social theory through attempts to explain social production and reproduction in terms of intended and unintended actions of individuals and the forms of conduct that are repetitively reproduced through space and time (Giddens 1984:xxi). At the core of structuration theory, often referred to as praxis theory, is the idea that activity, experiences, and performance reproduce social systems (or structures) and that the system can be changed through the strategies of human behaviour (agency). Giddens’ theories of structuration are useful when considering the built environment as architectural space goes beyond acting as a representation of the society to act as one of the primary means of organizing and reproducing society. I will review structuration theory here in order to understand this approach in analyzing the built environment.

At the most fundamental level, structuration theory uses time and space to explain how individual human actions constitute social life through both constraining and enabling social structures (Dornan 2002:307). Structuration is based upon the assertion that human beings are knowledgeable agents who are aware of the conditions and actions of their daily lives (Giddens 1984:281) and that those actions are the reproduction of institutionalized practices and the social system in general.

Some definitions and terminology will help us to understand the basis of structuration theory. Giddens (1979:65; 1984:25) has outlined the basic elements of a social system, where *structure* is defined as rules and resources, organised as properties of social
systems, system consists of reproduced relations between actors or collectives, organized as regular social practices, and structuration is the set of conditions governing the continuity or transformation of structure, and therefore the reproduction of systems. Social systems have structural properties, but are not structures in themselves. To study the structuration of a social system is to study the ways the system applies and generates rules and resources to produce and reproduce interaction (Giddens 1979:66). In structuration theory, rules and resources are a part of the production and reproduction of social practices. In general rules are the guidelines for human action, and both constitute meaning and sanction modes of social conduct. The rules are not rigid, as in a game, but are more closely aligned to principles and procedures rather than rigidly fixed instructions. Rules co-exist with resources, which are the means by which transformative relations are actually incorporated into the production and reproduction of social practices (Giddens 1984:18). There are two classes of resources. Allocative resources are material assets of the environment that people use for material production and reproduction of goods (Giddens 1984:258) and relate to the capability of controlling not just ‘objects’ but the object-world (Cassell 1993:21).

Authoritative resources organize the temporal and spatial boundaries of social groups and the regulation of individual identities (Ferguson 1996:4) and can be seen as people’s capabilities of controlling the humanly created world of society itself (Cassell 1993:21). Giddens also emphasizes the endlessly repetitive nature of rules and resources used to organize regular social practice, leading to his concept of the ‘duality of structure’.

One of the main tenets of structuration theory is the duality of structure, which entails that “the rules and resources drawn upon in the production and reproduction of social action are at the same time the means of system reproduction” (Giddens 1984:19). The first phase of the duality of structure occurs when social practices are used by the actor who
draws upon the rules. The second phase occurs when the unintended consequence of that action results in the reinforcement and perpetuation of the rules. Thus it can be said that the duality of structure reflects both the medium of social production and the outcome. For example, a speaker draws upon the words and syntax of the rules of language (the rules being the medium of language) and, then, through the production of a syntactically correct sentence, the speaker contributes to the reproduction of the language as a whole (the unintended outcome) (Giddens 1982:37). The duality of structure outlines how the structures of social practices are created through human action, and reciprocally how action is constituted structurally.

Importantly for this research, Giddens (1984:110-119) explicitly argues that recurrent and routine practices are located within a temporal-spatial relationship as a component of society. Giddens (1979:202) concluded that most social theory tended to relegate space to a passive role in social action, as “…most forms of social theory have failed to take seriously enough not only temporality of social conduct but also its spatial attributes” [italics in original]. Giddens (1984:110-158) developed two concepts related to time and space that are relevant here 1) presence availability and 2) locales and regionalization. Presence availability, or encounters, emphasizes the importance of face-to-face interaction versus the interaction of others who are absent. In other words it is the participation of actors in social activity within a spatial as well as temporal environment that is important (Giddens 1979:205-208). Giddens follows Erving Goffman’s (1956; 1961; 1963; 1967; 1971; 1974) analysis of co-presence within an individual’s activities of daily life in their social milieu, where co-presence can be seen as the perceptual and communicative modalities of the body. Presence availability is a useful concept in the context of a non-state society where most interaction occurs as face-to-face encounters as would be the case at Pot Creek. Goffman’s
notions of co-presence, focused and unfocused attention, and social gatherings are considered in greater depth in Chapter 3.

The influence of the physical presence and absence of others in time and space leads to the second set of concepts: locales and regionalization of space. Locales refer to the use of space to provide a setting in which social interaction occurs. Locales provide both the physical properties but also the contextual settings of social life (Urry 1991:164). Regionalization refers to the zoning of space in relation to routinized social practices. Giddens (1984 122-126) again follows Goffman in the use of front regions, where efforts are made to create and sustain the appearance of conformity to normative standards, while back regions tend to focus upon things that are hidden. Regionalization encloses zones of space that actors employ in the organization of the contextualization of action. For example, the front regions of a modern North American house would be the living room, dining room and perhaps the kitchen, while the back regions would contain the bedrooms, closets, and bathrooms. The concepts of locales and regionalization are important in the analysis of the spatial environment at Pot Creek where I analyze public/private spaces and spaces of enclosure of the plaza areas in Chapter 6, and the taskscape of corn grinding in Chapter 7.

1.2.1. Structuration Theory: Criticisms and Archaeological Applications

Structuration theory has been the target of considerable critique and evaluation that has stretched over the last several decades. For example, Thompson (1989:64) has argued that Giddens has not provided a clear account of what is meant by ‘rules’, leaving one to create a definition of rules in an intuitive sense. As the concept of rules and resources are at the heart of structuration theory, there is conceptual confusion as it is difficult to determine
the relative importance of different types or aspects of rules (Stones 2005:47). The most pertinent critiques for this research are criticisms related to the spatial environment.

Social interaction occurring within a spatial context has been addressed in structuration theory, yet many scholars feel that the Giddens has under-theorized the role of space in social production and reproduction. Urry (1991:171) points out that structuration theory has not addressed some of the most interesting questions regarding spatial distinctions and their position in social interaction. Questions that remain include: 1) how spatial divisions are set up, and sustained, 2) the degree to which social interaction depends upon spatial separateness, and 3) regimes of surveillance (Urry 1991:171). Urry (1991:172) has argued that Giddens failed to recognize the importance of politics in the construction and use of the spatial environment and the meaning of that environment to users of the space. Gregory (1989:187) has argued that structuration theory is virtually silent about the production of space (see also Saunders 1989). Yet, Giddens has responded to this criticism by claiming that the notions of ‘locales’ and ‘regions’ have to be thought of in light of their “reflexive involvement with social organization and social transformations” (Giddens 1989:280). In other words, Giddens (1979:206-207) maintains that space is not just a place where interaction occurs, but the spatial elements are mobilized as part of the interaction and are drawn upon by social actors to sustain communication. This point has been developed more fully in the works of Henri Lefebvre and Allan Pred, which I discuss further below.

A further group of critiques of structuration theory centre on the duality of structure and the interplay between structure and agency. Many archaeological studies (Crown and Wills 1995; Potter 2000; Spector 1991; 1993; Walker and Lucero 2000) have “equate[ed] agency with the strategies or intentions of relatively unconstrained self-interested individuals” (Hegmon 2003:219) rather than the imbedded relationship between agency,
practice, and structure. Duality within structuration theory is an overarching concept yet it is often conflated with the concept of dualism, or the interaction of both agency and structure. Archer (1988; 1995; 2000; 2004) has been a strong critic of the concepts surrounding the ‘duality of structure,’ pointing out that there appears to be a conflation or elision of structure and agent. Yet, for Thompson (1989) it is important to understand the difference between structure and action. It “is not how structure determines action or how a combination of actions make up structure, but rather how action is structured in everyday contexts and how the structured features of action are, by the very performance of an action, thereby reproduced” (Thompson 1989:56 italics in original). Thus, it is not how structure acts as a barrier to action so much as how structure becomes involved in its production.

Within North American archaeology, there has been a recent over-emphasis of the role of agency at the expense of structure or systems in the understanding of past peoples (Hegmon 2003:219; 2008:217). As Hegmon (2003:219) points out, archaeologists are seeing agents everywhere in the archaeological record. Western notions of the individual actor performing to effect change has appealed to many scholars (for example Arnold 1993; 2000; Dobres and Robb 2000a; 2000b; Kantner 1996). In contrast Joyce and Lopiparo (2005:365) reminds archaeology that agency and structure are indivisible parts of a single process and must be considered in concert. Giddens (1984:9) has defined agency as the actions of an individual who could have performed differently at any point in a sequence of conduct. Giddens is also careful to point out that both structure and agency are necessary and have a recursive relationship in order to create and perpetuate the social system.

In order to understand the architecture and spatial patterns of historic Zuni Pueblo in New Mexico, Ferguson (1996:3-10) used structuration theory from the perspective of space as a structuring mechanism that not only represents society but also constitutes society.
Ferguson’s study is premised upon Giddens’ idea that all structure can be both constraining and enabling while producing and reproducing social systems. Constraints inherent in the archaeological record prevent us from observing rules and authoritative resources, so Ferguson (1996:10) argues that we must rely upon the residue of allocative resources. The archaeological record contains the remains of buildings as they are dispersed within a settlement, which we can analyze together with the precept of structuration theory that rules and resources are bound together with social activity. Ferguson’s study of Zuni architecture reveal shifting patterns of spatial patterning that corresponded to changes in social organization as revealed through alteration in post marital residence patterns (Ferguson 1996:148). In a similar vein, Fisher (2007; 2009) analyzes architecture in Cyprus during the Late Bronze Age using structuration theory to understand the role that buildings played in controlling movement and encounter and aiding in producing and reproducing sociopolitical structures. Fisher (2007:iii) identifies the importance of construing the contexts of building spaces as socially constructed places in the creation of identity, memory, and places where the social political dynamics of Cypriot society occurred.

Recently there has been a recognition in Southwestern archaeology that understanding of both structure and agency is necessary (Hegmon 2008; Varien and Potter 2008). Understanding of agency in archaeology has evolved to recognize that there is a continuum of determination for the active agent, where more to less structure and more or less conscious awareness of actions are both present (Varien and Potter 2008:7). Perry (2008) has used an agency approach in his study of women and the grinding of corn in the social construction of community at Grasshopper Pueblo, Arizona, and argues that power structures in place limit or restrict the actions of the female corn grinders. Snead (2008:157) has drawn upon the structuring nature of landscapes surrounding Burnt Corn Pueblo in the
Galisteo Basin of New Mexico to argue that the surrounding spaces are structuring elements imbued with meaning and ritual that are ‘active’ rather than ‘passive’.

In order to flesh out the theoretical framework that Giddens provides, I turn to Lefebvre’s ideas of how space is produced, including how space is used to construct symbolic meaning and spatial organization. The process of producing place and the continuous on-going production and becoming of place as argued by Pred will follow. Finally, I turn to a discussion of place and power, as power has an undeniable influence on the construction of place and the social relations that it constitutes.

1.3 Spatial Environment: Production and Reproduction

In one of the most relevant critiques of Giddens’ social theory, Urry (1991) expresses dissatisfaction with Giddens’s ability to provide a fully developed theory of how space is produced and reproduced. Giddens places social action within the context of a spatial environment, and indeed deems the spatial environment to be a pre-condition for social action, but Urry (1991:160) argues that Giddens does not allow for how spaces are contested and determined, symbolically represented, or socially organized. In this section I address these concerns through the theories of Henri Lefebvre (1974) as he presents an approach that allows investigation of space as product (and a reproduction) of society and everyday life.

Through the interconnection of three different layers of understanding of space, as practiced or perceived, as conceived, and as lived space, Lefebvre (1974:50) argues that space is a social product developed through a complex social construction of meaning. The perceived/practiced category of space relates primarily to space-related modes of behaviour, or the practices of the everyday that are reinforced by routines for the production and reproduction of space (Soja 1996:66). The space of practice is an area for non-reflexive
action, with the repetition of activity that produces and reproduces its own circumstances in a circular fashion (Löw 2008:28).

Lefebvre (1974:50) categorizes the conceived space, or the representation of space as the second type of space and is the domain of the planners and designers of the space (Soja 1996:66-67). Conceived space is the realm of the ideological, cognitive aspect of space and tied to representation of the mathematical, models, and planning (Löw 2008:29). The conceived space is related to the design that is imposed upon space and thus is influenced by the hegemonic power over the deciphering of spatial practice and the production of spatial knowledge. This is the sphere of representation of power, through the control and surveillance over space.

The lived space is the third aspect of Lefebvre’s conception of structure and behaviour whereby spaces of representation may undermine prevailing discourses and some may envision ‘other’ spaces (Löw 2008:29; Soja 1996). These types of spaces overlay the physical space, making symbolic use of objects, non-verbal signs, ritual, and symbols. Swenson (2012) has argued that the ceremonial architectural space of the Late Moche period in Jequetpeque Valley, Peru could be lived space as defined by Soja and Lefebvre. Swenson goes on to argue that the ritually imbued ceremonial site instilled and created identity and self-awareness for the Moche people through the creation of place.

Lefebvre has a Marxist stance and argues that production and control of space are a capitalist means of appropriation. He suggests that those in power safeguard their position by defining access to space through dividing up and deploying space (Löw 2008:27). The idea that powerful elements control the division of space supplements Giddens’s structuration theory by focusing on how space is produced, rather than treating space as a backdrop where action occurs. In the next section, I will discuss geographer Allan Pred’s (1981; 1984) theory
of transforming space into place, which supplements Giddens’s ideas about spatial production and reproduction as a place of social encounter. I will then consider how the built form is mediated by power with the connection to architect Kim Dovey’s (1999) research. Dovey (1999) analyzes different forms of power and how power is displayed within the construction and design of the built environment.

1.3.1 The Process of Space Becoming Place

The construction of place occurs at the intersection of the physical built environmental and socialized space, where the concept of space is a constantly changing human product of becoming (Pred 1981; 1984; 1986). Pred (1984:6) argues that place always represents a process and a product of human activity. The understanding of place is based upon the on-going activity and social interaction of human practice that takes place in the context of the creation and use of a physical setting (Pred 1984:7). The participants in the process of creating place are integrated human beings whose thoughts, actions, experiences, and ascriptions of meaning are constantly becoming as part of the process of their involvement in society and its structural properties (Pred 1984:7).

We may consider space as any physical location that humans have modified in some way, while defining place as a space with multi-dimensional meanings, including symbolic, emotional, cultural, political, and biological ones, bound up with place identity and patterns of territoriality (Buttimer 1980:167). The two ideas become differentiated when we add experience to the equation. One strand of scholarly endeavour has been to understand the creation of meaningful places and places of social interaction from space (e.g., Bowser and Patten 2004; Cowell-Chanthaphonh and Ferguson 2006; Joyce 2009a; Joyce et al. 2009; Kuwanwiswima and Ferguson 2009; Low and Lawrence-Zúñiga 2003; Moore 2005; Munn
2003; Pellow 2003; Richardson 2003; Swenson 2012; Tuan 1977; Van Dyke 2004; 2008; 2009; Zedeño and Bowser 2009). The range of experiences that are associated with places can vary from direct, intimate knowledge to indirect, conceptual, and mediated knowledge via symbols. Place can also have different meanings for different individuals because of their varying life experiences and how they are situated within a society.

The primary importance of Pred’s contribution to the analysis of place is his idea that place is continuously created through a historically contingent process. As Pred (1984) indicates, place is always becoming, relying upon the human-made elements of place, and is inseparable from the everyday development of activities and the dissemination of structuration processes that are on-going. With archaeologists’ emphasis on time-space interactions, Pred’s theory of the continuous process of transforming is particularly pertinent and enhances Giddens’ theories of structuration by emphasizing the process of spatial change as a process of continuous repetitive actions of social production and reproduction.

1.3.2 Place and Power

A discussion of space, place and social interaction would be remiss without an understanding of the power structures that lie behind the creation of a place. On one level, place creation is determined by the control of resources, and is part of the concept of conceived space as outlined by Lefebvre (1974). At another level, the physical presence of the built environment and related spatial setting may contribute to overt expressions of power constructed by elite practices and can also express hidden power through reflections of identities, differences of gender, class, culture, and age (Dovey 1999:1). The structures and representations of power can be located within the built environment in such a way as to
be so embedded within the framework of everyday life that the elements of power become unquestioned (Dovey 1999:2).

In common usage, power tends to have negative connotations linked to oppression or control over others, yet power can be expressed across a continuum synonymous with force, coercion, manipulation, and authority to the ability or capacity to empower (Dovey 1999:10). The first form of power is force, an overt form of power that can be identified in the built environment through the use of enforced spatial confinement, housing enclaves, and doors with locks. Coercion is the second form of power that is maintained through the threat of force (Dovey 1999:11) and is displayed as a more latent spatial technique with implied sanctions. Coercive force includes domination and intimidation and is discernable in the built environment though spatial domination of exaggerated scales, such as monumental architecture, causing the individual to feel belittled. Examples include large public monuments, and areas for military parades. More subtle forms of coercion exist whereby the organizational control of space transforms group or communal space for the realization of another’s plan. In everyday life, the built environment frames certain spaces for particular activities and prevents other activities from occurring; these are not necessarily sinister in nature. For example, buildings and boundary areas can be placed within a settlement to create areas of segregation, where spaces are segregated by status, gender, or age and thereby creating zones of privileged access and community (Dovey 1999:15).

The third form of power is manipulation, a form of an invisible exercise of power whereby the power is made invisible to the subject, eliminating resistance and resulting in a form of manipulated consent (Dovey 1999:12). Those who are able to influence or control the built environment have power over others through the control of the design of buildings or settlement patterns that encourage or inhabit social interaction. The control of what is
observable and what is hidden, through the manipulation of the built environment, is a powerful tool in the organization of a community.

Finally the fourth form of power is authority or capacity to empower. This form of power may be the most embedded within the institutional structures of the society and is based upon unquestioned recognition and compliance (Dovey 1999:12). Authority is the most stable and pervasive form of power as it is based upon socially acknowledged rights and is manifested in the built environment through legitimized symbols, ritualized ceremonies, and displays. Buildings and settlement design are often imbued with symbolic representations and encoded with non-verbal meanings. A more complete discussion of non-verbal communication and the built environment, including the visible and the invisible, will be discussed further in Chapter 3.

1.3 Summary of Spatial and Social Theory

The goal of the above theoretical background was to outline a basis for understanding how the spatial environment and social interaction are produced and reproduced in order to facilitate the study of the settlement patterns and social interaction that occurred at Pot Creek Pueblo. I have drawn upon a number of social theories that have varying degrees of recognition of the spatial environment in which social interaction takes place. Giddens’ structuration theory provides a base for understanding how structure interacts with social agents in order to produce a social system. Concepts such as co-presence in a spatial environment and locales are important elements that have implications for this research and will be developed further in other chapters. Taken together, these theories allow me to develop a framework that helps us to understand how the built environment acted to produce and reproduce social interaction at Pot Creek Pueblo.
1.4 Spatial and Social Interaction at Pot Creek

In the next chapter, I set the stage for the analysis by situating the Pot Creek community within its temporal context and I outline environmental elements in the region as they had an overarching impact upon the inhabitants of Pot Creek and provide a setting for the growing community. The long history of scholarship at Pot Creek has resulted in numerous attempts to establish a chronology for the Taos area and it is important to review this literature to ensure that the temporal sequence of the community and its place within the greater region of the Northern Rio Grande is considered. I perform a brief review of the architectural elements common for each of the time periods in order to place the construction of the larger community of Pot Creek.

I explore the connections between non-verbal messages provided by the built environment and behaviour of the occupants in Chapter 3, with a discussion of the use of mid-range theories to bridge the gap between high-level social theory and on-the-ground data. Two middle-range theories that I outline are: 1) a morphological approach for studying the physical changes in an ancient community through time, and 2) a non-verbal communication approach to the built environment in order to structure social interaction through the identification of private and public spaces, territoriality, and the control of space. In Chapter 4, I present the modelling of perception and visibility as a method to link the physical environment, via a non-verbal communication approach, to social interaction and social structures. I present visibility techniques to recognize the contributions made in this area of scholarship in the past and I outline methods developed for this research.

The availability of raw materials and labour resources was a pertinent concern for the inhabitants of the region and is discussed in greater detail in Chapter 5 when I present my
interpretation of the construction sequence for Pot Creek. I update the construction sequence presented by Crown (1991) by revisiting assumptions regarding the analysis of dating and construction techniques and in light of excavation data that became available after Crown’s analysis. I develop a construction sequence for each of the roomblocks and then create a new construction sequence for the entire community. I then use the construction sequence to further our understanding of the capacity of the built environment to structure social interaction within the community over time.

The non-verbal communication approach to the built environment provides a means for decoding behavioural cues that were apparent to the occupants of Pot Creek and I will explore these in two distinct ways. Chapter 6 presents a diachronic approach to the settlement whereby the construction sequence over the 70-year period of occupation acts as a tool for understanding changes in the built environment and related changes in social interaction and behaviour. Patterns of visibility and non-visibility surrounding the buildings act to control behaviour through the creation of public and private areas, territorial control, and conformance to a general sense of embedded circularity that was prevalent in the Pueblo world. In Chapter 7, I have performed a synchronic analysis of the built environment and related visual affordances during one particular activity, the task of grinding corn, during the final phase of occupation. The final phase is the focus of the analysis as the archaeological data is the most complete during this time period. The different types of built structures where corn grinding took place provides diverse visual taskscapes or levels of visibility that afforded varying practices of social interaction. The built environment allowed varying degrees of visibility into adjacent areas; some areas were open, some areas had filtered views, while other areas had no visual connection to other spaces at all. Social interaction occurred within some of the corn-grinding rooms, but was impeded in other locations.
Different forms of social interactions were afforded by these spaces, producing layers of power and prestige, ritual behaviour, and social learning.

Finally, in Chapter 8, I summarize my findings and conclusions regarding the social implications that took place during the various phases of construction of Pot Creek Pueblo, New Mexico. I revisit the two main themes that resonate throughout this research; 1) archaeological understandings of past built environments, and, 2) the production and reproduction of social structures at Pot Creek through my investigation of the built environment of the community. I situate this research into the context of our knowledge of Pot Creek and within the greater region of the Northern Rio Grande in the American Southwest. Finally, I consider the computerized three-dimensional modelling and spatial analysis methods used here and the implications for expanding the method to other archaeological contexts.
Chapter 2
Pot Creek Pueblo: Environment and Cultural History

Introduction

My first, much anticipated, visit to Pot Creek Pueblo, New Mexico occurred in 2011. I approached the site from the southwest, crossing the Rito de la Olla. Clay deposits were visible along the creek banks and were, surely, a source of clay in the past. The volume of water in the creek was at a low point as the area was experiencing an extended hot, dry period. The constant flow of water, despite the drought conditions, spoke well for the water supply critically needed by village residents of the past. As I moved into the village area proper I paused to survey the surrounding vicinity. A feeling of tranquil peacefulness enveloped me and a sense of enclosure surrounded me. This feeling of being serene and present in the moment, a feeling of dasein, was reinforced by the peaceful calm that pervaded the site. The stand of trees encircling the site created a sense of privacy, where not even the nearby highway could be seen or heard. The view of the distant hills and mountains formed another layer of encircling enclosure. This could truly be the centre of the universe disconnected from the present. Yet, at the same time a fleeting bond was evident with the outside world. New Mexico and Arizona were experiencing drought and dry weather that season and conditions conducive to forest fires prevailed. Fires had been raging near Los
Alamos, approximately 100 km to the south, for the previous week. The air at Pot Creek was thick with smoke as the prevailing winds blew into the region and settled into the valley. A miasma of dry heat and smoke filled the air and choked my lungs. This was a very visible and pungent reminder of the connection between Pot Creek Pueblo and the outside world.

Multiple connections exist between Pot Creek Pueblo and the world beyond its periphery. The community is intimately connected to its physical location and environment, its place in time, and to the broader Pueblo world of the American Southwest prior to the arrival of the Spanish. Finally, it is also connected to the community of scholars who have made substantial contributions to archaeological research over the past century.

The fundamental core of this research is the spatial placement of architectural structures within the settlement of Pot Creek Pueblo, New Mexico and how the placement of those buildings affected the ability to interact socially within the community. In order to reach the point of evaluating spatial patterning and social interaction I will first introduce the geographic and environmental setting of the region in order to outline some of the challenges and opportunities that were faced by the people of the past. I will then place the community within its cultural historical context and will briefly summarize over 100 years of research regarding the cultural history of the Northern Rio Grande and the distinct history of the more local region surrounding Taos, New Mexico. And finally, I will briefly examine each of the cultural historical periods with particular focus upon population estimations for the region and the historical sequence of the built environment with examples of typical structures from each of the occupation periods at Pot Creek Pueblo.
Figure 2. 1. Map of Taos region with major sites indicated. Based upon Adler and Dick (1999).
2.1 Environment of the Taos Region

In this section, I present an overview of the geography and the environmental conditions surrounding Pot Creek Pueblo and the Taos region more generally (Figure 2.1). A description of the local landscape is an entry point into a discussion of the influences that affected cultural decision-making in the district. This overview highlights factors, such as the basic geography of the valley system, flora and fauna in the region, and past estimates of climatic conditions that are important factors to support human occupation in the area. Many early (Bandelier 1892; Mindeleff 1891; Nelson 1914; Wendorf 1954) and more recent scholars (Dean et al. 1985; Haas and Creamer 1993; Matson et al. 1988) have argued that environmental factors were prime motivators in aspects of cultural change, such as migration, aggregation, and social re-organization in the American Southwest. As Adler, Van Pool and Leonard (1996:385) have argued, however, environmental factors do not cause cultural change. Rather, changes in climatic and other environmental conditions all provide the potential for humans to respond through strategic changes in behaviour. Thus, it is important to have an understanding of the distinctive geographic setting in order recognise the cultural developments in a local area.

2.1.2 Geography

The Taos region is very striking, with flat plateau regions, mountain vistas, and many areas of diverse microclimates. It is bounded by the Rio Grande River to the west and the Sangre de Cristo Mountains to the east (Wetherington 1968:73). The Rio Grande River acts as an effective boundary for the region as the river flows through a deep gorge that has been carved into the plain by processes of erosion and rifting over the past 30 million years. The Rio Grande flows south from the Rocky Mountains in Colorado and contains water from
rainfall and snow melt from the mountain range. The river likely acted as a partial barrier for human movement across the landscape in the past as sides of the gorge are steep and contain a jumble of large, block-shaped boulders at the bottom of the gorge. The eastern border of the region is defined by the Sangre de Cristo Mountains, which rise to peaks of 3,000 to 3,600 m and form the highest mountain complex in New Mexico (Wetherington 1968:12). The mountains rise abruptly out of the plateau region and are at their most rugged in this area. Taos region is also defined by the Red River to the north and Rio Pueblo to the south. The Taos plateau, created from former sea beds, extends from the base of the Sangre de Cristo Mountains on the east to the San Juan Mountains on the west. This large flat plain is at an elevation of 2,100 m near the town of Taos and provides the region with fertile soils for agricultural production. A number of smaller rivers and creeks or arroyos bisect the plain and contain water on a seasonal basis. The plain is also divided by a series of foothills south of Taos known as the Tres Ritos Hills, in which Pot Creek is located. The valley systems resulting from these rivers and hills create pockets of isolation that result in subtle differences in climate, geography, and cultural diversity.

Pot Creek resides within the large valley of the Tres Ritos Hills at an elevation of 2,200 m (Wetherington 1968:13) and is located more specifically within the Rio Grande del Rancho valley, which is a tributary of the Rio Grande River and is approximately 16 km south of Taos New Mexico (Figure 2.2). The valley is situated in a low-lying section of the Sangre de Cristo Mountains at the southern reaches of the Rocky Mountains (Herold 1968:13) (Figure 2.3). The Rio Grande del Rancho is often considered to be the “Little Rio Grande” as it is a tributary of the Rio Grande. The region contains waterways that drain the surrounding mountain system and does not tend to suffer as greatly from water shortages
Figure 2. 2. Elevation map of the Rio Grande del Rancho Valley.
as other regions in the Northern Rio Grande. Pot Creek was built upon a small alluvial plain at the confluence of two streams, the Rio Grande del Rancho and the Rito de la Olla. Both of these streams are permanent and arise within the Sangre de Cristo Mountains (Herold 1968:14). The valley surrounding Pot Creek contains two well defined terraces and a narrow floodplain approximately 200 to 400 m wide (Herold 1968:14). The soils at the confluence of the Rio Grande del Rancho and the Rito de la Olla tend to be less rocky than the surrounding region with soils originating from the alluvial fan. The soil is approximately 45 cm deep and comprised of yellow-red clay mixture containing a high level of silt and clay (Herold 1968:17).

2.1.3 Flora and Fauna

Wild flora and fauna within the region contributed to the subsistence system of inhabitants within the valley and deserve consideration here. The Rio Grande del Rancho Valley contained the following large fauna: mule deer, elk, mountain lion, antelope, bobcats, coyotes, foxes, and grizzly bear and smaller animals, such as various species of birds, mice,
rats, squirrels, cottontail, and jackrabbits (Findley et al. 1975; Wetherington 1968:14). Today, the slopes of the valley are primarily covered with Ponderosa pine, but likely in the past the major trees in the area would have been pinyon pines (*Pinus edulus*) and Utah juniper (*Juniperus monosperma*) trees. The local access to trees facilitated the construction of the large pueblo structures without resorting to long-distance travel to acquire roof beams. In the tributary valley region there are sage and rabbit brush and some clumps of Gambel’s oak (*Quercus gambelii*) (Herold 1968:18). Subsistence practices would have benefited from the gathering of wild plants and seeds such as yucca, pinyon nuts, chenopods, amaranth, and Rocky Mountain bee weed (Arbolino 2001).

**2.1.4 Climate**

The high altitude of the Rio Grande del Rancho valley is near the outer limits for the production of certain crops, such as maize, yet the rainfall and temperatures in the region would have been adequate to support crop production. The region is classified as semi-arid. The number of frost-free days per growing season is a crucial factor in the success of crops and this region is on the edge of the range for successful corn growing. Most corn varieties require 120 frost free days and 45 - 60 cm of precipitation. In the modern era, very local micro-climate variations exist within the valley so that frost-free days can range on average from 115 to 140 days per season (Boyer 1994a:39) and precipitation can average 32 to 41 cm annually (Herold 1968:17). Yet the presence of many agricultural field system features provides evidence that local growing of corn did exist in the past.

Dendroclimatic analysis in the Taos region has produced coarse estimates for past climatic conditions (Figure 2.4). Temperature and rainfall provide indications of climatic conditions in a region, and as the width of tree rings reflect growth patterns related to
Figure 2.4. Climate data by decade for the Taos region, calculated from dendroclimatic data. The chart indicates the degree of variability in standard deviations from the mean tree-ring width as a proxy for rainfall and temperature. Positive departures from the mean indicate above-average rainfall and below-average temperatures. Data from Dean and Robinson (1977).
those variations, tree rings can be studied to determine climate changes over time. Dean and Robinson (1977) used tree-ring analysis to estimate deviations from mean annual temperature and rainfall on a decade-by-decade basis for the prehistoric periods from A.D. 1100 to the modern era. Any data above the mean, or a positive standard deviation trend, indicates above-average rainfall and below-average temperatures, while a deviation below the mean indicates below-average rainfall and above-average temperatures. Approximately two standard deviations from the mean, either above or below the mean, are considered to effect behavior, where effect could be defined as potential adaptive consequences for plants, animals, and humans (Arbolino 2001:161; Boyer 1994a:23; Dean and Robinson 1977:8).

The data were collected at Taos, approximately 20 km north of Pot Creek. While Pot Creek may have had unique climate pattern variations, distinct from those at Taos, the trends were likely fairly similar. During the Valdez Period (A.D. 1050 - 1200), fairly regular climatic patterns were demonstrated with only the 1170s showing slightly wetter and cooler conditions. Temperatures and rainfall patterns clustered around the mean for the majority of the A.D. 1200s, when small unit pueblos first appeared. Cooler, wetter climatic conditions were again demonstrated during the Pot Creek Phase in the 1230s and 1240s and this era corresponded to proliferation of small unit pueblos, foreshadowing the initial phase of aggregation into large pueblos, such as at Pot Creek in the 1270s. A hot, dry period, occurring around 1280, was part of a trend across the American Southwest, with the consequence being migration across a large geographical area. This was followed by a very significant wet, cool decade at the beginning of the 1300s. It appears that the largest number of inhabitants at Pot Creek corresponded to the two decades, the 1300s and the 1310s in the later portion of the Talpa Phase, when significantly higher rainfall and cooler temperatures prevailed. This era was coincidental with the second phase of construction at Pot Creek. A very significant hot, dry period occurred in the 1340s, or
Vadito Phase, Pot Creek was abandoned prior to this time. A further analysis of population and occupation sequence will be discussed in the next chapter. However, it can be seen that dendroclimatic data are useful to corroborate the evidence of the human occupation sequence in the region and to give context to the environmental challenges in the region. The significant fluctuations in the climatic conditions would have created a backdrop for decision making that would have influenced spatial and organization patterns and social interaction.

2.2 Summary of Habitation in the Taos Region

The area surrounding modern Taos, New Mexico has had a long history of human presence, beginning with transitory hunter gathers in the period prior to A. D. 1050, who left an ephemeral archaeological footprint upon the landscape. The presence of geographically dispersed small pithouses signalled the start of sedentary life in the region. Three architecturally distinct occupation phases occurred within the Taos region of Northern New Mexico, with the occupation beginning during the Valdez Period (A.D. 1050 - 1200) with subterranean pit house structures, followed by the Pot Creek Period (A.D. 1200 - 1270) with above-ground unit pueblos accompanied by circular below-ground structures, which may have been either pithouses or early kivas. Finally, during the Talpa Period (A.D. 1270 -1320), Pot Creek Pueblo was constructed and consisted of large multi-storey contiguous roomblock buildings surrounding plazas, with kivas located within the plaza areas, and possibly 1 or 2 large kivas (or Great Kivas) (Crown et al. 1996:191). At Pot Creek Pueblo, the buildings were constructed of coursed adobe with the ground-floor rooms containing no hearth features and were likely used for storage while the upper rooms were being used as the habitation facilities (Crown 1991:292). Several ground-floor rooms have been identified as corn-grinding rooms with multiple grinding stones found in situ with adobe collars fixing them in place (Wetherington 1968:26). At least one room was
constructed of *jacal*, consisting of tightly spaced upright wooden posts, and was adjacent to an adobe roomblock (Wetherington 1968:22). A feature that is unique to the Taos region was the roof-support post system. The support system consisted of a circular pit dug into the centre of the floor of the adobe room with an upright post fixed in place with stones or adobe. The upright post was used to support a wooden horizontal crossbeam and the remaining roof elements were laid cross-wise to this beam. It is believed that these central pit/support structures were used for the storage of dried corn (Wetherington 1968; Fowles 2004). The pueblo was abandoned sometime after the early 1320s. The occupants of Pot Creek Pueblo then likely dispersed to either Taos or Picuris Pueblos.

Further descriptions of the construction sequence and the architectural features of the Talpa Phase of occupation at Pot Creek Pueblo will be discussed at length in Chapter 5, but here I will outline the temporal chronology, include brief descriptions of the architectural features, and estimates of the population present in the region during each of the time periods.

### 2.3 Cultural Chronology

Reconstructing the cultural time periods of the Northern Rio Grande and the region surrounding Taos has occupied many scholars for much of the twentieth century (Kidder 1924; 1927; Mera 1935; Reed 1949; Wendorf 1954; Wendorf and Reed 1955) and continues into the present (Crown 1990; Fowles 2004; Ortman 2012) (Table 2.1). These attempts have included consideration of multiple lines of evidence, including pueblo historical narratives, biological and linguistic data, and archaeological evidence from pottery, lithics, and architecture. Despite all of this scholarship, disagreements still exist and none of the reconstructions are entirely acceptable (Cordell 1995). One of the key issues with the various versions of the chronologies is migration and the movement of people across the landscape. Further complication arises when considering
<table>
<thead>
<tr>
<th>Time A. D.</th>
<th>American Southwest Pecos Classification (Kidder 1927)</th>
<th>Northern Rio Grande Periods (Wendorf and Reed 1955)</th>
<th>Taos Area Phases (Crown 1990)</th>
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<tbody>
<tr>
<td>1700</td>
<td>Pueblo V</td>
<td>Historic 1500 - 1700</td>
<td></td>
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<tr>
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<td></td>
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<td>1500</td>
<td>Pueblo IV</td>
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<td>1400</td>
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<td>Talpa 1270 - 1320</td>
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<td>1300</td>
<td></td>
<td>Coalition 1200-1325</td>
<td>Pot Creek 1200 - 1270</td>
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<tr>
<td>1200</td>
<td>Pueblo II</td>
<td></td>
<td>Valdez 1050 - 1200</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>600</td>
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Table 2.1. Cultural historical chronologies of the Northern Rio Grande and Taos regions.
Table 2.2. Comparisons of chronological sequences proposed by scholars for the Taos area. All dates are A.D. Pot Creek relates to a temporal time period in this instance, not the physical location of Pot Creek Pueblo.

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Talpa</td>
<td>Temporary abandonment of the Pot Creek region (Pindi Period)</td>
<td>1250 - 1275</td>
<td>1250 - 1350</td>
<td>1175 or 1200 - 1350</td>
<td>1260 - 1320</td>
<td>1270 - 1320</td>
</tr>
<tr>
<td>Pot Creek</td>
<td>1200 - 1250 (Llano Period)</td>
<td>1200 - 1250</td>
<td>1200 - 1250</td>
<td>1100 - 1175 or 1200</td>
<td>Pot Creek I 1190 - 1215</td>
<td>Pot Creek II 1215 - 1260</td>
</tr>
<tr>
<td>Valdez</td>
<td>900 - 1200 (Early Llano Period)</td>
<td>1000 - 1200</td>
<td>1000 - 1200</td>
<td>900 - 1100</td>
<td>Valdez I 950 - 1050</td>
<td>Valdez II 1050 - 1190</td>
</tr>
</tbody>
</table>

a specific region, such as the Pot Creek area within the Taos region, in the context of a chronology for the Northern Rio Grande as a whole since not all traits have the same trajectory at the same points in time across all geographic locations. For example, changes in paint pigments on pottery were not universal throughout the Northern Rio Grande; the Taos region retained the mineral-based paint tradition throughout the Coalition Period while potters at other locations switched to organic pigments (Wendorf 1954:209). Nevertheless, cultural chronologies have been developed for the area and, more recently, these have been based on absolute dating rather than relative dating techniques. The period under consideration in this research for Pot Creek Pueblo corresponds to the Northern Rio Grande classification of the Pueblo III Period, or the Coalition Period (Wendorf and Reed 1955), while the equivalent local period is the Talpa Period.
Local chronologies for the Taos area by many scholars have become ever more precise as reliance upon relative dating techniques gave way to absolute dating, especially dendrochronology, archeomagnetic, and radiocarbon dating (Table 2.2). Although there are useful aspects of the Fowles chronology, for this research, I rely on the chronology presented by Crown (1991). Crown interprets dendrochronological data from a number of small pueblo sites in the Taos area and from some portions of the Pot Creek site. Dendrochronology provides a very fine level of detail, but it is not without some interpretation considerations (Dean 1969; 1978a; 1978b; 1988; 1997). The presence or absence of bark upon the wood samples, representing the best indication of cutting dates, and the use-pattern of the wood are just two considerations to include in the overall analysis. I will consider the implications of dendrochronology dating during the Talpa Phase in greater detail in Chapter 5.

2.4 Population Dynamics and Architecture

Population estimation is an important starting point when trying to understand social behaviour in the past. The estimate of the number of people inhabiting a region can provide a background for understanding the forces that shaped social interaction in their community or communities. In this research, population estimates for Pot Creek and the surrounding area of Taos, New Mexico can help to define parameters for migration and movement from both within the region and from more distant locales, community aggregation, and the processes of social integration (Boyer et al. 2010; Cameron 1995; Cordell et al 1994; Cordell et al. 2007; Mills 2011; Ortman and Cameron 2011). The transitory nature of human population movement across the landscape is a pervasive trend throughout the period and across the entire American Southwest and is certainly evident within the Taos region. The first step in understanding these processes is estimating the total population at various points in time.
The transition from a surprisingly small population in the area of the Northern Rio Grande prior to the thirteenth century to one of the most populous regions in the American Southwest at the time of the arrival of the Spanish is one of the most studied and yet elusive questions that has occupied Southwestern archaeologists for many years (Cordell 1979; Cordell 1996:230-233; Kidder 1924; 1927; Crown, Orcutt, and Kohler 1996:188; Ortman 2012; Wendorf 1954; 1956a; 1956b; Wendorf and Reed 1955). Researchers have considered many lines of archaeological evidence for population expansion, yet actual population numbers remain elusive. Defining population histories has been complicated by the need to evaluate numerous population growth processes (Ortman 2012:40-45) including; 1) migration from distant localities, 2) internal population growth, 3) inhabitant movement within a region, and 4) uneven knowledge of archaeological evidence over vast regions.

The estimation of population of a region and of particular sites in the Southwest has been notoriously difficult as population size is not necessarily correlated to site size. There are many processes that affect estimated population size, including contemporaneous use of facilities, room use variation, and asymmetrical abandonment processes (Dean 1969; Graves 1983; Plog 1975). There has been extensive scholarship regarding the estimation of population size in the Taos region and at Pot Creek Pueblo specifically (Arbolino 2004; Crown 1991; Crown et al. 1996; Fowles 2004; Wetherington 1968; Woosley 1986). I will present a summary of the most recent interpretation (Fowles 2004) for the periods leading up to the Talpa Phase and then summarize my interpretations that have been more fully discussed in Chapter 5.

In the next sections, I will summarize the occupation phases within the Rio Grande Del Rancho Valley region. Population estimates and typical architectural trends during each of the periods will be considered.
2.4.1 Developmental Period (A.D. 600-1050)

Evidence of occupation in the Taos region prior to the Valdez period (1050 A.D.) has been sparsely reported in the literature, yet there is some evidence that humans occupied the region either in temporary or seasonal hunting-and-gathering camps or on a more permanent basis (Fowles 2004; Woosley 1986:145-147). Three seasons of field survey established human presence in the Pot Creek region in the Rio Grande del Rancho Valley with the identification of 109 sites dating to the period prior to A.D. 1050 (Woosley 1986:150). These sites were identified by lithic scatters covering broad areas and, significantly, no evidence of ceramics appeared. Fowles (2004:128) has questioned the identification of these sites as Woosley describes no diagnostic lithic points. While the presence of diagnostic points is the gold standard for identification of Developmental sites in the Southwest, the absence of such data does not preclude the likelihood that these sites belong to this period. Woosley (1986) based identification upon lithic composition, primarily obsidian and basalt that was not native to the area. Identification of the seasonal camps was aided by the composition of the tool kit, which was quite extensive and included projectile points, knives, drills, scrapers, cores, and one-handed manos. Woosley (1986) suggests these represent a broad range of domestic tasks, rather than the more specialized, but limited, task of hunting only. The broader range of domestic tasks would have been performed by people living in a base community. The existence of a wide variety of large prey, and in substantial numbers, would also indicate that this area would have been highly desirable for exploitation and occupation.

The presence of petroglyphs in the area has also provided some indication of human presence in the region. Fowles (2004:135-138) has identified extremely weathered petroglyphs that are stylistically different from those that later people produced in the region. While petroglyphs are notoriously difficult to date (Munson 2002; Schaafsma 1986), the weathered
patterning and lichen growth superimposed upon the rock designs would indicate that they are very old. Despite the lack of diagnostic lithics, it seems clear, based upon the accumulation of evidence, that human presence in the Taos Valley region is as early as the Development period.

2.4.2 Valdez Period (A.D. 1050 - 1200)

While other regions in the Northern Rio Grande were beginning to adopt agriculture and more settled, sedentary lifeways during the Pueblo I Period (A.D. 600 - 1000), the area surrounding Pot Creek was late to adopt these strategies. Evidence of sedentary settlement did not occur in the Taos region until the middle of the 11th century A.D., or the beginning of the Valdez Period (A.D. 1050-1200). This late date of transition to a settled life-way may have been influenced by the abundance of hunting and gathering opportunities that the Taos region offered, precluding the need to switch to an agricultural existence.

Fowles (2004:201-208) has argued that the Valdez period should be sub-divided into two periods, consisting of a Valdez Period I (A.D. 950 - 1050) and Valdez Period II (A.D. 1050 - 1190). The proposed two periods are separated by time as well as geographic distance as Valdez Phase I pithouses are clustered in an area about 10 km to the north of the Phase II locations. Boyer (1994b:423-424) also has identified a difference between the two site locations and suggests that two different populations occupied the valley at the same time: one to the north with pit-house architectural structures and one to the south with both pithouses and surface-level structures made of jacal (thin, tightly packed upright posts). Fowles has presented a useful argument, however I rely on the chronology based on Crown’s (1991) interpretation which does not subdivide the era into two periods.
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Talpa</td>
<td>1270 - 1320</td>
<td>28</td>
<td>283-960</td>
<td>352-528</td>
</tr>
<tr>
<td>Pot Creek</td>
<td>1200 - 1270</td>
<td>132</td>
<td>N/A</td>
<td>467-700</td>
</tr>
<tr>
<td>Valdez</td>
<td>1050 - 1200</td>
<td>66</td>
<td>N/A</td>
<td>310-464³</td>
</tr>
</tbody>
</table>

Table 2.3. Summary of number of sites and estimated population in the Rio Grande del Ranchos drainage basin. ¹Based on estimates of 1.5 to 2.5 persons per room (both ground floor and second storey rooms). ²Based on estimated family sizes from 4 to 6 family members per unit. ³Valdez II Period (see Fowles (2004) chronology).

Fowles’ estimate of population during the later of his two Valdez periods is helpful when considering population changes in the area and for comparative purposes for later phases. The population of the region during the Valdez II Period is estimated to be approximately 310 to 464 individuals for families that have from 4 to 6 members (Fowles 2004:915) (Table 2.3).

Numerous investigators have conducted surveys of the region to determine the number of occupied sites during the Valdez Period within the Rio Grande del Rancho Valley (Fowles 2004; Herold 1968; Woosley 1986) and the estimated number of sites in the Valley is approximately 66 (Woosley 1986).

Survey of settlement patterns within the Taos region during this period revealed dispersed habitation with the dominant form of habitation being the pithouse, along with some small above-ground adobe pueblo structures. The pithouses were either circular or rectangular in shape and usually contained a hearth, an ash pit, an associated ventilator shaft, and a deflector to provide air flow for the fires in the hearth (Figure 2.5). The pithouses had wooden posts to support the roof assembly, also made of wood, and contained entranceways that allowed access.
through the roof via a ladder. Fowles (2004:209) argues that the above-ground roomblock structures were much more substantial than previously recognised, often containing three to four rooms, and as many as seven rooms in a structure. The Valdez Period roomblocks were constructed of adobe walls on stone foundations. The above-ground roomblocks may have been used for habitation or storage (Fowles 2004:209-219). In a study of 33 Valdez Period excavated sites Crown (1990) determined that the predominant architectural form in the Taos region during this time was either the isolated pit house or a small cluster of pithouses. Fowles (2004:234-261)
argues that the inhabitants of the region during the Valdez phase were the ancestors of the winter people, or one half of the dichotomous summer/winter ritual division, that would eventually inhabit the modern Pueblo of Taos, New Mexico.

2.4.3 Pot Creek Period (A.D. 1200 - 1270)

The next phase in the occupation sequence in the region began in the early 1200s and featured a shift to small, above-ground pueblo structures containing approximately 10 rooms. The small pueblos often had associated pit structures that may have been either living or socially integrative spaces, or kivas (Woosley 1986). Fowles has again subdivided the Pot Creek Period into two phases, and argues that the earlier phase (A.D. 1200 - 1215) relates to an era of migration into the region, a time of confrontation between new immigrants and interaction with the local population, and settlement in the northern portion of the Rio Grande del Rancho valley. The second phase (A.D 1215 - 1270) represents a time of population movement within the region towards the southern portion of the valley near the convergence of Rio Grande del Rancho and Rito de la Olla, near the site of what would become Pot Creek Pueblo in the Talpa phase. While splitting the Pot Creek Period into two phases appears reasonable (Fowles 2004), the overall trends across the region and period are more pertinent here. The architectural environment of the Pot Creek Period consists of small above-ground pueblo buildings, some of which were multi-storied, and associated subterranean pit structures. Sagebrush Pueblo can be considered a typical Pot Creek Period structure (Figure 2.6). The small adobe pueblo buildings take on the characteristic ‘U’ or ‘F’ shape patterns with the below-surface structure located in the centre of the plaza created by the arms of the building. The total number of ground-floor rooms is
Figure 2.6. Site plan of Sagebrush Pueblo (TA-30/500), consisting of a pit structure and a small above-ground “unit pueblo”. Based on Fowles (2004:376).
approximately 10 per pueblo, with multiple hearths both inside the structures and in the outside areas. The multiple hearths suggest that more than one family may have occupied the structures. Room sizes tend to vary within some of the small pueblos, from 1.4 m² to 14.5 m² (Fowles 2004:374). This suggests that specialization of the rooms based on function was occurring. One pueblo had a room containing two or perhaps three corn-grinding stations representing a move towards more intensive agriculture and a change in economic patterns in the region that is representative of the trend seen at Pot Creek Pueblo in the early 1300s. Fowles (2004:377) has noted that one of the small pueblo settlements (LA 80504) lacked a pit structure facility that dated to this period.

Estimates of the population in the Rio Grande del Rancho drainage basin of approximately 460 - 700 individuals during the Pot Creek Phase are helpful in gaining a general sense of the number of inhabitants in the region during this time (Fowles 2004:915) (Table 2.3). A survey in the region indicated an increase in the number of sites from the Valdez period (66 sites) into the Pot Creek era (132 sites) (Woosley 1986). This trend may not equate directly to increased population as many of the sites could have been abandoned and new ones created with no net increase in population (Gilman and Whalen 2011:48). However, Crown (1990:68) has argued that the tight clustering of dendrochronological dates in the 1230s during the Pot Creek phase indicates that population movement into the area was likely. The short lifespan of adobe structures—approximately 20 years—is a key factor in the analysis of contemporaneous sites (Crown 1991). The overall trend to more sites would indicate that population was likely expanding during this time and expansion could have resulted from either in situ population growth or immigration into the region from more distant locations.
Figure 2. 7. Site plan of Pot Creek Pueblo (TA-1, LA 260) at the end of the Talpa Phase. Dashed lines indicate probable walls. Based on Fowles (2004:406).
2.4.4 Talpa Period (A.D. 1270 - 1320)

The Talpa Period represented a 50-year period of rapid change and movement of inhabitants from the dispersed unit pueblos into a few large communities in the Taos region, Pot Creek Pueblo (TA-1, LA 260) (Wetherington 1968), Picuris Pueblo (LA 127) (Adler and Dick 1999), and possibly Cornfield Taos (LA 259) (Ellis and Brody 1964). Pot Creek is the best preserved example of the aggregation trend in the region and, in its final phase of habitation prior to abandonment in around A.D. 1320, consisted of approximately 350 ground-floor rooms with the vast majority of the rooms having second, and some third, stories above them (Figure 2.7). The Pueblo consisted of a number of roomblocks varying in overall configuration from ‘C’ and ‘U’ shaped buildings to long narrow strings of rooms joined together. One large or ‘Great kiva’ and possibly a second great kiva were present, and most of the remaining roomblocks had their own associated kivas. The final settlement would be considered a ‘big site’ by Southwest American standards. Archaeological research at the site has stretched over many years (Alder 1994; 1995; 1996a; Arbolino 2004; Blumenschein 1956; 1958; Crown 1991; Crown and Kohler 1994; Crown et al. 1996; Fowles 2004; Holschlag 1975; Jeançon 1929; Wetherington 1968; Woosley 1986).

The processes of aggregation and population movement occurred during the Talpa Period within the Rio Grande del Rancho Valley and it is critical to understand them in order to further our quest to understand the built environment and exploit its potential to help us understand social interaction that occurred within the Pot Creek Community. Woosley’s (1986) field survey indicates a marked decline in the number of sites from the Pot Creek Phase to the Talpa phase, from 132 to 28. While it may initially be tempting to see this as an indicator of declining population, the number of sites alone cannot be used as a proxy for the residential population (Crown 1991:310-311). The process of aggregation into much larger communities can account
for the decrease in number of sites from the Pot Creek to Talpa phases while maintaining or even increasing the total population in the region. There have been numerous attempts by scholars to determine the population of the region and of Pot Creek Pueblo itself during the Talpa period (Arbolino 2001; Bernardini and Fowles 2011; Crown 1991; Crown and Kohler 1994; Crown et al. 1996; Holschlag 1975).

Archaeological population estimation is not an exact science and requires many assumptions to form an understanding of the demographics. Crown’s (1991) study of Pot Creek Pueblo considered room use-life and site growth dynamics to infer population size. Crown argues that Pot Creek Pueblo had a relatively stable population until the final decade of occupation at the site, when a large increase in population was, ultimately, followed by a rapid decline in population and ultimate abandonment in the time after 1320. Crown’s (1991) efforts to estimate the population at Pot Creek were hampered by many unknown components of the site at the time of her analysis, where subsequent excavations revealed large portions of the community that were not available to Crown for her analysis.

Further research estimated the population of Pot Creek based on estimates of inhabitants in the entire Rio Grande del Rancho Valley region prior to the Talpa Period, on the number of ground-floor rooms at Pot Creek, an estimate of the number of floors in the roomblocks, the total covered roof area, and the number of people living in family units for each of these components (Arbolino 2001). Arbolino benefits from the excavation work performed in the field seasons 1993, 1994, and 1995 (Adler 1994, 1995, 1996a) which revealed several previously unknown roomblocks (Roomblocks 7, 8 and 9). Arbolino (2001:224) bases her calculations upon estimates of the number of rooms in use at three modern Pueblo communities in the Rio Grande region and estimates the population of Pot Creek Pueblo during the Talpa Period to be in a range from 283 to 960 (Table 2.3). Arbolino’s model may underestimate the total population as the number of
indigenous peoples declined dramatically after contact with the Spanish in the Northern Rio Grande Region in the late 1500s, skewing the assumptions for the number of rooms in use towards the low end of the spectrum. While the magnitude of the Arbolino’s population estimates may be low, it is likely that the population trends reflect the growth during the period. The main conclusion that Arbolino (2001) reaches is that rapid increase in the population growth represents migration into the region rather than in situ expansion.

As a further example of the complexities surrounding population demographics Fowles (2004:889-915) revisits the issue of population estimation for the region and reaches very different conclusions. Fowles (2004:913) argues that Arbolino’s estimates for the number of people per room in the smaller unit pueblos during the Pot Creek Phase are too high on the basis of the actual number of interior hearths in those buildings. Fowles (2004:915) follows this line of reasoning to revise estimates of the larger community of Pot Creek during the Talpa Period, where he concludes that the total population of the region declined from a range of 467 to 700 during the Pot Creek Period, to a range of 352 to 528 in the Talpa Period (Table 2.3). Fowles’ analysis leads him to conclude that there was likely a decline in population during the Talpa Period when aggregation from the Rio Grande del Rancho Valley into Pot Creek Pueblo occurred. Fowles considers the number of people in a unit pueblo (occurring during the Pot Creek Period) and translates that estimate into the number of people per room (after aggregation at Pot Creek Pueblo, during the Talpa Period) to estimate population. This method does not consider the changing nature of the physical configuration of the buildings at Pot Creek and possible differences in household and social configurations that may have occurred during the Talpa Phase. The result could be an underestimation of the total population at Pot Creek Pueblo. Fowles (2004:915) does admit that a large number of assumptions are built into his estimates of population for the region.
<table>
<thead>
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<th>Construction Episodes (All dates A.D.)</th>
<th>Estimated Population</th>
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<tr>
<td></td>
<td>1.5 people per room</td>
</tr>
<tr>
<td>1270 - 1273</td>
<td>35</td>
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<tr>
<td>1274 - 1277</td>
<td>134</td>
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<td>1280 - 1299</td>
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<tr>
<td>1300 - 1320</td>
<td>336</td>
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</tbody>
</table>

Table 2.4. Population estimates for Pot Creek Pueblo based on construction episodes. Estimates based on ranges of 1.5, 2.0 and 2.5 people per occupied room. Note: time intervals are of unequal duration.

The foregoing discussion points out the complexity of the issues and the array of assumptions that need to be considered when making population estimates in the Southwest. I revisit population growth at Pot Creek in Section 5.6, after I consider the construction sequence of the Pueblo in detail (Table 2.4). I estimate population based on my interpretation of construction activity and related habitation episodes at the site, and consider both ground floor and upper story room counts. I follow Crown’s (1991) analysis of an average 19 year use-life for the buildings and a 29% room occupation rate for older rooms. Population estimates are calculated based on the number of people per room reflecting occupancy rates of modern ethnographic pueblos. This interpretation results in a trend of increasing population until the latter two periods of occupation. The actual number of people inhabiting the site may have increased, or actually declined, depending on the population density (or the number of people per room) and the degree of population nucleation in the densely situated architectural arrangement of the final two occupation periods. In Chapter 5, I discuss the implications of population demographics in further detail.
2.4.5 Vadito Period (A.D. 1320 – 1490)

After the abandonment of Pot Creek Pueblo sometime in the period after A.D. 1320 there appeared only 2 recorded large sites in the Taos region, Picuris Pueblo (Alder and Dick 1999), located about 25 km to the southwest of Pot Creek Pueblo and Cornfield Taos (Ellis and Brody 1964), located on the lands of the modern pueblo of Taos 20 km to the north. There may have been an additional ten sites dating from this period across the entire Taos region (Ellis and Brody 1964:325), yet Picuris is the only site where extensive research has been conducted (Dick et al. 1999:52). At Picuris many of the pre-1320 buildings were demolished and replaced by larger roomblocks and many small kivas were constructed. Even larger roomblocks were constructed at the site after A. D. 1350 and the site has been almost continuously occupied through to the present (Dick et al. 1999:52). At the Cornfield Taos site minimal excavation revealed stratigraphic occupation layers, but little was revealed in the way of architecture. The oldest layers were dated by ceramic analysis to A. D. 1300 - 1350. The Cornfield site was abandoned in approximately A. D. 1400 and the inhabitants moved several hundred meters to the site where Taos Pueblo now stands. Taos Pueblo is still occupied today. The Rio Grande del Rancho Valley was apparently not occupied after the abandonment of Pot Creek Pueblo during the Vadito Phase.

2.5 Conclusion

A brief overview of environmental conditions that were present in the past helps us to understand the opportunities and challenges that faced past inhabitants. While I do not advocate a direct link between environment and social behaviour, or an environmental deterministic model, there can be no doubt that environmental conditions would have had an impact upon the
life-ways of the inhabitants in the region to some extent. The environmental summary indicates that altitude-related environmental constraints, such as the number of frost-free days and limited precipitation, would have provided constraints on agriculture through the limited availability of fields for the agriculture of corn. This would have a direct impact upon farming and settlement within the region. The dendroclimatic data support some of the population trends that have been outlined above.

The cultural history of the region surrounding Pot Creek and the larger region of the Taos area allows for an overview of the cultural sequence of the area. Indicators of human occupation are revealed in the history of architectural change and the shifting population in the region. Organization of social structure as reflected in both ritual and domestic space underwent dramatic change through the period. The 150-year Valdez Period, with geographically dispersed pithouse structures, and with some evidence of very small above-ground adobe structures, gave way to the Pot Creek era of more tightly clustered small unit pueblos. The unit pueblos were associated with socially integrative structures, or kivas, and tended towards specialized rooms distinguished by function, with rooms for domestic occupation containing hearths, storage facilities, and spaces dedicated to corn grinding. Aggregation into the large pueblo of Pot Creek proclaimed one of the major social trends of the Talpa Period. The shift to the large roomblock buildings indicates that a large number of individuals lived together within the same community and possibly indicates a greater number of extended families within the same roomblock. Social structures and social interaction would have been vastly different in the large community of Pot Creek as compared to the small unit pueblos of the previous era.

The estimation of population trends throughout the period provides an important source of information for the development of our understanding of social processes in the region. Overall population during the Valdez pithouse era appears to be quite low, while several
estimates of population indicate that the Pot Creek Period witnessed a rise in population. There is some controversy in the literature regarding the overall population of Pot Creek Pueblo in the Talpa period, with arguments for both increases and declines in population when compared to the unit pueblo era of the Pot Creek Period. It is sufficient to say at this point that numerous assumptions are necessary in order to estimate the population of the community and the more explicit the assumptions, the more we are able to test against data.

The background presented above regarding the environment, population trends, and architectural history that were present throughout the region surrounding Pot Creek Pueblo represents a very brief summary of the many years of archaeological research in the region. It would be remiss not to mention the importance of the contributions of past scholars that made much of the research in this project possible. In Chapter 5 I will turn to the examination of the construction sequence of Pot Creek Pueblo during the Talpa period in considerable detail. While Crown (1991) performed a thorough analysis of the pueblo, there has been significant subsequent archaeological investigation at that site that has revealed many more roomblocks and plaza areas than were evident at the time of Crown’s research in 1991. Re-examination of the entire sequence is necessary to take into account the new data as well as to interrogate some of the assumptions that were used in Crown’s analysis. In the next two chapters, I will introduce theory and methods that will be used for the analysis portion of the research project.
Chapter 3

Nonverbal Communication in the Built Environment

Introduction

The built environment and social interaction are intertwined in a complex web of mutual and reciprocal actions and influences and, as Preziosi (1979:15 italics in original) questions, “In what ways do built forms mark the presence of human individuals and groups, and how do made environments serve as data-banks for sociocultural information?” As I discussed in Chapter 1, Pred contends that designing, planning, and building of fixed structures are related to the social structures of the community and, equally as critical, are part of the lived social experiences that are afforded by those physical structures. Giddens has a less thorough discussion of the spatial characteristics of social interaction, yet still believes that space is an important element in the structuring process of social production and reproduction. The task of understanding the entangled web of social interaction and the surrounding environment is a challenge for modern social researchers and is an even more complicated assignment for the study of past societies where archaeological data sets are often incomplete. The relationship between the built environment and interactions between the humans that inhabit the structures is a constantly changing dynamic one (Habraken 1998:28) presenting challenges to the research agenda.
Research into social interaction and the built environment has been the subject of many disciplines over the years, with research occurring in anthropology, sociology, psychology (in the field of environment behavior studies), geography, urban planning, and architecture. Archaeology has the advantage of benefitting from a multi-disciplinary approach from across all of these disciplines. In this Chapter, I outlined a mixed approach to method and theory that will help to illuminate the often unacknowledged effects of the built environment upon social interaction that occurred within plaza areas associated with buildings at Pot Creek Pueblo.

Any discussion of the built environment and social interaction must be grounded in theory in order to fully understand the life-ways of the past, and should be grounded in what theory does and why we need theory. We need theory in three distinct ways. First, theories provide a framework to explain and interpret data and are broad in abstraction and scope. Second, theories enable us to see data in alternative ways, which are equal representations until tested by data. And third, theories, and in particular middle-range theories, imply methodology (Ellen 2010:390-391). The key component here is that theories can vary depending upon their level of claim and they can vary based upon spatial-temporal scope and degree of abstraction, leading to a hierarchy of theoretical levels. Theory encompasses a full and overlapping range, from claims about universal explanations of human behavior, to explanations of more proximate causes of social systems, and through to claims that enlighten us about particular situations (Ellen 2010:394). I believe that interacting with and applying theories from as full a spectrum as possible is the most appropriate approach in order to ask and understand the difficult questions that arise when considering the interface between the built environment and human social interaction in the past.

There are some common similarities between the classifications of urban environments, such as cities, and settlements the size of Pot Creek, thereby allowing for similar analytical
procedures to be used at both scales. Inhabitants of small, village-sized communities need to confront many similar social interaction and spatial issues as communities in larger urban settings, albeit on a smaller scale. For example, issues of what areas are common spaces, what is private and what is public, and who is authorized to use certain spaces present common themes for both urban and smaller villages. There exists a rich body of method and theory developed by researchers in the study of urban environments; both ancient (Ashmore 2002; Fisher 2007; 2009; 2014; Fletcher 1986; 1989; 1995; Joyce 2009a; 2009b; Smith 2007; 2009; 2011) and modern urban environments have come under scrutiny. The introduction of theories and methods from urban research into the scale of village settlements, allows me to delve into some of the methods and techniques that have been primarily developed in the study of urban settings. I believe that many of the urban-based approaches are relevant to smaller communities and should be expanded into this scale of settlement, such as the community of Pot Creek Pueblo.

In this chapter, I will introduce Merton’s (1949) theories of the middle-range, which are far broader in scope than Binford’s (1977) middle-range theory about site formation processes. Merton believes that there must be a level of theory that acts between the level of the grand social theories and the theories used to explain day-to-day research data. For example, within archaeology, the theories and methods surrounding excavation strategy would be considered a day-to-day group of theories. Urban morphology, or the methods used to study the change in a built environment over time, is an example of a theory interacting in the middle-range. I will outline a combination of approaches that focuses primarily upon a series of inter-related theories of social interaction within a built environment, which intersect at the point of visual connection between people within the spatial milieu. Visually connected spatial areas highlight potential social interaction which forms the fundamental thread among the theories and provides the platform for the methodology for this research.
3.1 Middle-Range Theories for the Built Environment

Theoretical approaches to the archaeological record for ancient urban cities and settlements have run the full gamut from detailed, thick description at the empirical end of the theoretical spectrum to studies performed with respect to high-level sociological theory (Smith 2011:167-168). Gates (2003) provided a descriptive account of numerous ancient urban sites in the Near East with the focus upon the form of the cities and their chronology, with little regard to the social life that existed within the cities and little interaction with theory. At the opposite end of the spectrum numerous, archaeological studies have invoked high-level overarching or ‘grand’ theoretical perspectives, which attempt to describe the social world from abstract, philosophical viewpoints (e.g. Ashmore 2002; Joyce 2009b). Smith (2011) advocates the use of theories that are between these two diverse poles of the theoretical spectrum.

Middle-range theories have been used within sociology for over 60 years, but the concept within archaeology is almost synonymously associated with Binford (1977). Binford’s use of middle-range theory is focused upon the use of ethnographic analogy to model and enlighten our understanding of site formation processes. Binford interpreted the middle-range as being placed between the static and dynamic processes of archaeology (Smith 2011:169). Yet the sociological use of theories of the middle-range extend far beyond this limited application. Robert K. Merton (1949:448) coined the term middle-range and defined middle-range theories as:

“theories that lie between the minor but necessary working hypotheses that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory that will explain all the observed uniformities of social behavior, social organization, and social change”.

Post processualists, such as Hodder (1982:5-6), have argued strongly against Binford’s concepts about middle-range theory (i.e. Binford’s notion of site formation processes) as they believe that
there is no separation or levels in theory. Part of the confusion that surrounds middle-range theory relates to the categorization of the lower end of the continuum as empirical generalizations (Raab and Goodyear 1984:257) as opposed to empirical data. The confusion over the definition of middle-range theory has been perpetuated within archaeology (Johnson 2010:51-53; Varien and Ortman 2005:133-135). In contrast, Merton (1949:448) clearly indicates that middle-range theories are abstractions, but are close enough to observed data to allow for empirical testing, unlike general theories of social systems that are too remote from social behavior and organization to allow testing against observed details.

Smith (2011) has strongly argued for the need to introduce middle-range theories in the discussion of ancient urban environments. There is a need to progress beyond detailed descriptive accounts of ancient urban environments on the one hand, and the practice of citing high-level social theories that are difficult to test with archaeological data on the other hand. The middle-range theories and methodologies have been overlooked by archaeologists in the past, and I argue that there is a place for these mid-level theories to provide a bridge between ‘grand’ social theories and the minute data that archaeologists want to interpret. Yet the high-level theories are also necessary in order to perform as complete an analysis as possible. Fisher’s (2009) research into the interior spaces of Late Bronze Age buildings in Ancient Cyprus uses an integrated approach to understand the power dynamics being played out within these ancient buildings. Both high- and mid-level theory need to be employed to expand the questions that are being asked of the data of ancient urban environments.

In this research I use multiple levels of theory including ‘grand’ theory, such as discussed in Chapter 1, as well as a number of middle-range theories, as outlined below. The mid-range theories that are employed in this research include: 1) urban morphology (Smith 2011:167), or a mid-level theory that moves well beyond descriptive accounts to include a historical perspective
of site growth and development, and 2) a taskscape approach to understand social interaction within the spatial environment of corn-grinding locations, and 3) environment-behaviour theory which attempts to understand the actions and interactions of people within a spatial environment. These mid-range theories will be discussed more thoroughly below.

3.1.2 Urban Morphology: Middle-Range Theory of Diachronic Change

Smith (2011:176) describes ‘urban morphology’ as a theoretical approach that has been used within the field of urban planning and historical geography to better understand the development of town plans and changes through time. The ‘townscape’ concept has been developed to study town layouts, building materials and fabrics, and the uses of buildings and open spaces. M.R.G. Conzen (1960) introduces urban morphology by studying the detailed morphological development of town plans of Alnwick, England. The close tracing of change in development patterns through time allowed the creation of typologies of morphological development. Urban morphology has been taken up in recent research in the areas of micro-morphology within a particular house or land plot and through the analysis of neighbour effects together with density (Whitehand 2001:107). Urban morphology has also been studied in the United States with attention to town planning and systematic morphological structure and character of American cities (M. P. Conzen 2001).

The trend to study change in urban forms through time is in direct opposition to research that tends to favour the final form or configuration of a city or region. Smith (2009:114) discusses the trend in scholarship to focus upon the final or most recent period of occupation. Both urban geographers and some archaeologists have followed this path where the most recent forms of the urban environment are given preferential treatment at the expense of prior periods
(Smith 2009:114). Archaeologists are in a unique position to delve deeply into the development of urban forms through time.

In Chapter 5, I will revisit the construction sequence for Pot Creek Pueblo using the middle-range theory of urban morphology to reconstruct the sequence of building the community. Detailed analysis of the site development through time reveals not only the building sequence, but allows us to understand patterns of human social interaction throughout the succession of phases of development and occupation. The series of construction episodes reveal how the structure of the community and the associated social interaction has changed through time. An analysis of change in the physical structure of the site and related social interaction within and between roomblock neighbourhoods follows closely with the Conzensian approach to urban morphology.

3.1.3 Taskscapes: Middle-Range Theory for Examining Activity Areas

A taskcape approach considers not just the activities being performed at one location but also the visual scene surrounding that location. Taskscapes can be used to understand how the built environment provides cues for users to inform them of expected behaviour. Indicators or signals are built into the physical surroundings to let people know the context for social interaction. The built environment, by providing a limited range of options, provides redundant cues and meanings that people use to interpret and to help them act appropriately. A taskcape method can be used to link high level social theory to the abundant data found within an archaeological context of an ancient site and more specifically to social interaction surrounding activity areas.

Ingold (2000) has highlighted the importance of space and the actions surrounding tasks or taskscapes within his argument of the dwelling perspective. The taskcape or dwelling
approach focuses upon “the forms that people build, whether in the imagination or on the
ground, [and which] arise in the current of their involved activity, in the specific relational
contexts of their practical engagement with their surroundings” (Ingold 2000:186). The taskscape
takes into account temporality and space and combines the various experiences and related
activities of those who participate in the process of social life within a given spatial context and
gives layers of significance to the surrounding location (Ingold 2000). The interface between the
physical environment and individual spatial activity is captured within this dwelling perspective
and parallels Pred’s (1981; 1984; 1986) ideas about space becoming meaningful through the
experience and interaction that transforms space. Ingold takes these concepts to a more concrete
level of spatial analysis with the concept of the taskscape. The taskscape can be identified with
temporally related social activities since people while performing their tasks also attend to one
another. The visual panorama surrounding a task or activity allows for the viewing of social
activity in the region and, while simultaneously attending to tasks in a given space, create links
between space, objects, and human experience.

While Ingold focuses his argument on the scale of landscape, I argue that these concepts
are relevant to the smaller scale of the settlement or even the household. Setha Low’s (2000) *On
the Plaza: The Politics of Public Space and Culture* uses a derivative of the taskscape approach
in a modern context as she considers social interaction in plazas in Central America. She found
that people performing certain activities at self-designated spots in the plaza areas, such as shoe
shine boys and old men playing chess, were also very aware and attentive to the social activity as
it was unfolding in the plaza. Julia Hendon (2010) uses a dwelling or taskscape perspective to
analyse households and memory in Mesoamerica. The repetitive tasks of weaving and cooking
could be argued to provide an opportunity for the surrounding visual taskscape to create social
memory. These two examples highlight the relevance of visual sensory perception in connection with task-specific experience in dwelling places.

Archaeology is well positioned to take advantage of the study of taskscapes through the material nature of our data sets. Features and objects imbedded within the taskscape present opportunities to study and understand the meaning of the spatial environment through the perspective of viewing the surroundings from a particular taskscape or activity area. This provides a unique opening for archaeology to consider the relationships between objects, the spatial environment, and social interactions that are possible for individuals using the space. In chapter 7, I use a taskscape approach to analyze the visual array surrounding corn grinding at Pot Creek Pueblo. While attending to the task of corn grinding, depending where the corn grinding is taking place within the built environment, the women could visually interact with others in near-by plazas, notice who is entering or leaving the kivas, and attend to children. The taskscapes that I create are imagined visual panoramas surrounding the task of corn grinding where the built environment affords different degrees of social interaction.

3.2 Nonverbal Communication: Middle-Range Theories for Social and Spatial Interaction

The group of middle-range theories outlined here all intersect at the locus of the built environment, generating nonverbal communication that is based upon the transmission of primarily visual information. Architect Amos Rapoport (1969, 1980, 1982), one of the founders of the field of environment-behaviour studies (EBS), states that the built environment promotes or impedes social interaction among inhabitants. Nonverbal communication relates to how people, through their gestures, appearance, and related artefacts (including buildings), transmit information (Rapoport 1982:48-49). Rapoport (1982:49) argues that one channel of nonverbal information transmission is through the built environment. The built environment produces
nonverbal cues for behavior as well as aiding in other forms of communication, or co-action, such as aiding forms of production of meaning and social interaction. In this type of communication the visual aspect is paramount as the ability to decode the messages conveyed by the buildings is critical (Preziosi 1979:15). The primarily visual nonverbal cues are received, decoded, and integrated into social interaction. The spatial environment plays a key role in encouraging nonverbal communication by affording and/or disallowing social encounters. The spatial distancing of inhabitants are structured in ways influenced by the built environment, contributing to the genres of communication that are possible through the creation of personal, territorial, public, and private spaces.

The main form of communication for the inhabitants of Pot Creek Pueblo occurred during face-to-face visual encounters modified by spatial architecture. The inhabitants would have been influenced by the co-presence of others, the spatial distances that mitigated the form of communication available to the inhabitants, and the ability to decode the cues of the built environment. The spatial environment provided areas where privacy and territoriality were paramount and allowed for certain socially defined forms of behavior to occur. It can be argued that the buildings and the spatial layout of the community acted in concert to produce meaning for the inhabitants of the community.

3.2.1 Meaning in the Built Environment

The built environment can be said to create meaning through initial affective reactions that people have when they come into contact with the built environment. These responses are produced by meanings of the environments and the particular affects that they produce in people (Rapoport 1982:14). Meanings of the built environment can develop from personal and social identities of the people using the buildings, as well as through ritual and metaphorical
connections (Lawrence and Low 1990:492) and from peoples’ interactions with these environments more generally. Meaning within a built environment occurs through the social interaction of people and that environment. One avenue within the study of the built environment has developed into a broad concern with social aspects of the built environment, including the social forces that produce the built environment and the social reproduction within that space (Lawrence and Low 1990:476-481). Research on social reproduction within the built environment has focused upon the spatial dimensions of nonverbal communication and explored the meaning of the built forms (Lawrence and Low 1990:476). This approach has been developed within archaeology by Fisher (2009; 2014) through an integrated approach to the study of potential social dynamics of interaction within both public and private spaces through the use of nonverbal communication in the built environment.

Meaning within a spatial environment can be transmitted in a number of ways and people react to an environment in terms of the meaning that environment has for them. In other words, there has to be a message communicated, received, and understood in order to behave as an effective pathway of communication. Messages and meanings can be transmitted by people in a number of ways, including verbally, vocally, and nonverbally. All three modes of communication may act together to transmit similar messages, reinforcing the message, or contradict one another resulting in a weakened message (Hall 1966:49). Nonverbal communication is perceived mainly through visual transmission pathways and relates to some message or communication that is transmitted without the use of words either between individuals, groups of people, or between objects and people. The built environment performs the function of nonverbal communication by providing cues for behaviour and also aids in other forms of meaning transmission, interaction, and communication.

“The environment acts on behavior by providing cues whereby people judge or interpret the social context or situation and act accordingly. In other words, it is the social
situation that influences people’s behavior, but it is the physical environment that provides the cues” (Rapoport 1982:57 italics in original).

The placement of buildings and the associated open spaces provide a background to everyday life as well as performance spaces. Spatiality contributes to people’s understanding of their identities and their relations with others. Differences in power can emerge through the control of space, material resources, time, and labour, and become routine through daily and periodic action (Hendon 2010). The subdivision of social space into public and private areas affects individuals’ mental states and experiences, regulates their behaviour, and superimposes long-lasting social structures onto human societies (Madanipour 2003).

The linkage of patterns of social behaviour, based upon activity areas, to spatial organization is an important theoretical approach for this research. Activity areas, when applied to the built environment, include bounded or partitioned spaces associated with particular social groups and their patterns of behaviour (Lawrence and Low 1990:462). These areas may be attached to specific functions (e.g., cooking or sleeping) and may be identified with social units to which they are linked (Lawrence and Low 1990:463). The fundamental question of what influences architectural design and the use of space and how each is related to the other underlies the structure of this research. From an environment-behaviour approach, Kent (1990a; 1990b) argues that behaviour and cultural organization determine architectural form. Kent (1990a:5; 1990b:127) argues that the organization of space can, therefore, serve as a predictor of social complexity, particularly with respect to social reproduction within partitioned or segmentation of the built environment.

3.2.2 Social Interaction within Physical Spaces
Social Encounter in Spatial Environments

Sociologist Erving Goffman (1956; 1961; 1963; 1967; 1974; 1971) discussed the importance of social encounters and behaviours within the social and physical structures that govern these encounters. Social interaction is governed by the awareness of others, or co-presence, within a given time-space location, as all social interaction occurs within a physical space. Giddens (1984:118) has also emphasized the need for presence, or presence availability, within a given spatial environment. Thus the areas of perception can be defined through co-presence, which is a condition whereby persons must sense that they are close enough to others to be perceived within a space (Goffman 1963:17). The metaphor of a dramatic stage was taken up in anthropology by Gregor (1974) and Roberts and Gregor (1971) with their discussion of privacy among the Mehinacu in Brazil (see also discussion of privacy and territoriality below) and within archaeology by Inomata (2006) in his discussion of political performance in plazas of the Maya.

Goffman (1974) pushes the concepts of social interaction in physical spaces further in Frame Analysis, and discusses the idea of frames as a way to organize experiences through the composition of visual images that force us to think in a particular way (Hancock and Garner 2011:326). A physical setting can act as a frame for a related social behaviour. The frame defines, organizes, and excludes what does not make sense and is, ultimately, a social construction that both enables and constrains an individual.

The idea of performativity within the presence of others is a useful concept in the development of a theory of social interaction within the built environment, but underlying that concept is the primary mode of social interaction, which is the visual connection between people. Goffman (1963:17) contends that the awareness of others within a spatial environment is
heightened through face-to-face interaction, or face engagement, and the ability to facilitate information flow and feedback is strengthened, as

“sight begins to take on an added and special role. Each individual can see that he is being experienced in some way, and he will guide at least some of his conduct according to the perceived identity and initial response of his audience” (Goffman 1963:16, italics in original).

The communicative behaviour that is facilitated through seeing others in a social situation is filtered through two intensities of awareness: 1) unfocused interaction, or the situation where one gleans information from merely glancing at another person, or the minimal communication from being aware that an individual is present, and 2) focused interaction, or communication gleaned from a more active awareness of another person, perhaps during a conversation (Goffman 1963:24). While Goffman refers to the face-to-face interactions as face engagement, Giddens refers to similar interactions as encounters. The importance of encounters is emphasized in the repetitive nature of these events in the production of social life, as “encounters are formed and reformed in the durée of daily existence” (Giddens 1984:72). The repetition of these daily routine and momentary encounters creates a link between the fleeting social encounter and social reproduction and more permanent social institutions (Giddens 1984:72).

The settings of social encounters are also of concern to Goffman (1963:66) (and used by Giddens) as he contends that regions of performance are bounded by areas of visual perception. ‘Front regions’ are areas where the actors are aware of the impressions that are being imparted upon others, and where the actor is attempting to maintain and embody certain performance standards (Goffman 1963:67). ‘Back regions’ are private areas where little observation and interpretation by others of the wider social community occur. The concept of front and back regions of performance of social activity supports the ideas of private and public spaces and territoriality as argued by Altman (1975; 1977), see the discussion below. The settings of performance (or the built environment) frames of analysis, and the intensities of visual attention
are related to the co-presence of other people and become factors in explaining social behaviour within the spatial environment.

Privacy, Personal Space, and Territoriality

Social performance within a spatial environment, including Goffman’s ideas about front and back stage areas, supports a perspective concerning the many issues surrounding privacy and territoriality. Fletcher (1986; 1989; 1995) argues that there are connections between settlement size, population density, and social stress arising from the frequency of social interactions. He believes that as communities grow in size they pass thresholds where communication technology and/or architectural configurations act to address social interaction. Spatial privacy is one mechanism that can be used to manage social encounters and is intimately linked to the spatial environment and social behavior through ideas of personal space, territory and crowding.

Generic notions of privacy occur in every culture but distinct systems exist to define and regulate privacy from both within cultures and between cultures (Altman 1975; 1977). Altman (1975:18, italics in original) defined privacy as a “selective control of access to the self or to one’s group”. Within this definition there are a number of important concepts, such as: 1) there could be a variety of social units, for example an individual or a group, 2) privacy is a bi-directional process, and 3) selective control implies that privacy can change over time and with different circumstances.

One aspect of privacy relates to the establishment of personal space, which follows Hall’s ideas of proxemics, and is used to regulate interpersonal interactions in order to achieve the desired level of privacy. Personal space can vary depending on the age, sex, social status and other cultural determinants of the individual. Privacy can be at the level of the individual or of a group, where a group lays claim to physical space; for example, a family within a house or a group of people within a neighbourhood.
A second major function of privacy is the regulation of interaction within the social environment (Altman 1977:46), which can extend to the control over certain physically defined territories. The mechanisms that establish privacy that are most relevant here are taken from cues provided by the built environment. Territorial behavior involves the personalization or marking of a place and the communication that the space is ‘owned’ by a person or group. Altman (1977:112) contends that territories can be subdivided into two categories. The first category are primary territories and are used exclusively by an individual or a group, where the space is clearly identified as theirs by others, and is central to the day-to-day lives of the group (Altman 1977:112). Goffman (1961:206) establishes that occasionally inmates of a mental hospital had personal territories where a private sleeping room could be said to be owned by the inmate and where the patient could control access of others. Secondary territories are the second category of territoriality and are less central, pervasive, and exclusive than primary territories (Altman 1977:114). Some secondary territories have a blend of public and semi-public availability with some control by occupants, or can be a bridge between primary territories and the completely free use of public territories. Secondary territories, or semi-public areas, often have unclear rules regarding their use and are susceptible to encroachment by others. An example of a secondary territory is the area outside of one’s house (the primary territory). The outside of the house can become susceptible to vandalism since this area may not be easily watched by the occupants of the house. Thus, the occupants of the house do not have control over the outside or secondary territory (Altman 1977:116). The concept of primary and secondary territories allows for the analysis of physical spaces and the social engagement of the people within those spaces. Visual connectivity within the spatial environment plays a factor in the social activities that are condoned within those spaces.
Communities of Practice

The theoretical concept of communities of practice began as a way to understand the processes of learning and knowledge generation based on legitimate, peripheral participation in a community of practice, where culture, history, and the social world were interrelated constituents (Lave 1991:63-64) and allows us to investigate social interaction in spatial environments of small, face-to-face communities. The parameters of communities of practice include sustained mutual relationships, shared ways of doing things, participants’ agreement on who belongs, specific tools and representations, and local lore and shared stories (Wenger 1998:125-126) and corresponds to Giddens notions of social production and reproduction through repetitive practice. The intersection of physical space and non-verbal communication during social interaction occurs at many nodes and I focus the scalar lens to examine the spatial environment of corn-grinding facilities in the late phase of occupation at Pot Creek. Female work groups consisting of on-going tasks, such as corn grinding, allow dissemination of knowledge through demonstration using verbal, visual, and physical cues, within a spatial environment.

I will now turn to the study of perception and visibility in order to understand how the mechanisms of vision contributes to the creation of social interaction and meaning within the built environment.

3.2.3 Perception and Visibility in Spatial Environments

The connection of social interaction to the spatial environment, through the process of the awareness of co-presence of others, is an essential building block in this argument, but it is important to look at an even finer grain of detail to understand the mechanisms of social interaction in space. Individuals use their perceptual system of the senses in order to perceive activities and interactions that are being played out in the surrounding environment. Sørensen
(2004:154) argues that the role of perception is a tremendously interesting question, one where the experiencing subject contributes to meaning through bodily transitions, movements, and awareness of others. This focus upon the individual as producing meaning is only part of the account as the physical environment also contributes to the production of meaning and difference.

Ecological psychologist James J. Gibson (1950; 1969; 1979; 2002) argues that the environment itself is a source of stimulation, and that all five senses convey information about the world. Aural receptors carry information about space through the mechanism of sound waves reverberating from distant objects and reflecting back to the listener. The sense of touch can provide information about the hardness of an object, the roughness of the surface a wall, and the temperature of the ambient air surrounding the individual. The sense of taste can be used to investigate the spatial environment as every young child would attest as they taste their surroundings through oral investigations. The sense of smell is powerful and connected to certain memories where the odours of certain foods evoke a sense of comfort and safety, while others suggest much more unpleasant recollections.

But the most powerful sense of all is the sense of vision. Humans have evolved the ability to respond to very fine degrees of differences in patterns and textures of ambient light and to be able to judge distances with accuracy (Gibson 1969:13).

“Vision is at its simplest when it fulfills its function: not when it meets the criterion of one-to-one projective correspondence in geometry. Its function is to help the organism cope with the environment” (Gibson 1979:12).

Gibson (1979; 2002) argues that an occupant in an environment has an ecological relationship with that space and can be studied through affordances representing those relationships. Through the direct perception of the environment, the visual system can detect and explore information. Perception refers to any experience in the environment surrounding the body that is detected via
visual awareness. Through vision, one is aware not only of the environment surrounding the
body, but is also aware of the self. The motion of a body compared to a stationary environment
can be detected visually, and the stationary environment can be detected visually by a body in
motion (Gibson 2002:77-78). Gibson (1979:85) argues that direct perception allows us to
understand the world around us based upon our experience in the world, a reflection of the
phenomenology philosophers. Gibson states that we do not see patches of light and dark and
familiar colours, but rather entire objects that we interpret as familiar things that can afford
certain behaviours, for example chairs, tables, and other people.

There are a number of important points discussed by Gibson (1979) that pertain to the
theoretical stance of this research. He stresses that the purpose of perception was not to convert
the physical world into a meaningful environment nor was there an inner replica of a scene in our
heads (Pylyshyn 2003; 2007:121), but rather the purpose of perception was to help observers
become more aware of their environment (Reed 1988:280). Gibson focuses upon three concepts
in his ecological approach. First, Gibson (1979:13) stresses persistence and change, replacing
scientific notions of space, time, and energy transfer. In contrast to the scientific definition of
conservation of energy objects can and do go out of existence in the ecological world. For
example, a block of ice melts and turns into a puddle of water, this would be considered a change
in the state of matter in the physical science whelm, while in an ecological approach the ice
would be considered destroyed as the object no longer exists. The later explanation is more
relevant to the behaviour of humans.

The second key element in Gibson’s theory relates to the concept of information
specifying its source or location in the environment (Reed 1988:280) and is related to Gibson’s
(1979:65) ideas of the ambient optic array. An ambient optic array radiates out from a position in
ecological space that is occupied by an observer and allows that observer to obtain information regarding objects of other people and their locations in the environment. This point of observation (i.e. from the observer) may be fixed or moving relative to the environment (Figure 3.1). The visual field that the observer encounters delineates angles of intercept that are determined by the persistent environment. Thus, while objects may remain fixed in certain environments the ambient optic array of the observer would be altered as the observer moves in the spatial environment. This is a key concept as people would have been moving around in the community of Pot Creek Pueblo and, thus, the observed views would have changed.

And finally, the third important concept that Gibson articulates is the notion that the environment consists of affordances for action, or offerings that can be perceived and used by observers (Reed 1988:280). Gibson (1979:127) defines affordance as what the environment
“offers to the animal, what it provides or furnishes, either for good or ill”. For example, a flat, rigid, ground surface affords support to an animal, either for sitting, standing, or for walking on. The surface of a swamp would afford much different characteristics to heavy individuals such as humans. Different categories of places can afford different kinds of behaviours; for example, hiding places afford concealment (Gibson 1979:135-136). The possibilities of the environment and the way of life of an animal go together, or put another way, the environment can constrain or offer opportunities for what an animal can do.

The interesting aspect of Gibson’s argument is the ability of the ambient optic array of an observer to detect and specify the affordances of the environment. The intersection of, at one extreme, the motives and needs of an observer, and, at the other extreme, the substances and surfaces of an environment highlights the value of a visual approach to analyse archaeological evidence. Within archaeological datasets we tend to have ample evidence of the physical surfaces and substances of the environment through the examination of architecture and settlement layouts. However, archaeological data sets lack the presence of human beings and the social behaviours that relate to those beings.

### 3.2.3 Proxemics and Social/Spatial Distancing

Anthropologist Edward Hall (1959; 1966; 2003) studies spatial perception and behaviour and postulates that humans have an innate distancing mechanism, modified by culture that regulates distancing in human interaction. Hall’s (1966:131-162) study of modern culture variation in Europe, the United States, Japan, and the Arab world led to his argument that the organization of space has an impact upon interpersonal communication and that the distances involved are culturally specific (Lawrence and Low 1990:478). Hall (1966) categorizes four levels of interpersonal communication that are regulated by the spatial environment. First is the
distance that consists of the intimate space surrounding the body (15 - 45 cm) and would facilitate personal intimate communication. The second distance is personal space (45 - 125 cm), which would be reserved for communication between family members or close friends. The third proxemic distance is social distance, which varies between 1.25 and 3.7 metres, and allows for a head-to-toe view of the person permitting interaction between acquaintances in a social-consultative style, while the fourth distance is used for communicating with groups of people at public distances of 3.7 m and beyond. Hall suggests that people manipulate spatial environments and spatial behaviour as a method of nonverbal communication. The interesting point about the middle-range theory of proxemics is that different types of social communication that can occur at these varying distances and that proxemic distances promote different expectations of appropriate behaviour. Moore (1996a; 1996b) argues that spatial proxemics was used to produce different levels of ritual communication in plazas in the ancient Andes. It provides a useful link between the spatial environment, visibility, and social behaviour, which is a useful tool for this research.

3.2.4 Summary: Nonverbal Communication in Spatial Environments

Buildings do not stand impassively as stationary receptacles or spaces where the occupants perform socioeconomic, political, and other everyday activities, but rather they contribute in an ‘active’ way to the production and reproduction of social life through the production of on-going communication of non-verbal messages. The spatial environment acts to create and to control social interaction through spatial affordances of social activity. Perception of space affords the possibility of social interaction to occur and the meaning of the interaction to be perceived by the observer. The spatial environment creates private and more public space
through the use of territoriality-marking devices. The separation of space into smaller sub-units allows for distance mechanisms to create varying levels of nonverbal communication.

3.3 Summary

Meaning within the built environment is created through the interaction of people and the social reproduction that occurs within that space. Through the emphasis upon nonverbal communication, and the use of visual connectivity in particular, one can identify areas where social encounter can occur within the spatial environment. Spatial areas which afford social interaction can be seen to be areas where social reproduction occurs in the form of performance spaces with private (or back stage) and public (or front stage) spheres. These areas of performance translate into a continuum of private-public areas where personal space and territoriality come into play. Communication of meaning is facilitated within the nonverbal built environment by perception of visual connections between people and between people and objects, including the built environment.

I will use the middle-range theories outlined here to create an integrated approach to the study of the built environment of Pot Creek with the goal to better understanding the social interaction that occurred in that location. The urban morphology approach will be used to understand the changes that occurred over time at the site of Pot Creek as it grew from a few small buildings into a large multi-roomblock community. In Chapter 5, I will revisit the construction sequence for the village and create three-dimensional models of each of the construction episodes, using the urban morphology approach. These models will become the basis for the visual analysis for the community in order to understand the changes in areas of potential social interaction through time in Chapter 6. In Chapter 7, I will model visual analysis while attempting to understand the social interaction surrounding one activity, corn grinding.
This taskscape approach will consider the potential for social interaction during the final phase of the occupation of Pot Creek, but from multiple locations within the Pueblo.

In the next Chapter, I will discuss the use of visibility as a methodological tool for analysis of the spatial environment. Visual studies, within archaeology and other research disciplines, will be evaluated to determine the effectiveness of the approaches in understanding meaning in the built environment. From the simple, visual studies of early researchers seeking to understand the spatial patterning of standing stones in Britain, to the sophisticated use of computer technology to comprehend city skyline patterns in modern urban areas, the use of vision as a tool to study social reproduction and meaning of the built environment has had a long history. I believe that the ability to model settlement designs and buildings from the past allows us to have insights into past social interaction which would not have been available otherwise. In Chapter 4, I will outline the methods that I have used to create computer models of Pot Creek and the three-dimensional visual analysis tools that I use in the remainder of the research project.
Chapter 4

Visualizing the Past: Techniques of Visual Spatial Analysis

Introduction

Using vision to help analyze the past is not a new endeavour within archaeology, as vision has been used from the time of the antiquarians attempting to understand Neolithic monuments in Britain to visualize ancient scenes surrounding the sites. Archaeology has long privileged the sense of vision in seeking to understand the past. Some archaeologists (Cochrane 2008; Van Dyke 2008; Watts 2008) have argued that the other senses have been neglected and in fact vision’s privileged role within archaeology is not enough. While I agree that it may be a beneficial approach to use a full somatic experience to evaluate the past, I feel that we have not fully explored the potential of vision as a methodology to allow for our understanding of ancient engagement with material and space.

Within archaeology there remains an unequal relationship between the spectator and the object of its gaze. Julian Thomas (1993; 2001; 2008) has referred to this phenomenon as the politics of vision, whereby space and place within archaeology are assessed through distancing technical devices, such as cartography, aerial photography, and geographical information systems. Vastly different understandings of space are created within archaeology which may be remote from that of the past communities they seek to understand. Archaeologists visualize and represent space through a series of conventions of observation and representation of materials.
(Renfrew 2008). The site maps are drawn and structures are represented in a prescribed manner that introduces an unequal relationship between the observer and the object of their gaze, the site map. Could these conventions of archaeological representation be obscuring how we view the past? Can we not begin to analyze visual responses to the environment from the viewpoint of past inhabitants? I argue that through the development of three-dimensional computer models we can progress in our knowledge of the spatial and social settings of the past. We are now capable of viewing a computer generated scene that models what could have been visualized in the past from the point of view of an individual situated within those surroundings.

In the next sections I will outline methods and techniques used to analyze visibility and how visibility has been used within archaeology and other disciplines to understand past and present social behaviours and the spatial environment. I will review research that has been conducted within archaeology, as well as within other disciplines, that relates to visual connectivity in a variety of spatial contexts. I have divided this review into three sections based upon the level of technology used to assist in the study of visibility across the spatial environment. First, I will evaluate the role of non-computer based visibility studies within archaeology, which range from the direct visual studies of early antiquarians to the recent turn towards phenomenological approaches. Computer-based studies are the next category of visual research. Computer-based studies primarily focus upon the use of Geographic Information Systems (GIS) and use statistical inference to help understand past environments. The introduction and use of GIS within archaeology has not been without controversy, but as the systems become more sophisticated, the computerized approaches to visual modelling has become increasingly accepted. And finally, I will review more recent advances in research, including virtual reality imaging, static rendering, and three-dimensional computer modelling in combination with GIS, in order to demonstrate the range and capability of these methodologies.
I will outline the methods used in this research to create three-dimensional computer renderings and to analyze these models within a GIS computer environment in order to understand how visual pathways surrounding the buildings at Pot Creek Pueblo influenced and shaped social behaviour. I have used two main approaches in studying the visual patterns. In Chapter 6, I study the visual areas surrounding the buildings during the five phases of construction development at the pueblo. This methodology uses the urban morphology middle-range theory discussed in the previous chapter and illuminates areas of privacy and more publicly visual areas to understand social control of space. In Chapter 7, I use an approach based upon the middle-range theory of the taskscape, and in this case, the visual scenes surrounding the task of corn grinding at various locations during the last phase of occupation at Pot Creek. This line of attack studies the visual patterns and potential for social interaction within enclosed corn grinding rooms versus more visually accessible locations in open-sided ramada shade structures. Both of these main methods of analysis use computer models of Pot Creek Pueblo rendered in 3D computer software and then exported to ArcGIS and analyzed by the related ArcScene 3D Spatial Analyst tools in order to study different patterns of vision across the spatial environment. In this chapter, I will outline the process for developing the 3D models and the 3D visual analysis tools that I have used in this research.

4.1 Visual Spatial Analysis: Research Review

Archaeologists have used visual analysis to perform spatial analysis for centuries, from the direct visual gaze of the early antiquarians, to the recent past of the last 20 years where Geographical Information Systems (GIS) have been employed to aid in the visual analysis of ancient landscapes (Lake and Woodman 2003:692-695). Visibility, as used within archaeology, can be described as a methodology to understand past acts of perception and cognition of the
physical placement and form of structures within a landscape, and, as well, the recreation of past peoples’ actions and practice that occurred within the spatial environment (Wheatley and Gillings 2000:2). The fields of urban planning, architecture, geography, and landscape research have contributed many concepts and ideas that are now being adopted by archaeologists. Research studies over vast geographical distances of the landscape have predominated, but there are few applications that are relevant to spatial distances within urban environments and smaller communities. First, I will review some of the archaeological applications of visual analysis that have been conducted using non-computerized methodologies, before turning my focus to computerized methodologies of visual analysis for the understanding of past landscapes and investigation of space within the built environment of communities and cities.

**4.1.1 Non-computerized Visual Studies of the Spatial Environment**

Non-computerized studies of the visual landscape have been performed within archaeology and can be sub-divided into three main groups: 1) studies that are informal in nature with no explicit methodology (Lake and Woodman 2003:690), 2) statistical studies that are concerned with quantification and inferential rigour (Lake and Ortega 2013:213), and 3) studies that focus on humanistic, cognitive approaches with emphasis upon the non-discursive knowledge of past people (Lake and Ortega 2013:213). There are many examples of the informal visual research strategy and they tend to concentrate upon visibility from and to various significant cultural locations, such as the Avebury Neolithic Monument complex (Devereaux 1991) and the Orkney’s stone cairns (Renfrew 1979). This type of study, while attempting to establish the significance of the features from vantage points that have been derived from an *a priori* idea of what their relevance may be (Lake and Woodman 2003:691), fail to establish whether the features and associated sightlines are apparent at other random locations.
More statistically rigorous studies of visibility, the second category of non-computerized visual research, have been conducted to include a positivist approach to the problem of visibility. For example Fraser (1983; 1988) revisits the Orkney stone cairns where the observation points were chosen systematically from background locations to test whether the stone cairns were sited at locations that did not occur through chance alone. Sampling of the adjacent areas was also used by Bradley et al. (1993) to suggest that prehistoric petroglyphs in Galloway, Scotland were deliberately placed to take advantage of wide expansive views along shoreline areas. The general principal that unites these studies is the use of a control sample of observation points to test against the viewsheds of culturally significant features to determine if the cultural sites were situated by chance or reflected intentionality.

While these increasingly positivist approaches did introduce statistical rigour to visual approaches to the landscape, many archaeologists (Bender et al. 1997; Bender et al. 2007; Tilley 1994; 2006; 2008; 2010; Tilley and Bennett 2004; 2008; Thomas 1993) have recently turned to a more humanistic, or post-processual, approach to visual studies of the landscape, representing the third category of non-computerized visual research. Tilley (1994) walked the Dorset Cursus, photographing and sketching the topography and archeological features that came into and out of view. This research focuses on the visual and relies on bodily location and experiences similar to those experienced by people of the past. Tilley (1994:1-2) emphasizes the relationship between the land and the people and the creation of social memory associated with the choice of location of landscape features. Bender et al. (1997) visualizes the landscape through doorway frames mimicking the doorways of hut circles in the past. These studies are concerned with the situated individual and their response to the visual panorama. The connections between the use of visibility to aid in the maintenance of power and social relations are the focus of other humanistic-based visual analyses (Barrett 1994:15-17; Thomas 1993:42). Barrett (1994:15-17)
considers the changing view in the region surrounding Stonehenge and Avebury and argues that the mortuary rituals performed on the landscape acted to produce new perceptions of the community’s own identity (Barrett 1994:113). Thus, some archaeologists consider the humanistic archaeological studies of visibility across the landscape can form part of the archaeological toolbox for analysis of past individuals and the consequent transformation of past social relations.

However, there has been a backlash against the use of phenomenological approaches in archaeological interpretation (Barrett and Ko 2009; Brück 2005; Fleming 2006; Johnson 2006; Olsen 2007). One of the key critiques of phenomenology centres around the rift between what we see and experience in the present and experiences considered significant to inhabitants in the past (Brück 2005:51). For example, intervisibility between landscape monuments may, or may not, indicate an important relationship that was produced and recognized by past inhabitants. Scholars (Brück 1998; 2001; Meskell 1996) critique phenomenology and embodied experience as these approaches assume a universal body, that men and women, old and young, would experience the world in culturally defined ways. While these critiques may be valid, I believe that phenomenology and embodied experience can still play a part in archaeological interpretation, particularly if we are sensitive to the issues that have been raised. In Chapter 7, I use computer modelling of phenomenological and embodied experience to tease out some of the differences in social behavior that occurred in corn-grinding facilities at Pot Creek to understand relationships between female corn grinders and the role of buildings to contribute to teaching young girls the art of grinding corn and social roles as females in the community.

The non-computer based visual studies of the antiquarians and the humanistic turn of the phenomenologists have contributed to the development of the field of visual examination of past landscapes and built environments. Limitations are inherent within these approaches as they are
not readily reproducible and may not demonstrate the full range of responses that are possible given the many differing interpretations of the spatial environment. The early processual approaches, where varying points of the landscape are tested against the actual physical location of a monument or object, lend a degree of rigour to the field of visibility studies, but lack the quantitative intensity of computer-based approaches.

4.1.2 Visual Analysis of Spatial Environments: Computer-Aided

The introduction of computer-based visibility analysis in the 1990s did not represent a ‘new’ theoretical turn, but rather provided a methodology, or solution, to problems encountered in earlier research on how to quantify and represent visibility across a spatial area. The solution offered by Geographical Information Systems (GIS) is based upon the analysis of line-of-sight (intervisibility) (Figure 4.1 e) and viewshed (all points visible across a broad region) (Figure 4.1 g) and are based upon the approaches taken by non-computer visual analyses (Wheatley and Gillings 2000:2). The proliferation of viewshed analysis (Fisher 1993; 1995; 1996; Fisher et al. 1997; Lake and Woodman 1998; Wheatley 1995) is a response to the adoption of the methodology and could be seen as the spark that ignited the storm of criticism against GIS use within archaeology. The general critique of GIS-based viewshed analysis is that it is a button pushing method that has no basis within archaeology theory. Wheatley and Gillings (2000) very proficiently opposed the many criticisms put forth against GIS studies and provided some possible solutions that have made GIS visibility studies more enriched and relevant to archaeological data sets.

The basic conceptual framework which underlies much of the computer-based visibility research is the ecological psychology approach of J. J. Gibson (1950; 1969; 1979). Gibson maintains that direct perception and action are interwoven and that the observer and the spatial
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Figure 4. 1. Diagrams of visual spatial analysis models. Representations of: a) plan view of buildings within an area, b) 3D orthogonal view of buildings in an area, c) plan view of 2D isovist, d) 3D orthogonal view with 2D isovist, e) plan view of lines of sight, f) 3D orthogonal view of buildings with 3D lines of sight, (g) plan view of 2D isovist, and (h) 3D orthogonal view of buildings within a viewsphere. Adopted from Turner et al. (2001) and Fisher-Gewirtzman et al. (2005:31).
environment are inseparable. The environment does not only consist of separate objects, but rather is defined as a continuous array of adjoined surfaces that the active observer perceives and uses in order to navigate through the spatial environment (Goldstein 1981:195). Gibson’s optic array is a cornerstone for much of the visibility analysis research, whereby perception originates from the eye of the observer and proceeds outwards in an ever widening display to all encountered surfaces (Paliou 2013:243). An isovist, defined below, begins with the concept of the optic array, and constructs a horizontal field of vision from an observer point. GIS enhances an isovist approach providing opportunities for analysis.

A variety of computer-aided visual studies have been developed within various academic fields, including archaeology, and have resulted in different methods and related vocabulary (Turner et al 2001:103) which need to be defined further for greater understanding of the relevant studies. Many archaeological studies have focused on two dimensional space and have either ignored the third dimension of height, or interacted with height in a very limited manner (Figure 4.1 a and b). Line of site models use an observation point and visual connections to distant specified objects (Figure 4.1 e). The term ‘isovist’ (Benedikt 1979) has had a long history of use within geography, architecture, and mathematics, while landscape architects and planners use the term ‘viewshed’ (Kim et al. 2004) to cover visual connections over large areas of landscape (Figure 4.1 c). An isovist can be defined as “the set of all points visible from a given vantage point in space with respect to an environment” (Benedikt 1979:47). Inherently, an isovist is a volumetric measure, but is often used as a two-dimensional horizontal slice of visible space from a vantage point. Most GIS related viewshed studies use a two-
dimensional approach across a three-dimensional area, for example across a digital elevation model (DEM) of a landscape (Figure 4.1 d).

Graph-based visual analyses is a further category of visual research and is represented by two main approaches; axial line graphs and visibility graphs. Axial line graphs were introduced
into the field of architecture by Hillier and Hanson (1984) as one component of their space syntax methodology (Figure 4.2 a). Axial line graphs use visibility relationships within buildings and across urban spatial environments to determine the fewest, yet longest lines of sight that transverse the largest physical areas within a building or region (Hillier 1999; Hillier and Hanson 1984; Hillier and Penn 2004). This analysis provides a method to mathematically calculate such parameters as circulation within an area (Turner et al. 2001:105). Built into this model is the underlying assumption that long lines of vision predominate and are the likely routes or pathways chosen by individuals. While this may be the situation in some circumstances, such as when a person is not familiar with the region and needs to transverse through a town, there are cases where this will not hold, for example when local people are fully cognizant of the vicinity and base their travel routes on their knowledge and experience of the area.

The second visual graph-based approach is proposed by Turner et al. (2001). This method of analyzing a spatial environment is based upon social network analysis (Figure 4.2 b), where the nodes, or points, are evenly spaced throughout the space, and the vertices are the visible pathways to and from the nodes. This allows for graph-based mathematical analysis of the visual connections within a space, as well as the pragmatic permeability of a space. Areas of visibility from a specific location can be compared to the visibility of the total area. Permeability within a spatial area is represented by the areas where one can move. For example, the placement of a building, or furniture within a room, guides and constrains one from moving into the space occupied by the objects (Turner et al. 2001:108). This method allows for a more in-depth analysis of spatial perimeters than the axial line graph method and is a better predictor of pedestrian movement in an urban spatial environment (Desyllas and Duxbury 2001:27.10).

Innovations in archaeological applications of GIS visibility analysis during the 2000s addressed many of the concerns and criticisms that were aimed towards the use of computer
aided analysis (Wheatley and Gillings 2000:4-16). These innovations have been aided by the development within the computer industry of substantially greater computer capability. Research conducted within archaeological applications of GIS visibility analysis has become progressively more sophisticated, addressing more complex questions than presence and absence in a visual field. For example, view reciprocity (or intervisibility) and the issue of contemporaneity (Llobera 2007:59-65), and the limits of human visual acuity (Ogburn 2006) can now be addressed. The combining of the humanistic views of the phenomenological approach and the GIS visual analysis approach has been challenging (Lake 2007:1-2), yet have demonstrated the value of GIS visual studies in the creation of place and memory in the landscape (Fitzjohn 2007:45-47). Challenges still remain with the GIS-based visual studies within archaeological contexts, as Ducke (2013:313) cautions through the comparison of two viewshed analyses from the same location performed by two different GIS programs.

Computer-based studies that do not use GIS have also added to the body of literature of visual analysis and the modelling of space use in the past. Fisher (2009) uses distance-ranked viewsheds to demonstrate the visual impact and social interaction of distance within a Late Bronze Age building in Cyprus. Clark (2007) uses a similar approach to understand visibility and social integration within liturgical spaces of Byzantine churches in Jordan. Visibility graphs are used within the built environment to demonstrate visual connectivity of spaces and the types of social interactions that may have occurred within those spaces. Pueblo communities in the Galisteo Basin, New Mexico are compared using visibility graphs and social network analysis to understand the use of plaza space within the communities (Beckwith 2009).

One factor that is common to all of the above computer-based visual analysis studies is the two-dimensional nature of the studies. All are concerned with visibility across a horizontal slice of space. The horizontal slice, while informative, does not provide the full range of view as
defined by Gibson’s optic array. People view not just a horizontal slice of their world, but a full view from the ground to the sky (Moore 1996a; 1996b:227; Fisher 2009:451). As people move through a space, while turning the head or through tilting the head towards the sky, a larger visual field becomes apparent, creating more visual cues with which to interact with the world. Computer programs, other than GIS viewshed analysis, have the potential to extend our knowledge beyond these programs, and to enhance archaeological understanding of the interaction of the physical environment and social interaction. The next section discusses three-dimensional computer methods that extend the analysis beyond two-dimensional views of space and is related to the main focus and methodology for this research.

**4.1.3 Visual Analysis: Three-Dimensional Computer-based Modelling**

The most significant factor in the use of computer assisted three-dimensional (3D) visual analysis is the ability to create models that take into account the height of features, or Z values, across a space. The third dimension, height, offers a much more realistic analysis of human visual perception and more closely follows Gibson’s definition of the optic array. Three-dimensional line of sight analysis within a three-dimensional spatial environment is now available and allows researchers to solve some of the dilemmas of 2D views in 3D space (Liu et al. 2010). Llobera (2003) introduced the idea of a visualscape to delve into human understanding of their surroundings through the use of visual study of all dimensions of the environment using GIS (Figure 4.1 h). A visualscape is defined as: “the *spatial representation* of any *visual property* generated by, or associated with, any *spatial configuration*” (Llobera 2003:30, italics original). A visualscape can include visual representations of all physical surfaces and terrain within either a natural or an urban environment (Paliou 2013:244). This approach is appealing to researchers interested in understanding spatial representations and
human interaction that closely approximates real life and could be considered a representation of a taskscape, for example the taskscape surrounding corn grinding.

The use of three-dimensional computer visibility studies has increased over the past 20 years and as the capacity and availability of powerful computers has increased, so has the sophistication of the studies. This category of research generally includes rendered images, photomontages of rendered images and real world photographs, animations, and virtual reality (VR) (Kim 2004:9). The common factor amongst these approaches is the varying levels of user interaction within the 360° model environments. While these tools provide visual data, the addition of GIS allows for spatial analysis within these environments with increasing degrees of interaction capability and information provided (Figure 4.3). The most interactive and the highest degree of visual and spatial information is offered through the combination of 3D GIS
and computer automated design (or 3D computer modelling software) and this is the basic methodology that I will be using in this research. Prior to introducing the technical aspects of my methodology I will focus on the research that has been conducted in the area of 3D GIS and computer automated design (CAD) within archaeology but also in other disciplines.

The potential of near three-dimensional computer modelling combined with visibility are investigated across a broad landscape (O’Sullivan and Turner 2001). This approach uses a triangulated irregular network (TIN) [a near 3D interpretation of the landscape] and a visibility graph approach to mathematically measure the amount of visibility across a landscape (O’Sullivan and Turner 2001:228). Various network indicators such as, mean shortest path length and cluster coefficients are analyzed from the accumulated viewshed data. The results are rather crude due to the limitations of the computing capabilities, but the approach highlights the scope for further research in this area.

The literature of urban planning and architecture presents some of the earliest incursions into three-dimensional visibility within urban settings of the built environment. Fisher-Gewirtzman and Wagner (2003) present a step towards the development of a quantitative comparative evaluation of building shapes and spatial configurations related to the 3-D observation of open space with the creation of a spatial openness index (SOI). The SOI is defined as the measured volume of space that is visible from an observer point (Fisher-Gewirtzman et al. 2005:31). The major advance with this approach is using a 3-D viewing angle to simulate human vision, or more closely approximating the Gibson optic array (Figure 4.1 h). Fisher-Gewirtzman and Wagner (2003:37-38) correlates this metric with ‘perceived density’ in an urban environment. The perceived density is a culturally interpreted environmental quality, where, for example an open view of a river may be desirable. The complexity of the calculations make the spatial openness index difficult to use in a different situation (Paliou 2013:248).
Other attempts have been made in recent years to create an alternative to the SOI calculation. Yang et al. (2007:990) calculate a quantitative volumetric measure of visible space, or a form of a viewsphere as defined by Llobera, resulting from the relationships between urban geometry and the viewer’s sight lines. This approach explicitly tests GIS-based 3D visibility analysis on a number of different urban areas and concludes that the model is much more sensitive to height, or the Z component of urban space, than traditional 2D-based models and more closely reflects the visual human perception of the space. This methodology is limited in that it only functions on either TIN or raster data, so that such elements as overhangs, bridges, or covered areas, such as a covered shade structure, would not be eligible for the analysis. Shach-Pinsley et al. (2011:250) create a metric for visual openness combining factors including: 1) the area of the building facades that are exposed to view, 2) the visual openness of the area isovists, and 3) the total sum of the visual exposure and sight line lengths. Morello and Ratti (2009:7-9) calculate 3D isovists and visibility matrices to determine the volume of visibility from given points. This approach focuses on the visible facades of buildings as well as the open areas between the buildings, but is restricted to relatively simple representations of the urban environment (Figure 4.1 f). It is clear from this short review that no one approach currently dominates within the urban environment/architecture literature, but research is progressing towards the goal of fully 3D computer models analyzing spatial environments.

Within archaeological research, computer 3D visualization studies have taken a number of approaches, including reconstructions of past environments. These studies recreate scenes from the past while altering variables that enhance our understanding of past visual experiences, for example, the quantity and quality of available light and altering vegetation in landscapes environments. Winterbottom and Long (2006) use 3D virtual reality modelling to recreate possible landscape vegetation scenarios surrounding a stone circle in Kilmartin Glen, Scotland.
Earl et al. (2013) use 3D modelling to recreate varying lighting conditions within the interior of the Basilica in the Roman town of Portus. Dawson et al. (2007) simulate lighting conditions within Thule houses to understand how lighting affected task performance. These examples were modelled from the point of view of someone situated within a scene from the past and thereby allowing the researchers a glimpse into those bygone worlds. This type of modelling is very valuable and significantly increases awareness of the available archaeological evidence and the original forms of the built environment (Earl et al. 2013:298).

Another 3D computerized visual approach used within archaeology is the textured viewshed approach (Earl 2005; Paliou 2013; Paliou and Wheatley 2007; Paliou et al. 2011). The textured viewshed uses a light source to test a scene to determine the number of times an object is seen from a variety of viewer locations to understand the visibility of culturally significant objects or locations. Paliou (2013) used this approach to understand the visibility of wall murals within buildings from viewers passing by on the street below the windows of the building. The textured viewshed analyzed 3D visibility from a grid of points (similar to a visibility graph) and concluded that the murals were meant to be seen and viewed by those outside of the building.

Three-dimensional approaches to visibility analysis of the spatial environment within archaeology have been somewhat limited and yet there appears to be significant potential for this category of investigation. The 3D computer modelling approach allows for the restoration of past sites that are no longer present on the landscape. Sites that are destroyed or have a limited archaeological footprint can be re-created to allow for further research and study. The process of 3D computer modelling is inherently in the hands of the creator of the model, and archaeological evidence is used to anchor the results in the realm of representativeness. The ability to create multiple scenarios helps to mitigate the effects of one way of viewing and can expand the viewshed approach into multiple viewpoints. The proliferation of 3D computer modelling
capacity (i.e. 3D graphics software, GIS) that has emerged in recent years offers an enormous potential for the investigation of visual structures of space and human perception and behaviour within the modelled spatial environment.

4.1.4 Summary: Review of Visual Analysis Methods

This review of research using visual connections demonstrates that there are a variety of methods that can be used to study visual properties across spatial environments. Visual inspection of built environments and surrounding landscapes are possible in some circumstances where the archaeological site is well preserved and where little change has taken place from the past. Phenomenology has a place within the archaeological toolbox, providing a rich embodied experience of a site. However, the preserved remnants of buildings and fixed features of archaeological sites are often incomplete and do not allow a full visual inspection or phenomenological experience of the site as it existed in the past. Poor preservation of sites has opened the door for computer rendering of sites to have a role in re-creating the spatial environment. The increasing sophistication of computer programs to model visual pathways aid in our understanding of past life-ways.

The methodology used for this research is based upon computer modelling of Pot Creek Pueblo in a three-dimensional environment and re-creating visual pathways and areas of spatial enclosure or openness of the plaza areas surrounding the roomblocks and other surrounding areas within the community. Visual connections across space and metrics of spatial enclosure have been adapted from research by the urban planning community.
4.2 Methodology: 3D Modelling and the Visualization of the Spatial Environment

The overall goal of this research is to investigate the built environment of Pot Creek Pueblo and determine how the configuration of the buildings, their placement within the community, and their sequence of construction over time affected social interaction within the village. Computer generated visibility studies will be used as a tool to connect potential areas of visual and social interaction in the past. The visibility analysis will take into account both the horizontal and vertical dimensions of the spatial environment in order to understand the space, as suggested by Gibson’s optic array or Llobera’s visual scape.

As I have outlined above, the visual and 3D spatial computer modelling of many archaeological examples have focused upon restricted or limited spatial environments. The space within the Basilica, the Thule house, outside of a building viewing murals on interior walls, or the restricted area surrounding a stone circle all evoke delimited spatial environments. With the development of increased technological capability, the scope of many archaeological studies can be extended beyond limited spatial environments, such as building interiors. The methods that are being investigated by the architecture and urban planning communities (Fisher-Gewirtzman 2012; Fisher-Gewirtzman et al. 2005; Fisher-Gewirtzman and Wagner 2003; Morello and Ratti 2009; Shach-Pinsley et al. 2011) offer unique and interesting avenues of research for the study of social and visual analysis of built environments on a scale of a larger, community-level expanse. The methodological approach used in this research for the creation of the 3D visibility models at Pot Creek is most closely aligned to the visual studies being conducted within the urban planning community. The scale of the analysis is at the settlement level, where the spaces surrounding the buildings and the plaza areas can be analyzed for visual and social interconnectivity.
4.2.1 Decision-making Points for Computer Modelling

Within the context of this research there are a number of issues that must be considered when using ArcGIS. For example, the location of a site must be considered with respect to the research question being investigated and the geo-referenced location on the earth. For this research, the actual geographic location is less relevant since the area surrounding the pueblo community is not part of the research. Within Pot Creek, elevation data has been presented by previous researchers (Crown 1991; Crown and Kohler 1994; Wetherington 1968), but the very slight changes in elevation across the pueblo likely relate to buried (and unexcavated at those points in time) mounds containing roomblocks, indicating that the plaza areas and the related buildings rest upon a flat horizontal surface. Therefore, the geographic reference location used was ‘no known reference points’ and the community is modelled within ArcGIS as if no information is available about the surrounding geography or elevation changes within the community. Additional modelling would be necessary to visualize situations outside of the community core.

Two further points to consider within an ArcGIS visual modelling strategy are the location and the height of the observation points. Again, the research question and strategy for the project informs this element of the model. When considering the overall visibility for the urban morphology analysis within the community and investigating the ability to see from one plaza to another, the center of the plazas associated with each of the roomblocks were used for the location of the observation points. The ‘C’ shaped roomblocks have a fairly easy to identify center point, while judgment was used to locate a central location for the observation points of the ‘L’ shaped plazas and the linear roomblocks surrounding the large plaza areas. When considering the views to and from rooftops, the observation points are located on the top of the
roofs of the roomblocks. For the taskscape approach, the observer points are located at random within the shade structures, although the location of the hearths have been avoided. In the semi-enclosed corn grinding room, Room 207, several observation points were used to simulate the locations of the corn grinding bins. The second consideration for decision making within ArcGIS is the height of the observation points. The height of the observation points can be adjusted with ArcGIS to correspond to the height of an observer in the past. For example, a height of 1.7 m was estimated to be the height of a standing observer, while 0.5 m was used to model the viewing position of a kneeling person, as would be likely for a woman grinding corn.

4.2.2 Creation of the 3D Models: Google SketchUp® 2014

The creation of the three-dimensional models of the buildings and site plan of the community of Pot Creek was performed within Google SketchUp® 2014. Google SketchUp® 2014 allows for precision modelling in an easy to learn environment with freely accessible software. There is an active online community for tips and tricks for dealing with technical details as well as online tutorials for learning the basics of the program. Books, such as an Introduction to 3D Data: Modeling with ArcGIS 3D Analyst and Google Earth (Kennedy 2009) and Google SketchUp® for Dummies® (Chopra 2011) are invaluable for learning the basic format of Google SketchUp and creating 3D models in ArcGIS. The books lead you through examples of building a small house structure and exporting the data into ArcGIS. Figure 4.4 outlines the procedures used and the order of the workflow used to create the models, and one of the visual analysis tools, the skyline analysis, created within ArcGIS.

Careful attention to the details of the site plan was an important consideration when preparing the original footprint from which the buildings were then extruded. The site plan was provided by Michael Adler, Department of Anthropology, South Methodist University,
Figure 4.4. Schematic workflow diagram for the skyline boundary analysis using Google SketchUp® and ArcGIS 10.2.2. ArcGIS contains several sub-programs that were used including ArcCatalogue, ArcMap, and ArcScene.
Figure 4.4. continued. Schematic workflow diagram for the skyline boundary analysis using Google SketchUp® and ArcGIS 10.2.2. ArcGIS contains several sub-programs that were used including ArcCatalogue, ArcMap, and ArcScene.
following the site map created by Fowles (2004). The spatial placement of the buildings was considered from both the linear distances between the buildings and also the angles between the various components of the roomblocks themselves. The overall spatial plan of the site becomes a crucial element when considering the spatial and social interaction which occurs in those spaces formed by the placement and form of the buildings.

The other critical element that was carefully integrated into the production of the 3D models was the vertical components, or walls, of the architecture. The vertical elements are fundamental to the definition of architectural space as they play a critical role in the establishing the visual limits of a space (Ching 2007:124). The overall height of the buildings depend upon both the height of each story and the number of stories in the structure. The height of each story of the buildings was estimated to be 3.0 m and this includes the interior roof height of about 2.5 m and approximately 0.5 m of roofing materials and support structures for the next story. The height of an individual story was based upon a sample sketch of an excavated room from Pot Creek (Wetherington 1968). The number of stories of the individual roomblocks, including the variation in the number of stories within the roomblocks, follows an earlier 3D rendering of Pot Creek (Fowles 2004:423). In order to incorporate all of the required data into the 3D model in Google SketchUp® 2014, careful measurements and attention to the details of the floor plans and overall site plan was required. The files were exported in a 3D file format in collada files with a .dae extension code (Tenney 2012), the files were then imported into ArcGIS for the 3D spatial analysis.

4.2.3 ArcGIS and ArcScene: 3D Analytical Tools

The ArcGIS 10.2.2 platform (Environmental Systems Research Institute ERSI 2014) contains a number of integrated software programs that enable geographical-spatial modelling in
a range of applications. The 3D Analytical Tools within ArcGIS employed in this research are: 
1) the suite of tools associated with skyline barrier analysis, and 2) those tools used to construct and perform line of sight analysis. The skyline barrier tools create a number of metrics that analyze the volumetric visible area from a given observer point allowing for both horizontal and vertical dimensions to be examined. The skyline barrier analysis allows for the perception of visual openness (or enclosure) within a spatial environment, or an overall sense of spatial openness, to be determined. As well, areas that are seen and/or not seen can be studied to determine private and public visual regions. It will be demonstrated that this is an important visual metric within the pueblo community of Pot Creek. The line of sight tools include all visual points between an observer and a target point(s) and indicate all points along a straight path that are seen or not seen. This metric is used to determined specific pathways of visual connectivity, for example from a roof top to the ground level to determine the visibility of activities taking place on the roof from those on ground level.

The skyline barrier analysis within the ArcGIS 3D Analyst Toolset is comprised of three different tools that are interrelated, yet provide slightly different pieces of information regarding the visual spatial environment. The skyline tool creates a skyline silhouette from a given observer point, and includes all intersection points that impede visual interaction along the ridgeline of all encountered features (Figure 4.5). The skyline tool defines the limits of visibility along the ridge of the various stories of the rooftop and continues for an extended expanse when no features are encountered. I have limited the extent of the visual field to 100 meters to coincide with the limits of social interaction over vast distances.

The next phase of the analysis is to use the skyline barrier tool to create an envelope of visual area, from the ground surface to the ridge of the building (Figure 4.6). The envelope includes all vertical surfaces encountered visually up to the top ridge of the building and includes
Figure 4. 5. Example of skyline analysis of the rendered image of Roomblock 2 at Pot Creek, A.D. 1300 - 1320. The black line represents all visible points at the top, or skyline, of the building as seen from an observer point within the plaza. The long lines radiating from the opening of the roomblock indicate no visual impedance in that direction.

Figure 4. 6. Skyline volumetric barrier analysis of the rendered image of Roomblock 2 at Pot Creek, A.D. 1300 - 1320. The grey area represents all visible points from the top, or skyline, of the building to ground level as seen from an observer point within the plaza.
Figure 4. 7. Skyline barrier graph for Roomblock 2, Pot Creek A.D. 1300 - 1320. The grey area represents all visible points from the ground level upwards to the sky, while the white area represents all unseen areas caused by visual barriers encountered, such as the buildings as seen from an observer point within the plaza.

Figure 4. 8. Diagrammatic representation of the lines of sight from an observer point in the plaza of Roomblock 2, Pot Creek Pueblo, A. D. 1270- 1273. The visible sightlines are indicated in black.
the unimpeded views through the entrance into the pueblo roomblock.

Volumetric measures can then be created by the skyline graph tool (Figure 4.7). The graph demonstrates the areas that are visible and not visible from an observer from horizon to horizon. The grey areas represent the visible areas, while the white indicate the views blocked by the buildings. The graph provides, in a very visually diagrammatic form, a sense of enclosure and/or expanse as it would be encountered by an individual from within a roomblock plaza area. The skyline graph tool also provides a percentage calculation of seen versus unseen areas. By comparing the skyline graphs through the various construction episodes at Pot Creek, the changing visual expanse from plaza areas can be analyzed.

The second group of ArcGIS 3D Analyst Tools that are used in this research are the line-of-sight tools. The line-of-sight tool is used in Chapter 6 based on a morphology approach, and in Chapter 7 with a taskscape approach. This group of tools determines the visible sight lines over any three dimensional data, such as obstructions due to buildings or elevated ground surface horizontal and vertical dimensions (Figure 4.8). This is a valuable tool for this project as both the observer points and the target objects can be defined and lines-of-sight can be constructed, such as from the perspective of an individual standing upon a rooftop to the ground level or to other rooftops, or the view from within a corn grinding room to the plaza areas through the partial obstruction of walls and doorways, e.g. Room 207. The first step in the model is to use the construct sight lines tool followed by the line of sight tool.

While there have been some publications within the academic literature regarding 3D visual methodology in an urban context, the vast majority of studies have been presented on the internet and particularly on YouTube (for example Negentig 2012; Shephard 2010; TeachuGIS 2013). The constantly changing computer software environment forces continuous adaptation by the users of the programs which favors the dynamic ability of the internet to communicate
information. As well, three-dimensional computer modelling is much more conducive to the dynamic media of video, than to static picture images. To fully appreciate 3D images of the built environment the video format enhances the sense of being in the space. The internet has been a crucial source of information for this research, both from an inspirational point of view and by providing information on more pragmatic issues revolving around how to create the models and perform the analysis.

4.3 Summary: Visual Spatial Analysis to Understand the Past

The review of past research into visual spatial analysis has allowed us to understand how the field has expanded and developed over time within archaeology. Through the examination of non-computerized techniques, such as phenomenology, the importance of multiple perspectives and the politics of vision has been highlighted. Some of the initial criticisms of computerized visual analysis conducted in GIS have been overcome by increasingly sophisticated computer technology. For example, the limits of human acuity can now be modelled by computerized GIS programs and computer modelling of various scenarios of past vegetation can help to envision how significant features were placed within a landscape. Through the reviewing of research that has been conducted in other disciplines into areas of visual analysis of the spatial environment we can expand our ability and applications that we can use to understand the past. Increasingly sophisticated computer capability has allowed for ever refined computer models and an expansion of the questions that can be posed of archaeological data. Archaeology can both learn from and contribute to the body of research into computer-based visual analysis of the spatial environment.

The outline of the methodology used here to create the 3D models and perform the visual analysis within ArcGIS and ArcScene is necessary in order to place this research in the broader framework of visual research that has been conducted by archaeologists and other researchers in
the past. A complete ‘how to’ has not been outlined as the methods used in this research become
dated very quickly as the software is continuously being updated. This introduction to the
methodology does serve to provide a platform from which to launch future research in a similar
vein. The approach outlined here, the 3D models of the built environment and the 3D visibility
analysis of the spatial environment, is a valuable set of tools to add to the methodological
toolbox of archaeologists. A similar approach could be used across a wide variety of spatial
scales and levels of complexity within the built environment, from the simplest village
environments containing one to two structures to the large urban environments of ancient cities.
This method could also be applied to landscape research as three-dimensional models can be
created for large regional areas and the visual patterns could be determined between sites or
features of interest, on both two- and three-dimensional planes.
Chapter 5

The Construction Sequence Revisited at Pot Creek Pueblo

Introduction

The chronology of the architectural environment and building construction sequence at Pot Creek Pueblo is an important focus for this research as it lays the ground work for the subsequent visual analysis. The standard, ubiquitous site maps that archaeologists produce from excavation data are very much a part of archaeological work, yet they tend to focus on the final occupation phase of a settlement, with little regard for development through time. They also tend to represent life from afar, from a bird’s eye view that has little in common with life on the ground. In order to understand the life-ways of the inhabitants who lived in the community, it is necessary to analyze the temporal sequence of the development of the community. The visual patterns would have altered radically as new buildings and other features were constructed. Thus, in order to understand the interconnecting visual landscape within the community, it is imperative to view the site, not as a completed whole, but as a work in progress where people lived and interacted. The Pot Creek community did not develop from one continuous, unified construction phase, but rather followed a discontinuous pattern of building through time. It is necessary to de-construct the site maps and determine the succession of building construction that occurred at the community of Pot Creek.
The goal of this research is to understand the social implications of the placement of the buildings in the built environment at Pot Creek and it is often difficult to bridge the gap between high-level social theory, and on-the-ground excavation data. As Smith (2011:167) notes, there is a wide range of analysis within the study of ancient urban communities, from those that have little regard for theory, or studies that provide ‘thick’ description’, to those that are less grounded in the real-world of excavation data but incorporate high-level social theory. As a mid-point between these two extremes, Smith (2011:167-172) proposes middle-range theories or “empirical urban theories” for the study of ancient cities (see Chapter 3 for further discussion of middle-range theories). One of these middle-range theories is ‘urban morphology’, which is a highly descriptive approach to urban form but also integrates physical, visual, and functional aspects of built form through dynamic historic iterations (Conzen M. P. 1960; 2001:5; Conzen M. R. G 2004:51). Smith (2009:114) argues that the phenomenon of focusing research upon later periods at the expense of previous ones is prevalent among urban historians and geographers. Archaeology is uniquely positioned to study all phases of a site’s occupation. The careful study of settlement sites and their historical sequences, or change through time, allows a level of analysis that combines well with other methods of middle-range urban analysis that will be used throughout this research (see Chapters 3 and 4 for other methods of analysis which build upon the urban morphological approach developed here for the Pot Creek site).

The chronological variation at Pot Creek has been the subject of scholarly research since the 1920s, when excavation at the site began (Adler 1994; 1995; 1996a; 1997; Blumenschein 1956; 1958; Fowles 2004; Jeançon 1929; Wendorf 1954; Wetherington 1968; Woosley 1980). The seminal construction sequence research by Crown (1991; Crown and Kohler 1994) was updated to reflect recent excavation data (Adler 1997; Arbolino 2001; Fowles 2004). As discussed in Chapter 2, the expansion and development of the Pot Creek community resulted
from a variety of processes, including *in situ* population expansion, aggregation, and migratory events from both the local area and more distant locales. This resulted in a building sequence that was intermittent and sporadic rather than one concentrated building event.

Crown’s (1991) research on the building construction sequence relied upon many lines of archaeological evidence, including dendrochronological analysis of wooden timbers. During her analysis, Crown (see also Ahlstrom 1985:65; 1989) identifies different explanatory options for the use of wooden timbers that had differing date clusters in the same location. I re-examine Crown’s assumptions regarding the use of stockpiled timbers and have re-evaluated the construction sequence for Roomblock 1. I have also re-examined the issue of cutting dates versus non-cutting dates in the dendrochronology analysis. While cutting dates, defined as the most reliable dates due to the presence of bark or the outer ring on a piece of timber, are the gold standard for dating, a cluster of non-cutting dates, or the ‘strength in numbers’ principle (Dean 1978a:250), does provide some indication that a construction event did occur (Wiseman 2004). Crown (1991) eliminates the non-cutting dates from the construction sequence of Roomblock 4 and thereby eliminates many timbers that could provide collaborating evidence for construction activity. I have re-evaluated the construction sequence and included some of the non-cutting dates that Crown omitted.

The above two changes in assumptions, combined with the evaluation of portions of the community that were not discovered by the time that Crown performed her analysis of the construction sequence, has forced a re-evaluation of the entire construction sequence at Pot Creek. Conclusions about population dynamics, migration patterns, and aggregation all stem from our understanding of the timing of the construction events. It is also important to reconstruct the construction sequence at Pot Creek in enough detail to understand the site layout
through all of its temporal iterations and the consequences of the built environment for social interaction over the occupation sequence.

In this chapter, I outline the process of constructing an adobe building in order to identify the labour and material requirements and the sequential steps in the processes of construction and repair. I consider social aspects of constructing an adobe structure, including the division of labour and seasonal aspects of the work. In order to contemplate alternative assumptions, I discuss wood drying, stockpiling of wood, and some of the interpretive issues inherent in dendrochronology. The quality and quantity of archaeological evidence that is available varies across the site of Pot Creek and has implications for the degree of confidence that we can apply to the recreation of site development through time. Within the limits of the available evidence, the construction sequence is reproduced using three-dimensional computer models of each roomblock. Each of the reconstructed roomblocks is evaluated from A.D. 1270 to 1320. Attention is given to the height of the buildings during the modelling process, since the buildings varied in height from one to three stories. The height component of buildings is an important variable that is not apparent on site plans, yet is an important factor in the lived experience of a place. Lofty elevations impede visual pathways and the height of the building can foster a sense of enclosure. Further analysis of the visual organization surrounding the buildings is in the next chapter.

5.1 Building an Adobe Roomblock Structure

In order to understand the sequence of development of the Pot Creek community fully, it is important to appreciate the process of building an adobe roomblock, as these buildings are the fundamental units within the site. The construction sequence of an individual building is an important component of the overall sequence and can highlight such issues as the reuse of wood
or the stockpiling of materials that are critical factors in understanding the dendrochronological sequence. An operational sequence of construction, or a chaîne opératoire of the building process, allows us to understand the steps and stages of construction necessary to bring the raw materials and labour components to a fabricated state and highlights the choices and decision-making of people in the past (Chazan 2010:57; Lemonnier 1986:149; 1992; Leroi-Gourham 1993; Miller 2009:27-30). The chaîne opératoire approach for the construction of an adobe building includes analysis of the entire building sequence from site selection and preparation, labour and material acquisition, the construction of the original building, any additions added to the initial construction, repair or remodeling of the original structures, and building abandonment (Figure 5.1). A number of summaries of the building process have been conducted for the Northern Rio Grande region in the Southwest (Cameron 1999:203-207; Stubbs and Stallings 1953:25-31), focusing primarily on the material transformation processes of architectural construction.

Social considerations in the production of architecture have been less well documented for the Southwest, although Bagwell (2006) provides an excellent analysis of the architectural production processes in the Chihuahua region of Northern Mexico, with explanations of both the material components that are used in the process, as well as the labour of production groups. Ritually sanctified considerations, household spatial needs, prior occupants of the site, and availability of the necessary labour force are some of the considerations in the construction of an architectural structure (Figure 5.2).
### Initial Construction

#### Site Selection Criteria
- Access to reliable water supply
- Level ground for building
- Availability of raw materials

<table>
<thead>
<tr>
<th>Land</th>
<th>Timber</th>
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</thead>
<tbody>
<tr>
<td>- Clear land of trees and large shrubs&lt;br&gt; - Remove large rocks&lt;br&gt; - Ensure a flat, stable building surface&lt;br&gt; - Dig trenches for walls for buildings</td>
<td>- Fell trees&lt;br&gt; - Cut branches from trees&lt;br&gt; - Allow wood to dry and cure&lt;br&gt; - Stockpile wood for later use</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Adobe</th>
<th>Water</th>
<th>Roof materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Collect clay and sand&lt;br&gt; - Collect and create temper</td>
<td>- Collect&lt;br&gt; - Carry water to adobe-mixing site</td>
<td>- Use stockpiled timbers or gather from distant locations&lt;br&gt; - Collect branches and other vegetation for thatch</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Adobe</th>
<th>Centre Post</th>
<th>Horizontal roof beams</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Clean clay&lt;br&gt; - Prepare temper&lt;br&gt; - Mix with water</td>
<td>- Cut timber into required length&lt;br&gt; - Dig circular basin</td>
<td>- Cut timber into desired length of room for viga&lt;br&gt; - Cut timber into desired width of room for cross members</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Walls</th>
<th>Centre Post</th>
<th>Roof</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Shape adobe by hand in courses for walls of room&lt;br&gt; - Dry between courses</td>
<td>- Position post in upright position in basin&lt;br&gt; - Secure with adobe or rocks</td>
<td>- Secure viga to centre post and to top course of adobe&lt;br&gt; - Overlay viga with cross members and thatch&lt;br&gt; - Cover with adobe</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Remodeling</th>
<th>Materials Preparation</th>
</tr>
</thead>
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<tr>
<td>- Add additional rooms and upper floors&lt;br&gt; - Add/remove doorways&lt;br&gt; - Repair damaged walls, centre supports, and roof structures&lt;br&gt; - Re-use wood from abandoned rooms or use timbers from stockpiles</td>
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<tr>
<th>Abandonment Procedures</th>
<th>Abandonment</th>
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<tbody>
<tr>
<td>- Remove objects from rooms&lt;br&gt; - Add any ritual items to space&lt;br&gt; - Ritually sanctify space&lt;br&gt; - Gather flammable materials (adobe not very combustible)&lt;br&gt; - Set fire to room&lt;br&gt; - Fill in room (if desired)</td>
<td></td>
</tr>
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</table>

Figure 5.1. Summary of the production processes for adobe roomblock structures.
<table>
<thead>
<tr>
<th><strong>Initial Construction</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site Selection Considerations</strong></td>
<td>Building Site Selection</td>
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<tr>
<td>Access to potential agricultural lands / hunting and gathering resources, water</td>
<td></td>
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<tr>
<td>Proximity to prior social network locations</td>
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<tr>
<td>Historical trajectory of land use</td>
<td></td>
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<tr>
<td>Defensibility of site</td>
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<tr>
<td>Ritual sanction</td>
<td></td>
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<tr>
<td><strong>Size of Area to Clear</strong></td>
<td>Building Site Preparation</td>
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<tr>
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<tr>
<td>Spatial requirements of separate households or extended kin groups within community</td>
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<td>Size of labour force available to perform the labour, gendered duties (?)</td>
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<td>Alternative responsibilities of labour force (alternate time commitments)</td>
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<td>Seasonal accessibility of space</td>
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<td>Quantity and quality of materials readily available</td>
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<tr>
<td>Organization of the labour force to gather and transport materials to building site, gender-based (?)</td>
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<td>Production groups based upon family and/or extended kin groups</td>
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<tr>
<td><strong>Preparation of Materials</strong></td>
<td>Material Prep</td>
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<tr>
<td>Size and number of rooms required will determine amount of material to prepare</td>
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<tr>
<td>Labour force for specific tasks, gendered-based (?)</td>
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<td>Production groups based upon family and/or extended kin groups</td>
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<tr>
<td><strong>Construction of Rooms and Buildings</strong></td>
<td>Primary Production</td>
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<tr>
<td>Construction of number of rooms and buildings - population, migration patterns, changes in number of households, and kin groups</td>
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<td>Approximately 19 year use-life for adobe buildings (Crown 1991:305)</td>
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<td>Increased spatial requirements due to population growth, new household units, Social requirements of space – domestic cycle (Goody 1969)</td>
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<td>Change in room use - e.g. habitation room to a storage room</td>
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<td>Change in privacy requirements - block doorways to plaza for more privacy</td>
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<td><strong>Abandonment Processes</strong></td>
<td>Abandonment</td>
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<td>Why abandon?</td>
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<td>- Environmental degradation of land, subsistence base</td>
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<td>- Better alternatives elsewhere</td>
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<td>- Amicable or disagreeable split in community</td>
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<td>Timing of abandonment</td>
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<td>- Sporadically throughout site occupation</td>
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<td>- Ultimate abandonment of community</td>
<td></td>
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<tr>
<td>Ritual closing of domestic rooms – removal of objects, burning?</td>
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<tr>
<td>Ritual closing of <em>kivas</em> - placement of sacred objects, burning</td>
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Figure 5.2. Summary of social or economic considerations for constructing adobe roomblock structures.
5.1.1 Architectural Production

Architectural structures have typically resulted in two distinct directions for archaeological analysis in the American Southwest. Most common is the analysis of the use or function of a building or a room and the other is a descriptive approach to the way the building was constructed (Bagwell 2006:45). Archaeologists have less frequently considered the choices and decision-making junctures that are inherent in the process of construction. The complexity of constructing a structure involves multiple material types, labour inputs, archaeologically invisible services, and intangible products such as cleaning or associated music (Costin 2003:1035) and may explain the lack of research in the area of architectural production. For example, the process of constructing adobe walls forces the workflow to adjust to the drying times needed between courses of adobe, highlighting the interconnectivity of the construction process, material attributes and less archaeologically visible social and labour considerations.

Social organization of architectural production has been the focus of ethnographic study by sociologist Udy (1959; 1961) and in archaeology by Bagwell (2006). Udy uses ethnographic information from the Human Relations Area Files (HRAF) from a sample of small and middle-range societies for a number of craft production processes, including construction. Udy (1959) finds that simpler production processes result in individuals performing a larger number of tasks, while more complex production processes result in some individuals performing fewer tasks, or specialization. The center-post and roof-beam complex in the adobe buildings at Pot Creek (discussed further below) may have required special knowledge of an expert, while collecting and mixing adobe clay could be performed by individuals who performed multiple tasks. Both simple and complex production processes require simultaneous group organization, but the level of complexity of the construction project affects how the groups are organized.
The intensity of architectural production, whether continuous or episodic, can result in different forms of social production organization (Udy 1959). Adobe needs time to dry adequately between courses to prevent instability of the wall structure, and therefore the material constraint of drying adobe determines how the production flow will take place (Bagwell 2006:55). A group of workers constructing one small adobe building would need to pause and wait between applications of adobe courses, an episodic work production process. The production process for a larger building, by contrast, could be continuous if a large production group applied adobe to previously dried areas on multiple walls. Thus, the scale of the construction project can affect the social organization and we will see that this may change over time as the size of the community expands.

In order to focus on the construction processes within the American Southwest and northern Mexico, Bagwell (2006:113-137) reviews ethnographic reports of architectural production within six communities in the region. In line with Udy’s findings, the organization of production in the local region varied by production step, such as collection of materials and preparation, and by material type, such as wood and clay and labour was divided on the basis of gender. There were inconsistencies across the six communities in the American Southwest that Bagwell studied and specifically the degree of participation of women in the production process. In Zuni and Hopi, considered western pueblo communities, there was a high degree of female involvement in the process of constructing adobe buildings while, in the remaining four communities, eastern pueblos, men dominated the construction process, with women participating in the plaster finishing of the adobe walls. Bagwell (2006:134) also argues that there were likely two types of production groups involved in the construction of adobe buildings, with both types consisting of adult men who were associated with either extended kin groups or non-kin religious-based groups.
These analyses highlight the challenges inherent in understanding archaeologically invisible social organization involved in producing architecture. The world-wide review of ethnographic literature and the local regional analysis both indicate that a number of labour strategies can be involved in building architecture and, even when there are distinct trends, it is tricky to tease out the exact strategy used in a particular incident. The use of ethnographic evidence to predict past behavior is complicated by the time elapsed between the cultures; in this case some 800 years elapsed from the building of Pot Creek to the modern ethnographic examples. Adding to the complexity of the analysis are the radical changes that took place in the American Southwest with the arrival of the Spanish.

However, some considerations aid our understanding of architectural production at Pot Creek. Different organizational configurations of production groups likely resulted from the building process associated with drying times for adobe courses, either forcing episodic or allowing continuous building to take place. Differences in the social organization of production likely occurred depending on the purpose of the construction, either the primary construction of a building or secondary construction episodes involving maintenance and repair. In addition, changes in the social organization of production likely occurred as the community and the associated labour force expanded.

It is important to consider the sequence of steps necessary to create an adobe structure, going beyond a physical description of the characteristics of the structure to include the interaction of materials, labour, and social components. The organization of production of an adobe structure in the next sections will set the stage for more in-depth consideration of the construction sequence of the adobe roomblocks at Pot Creek.
5.1.2 Building Site: Site Selection and Clearing

The initial step in the construction process is the selection of a site for the community and includes decisions about both physical and social factors. Social factors in the site-selection process include the proximity of a compatible social network, the historic trajectory of the use of the land in the past, ritual sanction or approval of the site, and the ability to defend the particular site from others. These issues are important but will not be considered further here as they have been well developed elsewhere (Fowles 2004).

The selection of a site location also depends on physical factors such as the distance to a reliable water supply, a level building site, proximity to pockets of fertile ground for agriculture, and availability of raw materials for construction such as wood and clay. Availability of labour would also be a consideration in the decision-making process for site selection and subsequent preparation of the site as the labour required to construct the buildings would have to be balanced with other duties of day-to-day living. While this may seem an obvious point, the labour needed to perform all of the construction tasks throughout the entire construction project is important when considering such decisions as the amount of land to clear, the amount of timber to be cut, and the custom of stock-piling timber. In the Pot Creek region, forests with a variety of tree species were available and each tree would require a significant labour expenditure to fell.

The estimate of the amount of land to clear is an element in the process of site selection and depends on the spatial requirements of the community, the nature of the environment, the size of the available labour force, other duties that may have priority, such as agricultural tasks, and seasonal considerations. It is unlikely that the entire site of Pot Creek was cleared in the initial phase of construction as the initial occupation phase was quite modest, with few buildings and occupants. The expansion of the site likely occurred over an extended period and episodically as the spatial requirements for the buildings and the plazas increased.
5.1.2 Raw Material: Acquisition and Preparation

The next phase of construction is raw material procurement of both clay and wood components. Wetherington (1968:19) states that no clay pits existed in the immediate vicinity of Pot Creek, but Fowles and his colleagues (2007:133-144) argue that clay pits were present, their analysis indicating that clay from Pot Creek originates from weathered local sandstones within 1 km of the site and that pottery from the site has similar mineralogy as the local raw clay. The timbers used for the construction of the roofs of the buildings were from the local area, indeed, possibly from the site itself. The species were all local varieties that are still present in the region. Further analysis of the wood and the practice of stockpiling the wood are discussed in greater detail below.

The social organization of production for the procurement and preparation of materials would have involved a number of considerations, including the quantity and quality of materials needed to build structures of required dimensions and these materials’ availability. Task groups for the collection of certain types of clay, water, wood, and other materials were likely gendered. The world-wide ethnographic survey noted that men tended to be responsible for acquisition of materials for framing, earth or stone, and thatch, while women were more involved in the procurement of decorative materials, although men still dominated in this activity (Bagwell 2006:65). There was no clear division of labour by gender for the procurement of materials in the American Southwest.

5.1.3 Production Processes: Primary and Secondary Construction

The walls consisted of coursed adobe at Pot Creek as at other contemporaneous pueblos in the region, such as at Picuris Pueblo (Dick et al. 1999) (Figure 5.3). Each course or layered
row of adobe ranged from 28 to 40 cm in width by 46 to 56 cm in height (Wetherington 1968:19). Wetherington (1968:20) states that each course of adobe was laid down and allowed to dry in situ before another layer was added. It has been estimated that the adobe courses needed one to two days of drying time before another layer could be added and that most adobe projects took at least a week to complete (Bagwell 2006:128). Rooms at Pot Creek had four or five courses of adobe depending upon the final height of the wall and the number of stories that were present (Wetherington 1968:20). Construction of this sort was likely conducted by local production groups using an episodic approach, where a course of adobe was laid down and then the workers performed another task, such as agriculture, before returning a few days later to add another layer of adobe. An alternative production scenario would be to construct larger
roomblocks with many rooms simultaneously. In this case, the production process could be continuous with adobe courses in one location being laid down and allowed to dry, while the labour force continued construction in another location before returning to the original location after the adobe had dried.

The labour involved in the construction of adobe roomblocks is less discernible in the archaeological record than the raw materials. However, a number of lines of evidence can assist us in appreciating some of its labour components. The presence of hand and finger marks on the adobe gives clues to the techniques used in forming the adobe. Fingermarks were present down the length of the adobe walls, which would indicate that the walls were constructed by hand without moulds (Wetherington 1968:19).

*Labour Tasks in Construction*

The cross-cultural study indicates that men in middle-range societies tended to perform the major construction activities, such as preparing and placing the wooden support beams and constructing adobe walls (Bagwell 2006:106). In some simple societies, framing and earth- and stone-production was conducted by men and by both men and women in others (Bagwell 2006:105). It is possible that the division of labour and the composition of construction groups changed during the time that Pot Creek was under development as the community grew from a very simple to a more complex society of the middle-range.

Ethnographic evidence is available at nearby Taos Pueblo, where, in the 1930s, women created ceramic pots and plastered roomblock walls and *kivas* with a thin clay/water mix (Parsons 1936:24). While the processes involved in creating pottery or plastering walls is quite different than the creation of adobe courses, this suggests that women had the necessary skills required to work with clay.
A further example of gender-specific labour is the production of adobe bricks, although the evidence regarding the division of labour is inconclusive. Adobe bricks were not used at Pot Creek, however, the division of labour for the task of creating adobe bricks is informative. In communities in northern Rio Grande, where adobe bricks were made, ethnographic data indicate that men were the main source of labour for brick creation, while women carried clay and plastered walls (Holschlag 1975:92). In contrast, ethnohistoric evidence indicates that women were the main source of labour for the construction of adobe bricks, as described in multiple accounts of the Coronado Expedition (1540 - 1542) and early Spanish chronicles:

“The women being engaged in making the mixture and the walls, while the men bring the wood and put it into place. They had no lime but made a mixture of ashes, coals, and dirt, which is almost as good as mortar, for when the house is to have four stories, they do not make the walls more than half a yard think. They gather a great pile of twigs of thyme and sedge grass and set it afire, and when it is half coals and ashes they throw a quantity of dirt and water on it and mix it all together. They make round balls of this which they use instead of stones after they dry, fixing them with the same mixture which comes to be stiff like clay¹ (Winship 1896:520)”.

It is difficult to pinpoint exactly the gender divide in the labour process of forming the walls, but it is safe to say that this activity garnered a significant labour force within the community of Pot Creek during the multiple phases of construction.

¹Winship interprets an account by Benavides regarding how churches and convents were built in the pueblo region: “Como lo testifican bien todas las iglesias y conuentos, que tienen hechos, los quales todos parecera enarecimiento el dezir, que siendeo tan suntuosos y curiosos, los hā hecho tan solamēte las mugeres, y los muchachos, y muchachas de la dotrina; porque entre estos naciones se vsa hazer las mugeres las paredes, y los hombre hilan y texen sus mantas, y van á la guerra, y a la caza, y si obligamos á algū hombre á hazer pared, se corre dello, y las mugere se rien.” (In Bandelier 1892:141).

Winship interprets from a description related during the Coronado Expedition of the building process in Cibola: “para dármelo á entender, tomaban tierra y ceniza, y echábanle agua, y señalábanme como ponían la piedra y como subían el edificio arriba, poniendo aquello y piedra hasta ponello en lo alto; preguntábales álos hombres de aquella tierra si tenian alas para subir aquellos sobrados; reianse y señalábanme el escalera, tambien como la podria yo señalar, y tomaban un palo y ponianlo sobre la cabez y decian que aquel altura hay de sobrado á sobrado.” Relacion de Fray Marco (In Pacheco and Cardenas 1866:339).
Central Basin-and-Post Complex

The central basin-and-support-post complex was a unique characteristic of the Taos region, including Pot Creek, and was an integral component of the buildings’ structural support system. It is important to understand the building design and structure of the central basin-and-post complex for three reasons: 1) the features are unique to the Taos region, 2) it is present in almost every excavated room at Pot Creek, and 3) the posts were an important source of timbers for dendrochronology. The feature consists of a circular basin or depression in the floor constructed of either adobe or flagstones and a central support post (Wetherington 1968:26) (Figure 5.4). The basins were either flush with the adobe floor or had a raised adobe rim. Some of the basins were lined with rock slabs. It is possible that the basins had a functional purpose, such as storing corn, but the function was not readily apparent at the time of excavation (Wetherington 1966; 1968).
The central-post support system is of interest here as the posts and beams supported the roof structure and upper stories of the buildings and were one of the reasons to perform maintenance and repairs to the buildings. Single, upright posts for roof supports are rare in the Northern Rio Grande region. More frequent are several posts spatially dispersed within the room and often in sets of multiple posts rather than as a single support mechanism (Kidder 1958; Wendorf 1956a). An alternative roofing arrangement would be to have no roof supports whatsoever. In this case, the horizontal roof beams would rest upon the adobe walls as the sole means of support. However, the central-post support system was ubiquitous in the Taos region and a common feature at the nearby contemporaneous sites of Picuris Pueblo (Dick et al. 1999:60) and the Llano site (Jeançon 1929). There is evidence that the system had survived until the Spanish arrived in the region, as the central basins and support posts were evident in abandoned rooms at Taos Pueblo until about the 1630s (Wetherington 1968:33). The central posts supported the roof with only a minimal number of notched cross-beams, or *vigas*. On top of the *vigas*, secondary pieces of timbers (*latillas*) of smaller diameter were overlaid by a tertiary layer of smaller wooden pieces, grasses, and other vegetation. The final layer was adobe to seal the roof from water or create a solid floor for an upper story.

There are concerns that the post-supported roofs did not effectively support multiple stories, particularly if the building was allowed to fall into disrepair or if the central post was on ground that was not fully settled, such as over an abandoned and filled *kiva* (Kidder 1958:90; Wetherington 1968:33). Major structural damage would ensue as the notched *vigas* could either list or break completely and thereby dislodge any adobe masonry above them. At Pot Creek, nearly all of the roomblocks had multiple stories and it does not appear that the center-post construction limited the capability of the buildings to withstand many years of use without collapse.
The ethnographic survey of world-wide cultures found that men formed the primary labour force for preparing and framing an architectural project in middle-range societies, while the activity often involved both men and women in simple societies (Bagwell 2006:104). Again, within Pot Creek the division of labour may have changed as the community expanded over time.

*Repairing and Remodeling Roof Support Systems*

The process of repairing and remodeling the roof supports is critical to the analysis of the construction sequence at Pot Creek. The use-life of an adobe building has been estimated to be about 19 years (Crown 1991:305). The process of repair would consist of removing any broken beams, repairing adobe walls, realigning a new central support post with a new *viga* and creating a new roof. For a single-story structure this is not too onerous a task, but for multi-story structures the repairs would have been much more complex.

Roomblock 1 at Pot Creek serves as an example of a simple process of repair. The Roomblock consisted of a single-story complex of eight rooms. It would have been a relatively simple process to repair any damage caused by water accumulating on the flat roof or from listing of the central support post. The old adobe roof structure would be removed along with the underlying vegetation and the smaller timbers used as crossbeams. Then the large *viga* or roof beam and central support post would be removed and replaced, if necessary, and reconstruction of the roof of the building could occur after replacing any of the cross beams that appeared damaged and covering them with grass and finally adobe. The presence of beams and wood timbers with clusters of dendrochronological dates within one room is explained through this process of construction repair. The dating and construction of Roomblock 1 will be discussed at greater length below.
The decision to repair or abandon an adobe structure would have been based on a number of factors related to the condition of the building, but also on social factors such as the need to use that particular space. Increasing population pressures within the community may have contributed to the decision to remodel a structure rather than abandon it and construct a new building. The reallocation of the use of the structure, for example from a living space to a space for storage, may also have been a factor in the decision to remodel.

5.1.4 Abandonment Processes

Room and site abandonment are relevant to the sequence of occupation of Pot Creek, and to the trajectory of construction and re-modelling that was performed within the community. Room abandonment may have occurred on a random, scattered basis, or as Crown (1991:307) suggests, as a larger community-wide abandonment event in the late 1280s, followed by reoccupation and final abandonment in 1320. It is unlikely that all rooms were in use at any one time and the average rate of room occupation may have been about 78%, as in an ethnographically occupied pueblo (Hill 1970:75). These rooms, whether occupied or abandoned, would impose visible barriers across plaza spaces as they were still fixed features on the landscape and thus blocking inhabitants’ views within the community.

Abandonment processes at Pot Creek involved a number of intricate steps that were not uniform across the pueblo. Various levels of complexity are related to the abandonment of spaces within the community, including the intentional and unintentional closure of mundane habitation and storage rooms and the ritual abandonment of kivas. The mundane spaces may have been abandoned with little to no preparatory efforts, with discarded implements relating to daily life scattered upon the floor, and the room subsequently filled with debris. A more elaborate method of abandonment involved the clearing of the room of items, perhaps the deposit
of offerings, intentional burning of the room, and later in-filling the room with debris. The intentional clearing and closure of rooms was quite common in the community where approximately 60 habitation and storage rooms contained evidence of clearing and burning, with most of these rooms facing onto plazas (Adler 1995).

More elaborate abandonment processes were reserved for kiva structures. The closure of the D-shaped kiva, or room 822 (Fowles 2004:628-650), involved placing offerings in the northern part of the kiva that included skeletal remains of dog, deer, beaver, and a decapitated human infant. In the southern section of this kiva, items related to plant materials were present, including a piece of yucca matting, fused corn kernels and husks, piñon nuts, and a fire-hardened wooden point, possibly used for digging (Fowles 2004:613). In the kiva associated with Roomblock 6, three deer skulls were found (Brown et al. 1992), providing further evidence of the deliberate placing of offerings prior to closing the kivas.

The elaborate preparations to terminate the ritually significant kiva spaces signifies the importance of these closure rituals to the community. The abandonment processes at Pot Creek were not without careful thought and concern for prescribed rituals. What makes this an important element for this research is that the abandonments and closures of the roomblocks and kivas occurred, perhaps sporadically, throughout the occupation sequence. The buildings remained standing and provided visible barriers in the case of the roomblocks, or provided visible reminders of the ritual activities of the past in the case of the abandoned kivas.

5.1.5 Summary: Building an Adobe Structure

Describing the construction process for an adobe structure is important because it helps us to understand the overall construction sequence at Pot Creek. The chaîne opératoire approach used here encourages an in-depth review of the process of constructing, using and abandoning an
adobe roomblock and forces us to consider the decision-making junctures involving both material inputs and social production. The purpose of this analysis was to understand the processes through which the raw materials were transformed into the finished product, the built adobe roomblock structure, and how this process might affect the reconstruction for visual analysis. At Pot Creek, the construction of new roomblocks was an important on-going activity that required planning and the allocation of resources. The process of mixing the clay and laying the adobe courses, together with the intervals needed for one layer to dry before proceeding to the next layer, gives insight into the daily lives of the inhabitants of the community.

5.2 Methods of Analysis for Recreating the Construction Sequence

Understanding the construction sequence is critical to appreciate the spatial development of the Pot Creek site and its potential for social interaction within the spaces as they changed over time. Practices such as stockpiling wood, re-using old wood, and using dead-fall trees can create alternatives for the interpretation of the construction sequence. The analysis that follows relies on various lines of evidence, including dendrochronology, wall bonding and abutment, and specific excavation data for each roomblock at Pot Creek. A construction sequence based solely on tree-ring data is not entirely conclusive and other lines of evidence are needed to interpret the construction chronology of a site like Pot Creek. Relative chronology of construction events can bolster the dendrochronology. For example, analysis of wall bonding and abutment can provide temporal construction patterns in a relative sequence. Excavation data can also aid in the interpretation of tree-ring dates by providing information on the relative position of timbers in the stratigraphic sequence.
Figure 5.5. Dendrochronological relationships. T1 represents germination of the tree, while T5 represents site abandonment. The simplest dating situation is A, where the dated reference and target events both occur at T4, illustrating contemporaneous events. A hiatus exists in situation B, between the dated reference (T3 - death of tree) and target (T4 - room construction) events. Bridging events, such as stockpiling, can occur to span a hiatus. Situation C illustrates a gap between the dated tree rings (T2) and death or cutting of the tree (T3). A disparity represents the interlude between the target event (construction - T4) and some later event, such as a repair, use of a hearth, or abandonment (T5). Adapted from Dean (1978a:227).
5.2.1 Dendrochronology: An Overview

Tree-ring dating or dendrochronology is an exacting science with a long history of development and use in archaeology in the American Southwest (Dean 1969; 1978a; 1978b; Douglass 1919; 1936; Nash 2002; Wiseman 2004), yet there remain numerous areas where considerable judgment is necessary in order to interpret the data. Interpretative issues in dendrochronology fall into three main themes: 1) gaps associated with cutting and non-cutting dates, 2) hiatuses related to bridging events that occur between cutting timbers and construction, and 3) disparities that occur after construction and before final abandonment (Dean 1978a:233). A thorough understanding of tree-ring dating will assist in the establishment of the construction chronology for Pot Creek Pueblo.

Prior to further discussion of tree-ring dating and interpretative analysis of tree ring dates for Pot Creek, it is important to understand the terminology involved with the events used in dendrochronological analysis (Figure 5.5). A dated event is an event directly dated by the chronometric technique, and for dendrochronology the dated event is the growth of the layer of xylem cells, or tree-ring (Dean 1978a:226). Dendrochronology can date many different phases in the life of a tree, from the germination date to the deposition of each layer of xylem cells. However, archaeologists are primarily concerned with a date that is related to a closely associated event, or a dated reference event (Dean 1978a:228). For tree-ring analysis, the dated reference event is the growth of the sample’s outer-most preserved tree-ring. The target event is the event to which archaeologists will apply the dates (Dean 1978a:228), for instance, the use of a beam in initial room construction. The target event could also relate to other events, such as renovation or abandonment. A bridging event acts to link events, for example, cutting trees for later use, or stockpiling, or reusing wood from another context, bridges the time between the death of the tree and room construction.
Time intervals in the sequence of events also need further clarification, and the first such interval is a *disjunction*, which occurs prior to the target event. The traditional term for a *disjunction* is *terminus post quem* (TPQ), which is the earliest possible date for an object, site, or stratigraphic layer (Grant, Gorin, and Fleming 2008:97). The simplest case occurs when the last dated tree-ring is in the same year as the construction date, or target event (Situation A, Figure 5.5). A *disjunction* occurs when there is a time lag between the last available tree-ring and the target event and is comprised of a *hiatus*, a *gap*, or both (Dean1978a:227). A *hiatus* can occur between the dated reference event (outermost tree ring) and the target event (room construction) (Situation B, Figure 5.5). Examples of a hiatus include stockpiling timbers for later use, using dead-fall trees in construction, or re-using wood used in a prior construction context. A *gap* occurs when outermost tree-rings are absent or not useable for analysis, as happens when the outermost layers of a timber are removed after the tree has been felled (Situation C, Figure 5.5). In dendrochronology, this gap is referred to as a *non-cutting date* which indicates that the final available tree-ring predates the reference event by some unknown number of years.

The second category of time interval is a *disparity*, which occurs subsequent to the target event. The traditional term for a *disparity* is *terminus ante quem*, or the latest possible date for an event (Grant, Gorin and Fleming 2008:97). Events in the *disparity* interval could include remodeling, renovation, or other datable events such as the last firing of a clay hearth.

In the next section, I consider issues surrounding tree-ring dating that impact archaeological interpretation of tree samples in an attempt to understand the many elements of professional judgment that play a role in the creation of a construction chronology.
<table>
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<th>Symbol</th>
<th>Proximity to Date of cutting</th>
<th>Attributes of the Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Cutting date</td>
<td>Bark is present</td>
</tr>
<tr>
<td>r</td>
<td>Cutting date</td>
<td>Outermost tree ring is continuous around circumference of specimen</td>
</tr>
<tr>
<td>v</td>
<td>Probable cutting date</td>
<td>Subjective judgment that the date is the cutting date or within a few years of the cutting date</td>
</tr>
<tr>
<td>vv</td>
<td>Non-cutting date</td>
<td>There is no way to estimate how far the last recognized ring is from the cutting date</td>
</tr>
<tr>
<td>+</td>
<td>Non-cutting date</td>
<td>Rings are missing near the outside and the absence cannot be determined since the series does not extend far enough to provide adequate cross-dating</td>
</tr>
<tr>
<td>++</td>
<td>Non-cutting date</td>
<td>Tree was under stress or dead when cutting occurred and therefore difficult to determine the date of cutting</td>
</tr>
</tbody>
</table>

Table 5.1. Summary of tree-ring dating symbols used by the Laboratory of Tree-Ring Research, University of Arizona. From Crown (1991:298) and Ahlstrom (1985:611-617).

Gap Disjunctions: Cutting and Non-cutting Dates

In order to establish the date of a specific site, or date specific phases of construction within a site, we should also consider many factors in dendrochronological analysis (Dean 1969; 1978a; 1978b; 1988; 1997; Dean and Robinson 1977). The significant dated reference event is the determination of the outermost layer of xylem cells, or the tree-ring, which may, or may not, be present and relate to death or felling of the tree. Tree death can result from either being cut (usually a human intervention) or from natural causes, such as windfall, and limbs can also be cut without killing the tree. The presence of bark on a wood sample can definitively indicate the outer-most tree-ring. However, the presence of bark, or the final tree-ring in its entirety, is quite uncommon, and the absence of the outermost tree-rings indicates a gap. Another factor to consider in tree-ring analysis is preservation of the sample. Preservation can affect the ability to date a sample, where well-preserved wood from an architectural context protected from weather-
related deterioration is more likely to have its outer rings preserved than a burned sample that has been exposed to the elements.

The sciences of dendrochronology and archaeology intersect at the outermost tree-ring of a wood sample as this layer is the final tree-ring produced prior to the demise of the tree. A variety of symbols are used to designate cutting dates and the implied accuracy of those dates from tree-ring analysis and relate to important attributes of the wood samples. There are three main categories of dating symbols used in dendrochronological analysis; 1) cutting dates, 2) probable cutting dates, and 3) non-cutting dates (Table 5.1). The cutting date category is the gold standard for accuracy for tree-ring analysis, and includes the presence of bark (symbol = B) or the outer most ring of wood around the entire circumference of the specimen (symbol = r). If either of these two attributes is present on the specimen then dating is relatively straightforward (Ahlstrom 1985:619). The probable cutting date category (symbol = v) is based on the dendrochronologist’s interpretation of the tree rings to be either cutting dates or within a very few years of the cutting date (Ahlstrom 1985:614). Factors in the consideration of probable cutting dates are the presence or absence of beetle tracks, smoothness or surface patination on the wood beneath the bark layer, and the indication of partial layers of outer rings (Alhstrom 1985:31). Subjective evaluations by experienced dendrochronologists provide assurance that v dates are another kind of cutting date (Ahlstrom 1985:39).

Absence of the outer layer or bark of a specimen leads to less reliable determinations of tree death and relates to a gap disjunction in Dean’s (1978a) classification system. The third, and least reliable date category, is the non-cutting date (symbolized by vv, +, and ++) which provides a terminus post quem, or the earliest time that an event may have happened. When there is no way to determine how far the last preserved ring is from the tree’s outer ring the symbol, vv is used. The + symbol indicates that 1 to 3 rings may be missing from the series whose presence or
absence cannot be determined since the series does not extend far enough (Ahlstrom 1985:31; Robinson, Harrill, and Warren 1975:6). The ++ symbols indicate that the tree was likely dead when it was cut. Pieces of dead wood are identified by breakage at the end of the beam caused by an axe breaking the wood, rather than cutting the wood, or from flaring occurring at the root when cut. The entire specimen must be analyzed to determine this attribute, not just a core sample. The poor structural integrity of dead trees prevents them from being used for structural support for a building (Ahlstrom 1985:615), such as a centre post or a horizontal beam, or viga. Most of the wood samples from Pot Creek were architectural in nature and therefore not likely to be from dead trees.

At first consideration, samples that are determined to provide non-cutting dates appear to have little utility in determining the construction sequence of a particular room or architectural element. However, when clusters of non-cutting dates are present for a single context, then there is some utility in inferring that the non-cutting dates pre-date the death of the tree by a few years (Crown 1991:298; Dean 1978a:250; Nash 2002:250). The total volume of dendrochronological dates, or the ‘strength in numbers’ principle (Dean 1978a:250), available at a location may also lend credence to overall cultural activity at a location. A cluster of non-cutting dates for a particular construction event, such as a room, can give some indication of overall occupation and intensity of activity (Wiseman 2004:160) and provides a terminus post quem or a date sometime after the interpreted cutting date. Appreciation of the many complexities of tree-ring analysis is relevant to this research as the range of interpretations of the data will have a bearing on the interpretation of the construction sequence at Pot Creek.
Hiatus Disjunctions: Stockpiling Timbers

Stockpiling timbers is the practice of retaining newly cut timbers for use in a construction project at a later date (Ahlstrom 1985:627), and is critical to tree-ring interpretation. Stockpiling timbers is a *bridging* event that connects the *dated reference event* (tree death) to the *target event* (room construction) and bridges the *hiatus disjunction* (Dean 1978a:230). Stockpiling is likely to have occurred when there are clusters of dates that range up to five years prior to the actual construction date (Ahlstrom 1985:627). It is important to consider the practice of stockpiling because it could easily sway the interpretation of the construction sequence by as much as 30 years for certain roomblocks at Pot Creek, and, thus, I will consider alternative explanations for bi-modal tree-ring dates.

A number of explanatory possibilities exist when we are confronted with a room with tree-ring dates that do not cluster around a point in time. The timbers could have been cut at an earlier date, stockpiled, and then used, or some of the wood could be from an older structure and re-used in a more recent construction episode, or there could have been repairs at a later date. Date intervals in the tree-ring sequence offer clues to whether the clusters represent stockpiling activities or not. A close date cluster of 1 to 5 years likely represents stockpiling, while longer intervals, or discontinuous date distributions, could be related to the re-use of older timbers or later repairs (Ahlstrom 1985:627-629). Another alternative is that construction occurred at the earlier date, with additional timbers added at a later point in time in a remodeling episode. Finally, construction of lower floors could have occurred followed by later construction of upper stories (Ahlstrom 1985:65-68; Crown 1991:298).

In Roomblock 1 at Pot Creek, the dendrochronological dates are bi-modal, with one cluster around 1279 and the other at 1309. Crown (1991) has argued that Roomblock 1 was built with wood that had been stockpiled from 1279, as well as new wood, and then completed in
1309. I argue that the structure was built around 1279 and then repaired in 1309. From a behavioural point of view, it seems unlikely that the inhabitants at Pot Creek would cut extra trees down at a time when the labour force was small in the late 1270s and then not use the timbers for thirty years, unless they needed to clear the trees anyway to make space for the buildings. That more timbers were cut in the 1280s and used in construction also makes Crown’s scenario unlikely. It is possible that the community needed to cut a large number of trees in order to clear fields for agriculture but, if this was the case, we must consider the state of the timbers after being exposed to the elements for 30 years.

Arguments against stockpiling of timbers for long periods relate to the necessity of seasoning the wood, as well as possible deterioration of the wood at the end of the stockpiling period. Seasoning, or drying, wood after cutting is necessary to prevent warping of the timbers. For ponderosa pine, *Pinus ponderosa*, it would take from 15 to 150 days to dry a 2.54 cm (1 inch) piece of lumber, depending upon the drying conditions (United States Department of Agriculture, Forest Services [USDA FS] 1999:24). The Taos region of New Mexico is considered dry (Rietz 1978:19) but has, on average, less than 6 months of good air-drying conditions per year (USDA FS 1999:23). A larger diameter timber would take longer to cure than the smaller example, but would likely be fully dry within a few drying seasons.

The suggested stockpiling time span of 30 years, however, is so long that deterioration of the wood could occur. The overall relative humidity in a region has the greatest effect on the storage of wood, but rain and snow accumulation on unprotected wood can lead to uneven moisture content in the wood and result in warping (Rietz 1978:4). In the dry regions of Northern New Mexico, cut timbers are relatively immune to damaging moisture unless the wood is unprotected outdoors and comes into contact with rain and snow, which can cause considerable damage through fungal growth, staining, warping, and decay (Reitz 1978:17).
Overall, it would appear that the ideal length of time for stockpiling timber in northern New Mexico would be one to two years. This would ensure that the wood was well cured, but is not so long that rain and snow moisture would penetrate the wood. This is in stark contrast to Crown’s (1991) argument that the wood for Roomblock 1 was stockpiled for 30 years and then used to construct the roomblock. It seems much more likely that the building was constructed around 1279 and then remodeled 30 years later.

One further issue that we must consider is the frequent practice of the reuse of old timbers for new construction projects and for repairs. Reuse of wood salvaged from an older structure for a more recent renovation project can obscure the temporal sequence (Dean 1969:9-11). Ahlstrom (1985:627) argues that the re-use of old wood is difficult, if not impossible to identify from tree-ring data. The re-use of old timbers in new construction projects was a common practice in some regions of the Southwest. In Chaco Canyon the reuse of timbers was commonplace (Windes and Ford 1996:297) and this practice also occurred in the historic era among the Hopi at Walpi Pueblo, a Western Pueblo in Northern Arizona (Ahlstrom et al. 1991:639). At Walpi some beams had been used in three or more contexts (Ahlstrom et al. 1991:639-640). The practice of reusing timbers was particularly evident in areas where wood was in short supply, as in the Chaco region.

Was the reuse of timbers a common practice at Pot Creek? Crown (1991:301) argues that eight rooms at Pot Creek contain evidence for the use of old wood in later construction and that these pieces of wood were cut from 6 to 38 years prior to their use in the rooms. I would argue that the reuse of wood timbers for construction was not a common occurrence in the region as timber was widely available in the area. The region today is heavily forested, with many varieties of large trees, and was likely similar in the past, to judge from the samples collected at Pot Creek. In addition, many of the pueblos in the Southwest where reuse of wood occurred had very
long histories of occupation, in excess of 500 years. These long occupations would have
influenced the availability and age of the standing trees in the region. The shorter occupation
history at Pot Creek (approximately 70 years) and the availability of mature trees in the area
make it unlikely that the reuse of timbers in construction was a common occurrence.

Stockpiling timbers for later use and reuse of old timbers in subsequent construction
projects can muddy interpretations of a construction sequence, yet through the careful analysis of
stockpiling conditions, availability of timber in adjacent areas, and consideration of the overall
longevity of the community, the construction sequence at Pot Creek can be disentangled.

Disparities: Room Use-Life

Dendrochronological analysis can provide estimates for when a target event occurred, for
example when a room was constructed (Dean 1978a:227), and in addition, it can aid our
understanding of the length of time a room was in use prior to abandonment through disparity
analysis. A disparity occurs in the temporal interval after a target event (Dean 1978a:229). For
example, tree-ring dating of room construction, C\textsuperscript{14} dating of a piece of charcoal in a hearth, or
dendrochronological dating of a timber used for renovating an existing room could all be
considered a target event where a disparity would occur after these dates. The disparity would
exist between the dated event and a later event, such as abandonment. Tree-ring analysis of
Roomblock 1 demonstrates a disjunction around the initial construction in A. D. 1279, and a
further disjunction surrounding the repairs completed by A. D. 1309. While the date of
abandonment is unknown, it likely occurred in the disparity after the renovation events of 1309,
providing us an indication of the length of occupancy for Roomblock 1.

The length of time that a room was in use is an important consideration when attempting
to estimate the construction sequence, and associated renovation patterns, as well as estimating
the population of a past community (Section 5.6 below). Crown (1991:305) suggests that the room use-life at Pot Creek was 19 years on average. The relatively wet climate surrounding Pot Creek causes adobe to disintegrate over a short time necessitating the replacement of roof beams damaged by moisture. This is corroborated by evidence from the nearby, modern pueblo of Picurís, where timbers in the *kiva* have to be replaced every 15 to 20 years (Crown 1991:305; Dick et al. 1999:50).

### 5.2.2 Wall Bonding and Abutment

The chronology of Pot Creek is based on architectural ‘horizontal’ stratigraphy and dendrochronology (Crown 1991). Bonded walls and corners in a room represent a continuous construction episode, while abutted walls indicate multiple construction events by having seams between the walls (Stubbs and Stallings 1953:25-30) (Figure 5.6). The walls of the initial room become the starting point for the abutment of subsequent additions, with each succeeding addition adding support and strength to the entire structure. Abutment can occur very soon after the initial wall construction or at some time in the distant future, resulting in a relative time sequence with no indication of the time interval between the stages of construction unless there is some indication of wear under the bond that would provide a rough indication of time elapsed. The sequence of construction based upon bonding and abutting of walls has been used as a relative dating technique for some of the roomblocks at Pot Creek (Crown, 1991; Crown and Kohler 1994; Wetherington 1968) and has been supplemented by dendrochronology, analysis of stockpiling and re-use of timbers, and stratigraphic information.
Figure 5.6. Diagram demonstrating wall bonding and abutment. The bonded walls have been constructed in a continuous adobe course, while wall abutment occurs in two distinct phases of application adobe.

5.2.3 Stratigraphic Excavation Data

Stratigraphy, the relative dating technique that is fundamental to archaeology, plays an important role in determining both the construction sequence at Pot Creek and the number of stories, or levels, in the various roomblocks. Wetherington (1968:37-40) uses stratigraphic data to supplement wall bonding and abutment, while Crown (1991:299-300) uses both of these techniques plus dendrochronology to clarify the construction sequence at Pot Creek. The later dates of timbers recovered on the floor of room 277 in Roomblock 2, and located in a lower stratigraphic unit than timbers from the upper story, allowed Crown to eliminate the possibility that the upper floors were constructed at a later date than the lower story. Crown (1991:299) concludes that the lower timbers must have come from a repair event after the initial construction of the two-story structure. The use of stratigraphic information will be used in conjunction with the other forms of evidence to bolster the determination of the construction sequence for the individual roomblocks at Pot Creek (Section 5.4).
<table>
<thead>
<tr>
<th>Roomblock or Feature</th>
<th>Dates of Construction (All dates in A.D.)¹</th>
<th>Evidence used to support the construction date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1279 and remodeled in 1309</td>
<td>Well dated based upon cutting and probable cutting dates. Early dates in 1279 may relate to either: 1) reuse of old wood in the construction of the rooms in 1308-1309, or 2) construction of 8 rooms, including room 103 and 104 in 1279, followed by repair and construction of the remaining 2 rooms (109 and 110) in 1308-1309.</td>
</tr>
<tr>
<td>3</td>
<td>Late 1270s and early 1300s</td>
<td>Numerous cutting dates and probable cutting dates. Also numerous rooms with no dates available.</td>
</tr>
<tr>
<td>4</td>
<td>Late 1270s and 1300 - 1320</td>
<td>Well dated based upon cutting and probable cutting dates, as well as non-cutting dates (Crown 1991:302).</td>
</tr>
<tr>
<td>5</td>
<td>Limited data</td>
<td>Limited data to support the construction sequence of this roomblock. This roomblock has been fully excavated but only one cutting date is available, 1286.</td>
</tr>
<tr>
<td>6</td>
<td>Mid-1260s to late-1280s and early 1300s</td>
<td>Well dated with cutting and probable cutting dates. Remodeling occurred in early 1300s. Some rooms assigned to date sequence by architectural construction analysis (Adler 1997:36-37).</td>
</tr>
<tr>
<td>7</td>
<td>1300 - 1320</td>
<td>Only one room, 701, has been excavated in this roomblock, producing one cutting date, 1315r, and two non-cutting dates of 1301vv and 1311++v (Adler 1997:28).</td>
</tr>
<tr>
<td>8</td>
<td>Comparatively late date</td>
<td>Excavation has not produced cutting dates, but dates have been estimated upon a limited ceramic sample by Fowles (2004:429).</td>
</tr>
<tr>
<td>9</td>
<td>Mid-1260s to 1280s</td>
<td>One cutting date has been produced for this roomblock, 1273rB and two non-cutting dates of 1248+v and 1273vv. Based upon these dates and the similarity in the overall design of the building it was likely constructed in the same initial construction period as Roomblocks as 2, 3, and 4 (Adler 1997:32).</td>
</tr>
<tr>
<td>10</td>
<td>Mid- to Late Date</td>
<td>Only one room has been excavated in this roomblock, producing 2 cutting dates at 1300. Formerly known as Room 113 (Crown 1991).</td>
</tr>
</tbody>
</table>

Table 5.2. Summary of construction sequence at Pot Creek and evidence used to support the construction sequence. Data from Adler (1997); Arbolino (2001); Crown (1991); Crown and Kohler (1994); Fowles (2004). ¹Dates include my interpretations where different from sources.
Table 5.2 continued. Summary of construction sequence at Pot Creek and evidence used to support the construction sequence. Data from Adler (1997); Arbolino (2001); Crown (1991); Crown and Kohler (1994); Fowles (2004). Dates include my interpretations where different from sources.

<table>
<thead>
<tr>
<th>Roomblock or Feature</th>
<th>Dates of Construction (All dates in A.D.)¹</th>
<th>Evidence used to support the construction date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Kiva</td>
<td>1318</td>
<td>Some cutting dates available.</td>
</tr>
<tr>
<td>Kiva A</td>
<td>1275</td>
<td>Some cutting dates available. Remodeling occurred in early 1300s.</td>
</tr>
<tr>
<td>Kiva 2</td>
<td>1154</td>
<td>Some probable cutting dates available.</td>
</tr>
<tr>
<td>Kiva 6</td>
<td>1260 - 1320</td>
<td>Tree-ring dates after 1305 indicate remodeling at that time. A new floor structure indicates that the kiva was remodeled.</td>
</tr>
</tbody>
</table>

5.3 Archaeological Evidence

I use various lines of evidence in order to tease apart the construction sequence at Pot Creek, including an analysis of wall abutment sequences, dendrochronology, and stratigraphic information on beam recovery locations. The dendrochronological analysis includes cutting dates, probable cutting dates, and non-cutting dates in order to provide support for the construction sequence at Pot Creek. The number and quality of the wood samples is uneven across the site, with the vast majority of the tree-ring dates coming from Roomblocks 1, 2, 3, 4, and 6, or the southern and eastern portions of the community (Table 5.2). The uneven distribution of tree-ring dates is primarily due to the preference given to certain roomblocks throughout the excavation history at Pot Creek. Data for this research has been compiled from a number of sources related to past excavations. Detailed roomblock drawings exist for the excavated units (Roomblocks 1, 2, 3, 4, and 6) complete with wall abutment and bonding information (Adler 1997; Arbolino 2001; Crown 1991; Fowles 2004; Wetherington 1968). No detailed data exists for Roomblock 5, which was excavated by another institution in the early
1970s and no records are available (Crown 1991). Little detailed information regarding wall construction and very few tree-ring samples are available for the areas of the pueblo where little excavation has occurred, Roomblocks 7, 8, and 9. The bulk of the data available for this portion of the pueblo was revealed through the process of carefully scraping the surface of the mounds with a specially fitted backhoe to reveal the walls beneath (Adler 1997:6).

The extensive excavation history at Pot Creek has provided a wealth of data including a vast collection of wood samples that have provided a large sample of dendrochronological dates. Crown (1991) analyzed results from excavations from the period between 1957 and 1983. Further analysis of tree-ring dates (Arbolino 2001; Fowles 2004) and relative dating (Adler 1997:37) include excavations up to the early 2000s. Fortunately for the purpose of dating the construction sequence, most of the wood samples come from building components such as support posts and roof beams. No wood used for tree-ring dating came from hearth features (Crown 1991:298). Some wood in the rooms may have come from trash deposited into the rooms after the rooms were no longer in use, but it is often impossible to determine if these pieces were used in the construction of the rooms or came from trash contexts.

For this research, I am concerned with the patterns of the exterior architectural forms of the buildings and the settlement patterns at Pot Creek and how the community changed over time. I use the construction sequence of the interior rooms to aid in the reconstruction of the buildings as whole units and have not analyzed the interior spaces as to their function, use, or areas of social interaction. The exterior form of the buildings allows me to focus on the resulting transformations in outdoor visual patterns and potential areas of social interaction across the community in the spaces between and surrounding the buildings. Thus, I have reduced the number of phases of construction from Crown’s analysis of Roomblock 2 from 8 down to 6
phases, thereby eliminating analysis of interior renovations that occurred during the later phase of occupation for this Roomblock and simplifying the construction sequence of the Pueblo.

5.3.1 Adding Height

The height of building structures is an often overlooked element of an archaeological site plan, yet is an important component for this research. The understanding of space that archaeologists typically create is remote from those of the past communities they seek to understand. Archaeological site maps are created from a bird’s-eye view, not from the lived perspective.

The height of the buildings, represented by the number of stories, allows or masks visual pathways over long distances and becomes a filtering mechanism for social interaction. The introduction of the element of height in a model allows a more realistic understanding of the spatial configuration of the physical environment. Through the use of three-dimensional computer modelling, I attempt to get back to ground level, to get a sense of the space from the inhabitants’ point of view.

I have added the element of height to the analysis of the buildings at Pot Creek by creating three-dimensional models with Google SketchUp® 2014, and using site maps by Adler and Fowles (Arbolino 2001; Fowles 2004). Additional data, including the number of floors in the roomblocks (Holshlag 1975; Wetherington 1968), outlines of household units (Arbolino 2001; Holshlag 1975), and bonding and abutment data (Adler 1997; Crown 1991; Wetherington 1968) were incorporated into the models. The nature of the computer software emphasizes straight lines and 90° angles, which was not the practice of the builders of the pueblo communities. Small variations exist between the models created here and the site maps, as not every curved wall was modelled precisely. The slight variations from the hand-drawn site maps were deemed to be
acceptable for the purpose of this research when considering visual interactions over large distances. A more complete description of the method for the creation of the 3-D computer models is included in Chapter 4.

5.3.2 Architectural Patterns

Typological classification is often used in archaeological analysis to create order by creating manageable groupings of information. Typology is particularly relevant when there are large quantities of data or when items under consideration are complex. At Pot Creek, the designs of the roomblocks can be grouped into three broad morphological categories based upon the shape of the roomblocks in their final form: C-shaped, L-shaped, and linear buildings (Figure 5.7). This typology will be used to aid in the development of the construction chronology for the entire pueblo.

Roomblock Form

During the final phase of occupation, A. D. 1300 - 1320, Roomblocks 2, 3, and 6 have a C-shaped building configuration, consisting of multiple contiguous rooms surrounding small plazas. The similarities between the three roomblocks are striking; with similar small plazas with gaps to the outside of the roomblock towards the southeast. Morphologically, each of the roomblocks appears to be initially constructed surrounding the plaza and then had rooms added at later dates on the external periphery of the buildings. Similarities in the configuration of the C-shaped roomblocks have been used to aid in the creation of the detailed construction chronologies of the buildings, below.
Figure 5. 7. Typology of roomblock form at Pot Creek during the final phase of occupation (A.D. 1300 - 1320). Dark grey areas indicate the buildings in the typology categories.
The second category in the building typology at Pot Creek is the L-shaped building, represented by Roomblocks 5 and 8 in their final configurations. Roomblocks 5 and 8 both had large open plaza expanses to the south and east of the roomblocks, created from a pattern of contiguous rooms in an ‘L’ pattern, dissimilar to the more enclosed, or C-shaped layout, of Roomblocks 2, 3, and 6.

The above interpretation of the L-shaped roomblock follows Fowles (2004; 2005), but the building consisting of Roomblocks 7, 8, and 9 can be interpreted in alternative ways. It is possible to consider Roomblocks 7 and 8 as a C-shape configuration and Roomblocks 7 and 9 as an additional L-shaped building. Further discussion of these possibilities are included below (Section 5.4.7). It is also possible that the roomblocks that follow the L shape are incomplete or unfinished C-shape roomblocks, but given the timing of the construction of the L-shaped roomblocks, this is unlikely.

The final type of roomblock configuration is the linear roomblock, represented by Roomblocks 1, 4, and 9. The long linear array of rooms contained in Roomblocks 4 and 9 provides an identifiable boundary on the eastern and western peripheries of the community. These structures define the boundaries of the open areas on the interior of the community and, together with other roomblock buildings, create the boundaries for large plazas. Roomblock 1 is situated between Roomblocks 2 and 3 and does not appear to have an associated plaza.
Directional Alignment of the Roomblocks

All three of the C-shaped roomblocks are oriented in a similar way, approximately 25° to the east of the north/south axis (Figure 5.8). The openings of the small plazas are all oriented towards the southeast in the final stage of occupation. In contrast, the directional orientation of the L-shaped configuration in Roomblocks 5 and 8 aligns approximately on north/south and east/west axis. The linear roomblocks follow two different orientations, with Roomblock 1 and 9
corresponding to the alignment of the C-shaped roomblocks (about 25° to the east of north/south axis), while Roomblock 4 has a north-south alignment.

Fowles (2004; 2005) discusses the different orientations of the C- and L-shaped roomblocks and concludes that the orientation is the signature of dualism within the community, perhaps an early expression of moiety organization (Fowles 2005:34). He associates the north-south opposition in the community with the three roomblocks in the southern portion of the village, which are oriented along the line of the December solstice sunrise position, while the northern group (Roomblocks 5 and 8) is aligned to the June solstice sunrise position (Fowles 2005:33). It is clear that there are two different alignments for the buildings in the community, yet Fowles does not consider all of the architecture present during the last phase of occupation, only the five highlighted roomblocks, which he considers to have been constructed early in the village sequence. Further discussion of the Fowles analysis is included in Chapter 6.

Width of the Roomblocks

A further distinction in the classifications of architectural patterns is the number of rooms across the width of the buildings. Roomblocks 5 and 8 both have a maximum width of two to three rooms, while the C-shaped roomblocks are up to six rooms in width in some areas. This may indicate that Roomblocks 5 and 8 did not have as long an occupation sequence as the C-shaped roomblocks, as greater width indicates longer accretion of rooms over time. The disparate building styles may be a further indication of dualism in the community.

5.4 Modelling the Construction Sequence at Pot Creek

Each of the roomblocks is analyzed individually in order of their number designations. The number designations relate to the historical excavation chronology at the Pueblo and not to
the actual sequence of construction events. For example, the numbers assigned to Roomblocks 7, 8, and 9 reflect the order in which these structure were found, rather than how or when they were constructed or used.

5.4.1 Roomblock 1

Roomblock 1 is the least complex structure at Pot Creek from the Talpa Period, A. D. 1270 - 1320, yet it occupies a crucial spatial pathway that would have influenced visual connectivity within the community. It consists of ten ground-floor rooms and was limited to a single story. Wall bonding and abutment demonstrate two distinct construction phases, an eight-room structure followed by addition of two rooms to the northern end of the building (Wetherington 1968:21) (Figure 5.9). The southern section of the building has continuous coursed adobe with one door leading from the plaza into room 105, and a second door leading further into the interior or room 106 (Wetherington 1968:21). It is unknown when the northern addition was built, as no tree-ring dates are available. Reconstructions suggest that two household units occupied this configuration, one in the eight-room portion and the other in the smaller northern addition (Arbolino 2001:191).

The stem-and-leaf diagram of the tree-ring data from the Laboratory of Tree-ring Research at the University of Arizona for Roomblock 1 is shown in Figure 5.10 (Crown 1991:304). The dates show a bi-modal distribution with one cluster in the late 1270s and the other in the later part of the first decade of the 1300s. There are three ways to interpret the construction of the main 8 rooms in Roomblock 1 from these dates: 1) constructed after 1309 from recently cut wood and from wood that had been stockpiled for 30 years, 2) constructed after 1309 from recently cut wood and from wood salvaged from other buildings across the
Figure 5.9. Roomblock 1 at Pot Creek with available tree-ring dates. Redrawn with data from Wetherington (1968:21) and Crown (1991:294).
A.D. Roomblock 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Cutting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>117</td>
<td>7</td>
</tr>
<tr>
<td>123</td>
<td></td>
</tr>
<tr>
<td>124</td>
<td></td>
</tr>
<tr>
<td>125</td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>7</td>
</tr>
<tr>
<td>127</td>
<td>1 6 9 9</td>
</tr>
<tr>
<td>128</td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>1</td>
</tr>
<tr>
<td>130</td>
<td>7 8 8 8 9</td>
</tr>
</tbody>
</table>

_ = cutting date or probable cutting date

Figure 5.10. Stem-and-leaf diagram of tree-dates from Roomblock 1 at Pot Creek Pueblo. Data from Crown (1991:304).

site, and 3) constructed in 1279 or 1280 and then remodeled after 1309 with wood dating to 1309.

Crown (1991:302) has interpreted the dates on the basis of the first option: the structure was built around 1309 using timbers cut and stockpiled from the earlier period in the late 1270s and from timbers cut just prior to 1309. There are three cutting dates from 1276 and 1279 that demonstrate that some of the timbers were cut during the first period. The question is, were they used to construct Roomblock 1 at that time? If Crown’s interpretation is correct, then the wood cut in 1276 - 1279 would have been collected and stored for 30 years before being used in the construction of Roomblock 1. Thirty years is a long time to keep wood, especially if it was stored outdoors in a dry climate, such as in the Taos region. As discussed in Section 5.2.1, the optimum time to allow timber to dry, without undue warping or splitting of timbers, is about two years in the Taos region. Keeping cut timbers for 30 years far exceeds this and is unlikely.

The second interpretation for the bi-modal tree-ring dates from Roomblock 1 is that the main portion of the building was constructed in 1309, using some new wood and some re-used timbers salvaged from other locations on the site. As the tight cluster of dates from 1276 to 1279
Figure 5.11. Three-dimensional computer rendering and floor plans of construction of Roomblock 1 at Pot Creek Pueblo. Scales vary between the phase diagram. Dark grey areas on the floor plans represent the walls constructed during that construction phase.

is within the five-year range, it is not likely related to the re-use of older timbers (Ahlstrom 1985:627-629). The pattern for re-use of older timbers is for the timbers to cross a wide range of dates as the collection of these timbers tends to be from random contexts, rather than a more systematic cutting and stockpiling event. The tree-ring dates of 1177 and 1267 could have been
from salvaged contexts, but the tight cluster of three dates prior to 1279 likely represents a stockpiling and construction event rather than use of wood from salvaged contexts. To further this argument, the region surrounding Pot Creek had abundant trees that could be used for construction, making reuse of old timbers unlikely.

The third interpretation is the most probable explanation for Roomblock 1. The building was initially constructed shortly after 1279 and then repaired shortly after 1309. The floor plan in Figure 5.9 shows that the later dates cluster in two of the rooms in Roomblock 1, Rooms 103 and 104, which suggests that repair work was done on these rooms.

The data for Roomblock 1 is not entirely clear, but the above analysis suggests that two distinct construction phases are likely (Figure 5.11). Roomblock 1 is the only one-story building at the site and is situated in a key spatial position within the community, between Roomblocks 2 and 3 (Figure 5.8), and therefore the analysis of the construction dates for Roomblock 1 is important when analyzing the visual access across the Pueblo at different points in time. Spatial and visual analysis surrounding Roomblock 1 will be considered in more detail in Chapter 6.

5.4.2 Roomblock 2

Roomblock 2 is a fully excavated feature with a wealth of data including architectural detail, stratigraphic information, and dendrochronological data, and can be seen as an archetype for a number of other roomblocks in the community (Figure 5.12). Roomblock 2 can act as a representative example for roomblocks 3, 5, and 6 as there are many inherent similarities. I will conduct a construction sequence analysis of Roomblock 2 and then use this as a guide for the other, similar roomblocks. This roomblock has been analyzed elsewhere (Arbolino 2001; Crown 1991; Crown and Kohler 1994; Fowles 2004; Wetherington 1968). Through the combination of tree-ring dates, bonding and abutment of walls, and the stratigraphic context of the timbers found
Figure 5.12. Roomblock 2 from Pot Creek Pueblo showing wall bonding and abutment and all available tree-ring dates. Redrawn from Wetherington (1968:22) and Crown (1991:294-295).
A.D. Roomblock 2

| 123 | 9 |
| 124 |
| 125 |
| 126 | 2 4 8 8 |
| 127 | 0 1 2 2 2 3 3 3 3 3 3 3 3 3 3 3 6 7 7 7 7 8 8 8 8 8 9 9 9 9 |
| 128 | 5 5 5 6 7 7 8 8 |
| 129 | 0 0 2 2 2 4 8 8 8 |
| 130 | 0 0 0 0 0 1 2 3 4 |
| 131 | 1 2 2 2 2 5 |

_ = cutting date or probable cutting date

Figure 5.13. Stem-and-leaf diagram of tree-ring dates for Roomblock 2 at Pot Creek Pueblo. Data from Crown (1991:304).

In specific rooms, Crown (1991:299) was able to establish construction dates for two rooms, or 13% of the total number of rooms of the western half of Roomblock 2, from tree-ring data alone. The construction episodes can be seen graphically in the stem and leaf diagram of the tree-ring dates for Roomblock 2 (Figure 5.13).

Rooms 226 and 227 will be used as an example of the dating technique using the multiple lines of evidence. Room 227 does have the benefit of seven tree-ring dates that cluster around the construction date of 1273 with repair in either 1298 or 1302. Analyzing the two rooms as a unit allows to tease out the construction sequence more fully. Rooms 226 and 227 were constructed as a unit as the bonded walls continue around the entire two-room unit. Both rooms were multistoried based upon excavation data of the fill from within the rooms. Three of the seven cutting dates on wood found in room 227 came from samples on the floor of the unit (1273, 1298, and 1302) and were likely from roofing materials of the ground-floor room. The remaining four dated samples (all 1273) were
Figure 5.14. Floor plans of construction sequence of Roomblock 2 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Figure 5.14 continued. Floor plans of construction sequence of Roomblock 2 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Phase 6 Floor Plan - A. D. 1300

Figure 5.14 continued. Floor plans of construction sequence of Roomblock 2 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Figure 5.15. Three-dimensional computer rendering of construction sequence of Roomblock 2 at Pot Creek Pueblo. Scales vary between the phase diagrams.
Figure 5.15 continued. Three-dimensional computer rendering of construction sequence of Roomblock 2 at Pot Creek Pueblo. Scales vary between the phase diagrams.
found at a higher stratigraphic level in the unit and could represent either the roofing materials from the ground floor or the ceilings of upper stories. Crown (1991:299) has interpreted the sequence as the lower level of room 227 being constructed in 1273 with repairs to that structure at a later date, possibly around 1302, since timbers with later dates were found beneath the four earlier samples. Branching out from this two-room unit, the relative dating sequence can be determined through the analysis of bonding and abutment of adjacent walls and floors. Room 215 would be the next to be constructed in the sequence, followed by room 216 and then rooms 212 and 213. The chronometric dating of these rooms rests upon the evidence of the probable cutting date of 1273 from room 213. It is possible that the construction of these rooms occurred in 1273 or shortly thereafter.

Following this methodology, Crown has created a construction sequence for the western portion of Roomblock 2, as follows: 1) room 201 constructed in 1272, 2) rooms 226 and 227 constructed in 1273, 3) rooms 204, 215, 216a, 213 and 212 were also constructed in 1273, 4)
rooms 203, 205, 206, 208 and 211 were constructed in the period from 1273 to 1279, 5) rooms 216 constructed in the period between 1285 and 1292, 6) room 207 constructed in 1300, and, finally, 7 and 8) remodeling/repair construction projects in room 227 in 1298 or 1302, room 202 in 1291, and rooms 212, 213 in 1311 or 1312 (Figure 5.14 and Figure 5.15). This example acts a demonstration of the type of analysis that is possible for each room within the roomblock, providing sufficient data is available.

The important point here is that dating the construction sequence includes, but does not rely upon, the tree-ring data alone. A combination of the architectural data, particularly wall abutment/bonding patterns, and data obtained through excavation, such as the stratigraphic level of the timbers within a location, together with the tree-ring dates, gives a much more complete picture of the construction of the roomblocks. Crown’s construction sequence is very comprehensive for the western half of Roomblock 2.

The construction sequence for the eastern portion of Roomblock 2 uses a similar methodology. The quantity and quality of tree-ring data for this portion of Roomblock 2 is more limited than that available for the western portion, requiring more conjecture and speculation on the actual construction sequence. However, a likely construction scenario can be sketched out. Preliminary construction started with room 232 sometime in 1273. Wall abutment indicates that Room 224 was constructed prior to Room 222, even though the timbers found in Room 222 are later in date than those of Room 224, indicating that renovation occurred in Room 224.

Room 221 was likely constructed about 1273, based upon a date cluster prior to 1273, and abuts Room 227. A renovation event likely then occurred in Room 221, related to five dates clustering around 1294. The construction dates for the remainder of the rooms of the eastern half of Roomblock 2 are less clear because there are far fewer tree-ring dates. I have relied upon
Crown’s model for the western half of the building, together with available tree-ring dates and wall abutment patterns to estimate the dates of construction for the remaining rooms.

Roomblock 2 has the most comprehensive data of all of the roomblocks at Pot Creek and I will use this as a model for similar roomblock structures. Roomblocks 3, 5, and 6 are comparable to Roomblock 2 in their final phases of construction, yet appear to have had very different construction trajectories. It is important to identify these differences to fully comprehend the earlier phases in the habitation sequence. There is wide variation, in both quantity and quality, of data available for Roomblocks 3, 5, and 6, each with different excavation histories and strategies. This poses greater challenges in understanding the site’s development. The construction sequence of Roomblock 2 is thus a valuable tool as a model to supplement the archaeological and dendrochronological data for Roomblocks 3, 5, and 6.

5.4.3 Roomblock 3

Roomblock 3 is at the southwest corner of Pot Creek Pueblo (Figure 5.8) and is very similar in design and room layout to Roomblock 2 in its final phase. Kiva A is situated in the centre of the plaza and is surrounded by adjoining rooms of the roomblock (Figure 5.16). There are 44 ground-floor rooms with most of the rooms having second stories and several having three stories. The stem-and-leaf diagram for tree-ring dates from Roomblock 3 demonstrates the clustering of dates and the episodes of building construction (Figure 5.17).

Bonding and abutment analysis of the excavated rooms reveal a core block of rooms, comprised of Rooms 313, 322, 323, 324, 328, 329, 330, and 304, that all appear to have been constructed at the one time (Figure 5.18 and Figure 5.19). This block of rooms was followed by the construction of Rooms 317, 318, 319, and 320 forming an irregular L-shaped structure with the plaza to the south. The only tree-ring dates available for the two initial blocks are from room
304 and they are non-cutting dates that do not form a distinct cluster. Dates can be inferred, however, as rooms added to the northern and western periphery of the two blocks of rooms do have associated tree-ring dates. An inferred date of construction for the two blocks of rooms would be the early 1270s, as these rooms are contained by the later abutment of walls of outer rooms that were constructed about 1279.

The next construction episode resulted in additional rooms (Rooms 302, 305, 306, 307, and 309) that expanded the Roomblock towards the north-east periphery of the building sometime between 1279 and 1285. Both Rooms 305 and 307 have numerous tree-ring dates to the late 1270s. Rooms 335 and 337 were likely constructed in the same time or within a short period after 1279, as each have a tree-ring date of 1279. I have inferred a construction period of 1279 to 1285 of the western block of rooms containing Rooms 331, 332, and 333. This is based on the wall abutment pattern of the nine rooms containing Rooms 331, 332, and 333. I have also assumed that the overall pattern of construction of Roomblock 2 has continued in Roomblock 3, and the trend towards a C-shaped building, following the building form typology, has prevailed in Roomblock 3.

The final major phase of construction occurred in the early 1300s with a large number of cutting dates clustering in 1303 and 1304 in Room 301 on the north east corner of Roomblock 3. As there is little data available for the remainder of Roomblock 3, I assume that construction continued to form the large C-shaped building with the interior plaza that was present in the final phase of development at Pot Creek.

The other architectural element in Roomblock 3 is Kiva A in the plaza, which appears to have been constructed in the mid-1270s and is contemporaneous with the irregular L-shaped pueblo structure. Renovations to Kiva A were conducted the mid-1280s and again in 1302. The
A. D. Roomblock 3

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___ = cutting date or probable cutting date

Figure 5.17. Stem-and-leaf diagram for tree-ring dates for Roomblock 3 at Pot Creek Pueblo. Data from Crown (1991:304).

pattern of a kiva associated with a roomblock is present in most of the roomblocks at Pot Creek. Roomblocks 4, 5 and 6 have associated kivas, while Roomblock 8 has a possible associated Great Kiva.

The general construction sequence for Roomblock 3 that I propose is slightly different than for Roomblock 2. At Roomblock 2, the construction began with one- and two- room units that were spatially segregated on three sides of a plaza followed by construction of rooms to connect the independent units to complete a C-shape and partially enclose the plaza. Roomblock 3, however, began with a block of eight rooms, expanded into an L-shaped configuration, followed by the construction of rooms surrounding the semi-enclosed plaza. This conclusion may be the result of the number of available tree-ring dates, rather than actual construction detail differences.
Figure 5.18. Floor plans of construction sequence of Roomblock 3 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Figure 5.18 continued. Floor plans of construction sequence of Roomblock 3 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Figure 5.19. Three-dimensional computer rendering of construction sequence of Roomblock 3 at Pot Creek Pueblo. Scales vary between the phase diagrams.
Figure 5.19 continued. Three-dimensional computer rendering of construction sequence of Roomblock 3 at Pot Creek Pueblo. Scales vary between the phase diagrams.
5.4.4 Roomblock 4

Roomblock 4 defines the eastern perimeter of Pot Creek and acts to control access into and out of the community. In its final form, Roomblock 4 also defines the form of the large plaza where the *Great Kiva* is situated (Figure 5.8 and 5.20). Roomblock 4 did not arise in one building episode, but rather was constructed over a number of years prior to reaching its final configuration. Crown and Kohler (1996:109) and Crown (1991:304) have argued that the vast majority of the rooms in Roomblock 4 were constructed during the period between A.D. 1310 and 1319. However, they are ignoring the many dendrochronological dates associated with this structure that date prior 1310. Wiseman (2004:160) has argued that a cluster of non-cutting dates, while not as definitive as cutting dates, still provides evidence that construction activity did occur. The tree-ring dates for Roomblock 4 cluster around three time periods, the late 1270s, the 1280s, and then again in the period 1300 to 1320 (Figure 5.21). The cluster of dates from 1277 to 1279 is worth noting as there are nine tree-ring dates (three cutting dates and six non-cutting dates) from this period. Since dates from three or more consecutive years are indicative of stockpiling prior to a construction event (Ahlstrom 1985:627), I interpret these dates as primary construction of some rooms, followed by construction of the remainder of the building and remodeling in existing rooms (Figure 5.22 and Figure 5.23).

Wall abutment analysis reveals three blocks of rooms that were constructed prior to adjoining rooms (Phase 1, Figure 5.21). The four-room block of 468, 469, 472, and 473 was constructed in one construction episode, as revealed by the wall-bonding patterns and was likely constructed prior to 1278, as the abutting rooms are dated to that period. The block containing rooms 453, 454, 457, and 458 has no available tree-ring dates, but rooms that are abutted to this block have dates in the late 1270s and then again in the 1310s. I interpret this four-room block to have been constructed in 1277 - 1278, with the surrounding rooms added in 1279 or later,

A.D. Roomblock 4

124 4
125
126 5 6 8 9
127 1 7 8 8 8 8 8 8 9 9
128 4 6 6 6 8
129 0 0 1 3
130 0 0 0 3 4 7 7 9
131 1 2 2 2 3 4 4 5 5 5 7 9

___ = cutting date or probable cutting date

Figure 5.22. Floor plans of construction sequence of Roomblock 4 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Figure 5.22 continued. Floor plans of construction sequence of Roomblock 4 at Pot Creek Pueblo. Scales vary between the phase diagrams. Dark grey areas on the floor plans represent the walls constructed during that construction phase.
Figure 5.23. Three-dimensional computer renderings of Roomblock 4 at Pot Creek Pueblo. Scales vary between the phase diagrams.
followed by a remodelling event in 1311 - 1315. The small one-room unit, Room 225, was constructed in one building episode with abutting rooms constructed at a later date. Room 225 was constructed after 1278, as there are cutting dates of 1271 and 1278 and a non-cutting date of 1278 for this room. It is likely that remodelling occurred in the late 1280s and again in the 1310s.

During the period from 1280 - 1290 the three original blocks of rooms each had three rooms constructed in a linear fashion north-west of the original rooms. Rooms 475, 476, and 477 extend to a line north of Rooms 468, 469, 472, and 473 and tree-ring dates indicate an initial construction event sometime after 1278. Rooms 459, 464, and 465 was built in one construction episode as indicated by the wall bonding, but the date of construction is less clear. I have based
my construction sequence on pattern similarity with the above block of rooms, creating two very similar reverse L-shaped buildings. Again, three rooms were constructed north-west from Room 225 indicated by two non-cutting dates from 1290. This new construction of three rooms linked two of the original structures in Roomblock 4.

During the final phase of construction of Roomblock 4, the remaining rooms were built around the existing architecture. Five ramada shade structures were also added to the exterior of the roomblock. This construction likely occurred during 1300 to 1320, as supported by numerous tree-ring dates. This construction phase completed the eastern perimeter, extending from Roomblock 2 almost to Roomblock 5, thereby defining the plaza to the west of Roomblock 4. Roomblock 4 follows the linear roomblock configuration in the building form typology (Section 5.3.2).

My interpretation of the construction sequence for Roomblock 4 uses both the cutting and non-cutting tree-ring dates. I concur with previous scholars (Dean 1978:250; Nash 2002:250; Wiseman 2004) that the presence of a cluster of timbers, even if they have the less reliable non-cutting dates, still provides some evidence that a building event occurred after that point in time. The effect of this interpretation is a more episodic construction sequence that began earlier (during 1277 - 1279) than in Crown’s (1991) interpretation of a continuous construction sequence from 1300 to 1320.

5.4.5 Roomblock 5

Roomblock 5 has been completely excavated, but little detailed data is available to assist in the establishment of its construction sequence (Figure 5.24 and 5.25). A Wake Forest field school excavated it in the early 1970s and little data is available for analysis (Adler 1997:6). Only one tree-ring date is available from the roomblock, with a cutting date of A.D. 1286, and
Figure 5.24. Roomblock 5 at Pot Creek Pueblo. Redrawn from Crown (1991) and Fowles (2004).

Figure 5.25. Three-dimensional computer rendering of Roomblock 5 at Pot Creek Pueblo. Construction date unknown, but likely A. D. 1280 - 1320.
the date is from a hearth rather than an architectural element (Fowles 2004:429). In Dean’s (1978) terminology, the tree-ring date is a dated target event indicating when the building was in use. A disparity of an unknown length of time would result after the tree-ring date to abandonment of the building. No wall bonding or abutment data is available for Roomblock 5. Ceramic seriation (Fowles 2004:429) places the roomblock in a later phase in the chronological sequence, after the initial construction phases of Roomblocks 2, 3, and 6, or between A. D. 1280 and 1320.

Roomblock 5 is an example of an L-shaped structure (Section 5.3.2). It is possible that Roomblock 5 is an incomplete C-shaped roomblock, at an earlier stage of construction, but there is no evidence to support this alternative interpretation. Similarities do exist between Roomblocks 5 and 8, as both are L-shaped, and oriented in a north-south direction which is different from the majority of the buildings at Pot Creek. Fowles argues that the alignment of Roomblocks 5 and 8 follows the June solstice sunrise.

5.4.6 Roomblock 6

Roomblock 6 is similar in overall design, during the final phase, to Roomblocks 2 and 3 and is grouped with the C-shaped roomblocks of the typology (Figure 5.26). The major construction episodes are similar to those of Roomblocks 2 and 3, with building episodes in the late 1260s and into the 1270s, followed by construction in the 1280s, and again in the early part of the 1300s. The initial construction of Roomblock 6 consisted of a two-room unit followed shortly by the construction of rooms forming an L-shape with the inner portion of the ‘L’ facing southwest (Figure 5.28 and Figure 5.29). These rooms form part of the section of rooms facing onto the interior plaza of the final configuration of the roomblock and follow a similar construction sequence as Roomblock 3. A further construction episode created an arm to form a
A.D. Roomblock 6

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Figure 5.27. Stem-and-leaf diagram for tree-ring dates for Roomblock 6 at Pot Creek Pueblo. Data from Crown (1991:304).

‘U’ shape, thereby enclosing the plaza on three sides. The final construction event added additional rooms to the outer perimeter of the already established structure. At the same time, an additional group of rooms were added in the southern portion of the plaza to create the C-shape roomblock with the enclosed plaza similar in design to Roomblocks 2 and 3.

The construction sequence for Roomblock 6 presented here is based upon data from the excavation report from the 1995 field season (Adler 1996), which is limited to a small number of rooms. Wall bonding and abutment arrangements indicate that several rooms were constructed in each unique construction event, indicating extensive periods of construction. The dendrochronological evidence available is limited to the northwest corner of the building and many of the dates are non-cutting dates. The tree-ring dates are distributed across many decades, indicating multiple construction or remodeling events (Figure 5.27).

Initial construction of Roomblock 6 began with Rooms 608 and 610 as a unit and then subsequent rooms were added shortly after to create an initial L-shape building (Figure 5.28). The distribution of tree-ring dates in rooms 608 and 610 has multiple nodes, early 1260, into the 1270s and 1280s, and finally into the 1300s, indicating an initial construction date of early 1260s
Figure 5.28. Floor plans of construction sequence of Roomblock 6 at Pot Creek Pueblo. Scales vary between the phase diagrams. Dark grey areas on the floor plans represent the walls constructed during that construction phase.
and then multiple refurbishing events. The construction of the initial two rooms was established by examining the wall abutment patterns relative to surrounding rooms.

A subsequent building phase likely occurred in the late 1270s or early 1280s expanding the roomblock outwards towards the north and east by constructing rooms on the rear of the existing rooms (Adler 1996:37). The western extension of the roomblock was likely created at this time, establishing a transitional U-shaped plaza. Crown and Kohler (1994:109) have dated this phase of development to 1310 to 1319, but they were dealing with incomplete data. Subsequent excavations have indicated that this wing of the roomblock was likely constructed sometime during the 1270s on the basis of a tree-ring date of 1274 from room 607 and the adjoining wall abutment information. Further remodeling and reconstruction probably occurred between 1300 and 1312, based upon the available cutting dates for rooms 603, 607, and 610.
Figure 5.29. Three-dimensional computer renderings of Roomblock 6 at Pot Creek Pueblo. Scales vary between the phase diagrams.
The final phase of construction occurred in the early part of the 1300s and into the 1310s with both horizontal and vertical expansion (Adler 1996:37-38). While one cannot definitively state the exact sequence of construction for Roomblock 6, there was a trend towards a final form similar to Roomblock 2 and 3.

Figure 5.30. Schematic drawing of Roomblocks 7, 8, and 9 at Pot Creek Pueblo. Possible L- and C-shaped roomblocks indicated. Overall shape resembles spokes on a wheel. Redrawn from Arbolino (2001) and Fowles (2004:486).
5.4.7 Roomblocks 7, 8, and 9

The massive, 85 m long building in the northwestern section of Pot Creek remained hidden from archaeological awareness until 1996 and has radically altered the interpretation of the site (Adler 1997; Arbolino 2001; Fowles 2004) (Figure 5.8). The recently uncovered edifice mirrors the building enclosure on the eastern flank of the pueblo (Roomblock 4) and effectively acts to limit access to the pueblo from west of the community (Adler 1997:11). The overall shape of the final structure resembles spokes on a wheel radiating from the intersection of the three roomblocks (Figure 5.30). The plan of the building, comprised of Roomblocks 7, 8, and 9, was determined scraping the surface of the ground to uncover traces of the walls (Adler 1997:10). Removal of brush and surface debris revealed the underlying plan or layout of the buildings beneath the surface.

Prior to further analysis of this structure, it is important to outline a number of points that influence our interpretation of the construction sequence of Roomblocks 7, 8, and 9. First, surface scraping only reveals the tops of the preserved walls that intersect the modern surface. It is possible to miss walls that never were high enough to reach the current surface level, so lower stories may be under represented. Second, some walls may have been damaged or have collapsed thus not appearing in the site plan. Third, as very little excavation has occurred in this area of the pueblo, key pieces of information are missing. For example, it is difficult to determine the number of stories represented as the depth to floor level is usually unknown. Information regarding wall bonding and abutment and the locations of interior doorways is not available. The limited excavation revealed very few pieces of timber available for tree-ring analysis. Fourth, the arbitrary numbering of roomblocks conceals the building construction sequence and the lived experience.
within those structures. The site plan does reveal two distinctly different directional orientations, and this likely represents two separate roomblock building episodes that were then made into a contiguous building through additional joining rooms (Figure 5.30). It is useful to discuss the three roomblocks as separate entities and then bring them back together in an overall construction sequence for the entire structure.

5.4.8 Roomblock 8

Roomblock 8 is similar to Roomblock 5 and corresponds to the L-shaped building typology (Section 5.3.2). As well, both Roomblocks 5 and 8 are oriented in an approximate
north/south direction, while Roomblocks 7 and 9 are approximately 25 degrees off the north/south axis (Figure 5.8). It is quite likely that Roomblock 8 was constructed as a unique entity and then joined to the Roomblocks 7 and 9 by a series of connecting rooms in a later construction event. Only one room, a D-shaped kiva structure (Figure 8.31, room 822) has been fully excavated in Roomblock 8 (Fowles 2004:595-622). This room is the only D-shaped kiva at the site and had a distinct pattern of ritual closing that involved the placement of animal and plant material. Fowles (2004:611-618) argues that these items were placed to conform to the moiety social organization of the community. The possible Great Kiva was not uncovered during the scraping exercise, but is conjectured from a depression in the area (Adler, personal communication).

A construction sequence has been surmised for Roomblock 8 based upon the limited wall bonding and abutment data and the available outlines of double wall constructions (Adler 1997:11) that the surface scraping revealed (Figure 5.32). No tree-ring data is available for Roomblock 8, but Fowles (2004:847-888) has estimated the construction dates for Roomblock 8 on the basis of ceramic seriation from the excavated Room 822. He places the construction of Roomblock 8 after the construction of Roomblocks 2 and 3 or approximately A.D. 1280. This analysis is very preliminary and compares weight and count percentages of ceramic types from different locations across the site. Different excavation methods, such as screening with 1/8-inch mesh versus no screening whatsoever, could limit the reliability of the results of this study.

Room 822 was one-story in height and this provides an indication of the number of stories for the entire roomblock (Fowles 2004:423). I have indicated that Roomblock 8 is one-story in height as this conforms to both the limited excavation data and the surface scraping’s exposure of the walls (Figure 5.33). The number of stories can be confirmed only by
Figure 5.32. Floor plans of construction sequence of Roomblock 8 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>Date:</td>
</tr>
<tr>
<td>Unknown, but likely around A.D. 1280</td>
<td>Unknown, but likely in the period between A.D. 1280 and 1320</td>
</tr>
</tbody>
</table>

Figure 5.33. Three-dimensional computer rendering of Roomblock 8 at Pot Creek Pueblo. Scales vary between the phase diagrams.
further excavation or remote sensing. As this research is dealing with vision across the Pueblo, the number of stories present is much less important than the presence or absence of the buildings themselves, as even a one-story building can block the vision of a person standing at ground level.

5.4.9 Roomblocks 7 and 9

Moving to Roomblocks 7 and 9, it becomes more and more difficult to determine the pattern of development of the roomblocks. The naming convention for Roomblocks 7 and 9 is more closely associated with the sequence of room discovery, than by how these structures were constructed and used in the past. In the first pass of surface scrapping, it appeared that the northern edge of Roomblock 9 was located at Room 901. However, later surface scrapping found evidence of more contiguous rooms to the north. It is quite possible that these two roomblocks were in fact one stand-alone structure with later additions of rooms connecting to Roomblock 8. Fowles (2004:435-437) has hinted at this configuration with an additional C-shaped roomblock, similar in shape and size to Roomblocks 2, 3, and 6, in the region of Roomblocks 7 and 9 (Figure 5.30).

During the 1996 field season, excavation was conducted in two rooms, one in each of Roomblocks 7 and 9, and a limited excavation in Room 902 (Alder 1997:27-34) (Figure 5.34). The excavation of Room 901 revealed a structure that was two stories in height and also revealed that this room likely collapsed at some point in its depositional history (large chunks of adobe wall were within and outside of the room). It is impossible to determine if the wall collapsed prior to the abandonment of the community or at some time thereafter (Adler 1997:33). Three tree-ring dates are associated: a cutting date of 1273rB, and two non-cutting dates of 1248+v and 1273vv (Adler 1997:31-32). From these dates we can infer that this portion of the roomblock
Figure 5.34. Roomblocks 7 and 9 (C-shaped roomblock) from Pot Creek. Redrawn from Arbolino (2001) and Fowles (2004).
was constructed some time during the early phases of construction of Pot Creek in approximately A. D. 1265 - 1280. Wall bonding and abutment information is limited in this section of the site, yet inferences about the construction sequence are still possible. Construction likely began with a small structure, consisting of an L-shaped building of 9 rooms, as this followed the construction projects in Roomblocks 3 and 6 during this period (Figure 5.35). Further excavation is necessary to provide a fuller understanding of the construction sequence in this region of the site.

The excavation of Room 701 provides further hints about the construction sequence of the Roomblock 7, 8 and 9 complex, and reveals that the room was two stories in height and was likely built on an earlier building. Three dendrochronological dates are available from Room 701, a cutting date of 1315r and two non-cutting dates of 1303vv and 1311++v (Adler 1997:28). Adler indicates that construction events in this room likely occurred sometime during the first two decades of the 1300s, but likely in the mid-1310s. It is likely that the rooms outside of Room 701 (i.e. north and east of Room 701) were constructed about the same time (Figure 5.35). I have assumed that the rooms south and west of Room 701 were constructed at the beginning of the period (in the early 1300s). This follows the conjecture by Fowles (2004:435-437) that the intersection of Roomblocks 7, 8, and 9 conforms to the C-shape configuration of Roomblocks 2, 3, and 6.

Limited testing in Room 902 at the south end of Roomblock 9 during the 1996 field season reached a depth of 30 cm (Adler 1997:33). One large room contained a thick layer of adobe construction materials, which suggests roofing materials from a two- or three-story structure. No wood was found so no tree-ring dates are available for this room. I have dated it to the late construction phase, A. D. 1310 - 1320 (Figure 5.35 and 5.36), paralleling the construction of the linear roomblock on the eastern edge of the community (Roomblock 4).
Phase 1 - A. D. 1265 - 1280

Phase 2 - A. D. Early 1300s

Figure 5.35. Floor plans of construction sequence of Roomblocks 7 and 9 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
Phase 3 - A.D. 1310 - 1320
Figure 5.35 continued. Floor plans of construction sequence of Roomblocks 7 and 9 at Pot Creek Pueblo. Scales vary between the phase diagrams. Grey areas on the floor plans represent the walls constructed during that construction phase.
<table>
<thead>
<tr>
<th>Phase</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>A.D. 1265 - 1280</td>
</tr>
<tr>
<td>Phase 2</td>
<td>A.D. Early 1300s</td>
</tr>
<tr>
<td>Phase 3</td>
<td>A.D. 1310s to 1320s</td>
</tr>
</tbody>
</table>

Figure 5.36. Three-dimensional computer rendering of Roomblocks 7 and 9 at Pot Creek Pueblo. Scales vary between the phase diagrams.
The construction sequence that I have suggested here relies on a number of architectural patterns established elsewhere in the Pueblo (See section 5.3.2). The construction dates of the two excavated rooms, Rooms 701 and 901, correspond to similar phases of building construction at the other C-shaped roomblocks at Pot Creek. The general pattern is that rooms on the interior of the plazas were constructed in the 1270s and 1280s, followed by later construction of rooms on the exterior of the structures some time prior to 1320. The completion of the long linear roomblock (Roomblocks 7, 8 and 9) on the western periphery mirrors Roomblock 4 on the eastern boundary of the community and likely was completed during the later period, in the 1300s.

Alternative construction sequences for Roomblocks 7, 8 and 9 are possible, but more archaeological research in this region of the site is needed to test the construction episodes for these buildings. Ground penetrating radar or further excavation would be beneficial to confirm wall bonding and abutment patterns as evidence for the construction sequence in these structures. Further testing would also be able to determine whether there are other buildings in that part of the site that surface scraping failed to reveal.

### 5.4.10 Other Architectural Features

Other architectural features within Pot Creek Pueblo occupy prominent locations physically and socially within the community. The below-ground circular *kiva* structures were important features for social integration in the community and have received much attention from archaeologists (Crown 1991:297; Fowles 2004:565-619; Wetherington 1968:41-44; Woosley 1980: 31). Many of them have been excavated. Since the *kivas* were usually quite low to the ground, the visual site lines over the tops of *kivas* allows unrestricted views beyond them, but also allows bystanders to view anyone entering or leaving them. The rough dating sequence
of these structures is summarized in Table 5.2. The only excavated *Great Kiva* is in the main plaza west of Roomblock 4 (Figure 5.37) and was likely constructed just prior to 1320 (Crown 1991:297). Wetherington (1968:40) has suggested that the *Great Kiva* was never completed or used, leading Fowles (2004:702-16) to explore implications of the half-finished *Great Kiva*. Adler (2011 personal communication) is not convinced that the *Great Kiva* was unused, as the excavation was performed by back hoe (Wetherington 1968:17) and the excavation methods were rather crude. Adler suggests the alternative that the seemingly unused hearth may have been part of a carefully prepared abandonment of the *Great Kiva*. The location of the *Great Kiva* in the middle of the large plaza would have made it visible to many occupants of the community and thus embed it in social interactions that occurred in the open parts of the site. There may be another *Great Kiva* in the plaza south of Roomblock 8, but this feature has not been confirmed by either excavation or surface scraping.

One further architectural feature of note is Roomblock 10, which was originally identified as rooms 113 and 131 (Crown 1991:298) and located on the northern fringe of the largest plaza in the eastern portion of the pueblo (Figure 5.37). Surface scraping in 1996 (Adler 1997:11) demonstrated that these were a set of rooms in a stand-alone structure now designated Roomblock 10. Surface scraping failed to outline the full extent of this structure as many of the wall tops had collapsed below the modern surface. While initially this structure seems to be rather insignificant, it does block a critical visual pathway between the large plaza on the eastern side of the pueblo and the areas to the north. Two cutting dates, both at 1300r, were associated with Room 113 and indicate that some part of Roomblock 10 was likely constructed around this time.
5.5 Reconstructing the Physical Edifice of Pot Creek Pueblo

The expansion of the Pot Creek community has many implications for our understanding of past life-ways in the Taos region. From population estimation, migration patterns, archetypes of integration, to daily social practices within the settlement, the construction sequence can provide a glimpse into the development of this village. The development of a plausible construction sequence for Pot Creek Pueblo is the main goal of this chapter and is an essential component of this research. The main objective now is to put the component parts back together in order to see how the morphology of the built environment changed over the entire site. Both three-point and top-down perspectives assist in visualizing the Pueblo from both ground-level and from a bird’s eye view (Figures 5.37 - 5.41).

The designation of chronological phases for Pot Creek Pueblo has had a long history with various scholars proposing different chronological sequences (Arbolino 2001; Adler 1994; 1995; 1996a; 1997; Crown 1991; Crown and Kohler 1994; Fowles 2004; Wetherington 1968). For example, the approximately 60 years of habitation at Pot Creek Pueblo has been subdivided using a variety of time intervals and methods of analysis, including one time interval for the entire Talpa Period (Fowles 2004:889-915), equal periods of 20-year increments (Arbolino 2001:228-230), periods based on four unequal construction intervals for Roomblock 2 (Wetherington 1968:37-40), and eight unequal time intervals based on the construction sequence of the western half of Roomblock 2 (Crown 1991:292-301).

My interpretation of the sequence of construction for Pot Creek Pueblo subdivides the Talpa Period into five sub-phases based on the construction sequence of all of the roomblocks for the entire Pueblo (Table 5.3). The time sequence is based on the availability of evidence for each of the roomblocks and periods that closely reflect the actual construction activity, and
Figure 5.37. Three-dimensional rendering of Pot Creek Pueblo, A. D. 1270 - 1273. Both three-point perspective and top down site plan views are demonstrated. Note: scales vary with the diagrams.
Figure 5.38. Three-dimensional rendering of Pot Creek Pueblo, A.D. 1274 - 1277. Both three-point perspective and top-down plan views are demonstrated. Note: scales vary with the diagrams.
Figure 5.39. Three-dimensional rendering of Pot Creek Pueblo, A. D. 1278 - 1279. Both three-point perspective and top down site plan views are demonstrated. Note: scales vary with the diagrams.
Figure 5.40. Three-dimensional rendering of Pot Creek Pueblo, A.D. 1280 - 1299. Both three-point perspective and top down site plan views are demonstrated. Note: scales vary with the diagrams.
Figure 5.41. Three-dimensional rendering of Pot Creek Pueblo, A.D. 1300 - 1320. Both three-point perspective and top down site plan views are demonstrated. Note: scales vary with the diagrams.
Table 5.3. Phases of construction episodes for Pot Creek. All dates in A. D.

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>1270 - 1273</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2</td>
<td>1274 - 1277</td>
</tr>
<tr>
<td>Phase 3</td>
<td>1278 - 1279</td>
</tr>
<tr>
<td>Phase 4</td>
<td>1280 - 1299</td>
</tr>
<tr>
<td>Phase 5</td>
<td>1300 - 1320</td>
</tr>
</tbody>
</table>

related human activity, that occurred at Pot Creek. The unevenness of the available evidence across the Pueblo tends to favour the Roomblocks located in the south-eastern section of the Pueblo, producing more detailed construction chronologies in this sector. Roomblock 2 has the most complete data, resulting in the highest number of construction phases. When analyzing Roomblock 2, I have emphasized construction processes that alter the overall site plan, so the changing pattern of the exterior of Roomblock 2 is stressed at the expense of interior modifications. This results in reduction of the number of construction episodes from Crown’s estimate of eight periods to five. This reduction reflects my emphasis on the morphology of the settlement plan over time, and helps to simplify the chronology by creating a ‘best fit’ for the construction episodes for all of the Roomblocks, even those with much less available evidence than Roomblock 2.

5.6 Population Dynamics, Talpa Period (A. D. 1270 - 1320)

Estimating population and tracking demographic changes are key elements in understanding human behavior and social practices in ancient communities. In Chapter 2, I discussed three population estimation models for Pot Creek during the Talpa Period (A. D. 1270
Many factors have been used to estimate population, including a constant for the number of people per roofed area (Brown 1987:2; Naroll 1962:587), a count of the number of houses or rooms (Hill 1970:75), and a consideration of architectural aggregation and house size (Dohm 1990:226-230). I will consider a number of these factors here.

5.6.1 Population Models

Fowles (2004:913) uses a ‘unit pueblo’ approach, dividing the number of rooms in use at Pot Creek into ‘unit pueblos’ based on the architectural signature from the previous period (in the Taos region this is the Pot Creek Period A. D. 1200 - 1270). This approach is premised on the assumption that a ‘unit pueblo’ consisted of 6 to 10 rooms and was occupied by 2.5 families. Fowles (2004:914-915) then calculates the number of families based on an average number of ‘unit pueblos’ for the entire site and an average family size of 4, 5, or 6 persons. Fowles thus estimates the population of Pot Creek to be somewhere between 352 and 528 individuals.

Fowles’ approach assumes that social organization did not change over the time the site was occupied and relies on a number of other assumptions, including the average number of rooms per unit pueblo, average number of families per unit, and average family size.

It is problematic that Fowles’ model does not consider the possibility that the nature of the community changed over time. We know that Pot Creek Pueblo began as a collection of ‘unit pueblos’, but it ended the Talpa Period as a large pueblo of the Pueblo III or IV type, with a very different architectural signature and probably also social organization from the ‘unit’ pueblos. Differing architectural patterns likely result in different levels of occupation. Dohm (1990) shows, for example, that for the same number of individuals, house size will likely be larger in nucleated villages than in more dispersed villages. By estimating the population on the basis of
initial form of architecture (and the accompanying practices of social organization) without considering the changes that occurred subsequently is to ignore a great deal of the evidence that is available to us.

Crown (1991) and Arbolino (2001) take a different approach as they model the dynamic nature of site growth and population changes over the time that Pot Creek was in existence. Both researchers rely on the construction sequence performed initially by Crown and updated by Arbolino. Crown argues that using the actual patterns of occupation based on the construction sequence at Pot Creek more accurately represents the population dynamics of Pot Creek Pueblo than would a population estimation model like that of Plog (1975:98). Plog assumes that maximum population occurred during the middle of a site’s occupation with smaller population on either side of the maximum, resulting in a stepped occupation pattern. Plog’s model does not allow for rapid abandonment, such as what may have occurred at Pot Creek. I would also argue that Crown’s approach more accurately reflects the population dynamics than Fowles’ approach which ignores evidence that the architectural pattern changed during the occupation history of the site.

Crown estimates the number of rooms present in the unexcavated mounds based on data available up to 1989, while Arbolino (2001:222-223) provides a cursory estimate of room counts made available during excavation in the 1990s. Crown’s (1991:309) estimate of 300 ground-floor rooms compares favourably with actual ground-room totals (276 rooms) found through subsequent excavation and surface-scraping procedures conducted by Adler (1997:10). My estimate of the number of ground-floor rooms is based on my interpretation of the construction sequence conducted in this chapter (Table 5.4).

In order to estimate the population of Pot Creek we should consider the total number of rooms compared to the number of rooms in use, or occupied, as it is unknown if new rooms were
Table 5.4. Ground-floor room counts for Pot Creek by construction episodes. Note that the construction periods are irregular intervals based on actual construction activity. All dates A. D.

<table>
<thead>
<tr>
<th>Roomblock</th>
<th>1270 - 1273</th>
<th>1274 - 1277</th>
<th>1278 - 1279</th>
<th>1280 - 1299</th>
<th>1300 - 1320</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>16</td>
<td>19</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>8</td>
<td>12</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>12</td>
<td>12</td>
<td>18</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>8</td>
<td>19</td>
<td>34</td>
<td>46</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>7</td>
<td>23</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>12</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>9</td>
<td>9</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Totals</td>
<td>16</td>
<td>60</td>
<td>106</td>
<td>215</td>
<td>276</td>
</tr>
</tbody>
</table>

built to accommodate growing populations or simply to replace abandoned structures. Estimates of pueblo occupation by previous researchers in the Southwest have used a variety of estimates of the ratio of occupied rooms to total rooms. The main source of information for occupancy rates is comparison with modern Pueblos in the Southwest. Hill (1970:75) found that the modern communities of Hopi and Zuni had average occupancy rates of 78%, while Plog (1975:98) uses an average occupancy rate of 78% based on several Southwestern ethnographic communities.

In contrast, Crown uses specific data from Pot Creek to form a model for occupation based on the unique characteristics of the community. In this model, Crown (1991) considers the construction sequence of the community, the average length of time before buildings required repair, and the total number of rooms that were likely occupied. Crown (1991:305) assumes a room use-life of 19 years as this is the approximate duration of one life-cycle of a family unit or household. The 19-year use-life also relates to the need to maintain structural integrity of the buildings through frequent and periodic repair (see Section 5.1.3). Crown (1991:310) calculates that 29% of the rooms in the eastern half of Roomblock 2 had been remodeled and assumes that they were occupied. It is likely that newly constructed rooms are occupied 100%, at least for the
Table 5.5. Summary of population estimates based on people per room and on area measurement of square meters per person.

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Data Source</th>
<th>People per Room</th>
<th>m² per Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill (1970:75-77)</td>
<td>Ethnographic data from Hopi and Zuni Pueblos</td>
<td>1.7 - 2.8</td>
<td></td>
</tr>
<tr>
<td>Dohm (1990:211)</td>
<td>Data from 25 historic and ethnographic Southwest Pueblos</td>
<td>2.1</td>
<td>13.8 (first floor area)</td>
</tr>
<tr>
<td>Clarke (1974:286)</td>
<td>Ethnographic data from Cochiti Pueblo</td>
<td>1.42 - 2.06</td>
<td></td>
</tr>
<tr>
<td>Arbolino (2001:224)</td>
<td>Ranges based on past research</td>
<td>1.5, 2.0, 2.5</td>
<td></td>
</tr>
<tr>
<td>Naroll (1962:588)</td>
<td>Data from 18 world-wide, non-industrial societies from Human Relations Area Files (HRAF)</td>
<td>10 (total roofed area of site)</td>
<td></td>
</tr>
<tr>
<td>Brown (1987:31)</td>
<td>Data from 38 cultures from the HRAF</td>
<td>6.1</td>
<td></td>
</tr>
</tbody>
</table>

first 19 years. Once newly constructed rooms are added to the older rooms with the remodeling rate of 29%, then Crown’s (1991:310) estimate for the percentage of occupied rooms varies between 55% in A.D. 1305 and 69% in the 1310s. The rate of 29% occupancy may be low as there could be rooms in use that did not exhibit evidence of remodeling. In addition, we do not know if the remodeling or occupation rate of 29% is representative of the entire site. However, I use this rate here as it is based on the specific and unique history of Pot Creek and reflects the actual length of occupation at the site, the unique location geographically, and does not rely on sites that are not contemporaneous.

The final phase in estimating population at Pot Creek is to consider the number of individuals that used the occupied rooms. Crown estimates the occupied versus the total number of rooms at Pot Creek over a 100-year span, but she does not equate the occupied rooms to an estimate of the number of inhabitants over the same period. Arbolino (2001:217-221) compared estimates of population as she considers Hill’s (1970) estimates from modern populations at Hopi and Zuni, world-wide ethnographic comparatives as studied by Brown (1987), and Historic-era Pueblos in the Southwest as reported by Dohm (1990) and concludes that a great
deal of variability exists (Table 5.5). Examples from the Southwest Pueblos likely provide
greater reliability than world-wide ethnographic comparatives as some factors, such as
environmental considerations, are more culturally and geographically pertinent to the Southwest.
However, no model will be 100% accurate in its estimate of past population size. Pueblo people
in the past likely had different spatial requirements, access to labour, and availability of material
resources needed to construct buildings, than modern communities (Clarke 1974:284). The
ethnographic data also have been subject to the effects of disease on post-contact populations. It
is clear that estimating prehistoric population and space use is complex and, without further
research, the best approach is to provide a range of values.

5.6.2 Population Calculation

Population estimates for Pot Creek Pueblo are based on the above discussion, on estimates of the number of rooms occupied, and a range of numbers of people occupying those rooms, as follows:

1. The construction sequence is divided into periods based on the interpretation of construction events (Table 5.3 for summary of dates).
2. The number of rooms has been counted for each of the roomblocks, both ground-floor and upper stories have been included for each period (Table 5.4 for ground floor room estimates).
3. Average use-life of rooms is assumed to be 19 years, as per Crown’s analysis.
4. Occupied rooms are assumed to be occupied as follows:
   a. Newly constructed rooms are 100% occupied
   b. Rooms older than 19 years are assumed to be occupied based on 29% of the older rooms being remodeled and occupied, per Crown’s analysis of the eastern half of Roomblock 2.
5. A range of possible occupancy rates is used: 1.5, 2.0, and 2.5 people per room (Table 5.5).
<table>
<thead>
<tr>
<th>Construction Episodes (All dates A.D.)</th>
<th>Total Number of Rooms (ground floor and upper stories)</th>
<th>Occupied Rooms¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1270 - 1273</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>1274 - 1277</td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td>1278 - 1279</td>
<td>183</td>
<td>183</td>
</tr>
<tr>
<td>1280 - 1299</td>
<td>379</td>
<td>249</td>
</tr>
<tr>
<td>1300 - 1320</td>
<td>493</td>
<td>224</td>
</tr>
</tbody>
</table>

Table 5.6. Occupied and total ground-floor and upper-story rooms for Pot Creek Pueblo based on an interpretation of the construction sequence data. ¹Based on assumption that occupation is 100% in newly constructed rooms, and 29% of rooms older than 19 years are occupied.

Figure 5.42. Estimated population for Pot Creek Pueblo based on construction episodes. Estimates based on ranges of 1.5, 2.0, and 2.5 people per occupied room.
5.6.3 Discussion of Population Estimate

During the first three phases of construction at Pot Creek (A. D. 1270 - 1279) construction increased from 23 to 183 ground-floor and upper-story rooms. These rooms were dispersed across the site and became the basis for the later large roomblock configurations. It was likely that all of the rooms constructed during the initial phases of construction were used 100% and fully occupied, as they were constructed within the 19 year use-life envelope, as Crown (1991) argues (Table 5.6). The remodeling rate of 29% for rooms in use for at least 19 years allows us to understand the occupation history that is unique to Pot Creek, and we do not need to rely on a generic, one-size-fits-all model for the Southwest, as Plog (1975) suggests. By using the unique history of the site we can consider its length of occupation, construction activity patterns, and unique evidence of population changes.

Estimates for population result in a range from 275 (1.5 people per room) to 458 (2.5 people per room) people with a mid-point of 366 by the end of A. D. 1279 (Figure 5.42). This represents a substantial increase in the population from the initial point in A. D. 1270 where the estimates range from 35 to 58 people. The initial inhabitants of the village likely consisted of 5 to 12 families. By the end of the first three phases, the number of families increased to around 55 to 92 families. Crown (1991:309) predicted the trend towards a substantial increase in population during this period, albeit at a reduced scale. The considerable increase in population during the 20-year period was not likely due to in situ population growth from within the community, so we need to look for sources of population outside the site. Population has been estimated to have been between 467 and 700 individuals (Fowles 2004:915, see also Table 2.3) in the surrounding region during the preceding period, the Pot Creek Phase (A. D. 1200 - 1270). This estimate suggests that the increase in population between 1270 and 1279 could have resulted from the
aggregation of people from the surrounding Pot Creek and Taos regions in the new community of Pot Creek.

After the initial three periods, construction focused on both newly created rooms and remodeling or renovating existing rooms in the next two 20-year periods. During 1280 to 1299, the total number of rooms increased dramatically, from 183 to 379 rooms. Yet, the number of occupied rooms only increased from 183 to 249 rooms (Table 5.6). This result shows a greater increase in occupied rooms than Crown’s (1991:309) interpretation. She interpreted the total number of rooms to have increased from about 150 to 225 during this period, while the number of occupied rooms remained fairly constant at about 125 rooms throughout the 20-year period. Crown must have interpreted some of the rooms to have been constructed at the beginning of the period (built just after 1280 to have required repair prior to 1299) in order to get this result. My estimate of population ranges from 374 to a high of 623 people, with a mid-point of 498 inhabitants living in the community during the two decades between 1280 and 1299, based on the count of occupied rooms and the range of 1.0, 1.5, and 2.0 people per room (Figure 5.42). Population increased from the prior period by 100 to 200 people, or approximately 20 to 40 families, depending on the number of people per room. Population could have increased from both in situ population increases, where birth rates exceeded death rates, and from immigration from outside of the community. Immigration could have occurred from the surrounding Taos and Pot Creek region or from further afield.

The final period of occupation at Pot Creek Pueblo, A. D. 1300 to 1320, saw an overall increase in the total number of rooms to 493, while the occupied rooms declined to 224 from 249 rooms (Table 5.6). This represents an overall occupancy rate of 46 %, compared to 66 % from the previous period. The 46 % occupancy rate is low compared to reports based on the ethnographic literature from other scholars (Hill 1970; Plog 1975), yet this low rate reflects the
29% rate of renovation calculated by Crown (1991) for Roomblock 2 at Pot Creek. Further
testing of Crown’s estimate of the rate of renovation is needed in order to ensure that these
occupancy rates are accurate. What it does suggest is that the housing stock at Pot Creek was
relatively old by the 1300s and that many of the adobe buildings were beyond the 19-year use-
life threshold and in need of repair. That construction was needed to replace the dilapidated
housing stock is reflected in the increase in new rooms (from 379, for the period between 1280
and 1299, to 493, in the period between 1300 and 1320). However, the increase in new rooms
does not necessarily translate into increased population.

Interpretation is necessary for the population curves for the last period of habitation at Pot
Creek, where population estimates for the 1300 to 1320 period vary between 336 and 560
individuals, with a mid-point of 448 (Figure 5.42). As outlined above, the population
calculations are based on a range of estimates of the number of individuals per occupied room. It
is possible that during one period the range that is most appropriate is at the lower end of the
spectrum, while during another era the upper range is more representative of the actual numbers
of inhabitants. Dohm (1990) argues that the size of households (the number of members per
household) depends on the degree of nucleation, or the physical proximity of house structures, in
a given area. In other words, where houses are more tightly packed into a geographic area, the
density of people per household increases. Her work is based on a review of historical and
ethnographic Pueblo communities in the Southwest and identifies a strong correlation between
dwelling size, or the number of rooms per household, and architectural aggregation (Dohm
1990:232). As within-community aggregation increases, there is a greater need for architectural
solutions for privacy and larger households tend to have larger spatial requirements. While it is
possible that the mid-range estimate of the number of individuals per household is appropriate in
earlier periods at Pot Creek, by the 1300s village aggregation had occurred to such an extent that
the number of individuals per household may have been closer to 2.5 or even 3.0. Further discussions of privacy and household architectural solutions will be considered in Chapter 6.

5.7 Conclusion

In this chapter, I use multiple lines of evidence and a blended theoretical approach to provide a rich interpretation of data to reconstruct the construction sequence at Pot Creek. I explore a production process model that allows us to understand both material components and social considerations required in the production of an adobe building. The availability of raw materials, suitability of the site location, and the construction of the buildings are some of the physical components of constructing adobe buildings. Social considerations, such as the orientations of the buildings on the site, gendered labour tasks in construction, and ritual abandonment processes, are also important to our overall understanding of the development of the community. Episodic versus continuous building, or the intensity of architectural production, provides insight into the related social organization of production. Both types of production were likely used at Pot Creek. For example, Roomblock 2 was likely built in discrete building episodes, while the long continuous block of rooms of Roomblock 9 was likely constructed in one continuous building episode. More testing is necessary to confirm this interpretation for Roomblock 9.

The methods used here to reconstruct the building sequence include wall bonding and abutment, dendrochronological dating, and analysis of stratigraphic evidence. In Roomblock 1, tree-ring dates can be interpreted in two ways. Crown and Kohler (1994) interpret the bi-modal distribution of tree-ring dates to be evidence of stockpiling timbers for 30 years, while I believe that construction activity occurred at the time of the initial cluster of tree-ring dates, followed by remodeling or renovation 30 years later. My interpretation is based on several factors, including
the deterioration of cut timber when exposed to the elements for long periods of time, the cluster pattern of the dendrochronological dates, and availability of timber in the local region reducing the necessity for stockpiling. Three tree-ring dates cluster around A. D. 1279 and it is unlikely that this pattern would occur if the timbers had been stockpiled for a long time or if the wood had been re-used from another architectural context. Therefore, I contend that the original construction of the southern ten rooms of Roomblock 1 occurred in A. D. 1279, followed by remodeling of the existing rooms in about A. D. 1310.

A further point to consider surrounds the interpretation of tree-ring dates that are non-cutting dates. The gold standard for dendrochronology is the cutting date, supported by the presence of bark on the timber or the outer few rings of tree growth, but many timbers lack these indicators. Dean (1978a) maintains that a gap disparity can exist when outer layers of a timber are not present, yet these timbers can still provide a termini post quem, or the earliest date when an event could have happened. Wiseman (2004) argues that the presence of clusters of tree-ring dates, even if they are non-cutting dates, indicates some form of construction activity. Crown (1991) removes the non-cutting dates from her analysis, while I interpret the non-cutting date clusters as evidence of some construction activity. In Roomblock 4, episodic construction likely occurred over a number of time periods with room groupings constructed in A. D. 1279, mid 1280s, late 1300s, and again in the 1310s. The effect of this interpretation is to spread the construction sequence for Roomblock 4 over a period of more than 30 years and has implications for population estimation and migration patterns in the community.

The interpretation of the construction sequence also considers architectural patterns at Pot Creek. The roomblock form typology contains three types: C-shape, L-shape, and linear forms, and allows comparison of construction sequences within and between the building form groupings to provide some indication of the construction trajectory for similar building types.
Identification of building alignment patterns aids the interpretation by identifying differences in architectural production, possibly based on a duality or moieties (Fowles 2004; 2005), and by correlating differences in construction timing between the two alignment categories.

Consideration of these multiple lines of evidence and theoretical approaches has provided a deep insight into the construction sequence for Pot Creek, yet judgment is still required to fill in gaps in knowledge left by the uneven excavation history of the site. The three-dimensional computer models that I have created have used all the evidence to produce a ‘best guess’ at the construction events that occurred in the past and further testing would be required to confirm this sequence.

The application of the construction sequence to the population dynamics at Pot Creek provides insight into whether the expansion of the architectural spatial environment reflected an increase in the number of inhabitants at the Pot Creek community, or whether the new rooms and buildings were only constructed to replace dilapidated architectural structures. By considering the length of time that a building was likely used and the rate of renovation required to maintain the adobe buildings, I have been able to predict occupancy rates and overall population for the construction episodes in the Pueblo’s duration. The length of occupation of the architecture is an important consideration in overall assessment of population dynamics, with lengthy occupation periods, such as more than 70 years at Pot Creek, necessitating new structures or maintaining older buildings. In general, archaeologists need to be cautious in estimating population and proposing aggregation models based on site size alone, and need to consider population dynamics together with the unique characteristics of the site and region.
Chapter 6

Community Transformation at Pot Creek: The Built Environment Fostering Visual and Social Interaction

Introduction

Three-dimensional computer modelling can be used in an archaeological context to enhance our understanding of the past, to recreate buildings and site layouts, and to fill gaps in our knowledge of ancient sites that have been damaged or destroyed. In Chapter 5, I revisited the construction sequence of Pot Creek and modelled the building episodes using three-dimensional (3D) computer software. In this Chapter, I use these models to investigate visual patterns across the site and possible social interactions that occurred over time. I evaluate the 3D models with 3D spatial analytical software in a geographical information system (GIS). Despite the wealth of excavation data available for the Pot Creek site, gaps in our knowledge result from the unexcavated portions of the site and the uneven collection strategies from excavations over the past 100 years. Preservation variability also affects the quality of information available from beneath the surface of the ground. Despite these constraints, computer modelling can aid our understanding of how the built environment affected social interaction through the various habitation phases at Pot Creek.
The general research question for this chapter is: how did the changing built environment of Pot Creek affect social interaction in the community? As the community expanded over time, the developing built environment allowed, but also limited social interaction. The deliberate placement of roomblocks and associated plazas contributed to establishment of both public and private areas within the community. Visual connections within and between the plazas of roomblocks played a critical role in the ability of inhabitants to interact on a variety of social planes. Practices of nonverbal communication associated with the placement of buildings allowed the community to exclude strangers and segregate space, while providing more public access in other areas of the site. I discuss middle-range theories regarding how the built environment contributes to nonverbal communication and social interaction in greater detail in Chapter 3. Here I use visibility analysis to assess the private and public areas afforded by the buildings in order to understand changing social relations in the community.

In Chapter 4, I discuss the three-dimensional computer-based methods that I use to investigate the built environment at Pot Creek Pueblo. Several techniques can help demonstrate visual patterns in the community, including skyline analysis, the examination of skyline barrier enclosure, overall visual interconnectivity between plazas, and the study of sightlines between the rooftops of the 3D buildings. I analyze the results of the modelling to further our understanding of the built environment of Pot Creek and how the settlement design changed over time, with attendant changes in patterns of social interaction. I will consider social interaction within both private and public spaces, and the expression of ritual within the increasingly enclosed plaza-oriented neighbourhood groups. The concept of neighbourhoods, as defined by Smith (2010), or districts, as defined by Lynch (1960), will be explored. Finally, I will evaluate the consequences of loss of privacy with respect to one of the roomblocks, Roomblock 1, and its implications for social interaction of its inhabitants with the remainder of the community.
6.1 Visualizing the Expanding Spatial Environment at Pot Creek

The results of the three-dimensional visibility analysis at Pot Creek demonstrate a number of critical characteristics that affected social interaction and highlight the changing nature of that interaction through the building construction episodes from A. D. 1270 to the final phase of occupation sometime after A. D. 1320. Three-dimensional rendering of the site plan through the five phases of expansion that occurred at Pot Creek (Figure 6.1) allows several observations. From the initial configuration of the small, unit pueblo buildings, which are located at some distance from one another, to the final configuration, in which large roomblock structures are packed into a concentrated area, there were significant changes in people’s ability to connect visually and socially across the community. Through the five phases of the community expansion, the dispersed building units coalesced into a smaller number of distinct roomblock structures. The enclosure of the large, southernmost roomblocks into C-shaped buildings reduced visibility into and out of those plazas, while other areas retained expansive views across the site. By the 1300s, the linear roomblocks, Roomblock 4 and the combination of Roomblocks 8 and 9, created a partial boundary that separated the community from its surroundings and reduced visual connectivity both within the community and between the village and the region outside it.

The location of observation points is important to the outcome and analysis of visual interaction at the site. From the site plan it is clear that there are areas within the C-shaped plazas where visual interaction is restricted, for example, there would be limited intervisibility from the southwest corner of the plaza of Roomblock 2 towards the outside of the plaza. Therefore, I have selected observation points to maximize the visual connections from each plaza to the area.
A. D 1270 - 1273

A. D 1274 - 1277

Figure 6.1. Three-dimensional renderings of Pot Creek Pueblo during major construction episodes, A. D. 1270 - 1320.
Figure 6.1 continued. Three-dimensional renderings of Pot Creek Pueblo during major construction episodes, A. D. 1270 - 1320.
A. D. 1300 - 1320

Figure 6.1 continued. Three-dimensional renderings of Pot Creek Pueblo during major construction episodes, A. D. 1270 - 1320.
Figure 6.2. Location of observer points in the plazas at Pot Creek, A. D. 1300 - 1320. Capitalized letters indicate the observer points related to each roomblock. Grey roomblocks are the C-and L-shaped structures.

outside of the plazas (Figure 6.2). The locations of the points were selected to demonstrate potential areas of visual and social connection between these important activity areas. Observer points are located towards the centre of each plaza and are placed to avoid the kivas.

6.1.1 Declining Overall Visibility

The results of the 3D viewsphere approach illuminate the trends in visibility and potential spheres of social interaction over the period of occupation at Pot Creek in the Talpa Period (Figure 6.3). The skyline border metric characterizes a complex collection of features, such as buildings or trees on the landscape, and allows us to consider the spatial openness or enclosure from a specified location (ERSI 2014). The metric calculates the amount of visible skyline
Figure 6.3. Comparison of skyline border visibility for each roomblock over time using 3D viewsphere analysis. Percentages represent the amount of sky that is visible from a given observation point. One hundred percent indicates visibility to all points on the horizon, while zero percent indicates complete enclosure with no views of the horizon.

border or the ratio of visible to invisible sky. It provides a global measure of observable sky from a specified observation point to all vertices and azimuth points.

The general conclusion that one can draw from this data is that overall visibility in the Pueblo from the plazas declined through time. As a specific example, the visibility from the plaza of Roomblock 2 declined from 83% in the earliest period, 1270-1273, to 31% in the period of 1300-1320. There was little change in the volume of skyline visibility surrounding roomblocks 1 and 5, although both of these roomblocks were only present in the last two construction episodes. Roomblock 1 had the highest overall percentage of visible skyline and this becomes an interesting finding when considered alongside the other visibility indicators discussed below. Roomblock 4 had the next highest percentage of visible skyline in all periods.
with a decline in visible percentage from the initial construction (86%) down to 66% in the final phase. The large open plaza west of Roomblock 4 would explain the high percentages of visible volume in this area.

The vast majority of the decline occurred prior to A. D. 1290. The percentage of visible skyline from each of the roomblocks (2, 3, 4, and 6) remained fairly constant, except for Roomblock 2, up to and including the period ending in 1279. After that, two factors influenced the volume of visible skyline: 1) new construction occurred at the site for Roomblocks 7, 8, and 9, and 2) Roomblocks 2, 3, and 6 all began to close in the entranceways into their respective plazas. These changes suggest that significant changes were occurring in the social structure of the community. A closer look at the viewsphere indicators for the individual roomblocks will help to clarify the changes that occurred.

6.1.2 Increasing Enclosure of Plazas

The skyline barrier graph demonstrates the impact that buildings have upon the ability to view open space from both a horizontal and a vertical perspective. The graph measures the amount of visible sky from an observer point in a circle to all of the vertices on the skyline (Shephard 2010:9). The skyline target points of interest are the tops of the buildings that are impeding the view from the observer point. It is similar to an imaginary hemisphere erected above the observer point, with any vertical building (or other object) intersecting that sphere and blocking visibility. The observer points used in the skyline barrier graphs are the same as those used in the skyline border visibility (Figure 6.2). The placement of the observer point affects the skyline barrier graph, with a point closer to a physical obstruction resulting in more of the sky being blocked.
Figure 6.4. Skyline barrier graphs for all roomblocks at Pot Creek during all occupation phases. White areas indicate no visibility due to obstruction of buildings, grey areas indicate visible sky. All dates A. D.

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Figure 6.4 continued. Skyline barrier graphs for all roomblocks at Pot Creek for all occupation phases. White areas indicate no visibility due to obstruction of buildings, grey areas indicate visible sky. All dates A. D.
The skyline barrier graphs for each of the roomblocks at Pot Creek demonstrate the amount of visible sky for each construction phase (Figure 6.4). The grey areas are visible sky and the white areas result from the sky being blocked by buildings. In all of the roomblocks (except Roomblocks 1 and 5), the total amount of visible sky declines from the initial construction of the roomblock to the final period of construction in A.D. 1300-1320. The overall number of roomblocks present and their size has a large impact on the amount of skyline visible. In addition, the height of roomblocks, or the number of stories present, contributes to how much the buildings block views of the sky. As more rooms are constructed and protrude into the plazas of the roomblocks, the skyline views decline. The plazas in Roomblocks 2, 3, and 6 show a dramatic decline in the amount of visible sky in the later building episodes, yet all of these plazas retain one visually expansive region through openings in the building formations from the plazas in a south-easterly direction towards the outside of the community. The plazas associated with Roomblocks 4, 8, and the plaza bordered by Roomblocks 7 and 9 all exhibit more open visual sky space and experience a sense of enclosure, although the sense of enclosure is at a greater distance from the observer points, than is the case for the smaller plazas. In Roomblocks 1 and 5, the skyline visibility graphs are essentially unchanged between the two later construction episode periods, which indicates that these structures reached their final form early in their construction sequence with little alteration in their surroundings or sense of enclosure subsequent to the initial building phase.

The skyline graphs allow us to understand the relationships between visible and non-visible space within each of the plazas and the nature of the changes that occurred in those spaces through the period of occupation at Pot Creek. As discussed further below
(Section 6.2), the sense of visual enclosure and openness within the spatial environment gives us clues that help us understand the social interaction that was associated with each of the time periods.

6.1.3 Visual Interaction between Activity Areas

The investigation of the built environment of Pot Creek continues with an analysis of the physical locations where activity and social interaction occurred, such as in plaza and on rooftops. Intervisibility between these locations, from plaza to plaza, from rooftops to rooftops, and from rooftops to plazas, allows us to understand how the placement of buildings across the site can have an impact on inhabitant’s ability to interact on a daily basis. The 3D Skyline analysis, produced within the ArcScene 3D Analyst toolset, provides another layer of inquiry that can be used to investigate the spatial environment and social interaction that took place within that environment. The visual inspection of the skyline images allows us to consider the location of visually accessible and inaccessible areas within the pueblo through all phases of the construction and occupation sequence. The 3D Skyline tool creates a representation of the continuous line separating the sky from the ground surface at the horizon and any interference with the view caused by the edge of features, such as buildings, from a given observer point (Environmental Systems Research Institute ERSI 2014). The unique advantage of the 3D Skyline approach is that it shows only the outline of the visual area and thereby allows us to analyze overlapping visual fields from different observation points and to take under consideration the impact that the height of building structures have on the skyline. For the intervisibility analysis, a separate 3D Skyline was created for each observer point associated with the plaza of each
roomblock (Figures 6.5, 6.6, 6.7, 6.8 and 6.9) during the multiple construction episodes, allowing examination of areas that are visible, or not, from multiple observer points.

The views from the rooftops are investigated using the ArcScene 3D Analyst Line-of-Sight tool to assess views towards other rooftop areas and towards plazas below. The line-of-sight analysis takes into consideration the geometry of the buildings and their placement to allow for visual interconnectivity between the observer and the target area. Observer points have been selected to represent people sitting and standing as they move about their daily lives. Consideration is also given to the more purposeful act of watching performances in the plazas below.

*Intervisibility between Plazas*

The skyline view of Pot Creek during the earliest Talpa Period occupation phase, A. D. 1270 - 1273, demonstrates both visual accessible areas and areas that can be considered visually inaccessible (Figure 6.5). All three observation points located in the plazas of Roomblocks 2, 3, and 6 had very broad ranges of visibility, yet none of the three plazas were intervisible from one to the other, as indicated by the absence of the skyline views penetrating to the adjacent plazas. Roomblock 6 is situated so that the initial L-shaped roomblock acts to protect the plaza from visual interaction with Roomblocks 2 and 3. The placement of the three small buildings of Roomblock 2 prevents intervisibility with either Roomblock 3 or 6, and primarily focuses towards the southeast. From this earliest occupation phase, the visual interaction between the plazas of the roomblocks was respected and seems to have been a significant consideration for the builders and occupants of the fledgling community.
Figure 6.5. Skyline views of Pot Creek, A. D. 1270-1273. Radii from observation points are 100 m.
Figure 6.6. Skyline views of Pot Creek, A. D. 1274-1277. Radii from observation points are 100 m.
Figure 6.7. Skyline views of Pot Creek, A. D. 1278-1279. The black oval represents a region of intersection of several skyline view areas. Radii from observation points are 100 m.
Figure 6.8. Skyline views of Pot Creek, A. D. 1280-1299. Black oval represents an area of intersection of several skyline view areas and location of Roomblock 1. Radii from observation points: 100 m.
Figure 6.9. Skyline views of Pot Creek, A. D. 1300-1320. Radii from observation points: 100 m.
With the expansion of the Pot Creek community during the subsequent occupation phases, the trend toward non-intervisibility between plazas continued. The location and positioning of Roomblock 4 continues the tendency of increasingly limited visual interaction between the plazas, during 1274-1277 (Figure 6.6). Despite the disjointed nature of the Roomblock 4 buildings, and widespread overall visibility, visual interconnectivity is limited with the other extant plazas in the adjacent roomblocks. During the 1280 - 1299 phase, the plaza of Roomblock 4 was partially visible from both Roomblocks 8, and the combination of Roomblocks 7 and 9 (Figure 6.8), but this area of visibility was blocked off by construction located at the northeast corner of Roomblock 6 during A. D. 1300-1320. There is, however, visual interconnectivity from the rooftops of Roomblocks 2, 3, and 6 with the plaza of Roomblock 4, as discussed in the next section.

During the final phase of occupation, 1300-1320 (Figure 6.9), each of the plazas related to the individual roomblocks had exclusive areas of visibility with no interconnectivity between the plazas at all, with the exception of Roomblock 1, discussed below. The entrances into the plazas of Roomblocks 2, 3, and 6 all became narrow during this phase and oriented in a generally southeastern direction. This orientation of the roomblocks prevented any visual interconnectivity between plazas. Roomblocks 5 and 8 both had their openings from the plazas into the wider surrounding region directed away from the community, thereby excluding visual interaction from and to their plazas with the remainder of the community. The visual expanse of the plaza bounded by Roomblocks 7 and 9 was effectively blocked from other plazas by Roomblocks 3 and 6. The views within the Pot Creek community appear to have been very carefully orchestrated and managed.
Views from the Rooftops

The rooftops of the buildings were important areas for social interaction, where mundane everyday activities occurred and where access was available to rooms in the buildings below. For example, the routine events of everyday life occurred on the roofs of both one- and two-story buildings of Roomblock 4, and on the roofs of some of the ramada structures (Holschlag 1975:100-104). Holschlag clearly delineates stratification comprised of floor components and roof fall, and a typical assemblage from an upper-story roof area of Roomblock 4 includes manos, metates, hammer stones, pots, bone awls, and flaking tools. The presence of these artefacts indicates that food processing, such as mealing corn, likely took place on the rooftops, while the presence of hearths indicates that cooking was performed there too (Holschlag 1975:102). The visual interaction from one rooftop area to another allowed some degree of social interaction between buildings during all these activities.

Terrace doorways and rooftop hatchways into interior rooms allowed social interaction at these points of egress as these were important spaces and pathways. The space surrounding hatches and doorways allowed movement in space and time and would be of interest to any person in the vicinity who might want to monitor the flow of people into and out of these spaces. The presence of roof hatches to rooms beneath and doorways leading to upper terrace rooms indicates that access into interior rooms frequently occurred from the rooftops of Roomblock 4, even though doorways at ground level were also sometimes present. The hatchways were constructed of puddled adobe and were 40 to 55 cm in diameter, while the terrace doorways were about 2/3 the height of a man (Holschlag 1975:102). Visual connectivity between the rooftops, and the monitoring of doorways, could be seen as important categories of social information.

The rooftops would also have been used as vantage points for viewing activities that occurred in the plazas, including both everyday mundane activities and ceremonial events. Both
accidental and more deliberate, or contrived, viewing may have taken place and contributed to social interaction at the site. Accidental witnessing of activities would include someone casually noticing an event that may not have been for public consumption or viewing. More formal and deliberate viewing of events would include an audience situating itself on a rooftop to use it as a viewing platform for a staged performance in the plaza below.

The ability to see from the rooftops to the plazas below depends on geometric principles of lines of sight. Viewing the ground depends on the height of the building and the location and height of the observer (Figure 6.10). Buildings of varying elevation above ground level, would require different viewing angles to see the ground beneath. Architect Francis Ching (2007:107) states that “The degree to which [.....] visual continuity is maintained between an elevated space and its surroundings depends on the scale of the level of the change.”

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<td>Moderate elevation</td>
<td>Visual continuity is maintained for both the seated and standing individuals</td>
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<td>Higher elevation</td>
<td>Visual continuity is interrupted, in order to visually connect with the ground the individual must be close to the perimeter of the elevated space</td>
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Figure 6.10. Schematic of visual continuity of elevated structures. The amount of visual interconnectivity depends on the scale of the elevation, or height of the building. The location of individuals at the perimeter has greater visual connectivity to the ground level, than those located away from the perimeter. Adapted from Ching (2007:107).
Figure 6.11. Schematic of visibility while sitting and standing on the second story of Roomblock 2, Pot Creek with a distant target. There is a wider range of view while standing versus sitting.

structure, the less one is able to see the ground immediately adjacent to the building, unless the viewing individual is looking directly down from the edge of the building. Observer location and stance are important variables in the ability to see into the plazas from the rooftops. Visual connectivity from rooftops to plazas is enhanced when the observer is situated close to the edge of the building. Observer stance impacts the ability of the observer to view the ground by affording a larger viewing area to a standing observer than to someone sitting on the rooftop. Principles of geometry can help us to understand the different ways of viewing and being seen when people are located on rooftops of the roomblocks, from intentional and deliberate viewing of a scene, to casual, perhaps incidental viewing of a scene, to not being able to see a particular scene at all, or remaining invisible from people in the plaza below. The seated individual has a more restricted visual field than the standing structure, the less one is able to see the ground
immediately adjacent to the building, unless the viewing individual is looking directly down from the edge of the building. Observer location and stance are important variables in the ability to see into the plazas from the rooftops. Visual connectivity from rooftops to plazas is enhanced when the observer is situated close to the edge of the building. Observer stance impacts the ability of the observer to view the ground by affording a larger viewing area to a standing observer than to someone sitting on the rooftop.

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The Exception: Roomblock 1

The exception to the trend of limited to no intervisiblility between plazas is the visual area surrounding Roomblock 1. During the 1278-1279 occupation phase, this was one area within the pueblo community where high visibility occurred. The plazas of Roomblocks 3, 4, 6, and the plaza created by the junction of Roomblock 7 and 9 overlooked one particular region of the pueblo, represented by the black oval (Figure 6.7). In the very next construction phase (1280 -
Roomblock 1 was constructed in this highly visible area (Figure 6.8). Roomblock 1 was visible from the plazas of Roomblocks 3, 4 and 6, with only the extreme southern end of the roomblock being invisible to other roomblock plazas. By the final occupation phase, Roomblock 1 was still intervisible with 2 other plazas, being visually interconnected with Roomblock 4 and partially with the plaza of Roomblock 6 (Figure 6.9).

As a further indication that Roomblock 1 was being ‘watched’ at all times, views from the surrounding rooftops warrant consideration (Figure 6.12). The entire area surrounding Roomblock 1 was under continuous surveillance whenever individuals were watching from one of the surrounding roomblocks. Roomblocks 2, 3, and 6 all overlooked Roomblock 1. All of Roomblock 3 and 6 and portions of Roomblock 2 had two stories, while Roomblock 1 only consisted of one story, and allowed viewers from the higher rooftops to look down on the roof and surrounding ground level areas of Roomblock 1. The higher elevation of these surrounding roomblocks allowed higher levels of visual access, than from the lower roof towards the higher
buildings. Roomblock 1 was the only building in the community that was exclusively 1 story and was overlooked by the nearby roomblocks. Roomblocks 7, 8, and 9 could not visually access Roomblock 1, while visibility from the rooftops from Roomblocks 4 and 5 was possible but from a longer distance. Roomblock 1 was the only building in the community that had the potential to experience continuous surveillance.

The higher level of visual interaction between Roomblock 1 and surrounding roomblocks seems to be significant. The Pot Creek community was fully able and cognizant of the placement and construction of buildings to manipulate visual pathways and interconnectivity, and thus it is not likely that this level of visual interaction occurred by accident. The deliberate construction of Roomblock 1 at a highly visible location undoubtedly had a specific meaning. Connections between the spatial layout of the community and the social interaction that occurred in the region of Roomblock 1 will be discussed below (Section 6.2.4).

### 6.1.4 Summary of Visual Interaction at Pot Creek

There are four main themes of visual interaction that were prescribed by the buildings at Pot Creek, including: 1) a general decline in the percentage of skyline visibility over time, 2) a trend towards an increased sense of enclosure for each of the plazas within the Roomblocks over time, save Roomblocks 1 and 5, 3) a tendency towards visual exclusivity (or limited visual interconnectedness) between the plazas in all occupation periods throughout the Talpa period, 4) observer intentionality, and socially acceptable viewing, guiding a broad range of viewing options from rooftops, and, finally, 5) the anomalous visual interconnectedness of Roomblock 1 and several of the other roomblocks. The next section will discuss some of the social implications of these visual trends and their likely impacts on the inhabitants of Pot Creek.
6.2 Social Consequences of Visual patterns at Pot Creek

Built environments provide more than just shelter from the climatic elements of the natural world, as they have many socially and culturally constructed functions. Built environments shelter people and their possessions from climate, animals, other people, and supernatural powers. Buildings establish a humanized safe space from the powers of the profane and dangerous world, and act as communicating devices to confirm place, social identity, and status (Rapoport 1980:159). The wide variety of decisions inherent in the process of constructing a building and an entire built environment reflects the cognitive processes of the decision-makers. “One can, [...], look at built environments as physical expressions of schemata and cognitive domains: environments are thought before they are built” (Rapoport 1980:158). The interpretation of the organization of the physical environment goes beyond understanding the construction process or the placement of buildings, and delves into the way buildings act as vehicles for both verbal and non-verbal communication. Spatial patterning within a settlement provides clues as to who can communicate with whom, when, and under what conditions, and is an important element in the link between the built environment and social organization (Wernke 2007:132).

One way of understanding social organization is to study ancient communities, both real and imagined and associated social interaction that may have taken place in the past. I approach the study of communities from an approach that aligns with practice theory and human interaction (Chapter 1). The emphasis is on individual and structural elements combining to produce and reproduce processes that create society (Yeager and Canuto 2000:3). A community can be defined emphasizing specific actions, such as the three factors of importance for Kolb and Snead (1997:611); social reproduction, subsistence production, and self-identification. This leads to a functionalist approach, while ignoring social creation of meaning and dynamic change
A broader definition of community focuses on the evolving nature of social institutions produced by household interactions that are structured by a shared idea of place over a period of time (Yeager and Canuto 2000:5). The emphasis is on interactions that require frequent co-presence, aligning space and practice (Mac Sweeney 2011:28). A further aspect of a community is differentiating between the nature of community identity and interactions that can result in other types of group formations or multi-scalar ‘imagined communities’ (sensu Anderson 1983). An interactive approach to communities recognizes the importance of multiple scales of social interaction in creating community identity (Yeager and Canuto 2000:8). For example, the Pot Creek community could also have multi-scaled ‘imagined’ communities involving roomblock-level social interaction and work-group communities, such as the women grinding corn (Chapter 7). In this section, I use intervisibility to understand how the spatial environment acts to create ever-changing potential social interactions for the inhabitants of Pot Creek.

Visual connectivity is a key variable in decoding the clues embedded within the built environment and the associated social interaction that is possible within that environment (Stone 2016:61). Archea (1977:116; 1984) argues that the spatial arrangement of architecture can affect an individual’s ability to acquire information about the surrounding environment and the ability of others to take notice of the individual’s behaviour. The spatial arrangement of buildings can provide opportunities as well as create situations that inhibit the distribution of information and, thereby, regulate interpersonal behaviour. Thus, vision becomes a critical element in decoding the visual cues that are present in the surroundings.

The built environment of Pot Creek resulted from the purposeful placement and construction of buildings and plazas. A cognitive concept, or a vision, of how the buildings should look and the location of all components of the buildings seems to have been prevalent
throughout the community’s existence. Visual pathways between plazas were planned and deliberately manipulated to produce the desired level of visual interaction between plazas. Control of the visual environment was created through the construction and placement of the buildings, and had profound consequences for social interaction within the community. The visual exploration that the 3D Analyst tools allows helps us identify the kinds of information that the inhabitants of Pot Creek would have perceived while inhabiting the plazas and roomblocks at Pot Creek.

6.2.1 Spatial Enclosure and Privacy

As seen from the skyline barrier graphs (Section 6.1.2) an increasing sense of enclosure characterized occupation at Pot Creek. Even the large plazas associated with Roomblocks 4, 8, and the plaza created by Roomblocks 7 and 9, experienced increasing enclosure by the final occupation phase. Skyline boundary analysis (Section 6.1.3) from observation points within the plazas demonstrates the absence of visual interconnection from one plaza to another. This trend continued throughout the site’s occupation and even the initial buildings and plazas were situated in such a way that intervisibility between the plazas was limited.

These indicators point to an increasing sense of privacy between the plazas. In this section, I will delve into the theories of privacy and how the built environment organizes privacy and then explore the function and importance of privacy within a physical environment and social interaction. I will then relate the theories of privacy to Pot Creek in an attempt to understand how the placement of the architecture structured privacy and, in turn, social relations within the community.

Psychologists have defined privacy generally as “control over, or regulation of or, more narrowly, limitations on or exemptions from scrutiny, surveillance, or unwanted access”
Figure 6.13. Proxemic social distances (Hall 1966:126-127).

Table 6.1. Approximate dimensions and areas of plazas during the final occupation phase (A.D. 1300 - 1320) at Pot Creek. Area calculations include buildings and rooms encroaching into the plazas.
This broad definition captures privacy as both a limitation of access to an individual or social unit and emphasizes the idea of control as a result of social power. Relevant to this research is Altman’s theory of privacy, which focuses upon environment-privacy linkages and the process of regulating social interaction through the “selective control of access to self or one’s group” (Altman 1975:18, italics in original). Altman (1977:66) believes that privacy is a universal phenomenon, but the mechanisms to control privacy are culturally specific. Varying levels of environmental mechanisms work in concert to regulate privacy, including culturally mediated personal adornment, personal space, and territoriality (Altman 1975:33-42). The benefit of Altman’s model is that it connects how people use human spatial techniques to the regulation of social interaction (Margulis 2003b:422). The ideas surrounding space and control can be related to the overarching social theories discussed in Chapter 1, where Lefebvre’s work was summarized. Lefebvre (1974) suggests that the construction of space is a social product developed through a complex social construction of meaning. His second category of space, or conceived space, is related to the design that is imposed upon space and thus is influenced by hegemonic power over spatial practice and the production of spatial knowledge. The limitation of visibility from plaza to plaza and the privacy afforded within plazas of individual roomblocks had a significant impact upon social interaction at three distinct levels within the community.

6.2.2 Social Consequences of Privacy and Enclosure at Pot Creek

Within the plazas there existed a dynamic visual world where social interactions were regulated by the privacy of the spatial environment. Hall’s (1966) model of culturally-specific “proxemics” and categories of social interaction that can occur at varying distances is prominent in Altman’s (1975:76-77) analysis of factors that regulate personal space. Visual contact at very close distances (up to 0.5 m) constitutes intimate interaction with another individual, revealing
minute details and distortions of facial features (Figure 6.13). The personal level (0.5 to 1.2 m) is comparable to a bubble of space surrounding an individual, just outside touching distance, and visual interaction would reveal detailed, undistorted views of facial features. Slightly longer visual distances (1.2 to 3 m) result in social-consultative forms of interaction, where the low end of the range allows viewing the upper body and gestures, while the 3 m distance allows observation of the entire body of a seated individual. Public forms of social interaction occur at even wider visual distances with near distances of 3 to 9 m allowing the entire body, including surrounding space, to be seen, while the far form of public space (6.5 to 12 m) shifts to viewing the entire body and communicating via body stance and broad gestures (Hall 1966:118-119).

The plazas at Pot Creek allowed social interaction to occur at all proxemic levels but it was circumscribed by the dimensions of the plazas (Table 6.1). During the final episode of occupation, Roomblocks 2, 3, and 6 enclosed small plazas that provided opportunities for social interaction at shorter physical distances. Intimate and personal interaction could have occurred in these plazas, the range of behaviours exhibited depending on culturally acceptable norms. Social interaction could also have occurred at the social-consultative and public proximity distances, but the most extended distance of the public range would have reached from one side of the plaza to the other or across the entire dimension of the plaza space. While the actual distances associated with the proxemic ranges are culturally dependant, it is evident that the plazas for these roomblocks would have been able to accommodate all forms of social interaction. The remaining plazas associated with Roomblocks 4, 5, 8, and the combination of 7 and 9 are even larger, allowing all levels of proxemic social interaction.

Within the plazas, inhabitants would have had visual access, or would be able to monitor, the immediate surroundings by sight, in order to obtain the necessary information to ensure appropriate behaviour (Archea 1977:123; Bowles and Gintis 2002:F432). The physical
environment acted to regulate and control the flow of information. Active surveillance of the plaza would have provided each individual with visual information to identify acceptable or appropriate ranges of behaviour within that social context. In addition, the ability to survey the entire plaza allowed identification of any individuals who were not performing in the appropriate or acceptable manner. The monitoring of behaviour can occur through visual exposure; “the probability that one’s behaviour can be monitored by sight from one’s immediate surroundings” (Archea 1977:123). The views within plazas allowed for ongoing monitoring of social behaviour and even acted to ensure that only group-sanctioned individuals were present in the defined space of the plazas. Activities within the plazas would have been deemed appropriate only for the select and socially approved individuals within those roomblocks. The private spatial environment of the plazas allowed the regulation of social interaction from within the roomblock group, while excluding those from the remainder of the community.

Neighbourhoods at Pot Creek

The limitation of visibility also affected social interaction within the Pot Creek community in a second important manner. The regulation of interaction with others occurred through the visual segregation of the plazas, creating distinct areas where privacy was provided for select individuals through the exclusion of others. Community-based social identities linked to identifiable sub-groups within distinct localities are one way to categorize regions within a large urban environments. Kevin Lynch (1960:66-72), The Image of the City, argues that districts within a city occur when an observer physically enters an area that has some recognizable, common, or identifying character. Districts are identifiable from the inside, but also often from the outside. The roomblocks of Pot Creek have identifiable interior plazas and are bounded by
Figure 6.14. Schematic of North and South Moieties at Pot Creek ca. A.D. 1300 - 1320 as presented by Fowles. The dashed line indicates the proposed division between the two moieties. Adapted from Fowles (2004:486).
the edges, or walls, of the roomblocks themselves and thus have identifiable exteriors. Michael Smith (2010:137) has refined the notion of spatial separation within cities and suggests the term neighbourhood as a small area where frequent face-to-face interaction occurs, while districts are larger zones with administrative or social significance within a city. Pot Creek’s roomblock plazas allow face-to-face interaction to occur on a regular basis. Smith’s neighbourhoods and Lynch’s districts both articulate similar concepts that smaller divisions within a larger community tend to develop their own distinct physical and social characters.

The classification of neighbourhoods within cities is an appropriate analogy for Pot Creek, despite differences in community scale. Smith (2010:141) argues that communities smaller than urban settlements can still develop neighbourhoods and uses Pot Creek as an example. The inhabitants of Pot Creek needed to deal with similar concerns as larger urban populations when negotiating such factors as locating and constructing new elements of the built environment, creating and maintaining social identities, and living on a daily basis in a fairly dense, geographically-constrained spatial environment. Smith (2010:141) suggests that Fowles’ grouping of the architectural elements at Pot Creek into two distinct moieties follows Smith’s definition of neighbourhoods (Figure 6.14).

The moiety classification at Pot Creek, as Fowles argues, is based on several lines of evidence, including ethnographic comparison with the modern Pueblo of Taos, ritual abandonment processes found in a ‘D’ shaped kiva in Roomblock 8, and the architectural alignment of some of the roomblocks at Pot Creek (Fowles 2004:480-486). Roomblocks 2, 3, and 6 (the three C-shaped roomblocks) are aligned with the openings from their interior plazas angled to the south, while the L-shaped Roomblocks 5 and 8, are aligned differently and with large openings towards the east. The two distinctly different roomblock and spatial orientations could be occupied by different groups of people interacting in different social spheres within the
larger site of Pot Creek. But is this enough to qualify as a neighbourhood as defined by Smith or a district as defined by Lynch? An analysis of the moieties can be extended to include the visibility analysis presented here to aid in our understanding of a neighbourhood system.

Physical boundaries demarcating distinct geographical regions and the ability to have face-to-face interactions are hallmarks for Smith’s (2010:138-140) definition of a neighbourhood (See also Kolb and Snead 1997). It is possible that the roomblocks themselves could demark individually distinct neighbourhoods. Each roomblock consists of a distinct physical entity and likely contained some form of socially distinct group, perhaps based on kinship. For example, Roomblock 3 contained a number of household groupings and had a small plaza that is physically bounded by the architecture of the roomblock, providing opportunities for face-to-face interaction. People from outside of Roomblock 3 would know the limits or boundaries described by the architecture and the plaza, which was not visually accessible to those outside the roomblock. However, the individual roomblocks are compact sub-units of the entire community and represent very small segments of the population. A broadening of the spatial unit and social entity, beyond the roomblock, should be considered in order to understand neighbourhoods at Pot Creek.

The moiety division, as Fowles proposes, is an alternative neighbourhood division that does present some difficulties when analyzing within the framework of a neighbourhood. The first criterion of face-to-face interaction in the North and South Moieties is only partially met; there are portions of the moieties that would have been invisible to other areas within the moiety. For example, the plaza of Roomblock 8 has no intervisibility with Roomblock 5. The physical structures of the buildings prevented inhabitants in one plaza from seeing to the other, but individuals could also move around in their physical environment to initiate face-to-face
interaction; they were not confined to one location. Thus, the criterion of face-to-face interaction can be met through movement of individuals within the bounds of socially acceptable norms.

Smith’s second condition for a neighbourhood is a distinct boundary that can be recognized from both within the border and outside the neighbourhood (Kolb and Snead 1997). Defining distinct boundaries for neighbourhoods can be difficult, however, due to the cross-cutting of social interaction and spatial boundaries (Smith 2010:140) or the openness of spatial interactions. At Pot Creek there are no clearly distinct boundaries to demarcate the moieties, however some attempts were made to physically define spatial areas. Roomblock 4 was completed during the final phase of occupation, A.D. 1300-1320, and defines the eastern margin of the village and its related plaza. Roomblock 10, a small collection of rooms constructed during the same period as the completion of Roomblock 4, partially limits visual connectivity with roomblocks to the north and helps to delineate the northern perimeter of the plaza of Roomblock 4. The boundary is somewhat imperfect as the plaza of Roomblock 5 has visual interconnectivity south towards the plaza of Roomblock 4. The physical placement of the buildings helps to define the spatial boundaries of the two moiety neighbourhoods, although a single, clearly defined boundary does not exist.

Based upon the visibility analysis I would argue that the North and South moieties, as identified by Fowles, are distinct neighbourhoods, as they are: 1) small areas where frequent face-to-face interaction could occur, despite having privacy in the roomblock plazas, 2) physically definable, although the boundary between the regions is imperfect, 3) accessible from an outside area, and 4) readily identifiable from the inside.
Nested Enclosure and Ritual

The third level of social interaction that visual analysis of the Pot Creek community has revealed relates to ritual interaction and interpretations of the roomblocks and plazas. The 3D skyline barrier graph analysis has uncovered a link to ritual ideology within the Pot Creek community and the mechanism may be linked to neighbourhood creation. The sense of enclosure within the plazas increased over time for all of the roomblocks. By the final occupation period, the buildings formed almost complete circular enclosures surrounding some of the plazas, and the height of the buildings and shrinkage of plazas all contributed to a sense of enclosure. Three-dimensional viewsphere research into modern urban settings has suggested that views of the sky are important indicators for the amount of light available, openness to the air, and overall
availability of long views, and these elements have been linked to desirable attributes resulting in high real estate values in urban settings (Fisher-Gerwirtzman 2012; Fisher-Gerwirtzman et al. 2005; Yang et al. 2007). These are modern Western notions of the concept of sky view enclosure and are based upon culturally determined value judgements. However, the 3D viewsphere approach can be interpreted through the lens of alternative cultural norms for the enclosure of space. The underlying geometry that creates either open or closed sky views remains linked to the built environment, but the desirability of different degrees of the enclosure could be connected to cultural preferences.

At Pot Creek, it seems evident that increasing the perception of enclosure was a deliberate and intentional characteristic of site design, especially during the final occupation phase, and could be related to the increased sense of nested circularity, which was prominent in the Pueblo world view (Fowles 2004:548; Ortiz 1969:18; Saile 1990:163-172) (Figure 6.15). The Pueblo concept of centre place is reinforced by a multi-scalar understanding of the world surrounding the villages of the Pueblo people (Duwe 2011:89-91). From the distant mountain peaks and places of sacred importance at positions radiating out from the community in cardinal directions, to the roomblocks and plazas, and the circular ritual structures, or kivas, the landscape and built environment all act to reinforce this sense of centre place (Ortiz 1969:19-20). The ultimate middle or centre place is the sipapu (a small hole in the floor of the kiva) and is considered the earth’s naval (Ortiz 1969:21). The plazas at Pot Creek supported the circular metaphor and centre place themes of Tiwa cosmology as they were almost entirely enclosed by the roomblocks towards the end of the site’s occupation, especially the oldest roomblocks on the site, Roomblocks 2, 3, and 6. The sense of enclosure increased as plazas diminished in size and buildings were augmented by upper stories. The roomblocks can be seen as representations of
the wider cosmology of the Pueblo world, with the multistory buildings symbolizing distant mountain peaks and plazas representing centre spaces.

*Views from Rooftops: Mundane and Ritual*

Line-of-sight analysis indicates that visual interaction, including both everyday activities and ceremonial performances, could have occurred from the raised vantage points of the rooftops towards plazas below at Pot Creek (Section 6.1.3). The observer’s stance, either sitting or standing, location, near the edge or towards the centre of a roomblock, and level of the gaze downwards or towards the distance, all play a role in one’s ability to see activities in the plazas below. Deliberate and intentional placement of the body, together with the location of roomblocks in the immediate vicinity, would allow one either to remain hidden on the rooftop when viewed from the ground, or to have a full visual panorama of the plaza. The deliberate placement of an individual on the edge of a rooftop would allow visibility into the plaza, but would also allow that individual to be seen by the people in the plaza below. The awareness of this visual scrutiny could illicit a range of responses, from an intrusive, invasive response to complete indifference to the spectator, depending on the social context of the situation. The deliberate act of sitting on the edges of the rooftops may have occurred when spectators viewed ceremonial activities in the plazas, although the extent to which ritual ceremonies were performed in the plazas at Pot Creek is an area of scholarly debate.

Controversy exists regarding the prevalence of *Katsina* culture and whether it was considered part of life at Pot Creek, with several scholars arguing that the northern extreme of the Pueblo world, including Pot Creek, did not participate in the ritual ceremonialism and, in particular, the masked dances of the *Katsina* (Anderson 1955:405; 1956:33-34; Parsons 1936:115; Schaafsma and Schaafsma 1974:543). *Katsina* culture in the American Southwest is
most strongly identified with masked dancers who represent benevolent anthropomorphic spirits most commonly associated with rhythms of the natural world, including rain, sun, and growing corn (Schaafsma and Schaafsma 1974:535). Fowles (2004:673-717) has argued from multiple lines of evidence that the Katsina cult was practiced at Pot Creek, including a fragment of pottery that clearly depicts a masked face, and portions of a turtle carapace, possibly used as a rattle (Fowles 2004:673-680). Fowles (2004:681) concedes that evidence for masked Katsina rituals is sparse at Pot Creek and the masked dances may not have been developed fully, but he argues that other variants of the Katsina cult, related to lightning bolts, rain, and clouds may have dominated. Evidence for the presence of zig-zag and terraced pyramid motifs include painted and incised pottery sherds, as well as depictions of macaws, rainbows, terraced pyramids, and lightning bolts on kiva murals at the nearby contemporaneous pueblo of Picurís (Crotty 1999:158-181). These design elements indicate that ritual performances related to the natural world were likely practiced at both Picurís and Pot Creek. Spectators seated on the edge of the buildings could observe and be an audience for ceremonial ritual performances in the plazas.

Concepts of spectatorship and performance are important in relation to the performance of ritual and viewing from the rooftops at Pot Creek. The study of performances to be viewed by spectators has been explored recently in attempts to understand the role of socially integrative rituals and political organization in ancient communities (Chamberlin 2011; Hull 2014; Inomata 2006; Inomata and Coben 2006; Johnston et al. 2014; Triadan 2006). Performance of rituals, whether routine doings of daily life or the highly circumscribed acts of a grand staged spectacle, works towards establishing a sense of community, promotes commonly held values, and maintains moral order, and is particularly important in societies where face-to-face interaction is the primary mode of communication (Bell 1997:73; Inomata and Coben 2006:11; Hull
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Bell (1992; 1997:72-83) argues that the central quality of ritual is the repetitive nature of the act through movement of the body and its senses within a spatial environment. Viewed performances can have social effects on the performers, the audience, or both, as the shared experience can ground and display a sense of community and facilitates communication of information, exchange of goods, and, possibly, finding mates (Inomata and Coben 2006:24).

Deliberate and intentional viewing of ritual performances by an audience sitting on the edge of rooftops at Pot Creek would have allowed the audience to be on full public display, thus aiding the establishment of audience member’s social roles and identities. The practice and repetition of performances would allow performers to be seen by, and also see the audience, acting in prescribed ways to communicate information about the social and political order of the community. Plazas and their surrounding roomblocks would act as a theatre, or setting, for the performance and would have been imbued with meaning as the performances were enacted within them. The enclosed environment of the small plazas of Roomblocks 2, 3, and 6 would have provided space for more intimate performances, with the audience seated on the perimeter rooftops and looking down. The number of audience members viewing these performances would have been more limited in these more constrained spaces, so the audience may have been restricted to those inhabiting the buildings. The sizeable plaza, west of Roomblock 4, by contrast, would have accommodated much larger performances and viewing audiences, perhaps even the entire village.

6.2.3 Summary of Spatial Enclosure and Privacy

Overall, the visually private regions of the Pot Creek plazas and roomblocks, during the last occupation phase, A.D. 1300-1320, allowed: 1) social interaction and communication on different proxemic planes within plazas, 2) regulation of personal and interpersonal behaviour...
within the private plazas, to the exclusion of unsanctioned individuals, 3) development of distinct
neighbourhoods that promoted unique social group identities, based on a moiety system, 4) creation of a sense of enclosure by surrounding plazas by roomblock buildings, which acted as a metaphor to support the Pueblo world view of centre place, and, finally, 5) visual connections from rooftops to plazas, defining and enhancing social identity within the community. The buildings were not homogenous environmental entities, but acted to vary visual access and exposure to regulate privacy within plaza spaces and thereby social interaction both within and between the plaza groups.

6.2.4 **Roomblock 1: An Incongruity**

Roomblock 1 is an anomaly in the visual and spatial patterning at Pot Creek as it defies the overall trend of increasingly limited visibility within and between plazas. Roomblock 1 was constructed in the area of highest visibility during the period A. D. 1280 - 1299. During the final phase of occupation, despite the reduction of visual interconnectivity among all of the other roomblocks, Roomblock 1 was still highly visible from the plazas of Roomblocks 4 and 6, and from the rooftops of buildings 2, 3, and 6. While Roomblock 1 was in an area of very high intervisibility with several of the other roomblocks, it was also at a significant distance from them. It was some 30 m from the nearest plaza, well beyond the outer limit Hall’s (1968) public range. The deliberate placement of Roomblock 1 in a highly visible but relatively distant location in the settlement likely reinforced a nonconforming pattern of social interaction. The highly visible location created, not a space of privacy, but a space that was very public and, potentially, under continuous surveillance.

A number of anomalies associated with Roomblock 1 were unique within the Pot Creek site. It had only one story, the only example of a one-story building at the site. It had no bounded
plaza associated with it. There is open space around it but no distinct bounded space that would suggest a private space. Nor is there an associated *kiva*, while most of the other roomblocks have a *kiva*. (Roomblock 2 is also unusual. Its *kiva* was filled in and rooms were built on top of the fill.)

Roomblock 1 initially consisted of a linear module of eight rooms situated in two rows of four, each room containing a centre basin support which is consistent with the construction technique elsewhere in the pueblo. A further addition of two rooms to the north end of the structure occurred in A. D. 1300 - 1320. Wall construction differed slightly at Roomblock 1 as the outside walls were built directly upon the ground rather than in foundation trenches, as in the remainder of the community (Wetherington 1968:19). Its one doorway opened directly to the outside plaza (Wetherington 1968:21). Elsewhere in the site, most of the original doors from ground-floor rooms to the outside of the buildings were subsequently blocked.

What can explain these anomalies? Possibly, Roomblock 1 was simply in an early stage of construction and the site was abandoned before it reached its final form. However, when considered alongside Roomblock 1’s highly visible location, is it possible that an atypical social relationship existed between the inhabitants of this roomblock and the remainder of the community?

All these architectural peculiarities raise a number of possible scenarios that could fit the evidence. Functional explanations for a community-wide desire to connect visually with a specific structure (and the people who dwelled in that structure) lean towards either the requirement to see things or people. For example, it is possible that the building functioned as a highly visible storehouse and the members of the community acted as gate keepers for communally stored goods. But this theory is weak as the roomblocks at Pot Creek had their own storage areas usually located on the ground floors.
The highly visible location of Roomblock 1, differing substantially from the norm of the community, may have involved a variation in the customary manner of social interaction. The high level of intervisibility acted to frame or focus the attention of others in the community, the placement of Roomblock 1 acting to increase awareness of people that should or at least could be seen. Thibaud (2001:47) has argued that there can be a distinct hierarchy between those being viewed in a scene and observers or spectators. Roomblock 1 was in a highly visible but relatively distant location. All the plazas of Roomblocks 3, 4, and 6 were outside even the most public range as expressed by Hall (1966:118-119), that is, at distances greater than 30 m. The distances from the rooftops of Roomblocks 2, 3, and 6 were similarly beyond the public range, and thus beyond the distance for communicating with an individual. The placement of Roomblock 1 thus precluded intimate social interaction to a large extent. While occupants of Roomblock 1 were under continuous potential surveillance, they were also kept at a distance, limiting their social interaction with occupants of other roomblocks.

Continual surveillance, or focusing of attention, can result from social interaction at two ends of a spectrum: 1) high visibility within the spatial environment can be associated with the observation of powerful objects or persons (Dovey 1999:10-12), and 2) high visibility can also result in loss of privacy and be associated with control by powerful others resulting in some form of social stigma (Foucault 1977; Margulis 2003a:247).

In the first case, the spatial environment can be manipulated to achieve the goals of the powerful through the display of people or the arrangements of buildings in order to foreground overt displays of power. More subtle forms of authority can be expressed when the organizational control of space transforms group or communal space for the realization of another’s plan. The construction of Roomblock 1 transformed the spatial environment of the
pueblo and it is possible that the Roomblock focused attention upon powerful people who lived in the building.

In the second scenario, members of the Pot Creek Community could have required inhabitants of Roomblock 1 to be carefully scrutinized, albeit from a distance, and prohibited from being fully integrated into the existing community. Loss of privacy can result in the inability to manage social interactions, establish plans and strategies for interacting with others, or develop and maintain self-identity (Altman 1975; 1977; Margulis 2003a:246). Isolated social interaction could arise from either someone violating the social norms of the community, or a need to inspect someone from outside the community prior to fully embracing them as members of the community. Practices of surveillance act to render individuals and their behaviours available for others to consume (Cohen 2008:182). The consumers, in this case, would be the other inhabitants of Pot Creek and loss of privacy would have been the price that inhabitants of Roomblock 1 had to pay.

These alternative explanations for the visible areas around Roomblock 1, as a visual focal point for powerful individuals or as a location where suspect individuals needed to come under visual scrutiny, offer plausible rationales for the placement and form of the building. While it is impossible at present to favour one model definitively over the other, the analysis of visual patterns enables us to begin to understand some of the finer distinctions of potential social interaction that the location, form, and visibility of Roomblock 1, with respect to the rest of the site, appear to have fostered.

6.3 Summary

Visibility analysis provides opportunities to analyze Pot Creek Pueblo as it has expanded and transformed over its approximately 50-year history as a village site. A number of trends
emerged from this analysis. The roomblocks (except Roomblock 1) became increasingly enclosed and more private towards the end of the occupation, with little to no visual interconnectivity between plazas. The spatial environment of roomblocks and plazas structured social interaction through the size and shape of plazas and placement and orientation of openings to other plazas. Between plazas, little intervisibility was evident, offering few opportunities for casual inter-roomblock social interaction, yet, within each plaza, varying levels of social interaction could occur. All of the plazas allowed face-to-face interaction on a daily basis, while affording public forms of communication across larger proxemic distances. Clearly the inhabitants could have moved throughout the community and have interacted with any of the inhabitants of the plazas (individual agency), but the intrusion of an outsider into one of the plazas would have been noticed and perhaps closely monitored.

The ability to identify neighbourhoods, or distinct regions within a site, is an important component in understanding social interaction. Fowles (2004) identified two distinct regions in the last phase of occupation at Pot Creek and argues that they follow the moiety classification scheme evident in later proto-historic and historic Pueblo communities. The visibility analysis supports the identification of North and South moieties, as Fowles suggests, which we could also consider as distinct neighbourhoods, as defined by Smith (2010). Typically, neighbourhoods occur in large and more complex urban sites, and archaeologists have not usually tried to identify neighborhoods at smaller sites, such as Pot Creek. Identifying patterns in the built environment of moieties, or neighbourhoods, allows us to gain a better understanding of complex social behaviours in these smaller sites.

A sense of enclosure of the plazas increased over time and was perhaps related to the cosmological principle of centre place (Ortiz 1969). Plazas became smaller over time and were more clearly bounded by architectural elements. The walls of each roomblock physically closed
off opportunities to interact visually outside of the bounded space, while the height of the roomblocks, often multistory structures, increased the sense of enclosure within the plazas. This phenomenon was most evident in Roomblocks 2, 3, and 6, but still present, in the remaining roomblocks except Roomblocks 1 and 5. The sense of enclosure in the plazas may have been a tier in the nested circular and enclosed Pueblo worldview.

Visual interaction with other rooftops and plazas at ground level reveals the possibility of intentional or deliberate action. Individuals could either encourage observation of, and by, others or they could deliberately arrange for privacy as they move and change locations on rooftops. The rooftops were actively used for the preparation of food and were the location of doorways to below. These mundane activities would have been available for public viewing, especially if the viewers were on the same story as the observed. The geometry of viewing from a lower to a higher elevation allowed activities occurring towards the centre of a roof to be invisible from ground level. Rooftops could be seen as viewing platforms, or prepared environments, for performances in the plazas below and supported the separation of audience and performers in ceremonial presentations.

The exception to the trend towards private spatial environments in roomblock plaza space is evident in the lack of privacy surrounding Roomblock 1. The highly visible location of the roomblock created a scenario for very different forms of social interaction. Being both highly visible, and at a distance, points to the likely purpose of keeping the inhabitants of Roomblock 1 under continuous surveillance, and limiting social interaction to the public realm as determined by the long visual distances. A possible reason for structuring the built environment in this manner would be to visually monitor discredited individuals or people who behaved outside of the social norms of the community. An alternative explanation links power and focusing of the visual gaze towards the highly visible location and built form of Roomblock 1.
The methods that I use in this chapter allow me to analyse the built environment of Pot Creek in new and unique ways and builds on the many years of excavation and dendrochronological analysis that have contributed data for this site. The key benefit of my application of these new methods and techniques to the interpretation of old data is the broadening of our understanding of the interaction between the structuring elements of the built environment and their implications for social interaction at Pot Creek. Creation of three-dimensional models and use of computerized techniques, such as the suite of 3D visual analytical tools, allows us to use old data in new ways without further degrading the archaeological record through more excavation. This method could be used more broadly in sites of varying sizes and complexity, and even where no standing architecture is available.
Chapter 7

Corn Grinding: Spatial Environments and Communities of Practice

Introduction

Anthropologist E. T. Hall (1966:xi) argues that “No matter what happens in the world of human beings, it happens in a spatial setting, and the design of that setting has a deep and persisting influence on the people in that setting.” The relationship between spatial environments and social interaction is summarized in Chapter 1, where social production and reproduction, in terms of intended and unintended actions of individuals, are based on forms of conduct that are repetitively reproduced through space and time (Giddens 1984:xxi). People construct and organize the spatial environment, which, in turn, effects the social lives of people through the creation, transformation, and reproduction of social structures. Swentzell (1990:19), an anthropologist from Santa Clara Pueblo, argues that the walls and buildings in the Pueblo World are positioned and built to create boundaries for the plazas. The key here is not the buildings per se, but the spatial limits that are created by the placement of the buildings and resulting plazas. The constructed plaza spaces facilitated and provided a spatial stage for social interaction, including the negotiation of social status and identity. Spatial geometric properties provide context for social reproduction through mutual awareness of others, or co-presence, and includes
a range of social potential from intimate face-to-face social interactions to more visually distant ways of communicating meaning. The built environment surrounding corn grinding allowed varying levels of social interaction, reproduction of social norms, and areas where knowledge was transferred amongst female corn grinders.

Corn, or *maize*, was a fundamental ingredient of Pot Creek society during the final period of occupation, A. D. 1300 - 1320, as corn intersected daily life in multiple domains beyond subsistence, including matters such as economic decision-making, agricultural practice, land distribution customs, construction of storage facilities, and ritual practice. Corn grinding occurred at a variety of locations at Pot Creek Pueblo, where the built environment provided spatial cues for proper behaviour, including “*who does what, where, when, how, and including and excluding whom*” (Rapoport 1982:59 italics in original).

Archaeologists have considered the task of grinding corn from multiple perspectives in order to understand the role of this important food staple in Pueblo society. Southwest archaeologists have analyzed use-wear of ground stones (Adams 1993:341-342; 1994; 2010), tool life and corn meal production rates (Wright 1993), production differences between households and relationships to the degree of aggregation of communities (Fratt 1996), and locations of ground stones on either the interior or exterior of pit houses (Schlanger 1991) to understand the significance of grinding stone sets. Ceramic analysis has related the need for women to grind corn for larger numbers of individuals inhabiting larger sites into the Pueblo IV period (Mills 1999:113). An alternate explanation could be that increased production of ground corn was needed for communal ceremonial feasting (Crown 2000b:261; Mills 1999:111; Potter 2000; Spielmann 2000:365). At Pot Creek an analysis of household labour strategies in the production of corn meal is used to understand agricultural output (Arbolino 2001). The role of women in corn production has garnered research efforts focusing on female power and prestige,
including household decision making and the capacity to have a domain of control (Crown 2000a:20; Hegmon et al. 2000). Hegmon and her colleagues (2000:86-87) conclude that women’s prestige declined in the Pueblo Period IV with the introduction of large pueblo architecture with a loss of power resulting from exclusion from kivas, cessation of grinding rooms, and reduction in the significance of household social organization. But, women did retain prestige by providing ritual food (Crown 2000b:265-266). Women participated in ritual production through food-manufacturing processes and these roles appear to have a long time depth in the Southwest (Mobley-Tanaka 1997). Study of the Pueblo IV Period reveals that public display of food preparation was an important aspect of female participation in the modern pueblo worldview and involved the pooling and redistribution of prepared food during plaza-oriented ceremonies (Ortman 1998:183). Investigation of burnt architectural contexts reveals a high incidence of food preparation items in burnt structures, indicating that grinding stones had significance as both domestic and ritual-use items (Fratt 1996:307; Walker 1995:134; Walker and Lucero 2000). Fowles (2004:558-565) discusses the use of corn-grinding rooms to perpetuate female puberty rituals.

One consequence of corn’s ubiquity in Pueblo society was the many labour hours devoted to grinding corn and the resulting lengthy periods occupying corn grinding locations. The spatial environment of corn grinding became social interaction zones where the mundane task of grinding corn was practiced, where social identities were produced and reproduced, where innovation occurred, and where knowledge of mundane and ritual practices was passed to the next generation. Communication and knowledge transfer occurred among female group members through face-to-face interaction with visual, verbal, and physical cues dominating, which was unlike interaction with people outside of the corn-grinding work groups. The process of corn meal production can be seen as a work-group environment similar to a community of
practice (Lave 1991; Lave and Wenger 1991), where a work group develops sustained relationships with people, activities, and the surrounding environment.

Communities of practice aid our understanding about social interaction and knowledge transfer in work groups and helps us consider systems of relationships between people, activities, and the surrounding spatial environment (Lave and Wenger 1991:98). Knowledge transfer is considered part of the experienced, lived-in social world, where peripheral participation is part of ongoing practice (Lave 1991:64). Parameters for communities of practice include sustained mutual relationships, shared ways of doing things, agreement on who belongs, specific tools and representations, and local lore and shared stories (Wenger 1998:125-126). This framework is a way to understand the processes of learning and knowledge generation based on legitimate, peripheral participation within a group, for example a group of women in a dedicated corn-grinding room, where culture, history, and the social world are interrelated constituents (Lave 1991:63-64). Communities of practice are relevant for small communities with face-to-face interaction, such as corn-grinding groups, that disseminate knowledge through demonstration using oral, visual, and physical cues.

A community-of-practice approach assists in answering a number of questions regarding corn grinding at Pot Creek Pueblo. Who was actively or peripherally involved in corn grinding? What role did the built environment have in creating and maintaining social interaction for corn grinders? How was knowledge and learning accomplished while performing the task of corn grinding? I use visibility surrounding the taskscape of grinding corn, together with three-dimensional modelling of the site, to demonstrate that the built environment created spatial regions that had varying degrees of intervisibility, which in turn affected patterns of social interaction and knowledge transfer in the production of corn meal.
7.1 The Centrality of Corn in Pueblo Society

The importance of maize or corn to the Pot Creek community cannot be understated. Robert Mirabal, a current resident of the nearby community of Taos Pueblo states: “Everybody comes to Taos Pueblo hoping to learn secrets. It’s simple, the secret is corn. If you understand corn, you’ll understand pueblo culture. We’re corn farmers” (Mirabal and Zink 2011:1). Similarly, at Pot Creek, corn was a critical factor in subsistence, affected economic decision-making through the allocation of labour and agricultural land, and performed a central role in ritual activities.

The historically documented evidence for the ubiquity of corn in the American Southwest, including the area surrounding Pot Creek, is strong. Corn was a dominant agricultural product in the Northern Rio Grande region as evidenced by the Spanish expeditions into the area, including the Coronado Expedition of 1539 to 1542. Numerous Spanish chroniclers, such as Fray Toribio de Benavente’s narrative (1540) (translated in Flint and Flint 2005:296-302) and Hernando de Alvarado’s narrative (1540) (translated in Flint and Flint 2005:303-308), note that the trilogy of corn, beans, and squash was a primary component of the diet for inhabitants of the region. Parsons (1936:24) documents the use of corn in the diet of the inhabitants of Taos Pueblo in the 1930s, where Ňowawa, corn meal baked in corn husks, was baked in the conical ovens brought by the Spanish. As well, Parsons (1936:24) notes the making of corn-meal wafer bread, which is cooked on flat stones and used for ceremonial occasions. This may be similar to piki bread made from finely ground blue corn on griddle stones and is a food that is important to ceremonial gatherings according to a current resident of Taos Pueblo (Mirabel and Zink 2011:125).

The intersection of corn and ritual ceremonialism within the Northern Rio Grande Ancestral Pueblo groups has been well documented. At Taos Pueblo, corn meal and pollen from
corn were considered to be sacred and fed as fetishes to the water spirits, Wind Old Woman and Earth Mother (Parson 1936:102). Wind-blown meal and pollen were sprinkled on a number of ritual occasions, for example when cutting roof beams to ensure a sturdy and lasting structure and during meals when people would drop corn meal on the floor (Parson 1936:102-103). Corn also figured into the ritual practices surrounding the architectural feature of the centre post and basin complex (see description in Chapter 5) within the rooms at historic Taos Pueblo (Fowles 2004:551-553; Stevenson n.d.: File 2.3) in the later part of the 19th century:

“Men and women of the village gather in the [Feather] kiva, each bearing several ears of corn tied together with corn-husk ribbons….. After prayers, the three heads of the Koyukán'na each blesses the corn and sprinkles it with medicine water made from the medicine of the Koyukán'na…….The corn is afterwards placed at the base of the corn heap in the home as the “Mother” corn.”

These specially blessed ears of corn were then placed in homes of participants in the centre basin complexes.

Parsons (1936; 1939; 1940) observed the practice of corn grinding during her ethnographic study of the Taos Pueblo inhabitants in the 1930s. Parsons (1936:24) notes that the practices of corn grinding changed during a relatively short time, from 1896, when very little corn grinding occurred, as they used a distant mill, to 1934 when some of the women were grinding corn on their own matates, or grinding stones, when they were out of store-bought flour. Modern inhabitants at Taos pueblo are endeavouring to bring back some of the traditional methods of growing and grinding corn, as these practices have been in steady decline since the 1940s (Mirabal and Zink 2011:i-ii).

The process of grinding the corn was documented by the Spanish in 1560 (Pedro de Castañeda de Nájera’s narrative (1560), translated in Flint and Flint 2005:419):

“The grinding is done in a small separate room, where they have a large grinding section with three stones set in mortar, where three women go each to her own stone. One of them breaks the grain,
the next grinds it, and the next grinds it again. Before entering through the door the women they remove their shoes and gather up their hair. They shake their clothes and cover their heads. While they grind a man is seated at the door playing music on a flute. To the melody they draw their stones and sing in three parts. On a single occasion they can grind a large quantity of flour, because they make all of their bread, like wafers, from the flour mixed with hot water.”

This account emphasizes the grinding processes as a series of steps that incorporates a sequence of grinders with grinding stones performing the chore in assembly-line fashion. Each successive grinder uses a different coarseness of grinding stone and thereby grinds the corn into finer and finer powder until a fine corn flour is achieved. The Spanish narratives also emphasizes the social interaction that surrounded the process of grinding of corn and it is significant as it highlights the social interaction that occurred amongst the women and between the women and the men. The social aspect of corn grinding has been reiterated in the documentation of modern corn-grinding songs that help to establish a rhythm for the process and ward off tedium for the grinders (Mirabal and Zink 2011:123).

The long history of the use of corn in Pot Creek Pueblo is supported by archaeological evidence, from the presence of agricultural field modifications to the multiple grinding stones that were recovered from the excavations at Pot Creek. Corn is estimated to account for 75% of the dietary intake of inhabitants of Pot Creek, based on ethnographic analogy (Arbolino 2001:299). Arbolino (2001:241-290) presents results of a field survey conducted in the region surrounding Pot Creek Pueblo and identified numerous check dams (low stone walls placed along intermittent streams to help to retain water), gridded fields (low stone walls to assist in the retention of soil), rock piles (could be used for rock mulch for plantings or property markers), ditches (narrow cuts in the earth to carry water in a controlled manner), and canals (wider forms of ditches). Ephemeral field structures and field houses, possibly used for temporary
Figure 7.1. A collection of metates and a mano from various excavations at Pot Creek Pueblo. The metate, or bottom grinding stone, is worn into a curved surface to allow the corn grinder to work the meal away from the body.

accommodation for workers in agricultural fields, were also present (Arbolino 2001:249-255). Burnt corn fragments were found in many of excavated rooms at Pot Creek (Wetherington 1968:30). Numerous manos and metates were recovered from room fill (Wetherington 1968:65-68) (Figure 7.1). Mealing rooms, or corn-grinding rooms, were identified by the presence of in situ metates, which consist of stone grinding slabs fastened to the floor with adobe collars (Wetherington 1968:22-23).

Further archaeological evidence of the presence and importance of corn within the cosmological world Pot Creek is represented by kiva murals at Picurís, a Pueblo located approximately 15 km southwest of Pot Creek. One of the kivas was constructed in the mid-1200s, while the other in the mid-1300s. Based on ceramic chronologies they were later in-filled between A. D. 1400 and 1500 (Dick et al. 1999:52). Both kivas would have been contemporaneous with Pot Creek’s occupation. The wall murals depicted corn plants, birds, rainbows, and stepped clouds, with the images suggesting summer thunderstorms bringing rain...
and growth to the primary subsistence crop, corn (Crotty 1999:163-165). Painting the murals can be seen as an early manifestation of Pueblo ritual practice to encourage the Spirit world to bring rain and promote successful corn harvests, while promoting a sense of general well-being and prosperity for the community (Crotty 1999:182-183).

Archaeological, historic, and ethnographic evidence all emphasize the significance and centrality of corn for inhabitants of Pot Creek. Corn was the main factor in the subsistence strategy for the population and represented a key economic component for the allocation of labour and limited agricultural resources. Corn had a significant place in the ceremonial world of the inhabitants through its involvement in the rituals of everyday occurrences, as well as its role in more formalized ritual practices, as evidenced by the kiva murals. Thus, the study of the spatial configurations of corn grinding and the related social interactions that occurred during the processing of this important material will enlighten our understanding of the past life-ways of the inhabitants of Pot Creek Pueblo.

7.2 Taskscape and Embodiment: Corn Grinding

The concept of a taskscape involves the settings that people construct, either on the ground or imaginary, while involved in activity in the context of practical engagement and their surroundings (Ingold 2000:186) (Chapter 3). A taskscape embraces the spatial environment, temporality, and the undertaking of everyday life, where participants give layers of significance to the surrounding location. The activities or tasks can be treated in a ritualized sense, in that they are performed in a particular way and are often routinized. The intersection of people’s experiences with objects, space, and other people creates a form of knowing through both embodied and sensory knowledge (Hendon 2010). The processes used to perform a task become normalized through repetitive and habitual methods. Practical knowledge related to production
would include an awareness of bodily movements, rhythm, and the spatial environment, and require dexterity as well as cognitive processes associated with the technological production processes (Jørgensen 2013:91). While the end products or artefacts of production processes have been investigated extensively within a North American archaeological context, the practices of production have received less attention (Schiffer and Skibo 1987). There is a need to unravel the mysteries of how production processes can reveal socially intertwined histories of products, people, and spatial environments and the social contexts under which they are produced (Dobres 1999:210; 2000).

The task of grinding corn would have involved a degree of knowledge that was learned through the experience of performing the task over many repetitions. The process of grinding corn affords potential interaction between body, materials, and senses within varying spatial environments. Touching the corn grains and the grinding stones, listening to others in the immediate area, and visually connecting with both the space and the people surrounding the person grinding the corn are all part of the process of producing fine corn-meal flour. A taskscape can be imagined as a multi-sensorial region spreading out from the corn grinder. The degree of concentration demanded by the grinding process would have an impact upon the ability to construct social interactions. The repetitive process of grinding corn trains the body, while allowing interaction within the surrounding vicinity and, through sensory interaction, both auditory and visual, the bodies act as nodes of social interaction.

The process of grinding corn in the Northern Rio Grande involved women kneeling on the ground and moving a one- or two-handed stone, *mano*, over a larger stone slab, *metate*, with extended arms (Figure 7.2). Considerable force is required to crush the dried corn kernels into corn meal. The frequency and the intensity of the activity left lasting markers on the bodies of the women who performed corn grinding (Perry 2008:103-106). Skeletal evidence indicates that
women were the primary grinders of corn (Martin 2000). Long-bone morphology and activity-induced pathologies indicate that adult females spent considerable amounts of time grinding corn meal by kneeling and extending their arms across the metate (Martin 2000:291-292).

Ethnographers at the historic pueblos report that young women began to grind corn at the time of puberty (Beaglehole 1937; Cushing 1920; Parson 1939; Stevenson 1904). A study of 140 adult skeletal remains from Grasshopper Pueblo indicate that the clavicular ligaments (the ligaments that help to stabilize the chest and shoulder areas) had the same degree of robustness in young women as the older women, and that the clavicular ligaments were more robust for women than for males of the population (Perry 2008:103-105). Differences between the hands of older and younger women at the Tewa Pueblos (modern era) provide a sense of what the women of the ancestral pueblos may have experienced (Hewett and Dutton 1945:83):

“Older women contrast their hands, in which certain muscles
are largely developed, while the fingernails are worn down obliquely by rubbing on the metate, with the slight hands of the girls.”

The intensity, frequency, and the duration of corn grinding left lasting indicators on the bodies of women who performed this task. Their days revolved around the task of grinding corn, leaving an impression upon their bodies as well as their social lives.

The embodiment of the task of grinding corn involved the kneeling position, but also involved the head tilted towards the metate to watch the processing of the corn meal. Two important considerations arise from the analysis of the body position. First, while careful observation of the process was necessary in order to ensure that the corn kernels and the resulting flour remained on the metate, the observation of the process was not necessarily a continuous activity and frequent lifting of the head to view the proximate spatial environment was possible. The process of grinding corn into meal could be accomplished with frequent short pauses to rest and observe the surrounding area, as there is no imperative to grind continuously. Lifting of the head during short hiatuses allowed the women to scan the adjacent region visually and afforded possible social interaction. Secondly, the kneeling position forced the women to view the surrounding area from about 1 m above the ground surface, which offered them a unique visual perspective. Viewing from 1 m above the ground would likely prevent any visual interaction with the adjacent rooftop areas, especially rooftops two and three stories high. As well, the women themselves would have been seen by others as much smaller than their normal height. The spatial and social implications of the body position associated with grinding corn will be discussed further in the sections below through the analysis of visualizing the taskscape of grinding corn.
7.3 Methods of Visualizing the Taskscape

The understandings of space that are created within archaeology are vastly different and remote from the past communities they seek to understand. Renfrew (2008) argues that archaeologists visualize and represent space through a series of conventions of observation and representation of materials, which may not have been the lived experience of past inhabitants. The site maps are drawn and structures are represented in a prescribed manner. Could these conventions of archaeological representation be obscuring how we view the past? Why are site maps always created with north at the top of the page? Archaeological site maps are created from a bird’s eye view, not from the lived perspective. Through the use of 3-D computer modelling, I attempt to get back to ground level, to get a sense of the space from the inhabitants’ point of view.

I use visibility across the spatial environment to understand behavioural affordances, privacy, and social interaction, and how these parameters differ within the pueblo community. Hall (1966; 2003) defined proxemics as visual perception over varying distances that communicate varying levels of nonverbal cues that inform social interaction and communicate meaning (Chapter 3). Short distances can result in very intimate face-to-face encounters, while longer distances result in more a formal, or public type of communication, through speech acts and transmission of meaning via visual cues of the entire body. The distances associated with the categories of communication are culturally variable.

Modelling visibility at Pot Creek Pueblo will help us understand the areas where social interaction could occur around the important task of grinding corn. Humans are visual beings who gain considerable knowledge of their environment from and also communicate information through visual perception. Visual connection between inhabitants would increase the likelihood of different forms, or levels, of social interaction. For example, limited visual access into and
Figure 7.3. Three-dimensional rendering of Pot Creek illustrating locations of known grinding rooms and ramada shade structures (R1-R5), A.D. 1300-1320.
out of corn-grinding rooms would have allowed very close social interactions with other corn grinders, but may have limited social interaction with unseen people outside of the room.

The computer model for this analysis is based on the latest phase of occupation of the Pueblo, completed in the decades between A. D. 1300 and 1320. Chapter 6 uses a diachronic approach, focusing on the changing nature of social interaction within the built environment of Pot Creek Pueblo over time. Here, I focus on a synchronic approach (one point in time), centered on the final phase of habitation and examine taskscapes surrounding various corn-grinding locations.

I use three-dimensional computer models, created in Google SketchUp® 2014, in conjunction with 3D Analyst tools from ArcScene, ArcGIS 10.2.2, to recreate taskscapes surrounding corn-grinding locations. The computer model is enhanced to include details of the ramada structures and the corn-grinding rooms in Roomblocks 2, 3, 4, and 6 (Figure 7.3). ArcScene allows visualization of spatial data in an environment that takes into consideration the height of the components. Computer capabilities of this software allow consideration of elements that have more than one height value. For example, within the shade structures, both ground-level and roof heights are factors in the analysis. These factors are important for considering visibility from within a roofed structure or from a position on a higher story of a roomblock.

Two ArcScene 3D analyst tools are used in this analysis. The line-of-sight tool calculates direct visual interaction between an observation point and a target range, taking into consideration 3D obstructions that block the view. I have set observer height to 1 m above the ground to reflect the height of corn grinders in a kneeling position. The target
was set at ground level at a far distance from the observer point to model views to the entire community. Obstruction points act as the first physical barrier to visibility and generally relate to the 3-D buildings. Visible and invisible lines were then created in a 360° array out from the observer points at 20° increments to mimic the ambient optic array (Gibson 1969; 1979). The line-of-sight tool depicts the degree of visibility from the corn grinders in the different structures to surrounding plazas.

The second ArcScence 3D analyst tool used is intervisibility. This is quite similar to the line-of-sight tool but, instead of an array of points about the observer, it analyzes the intervisibility between two potential observer points. Again the 3D buildings act to obstruct the views creating visible and non-visible pathways between observer points. The intervisibility tool was used to analyze visual connectivity between corn-grinding locations in the ramada shade structures.

7.4 Visualizing the Corn-Grinding Taskscape

Corn grinding occurred in a number of contexts in the Prehispanic Southwest, including specialized mealing rooms used by single households, communal areas separate from domestic architecture, kivas or subterranean rooms, multi-use non-specialized rooms, outdoor facilities under ramada shade structures on the outside of roomblock walls, and outdoor rooftop locations (Arbolino 2001:206). I employ a typology based on architectural features that define spatial environments to determine patterns of potential visibility into and out of the locations where corn meal was produced at Pot Creek. Vertical definition of spatial volume and boundary elements are important architectural classification features, but equally as important is the varying degree of visual
| Type 1: Vertical corner posts defining a spatial volume. This type is similar to the ramada shade structures, but the shade structures tend to place the upright columns in from the edges of the space. |
| Type 2: Repetitive series of columnar elements further strengthening the definition of the perimeter of the space, similar to a latilla structure. |
| Type 3: Jacal walls, similar to wattle and daub construction, use upright elements covered with adobe and define the outside perimeter of space. May have gaps for doorways or sections with no adobe, similar to grinding room 207. |
| Type 4: Fully opaque walls defining the outside boundary of the space, similar to grinding rooms 306, 334, and 603A. |

Figure 7.4. Typology of boundary edges defining a spatial volume. Based on Ching (2007:127).
Figure 7.5. Three-dimensional view of ramada shade structures associated with Roomblock 4 at Pot Creek. Roofs of shade structures are not represented in order to demonstrate interior features (after Holschlag 1975:103).
permeability that is associated with the four types of spatial boundaries (Figure 7.4). Corn-grinding locations have been categorized based on an architectural typology of vertical definition of spatial barriers. Ramada shade structures are examples of the first type of boundary edge, where four posts define the four outer corners of a spatial boundary. The shade structures differ slightly from this type as their irregularly spaced support posts were located within the perimeter of the roofed structures. Abutment with the walls of Roomblock 4 provided greater structural integrity and support for the shade structure rooftops, while the adjacent walls prevented visual connections to outside areas. I include shade structures in Type 1 as the posts are few in number and tend to be dispersed across the space. Four of the shade structures were on the village interior side of Roomblock 4, overlooking the large plaza and *Great Kiva* (Figure 7.5 [R1-R4]). Ramada R5 (Figure 7.5 [R5]) was located on the village exterior side of Roomblock 4 and overlooked the outside of the village.

The second type of architectural boundary is a repetitive series of columnar elements that defines the perimeter of a space (Figure 7.4 [Type 2]). A *latilla* structure would be classified in this category and consists of multiple upright posts lashed together to create a lattice-work structure. The spacing between the upright supports is variable, and does allow some visual access between the posts. *Latilla* structures were present at nearby Picurís Pueblo in the early 1900s (Figure 5.3), but there is no known structure constructed of *latilla* at Pot Creek.

The third architectural boundary type, or *jacal* structure, consists of tightly spaced upright posts that are covered in mud or adobe, similar to wattle and daub construction (Figure 7.4 [Type 3]). Boundaries of this type may be used as spatial dividers within a
room or act as a spatial perimeter to create a separate room. Segments of *jacal* walls can enclose a space as an extension, or a lean-to, on the outside of a building. The structure may contain gaps or spaces where there is no *jacal* wall, allowing for doorways and other openings. This type of wall boundary forms densely opaque walls that block visibility. Grinding Room 207 at Pot Creek is constructed of *jacal* walls (Figure 7.3).

Finally, in the fourth boundary type solid walls define the outside perimeter of a space, similar to rooms constructed of adobe walls and represented by Rooms 306 and 334 (Figure 7.4 [Type 4]). Similar to boundary Type 3, the solid walls define spatial volume for the rooms and allow no visual access from the rooms into other areas, except through possible doorways.

The type of wall construction surrounding corn-grinding locations allowed inhabitants to have varying levels of visual connection with surrounding spatial areas. Spatial boundary types afforded differing visual permeability from completely obstructed views of adobe walls, to filtered views associated with the tightly spaced posts of *latilla* walls, to unhindered views from the open-sided ramada shade structures. Corn-grinding locations and features are considered in more detail below (Table 7.1). Visual taskscape surrounding each of the structures is analyzed in order to compare patterns of spatial and potential social interaction.
<table>
<thead>
<tr>
<th>Mealing Room / Ramada</th>
<th>Fixed or moveable metates</th>
<th>Number of metates</th>
<th>Wall construction</th>
<th>Number of sides open¹</th>
<th>Doorway at ground level</th>
<th>View into plaza</th>
<th>Area of visible plaza (sq. m.)</th>
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<tr>
<td>207</td>
<td>Fixed</td>
<td>6</td>
<td><em>Jacal</em></td>
<td>N/A</td>
<td>Yes</td>
<td>Limited - through gaps</td>
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<td>7</td>
<td>Adobe</td>
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<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>334</td>
<td>Fixed</td>
<td>4+</td>
<td>Adobe</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
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<tr>
<td>R1</td>
<td>Moveable</td>
<td>N/A</td>
<td>Open sided</td>
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<td>N/A</td>
<td>Unobstructed</td>
<td>3050</td>
</tr>
<tr>
<td>R2</td>
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<td>N/A</td>
<td>Open sided</td>
<td>3</td>
<td>N/A</td>
<td>Unobstructed</td>
<td>3050</td>
</tr>
<tr>
<td>R3</td>
<td>Moveable</td>
<td>N/A</td>
<td>Open sided</td>
<td>1</td>
<td>N/A</td>
<td>Unobstructed</td>
<td>3050</td>
</tr>
<tr>
<td>R4</td>
<td>Moveable</td>
<td>N/A</td>
<td>Open sided</td>
<td>2</td>
<td>N/A</td>
<td>Unobstructed</td>
<td>3050</td>
</tr>
<tr>
<td>R5</td>
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<td>N/A</td>
<td>No</td>
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<td>Fixed</td>
<td>1</td>
<td>Possibly open sided</td>
<td>N/A</td>
<td>N/A</td>
<td>Possibly unobstructed</td>
<td>206</td>
</tr>
</tbody>
</table>

Table 7.1. Summary of the known locations for corn grinding at Pot Creek Pueblo. Mealing rooms and ramada shade structures have been analyzed for the available views into the plaza.

¹The ramada structures are built abutting walls of buildings, with the number of sides open to the plazas indicated. ²Room 603A may have been a ramada shade structure.
Figure 7.6. Photo of ramada shade structures at Taos Pueblo, 1899. Photo by A. C. Vroman. A stand-alone ramada is located in the centre of the photo, while a lean-to ramada is located on the left. The beehive ovens were introduced with the arrival of the Spanish. Photo reproduced with permission. National Anthropological Archives, Smithsonian Institution [Photo BAE GN 1895 B].
7.4.1 Ramadas

Ramada shade structures, or *portales*, were located in outdoor plaza areas and associated with the enclosed plaza settlement plan that was adopted in the Rio Grande region during the 1300s (Creamer 1993:57). Ramada shade structures are still in use in the north plaza at Taos Pueblo today (Figure 7.6). The shade structures were used for a wide variety of domestic activities, including *mealing*, or corn grinding, winnowing activities, cooking over hearths, and making clothes (Creamer 1993:85). As well, the areas could have been used by people working with leather, wood, or stone (Creamer 1993:87).

Despite the seemingly widespread use of shade structures there has been little research on them due to the preference to excavate within defined architectural buildings, such as rooms and *kivas*, rather than excavating plaza areas in general. An exception is the extensive research conducted during the 1970s at Arroyo Hondo Pueblo, 8 km south of Santa Fe, New Mexico (Creamer 1993:57). At Arroyo Hondo Pueblo, there was such a large quantity of post holes along some of the plaza walls that it made it difficult to distinguish individual ramada structures (Creamer 1993:72).

Differing excavation strategies have resulted in varying levels of knowledge of the activities that occurred in plazas at Pot Creek Pueblo. Beginning in 1957, excavation of plazas relied on test trenches dug by back hoe towards the southeastern portion of the site (Wetherington 1968:16). Excavation in the 1970s was performed by hand-trowelling and the use of ¼-inch screens and revealed the presence of five ramada shade structures along the length of Roomblock 4 (Holschlag 1975:103). These structures were contiguous with the architecture of the roomblock and were identified by the presence of upright support posts and roof elements in the excavated fill. No excavation data is available for the plazas.
on the northern and western portions of the site and has limited our understanding of outside corn-grinding activities in these areas (Arbolino 2001:207).

Ramadas were areas where corn grinding occurred at Pot Creek, even though excavation outside of Roomblocks 1, 2, 4, and 6 reveal no permanent outside corn-grinding facilities, or mealing bins (Arbolino 2001:207). However, free standing metates and manos have been found outside of the roomblocks, indicating that at least some outdoor corn grinding did occur. Four whole free-standing metates were found during plaza excavations and eight metates were also found during midden excavations during the 1980s (Arbolino 2001:207). Manos and metates were also found on the floor of Ramada 5 attached to Roomblock 4 (Holschlag 1975). The use of outdoor grinding facilities follows the trend found in the Southwest more generally where open air facilities in plaza oriented villages became more common during the Pueblo III-IV transition (Ortman 1998:192). Overall, ramadas played an important role in the production of corn meal at Pot Creek.

Ramada R1

Ramada R1 is a rectangular structure that is contiguous on two sides with the two-story building, Roomblock 4, allowing two sides of the structure to be open to the plaza (Figure 7.7). The L-shaped position of the walls of the shade structure prevents any visual connection towards the north and east. Upright support posts are placed within the area bounded by the rectangular roof (Figure 7.5). Support posts are placed close to the walls of Roomblock 4, allowing a relatively unobstructed view into the plaza. Views from the shade structure are towards the southwest section of the plaza of Roomblock 4 looking over the Great Kiva towards Roomblocks 1, 2, 3, and 6 (Figure 7.8). As indicated by the
Figure 7.7. Three-dimensional rendering of Pot Creek and view from ramada structure R1. Angle of view indicated by arrows from R1.
Figure 7.8. Lines-of-sight from ramada structures R1 - R5 at Pot Creek. Black lines denote visible areas, and grey lines represent areas that are invisible.
Figure 7.8 continued. Lines-of-sight from ramada structures R1- R5 at Pot Creek. Black lines denote visible areas, and grey lines represent areas that are invisible.

Figure 7.9. Intervisibility between ramada shade structures in Roomblock 4 at Pot Creek. Black lines indicate visible pathways, while white lines indicate invisible pathways. In R1 intervisibility is blocked by an upright post and is also blocked by the roomblock wall, so that there is no visual interconnectivity between R1 and R2.
intervisibility analysis, it is important to note that no views are available towards the northern part of the plaza from an individual situated in Ramada R1. As well, no intervisibility is possible with any of the other ramada shade structures (Figure 7.9). In other words, an individual grinding corn in ramada R1 could view the plaza to the south and west towards the Great Kiva, but had no visual connection to the other ramadas located along the length of Roomblock 4.

**Ramada R2**

Ramada R2 is centrally located along the western side of Roomblock 4 overlooking the plaza to the west and is placed in a highly visible location (Figure 7.10). The structure is connected to Roomblock 4 by one wall towards the rear of the structure allowing a wide range of visibility in three directions, north, west, and south. Four upright support posts were placed towards the outer perimeter of the space defined by the overhanging roof. The spacing of the upright posts is large enough that visibility into the plaza would have been virtually unobstructed. An important point to note is that, even though Ramada R1 is in a very highly visible location vis-à-vis the plaza area of Roomblock 4, there is only one other shade structure that is intervisible from R1 and that is R4 (Figure 7.9). A corn grinder located in R2 could only be in visual contact with someone in R4, but not with anyone in the remaining ramadas.

**Ramada R3**

Ramada R3 is situated in a recessed alcove along the western side of Roomblock 4, where the rectangular structure is enclosed by roomblock walls on three sides, with
Figure 7.10. Three-dimensional rendering of Pot Creek and views from ramada structure R2. Angle of views indicated by arrows from R2.
the fourth side being open to the plaza area (Figure 7.11). The walls of the shade structure act to restrict the array of visual interaction with the plaza, with no views available to the north, east, or southern sections of the plaza. Three upright support posts were spaced across the opening of R3, limiting visibility into and out of the ramada. The recessed alcove also prevented intervisibility with other ramadas located on the plaza side of Roomblock 4 (Figure 7.9). Thus, corn grinders located in R3 would have had the lowest visibility of anyone located in the ramadas.

**Ramada R4**

Ramada R4 abuts two walls of Roomblock 4, creating an L-shaped wall backdrop with two open sides, similar to the configuration of R1 (Figure 7.12). The walls prevent any visual connections to the north and to the east of the structure, while the open sides allow visual connections towards the south and west into the plaza of Roomblock 4. The structural support posts are placed towards the rear of the structure and do not impede visibility into the plaza area. Individuals in this ramada structure would have clear visual interconnectivity to one other ramada, R2 (Figure 7.9).

**Ramada R5**

Ramada R5 is uniquely situated on the east side of Roomblock 4 overlooking the outside of the village (Figure 7.5). There is some question as to whether this is indeed a ramada structure or not as some of the typical features of the other ramadas are not present in this structure (Holschlag 1975). Excavation did not find any upright support posts, but did locate a rim of adobe around the perimeter of the building. It is possible
Figure 7.11. Three-dimensional rendering of Pot Creek and view from ramada structure R3. Angle of view indicated by arrows from R3.
Figure 7.12. Three-dimensional rendering of Pot Creek and view from ramada shade structure 4. Angle of view indicated by arrows from ramada R4.
that the upright posts were removed prior to the abandonment of the ramada and therefore would not have been found during the excavation procedures. No hearths were found in this structure, but fragments of a mano and a metate were found. If we assume that R5 is indeed a ramada shade structure then it followed the construction pattern of R1 and R4, where two walls of Roomblock 4 acted to create two sides of the shade structure in an L-shaped pattern and there were two walls of open area. The open wall areas allowed views to the north and east on the outside of the community. There was no visual interconnectivity between R5 and any other ramada structure at the site (Figure 7.8).

Ramadas: Summary

The ramada structures provided women with an outdoor sheltered location to perform the daily task of grinding corn in areas that were distinct from the general space of the plaza of Roomblock 4. The shade structures had fairly clear visual pathways into the plaza or, in the case of R5, to the outside of the village. The abutment of the ramadas against the walls of Roomblock 4 provided varying levels and abilities to see across the plaza. The most visually open form was R2, followed by R1 and R4, with R3 having the most restricted views into the plaza. The ramadas afforded little privacy for women within, as the women were clearly visible to anyone located in the plaza.

A further interesting finding is that little visual interaction was feasible from one ramada to the next and possibly limited opportunities for social interaction between the women located in the separate ramadas. Placement of the ramadas against Roomblock 4 reduced intervisibility between the ramadas and allowed women to have a semi-private
space from the occupants of neighbouring ramadas. The exception was Ramada R2, the most visually prominent outdoor shade structure, which did have intervisibility with R4.

I next turn to visual analysis of enclosed corn-grinding facilities and demonstrate that the views from these rooms were vastly different from those of the ramada structures.

7.4.2 Enclosed Corn-Grinding Rooms

At Pot Creek, large quantities of ground corn were likely produced in locations other than the outdoor ramada structures, using distinctive modes of production and associated ground stone technology. Dedicated corn-grinding rooms are examples of alternative spatial environments where corn meal was produced. The enclosed corn-grinding rooms, constructed of either adobe or jacal walls, correspond to Types 3 and 4 in the spatial boundary typology (Section 7.4). The archaeological identification of corn-grinding rooms is based on the presence of permanent grinding facilities, or mealing bins. Mealing bins are considered permanent fixtures when the lower element, the metate, is fixed to the floor with an adobe collar. Each mealing bin typically contains a metate, consisting of a sandstone slab or the immoveable element of a grinding pair, and a mano, the moveable stone held in either one or two hands depending on the size of the mano and metate. Multiple mealing bins were present in some rooms at Pot Creek, where varying metate coarseness and slope allowed an assembly-line approach to produce ever finer ground corn. At Pot Creek, both one- and two-handed manos were found as well as slab and trough metates (Wetherington 1968:66-68).
Located at the northwest corner of the plaza of Roomblock 2, Room 207 was constructed of jacał walls consisting of closely spaced wooden posts covered with adobe and topped by an adobe roof (Figure 7.13). The room was tucked into a corner of the plaza and abutted two walls, which provided structural support for Room 207. Two large posts, located at the southeast and northeast corners of the room, supported the roof. A doorway in the jacał walls opened to the northern portion of the plaza. There was a gap in the upright posts on the south side of the jacał wall, which may have been an opening for light or ventilation. Six D-shaped mealing bins were located in a row on the floor approximately 1 m from the west side of the structure with metates held in place by adobe collars (Wetherington 1968:22). Multiple manos were also found within this structure. There is little doubt that corn grinding occurred in this room.

Within the confines of grinding room 207, visibility was limited to the close range surrounding the mealing bins. The six grinding stations allowed multiple women to grind corn simultaneously, likely while kneeling along the straight portion of the D-shaped mealing bins and facing the eastern jacał wall. Close face-to-face encounters would have been possible within this room while grinding corn at the personal social distance (.5 - 1.2 m) (Hall 1966) (Figure 6.13). As the grinding bins were aligned along a straight axis, the women would have had to turn their heads, if not their entire bodies from the waist up, in order to ace other occupants of the room fully. The walls and roof created dim lighting conditions within the room decreasing overall visibility, but auditory interaction could have occurred easily in the spatial confines of the room.
Figure 7.13. Mealing room 207 at Pot Creek Pueblo. After Wetherington (1968:22).
Openings from Room 207 towards the plaza would have allowed limited interaction with other inhabitants. The doorway, opening towards the north, would have allowed visual access onto a small portion of the plaza, since the door faced onto a wall only 3 m away. Visual access through the doorway would have allowed social interaction to occur with any individuals standing immediately outside this doorway, but any further interaction between the occupants of the room and occupants of the plaza would have been restricted. The distance from the mealing bins through the doorway would have been at the social-consultative distance (1.2 to 3 m) based on Hall’s (1966) proxemic classification. The only other visual connection from Room 207 towards the plaza was through the possible gap on the south jacal wall. This gap would have been narrow, offering very limited views into the plaza and views by people in the plaza into the mealing room. Thus, women in Room 207 likely had restricted visual and social interaction with occupants of the plaza, except for those intentionally located outside the doorway or narrow gap in the jacal wall.

The interior doorway into ground floor room 213 would have provided the corn grinders restricted visual and auditory interaction with the inhabitants of the inner room, due to limited lighting and the physical placement of the mealing bins. The direction of grinding at the mealing bins required the women to face east with their backs positioned towards the door into Room 213. The women’s body positions would require them to turn their heads to see into the room. Restricted lighting in both enclosed rooms would have further reduced intervisibility.

Thus, women located in Room 207 were able to interact socially with others in three different ways: 1) close face-to-face interaction with women within the room, 2)
possible social-consultative interaction with people in the plaza via the plaza doorway and the gap in the *jacal* wall, and 3) primarily auditory interaction with those in the interior Room 213, behind the corn grinders.

*Room 306*

Room 306 is an enclosed room with fixed corn-grinding facilities and no direct access to the outside at ground level (Figure 7.14). The mealing room was located on the exterior perimeter of the eastern aspect of Roomblock 3 (Fowles 2004:443; Wetherington 1968:23), which is in contrast to the other known enclosed grinding rooms at Pot Creek, which were all in plazas. Room 306 was constructed of adobe walls and the exit was through a roof hatch via a ladder into an upper-story room. No visual interaction outside of the room would have been possible, except for possible visual access to the room above via the ceiling hatch.

Within grinding Room 306, visual interaction was limited to the women who were performing the corn grinding. The room contained seven corn-grinding (or mealing) stations with stone slab *metates* fixed to the floor with adobe collars. The stone slabs were in two parts; the *metate* portion and, also, a stone slab which may have been used to kneel on. The mealing bins were adjacent to one another in a row along the western wall of the room allowing the women to kneel and face towards the east. Women would have been lined up in a shoulder-to-shoulder pattern and would have been quite close to one another. This configuration is similar to Room 207, allowing women to connect visually by turning their heads towards one another. There would have been dim lighting in the
Figure 7.14. Mealing room 306 at Pot Creek Pueblo. Small ovals represent grinding slabs or metates. After Fowles (2004:443) and Wetherington (1968:23).
room, with any light coming from a source of fire. Unless the light source was reasonably bright, visual connections between the women would likely have been indistinct.

**Room 334**

Room 334 is located at the north-west corner of the plaza associated with Roomblock 3 (Heurbst et al. 1971). Room 334 is an enclosed room constructed of adobe walls, and as in Room 306, there was no visual connection to the plaza. Artefacts found in the room included 21 hammerstones, which were used periodically to refresh the surfaces of the grinding implements (Heurbst et al. 1971; Young 1971). The mealing bins in Room 334 were aligned in two distinct rows facing one another (Figure 7.15), unlike the long line of mealing bins in Rooms 207 and 306. Two mealing bins faced towards the centre of the room from the north-west, while two, or possibly three, units faced the centre of the room from the south east. The grinding stones had been removed from three of the mealing bins (Fowles 2004:561). One *metate* and *mano* set found in the southwest corner of the room contained residue of red pigment and may not have been used for grinding corn, indicating that the room may have been used for ritual as well as food production (Fowles 2004:561). The positioning of the mealing bins would have allowed pairs of women to work side-by-side and face another pair across the room. Social interaction would have been at the personal face-to-face level (.5 - 1.2 m) between the adjacent women, while at a social-consultative level across the room (1.2 - 3m) (Figure 6.13). Again, dim lighting would have hampered visibility in the room, although illumination from a fire source was likely.
Figure 7.15. Mealing room 334 at Pot Creek Pueblo. After Fowles (2004:444).
Room 603A

Room 603A was the only interior corn-grinding facility uncovered during excavation of Roomblock 6. It was located in the northwest section of the plaza and contained at least one corn-grinding bin and may have been a ramada structure (Arbolino 2001:208; Bibb et al. 1991). This room followed the same pattern as Rooms 207 and 306 in regards to location on the northwest side of the plaza, but differed from the other rooms in that it had only one mealing bin. Incomplete documentation precludes use of this room in this study.

7.4.3 Other Locations

Corn grinding occurred at other locations within the Pot Creek community as free-standing metates (no adobe collars to fix them to the floor) were found in all of the excavated roomblocks. However, room fill from trash, roof materials, and walls of upper stories has made interpretation of these metates difficult. For example, corn-grinding metates were found in rooms 327, 305, and 325 within Roomblock 3 (Arbolino 2001:231). It is unknown whether these metates were originally used in the ground-floor rooms or were used on the second-story location. Roomblock 4 contained many moveable metates that may have been used in upper-storey rooms or rooftop locations (Holschlag 1975:100-114). One portable metate was found in the roofing material fill above room 822 (Arbolino 2001:208), but no further information about corn grinding is available from the northern portion of the site.

The portable nature of free-standing metates prevents us from determining the original location of grinding activities and many of the stones may have been removed
before rooms and buildings were abandoned. It is likely that corn grinding did occur in individual rooms of household units and on rooftops. The total number of known grinding stones is likely under-represented and may be a product of excavation technique and surviving documentation rather than the total that were found (Arbolino 2001:210). We can conclude that corn grinding likely did take place in other locations, outside the more formal grinding rooms and ramada shade structures. The portability of the grinding stones and our inability to determine where they were used prevents us from including this category of corn-meal production.

### 7.44 Summary of Corn-Grinding Taskscapes

Corn grinding occurred in different contexts at Pot Creek during the last period of occupation, A. D. 1300 - 1319, with both the fixed environment of the buildings and the semi-fixed environment of the mealing bins and moveable *metates* structuring physical embodiment of corn production and related social interaction. Diverse taskscapes surrounded female corn grinders, from solitary workers in ramada structures and on rooftops, to groups of women producing corn meal in a production line in dedicated, enclosed corn-grinding rooms. In the next section, I consider how the built environment acted to structure social interaction between women and others in the community.

### 7.5 Situated Practice: Spatial and Social Interaction

Underlying this research is the fundamental question of what influences architectural design and the use of space and how each is related to the other. The built environment acts as an envelope containing social interaction, where empty space
becomes socialized space through repetitive actions. Giddens (1984) argues that the structuring elements of a social system are perpetuated by the actions of those within the system and hints at the affordances inherent in the built environment to allow social interaction. The dualistic approach in his theoretical perspective implies that performing some action within the structure of the social environment causes the structure to be supported and sustained by the action (Chapter 1, Section 1.2). Kent (1990a:5; 1990b:127) argues that behaviour and cultural organization determine architectural form, and that the organization of space can, therefore, serve as a predictor of social complexity, particularly with respect to partitioning, or segmentation, of the built environment. By segregating women into specific spatial environments, such as enclosed corn-grinding rooms and ramadas, women are reinforcing and perpetuating the social order.

Distinct differences in spatial and visual patterning were associated with the different corn-grinding locations giving rise to a number of possible social interaction scenarios. The ramadas and the enclosed grinding rooms afforded very different visual taskscapes while occupants performed similar activities. The ramadas allowed open views across Roomblock 4’s plaza with limited visual connectivity among occupants of separate shade structures. Enclosed grinding Room 207 offered very restricted visibility into the plaza, while no visual connectivity was available between Rooms 306 and 334 and their respective plazas. Yet the enclosed corn grinding rooms had multiple grinding facilities to accommodate many occupants at one time, creating areas where visual connections and face-to-face encounters could occur.
I continue archaeological investigation into corn grinding by using a community of practice approach to delve into how knowledge and learning, spatial environments, and social interaction intersected for corn grinders. Communities of practice are relevant to small, face-to-face interaction communities, such as corn-grinding groups, that disseminate knowledge through demonstration using verbal, visual, and physical cues.

Communities of Practice: Ways of Knowing

The theoretical concept of communities of practice began as a way to understand the processes of learning and knowledge generation based on legitimate, peripheral participation in a community of practice, where culture, history, and the social world were interrelated constituents (Lave 1991:63-64). Lave and Wenger (1991:98) define a community of practice as “a system of relationships between people, activities, and the world; developing with time, and in relation to other tangential and overlapping communities of practice”. Communities of practice are related to close spatial proximity to others, where facial and social familiarity are intertwined with the routines of shared work, and may lead to social learning and tacit knowledge (Amin and Roberts 2008:354). The parameters of communities of practice include sustained mutual relationships, shared ways of doing things, participants’ agreement on who belongs, specific tools and representations, and local lore and shared stories (Wenger 1998:125-126).

A communities of practice approach has been used by archaeologists in the American Southwest to understand learning and knowledge transmission in the study of ceramic production (Crown 2001; 2007; Sassaman and Rudolphi 2001; Minar and Crown 2001). Models and theories drawn from other disciplines have framed this research and
include such ideas as developmental stages of learning during childhood and differences in development when a child is working alone versus learning conducted under the guidance of adults (Crown 2001; Minar and Crown 2001). Crown (2001; 2007) found that adult and child collaboration was required for completion of some pots. Sassaman and Rudolphi (2001) have drawn upon situated learning theory and communities of practice, as outlined by Lave and Wenger (1991), to understand the social interaction of communities required in learning pottery production. Processes of ceramic pottery production are far more complex than grinding corn into corn meal flour, but similar strategies for teaching and learning would be employed for a child to become a competent grinder of corn.

The concept of communities of practice is a useful tool in our attempt to understand social interaction in the corn-grinding contexts at Pot Creek, especially useful as the original tenets were construed and applied to small craft-based groups of Yucatec Mayan midwives (Lave 1991:68) and task-based groups of Vai and Gola tailors (Lave and Wenger 1991). Learners of these tasks participated in communities of practitioners where they were required to master both skills and conventions of the working community.

Amin and Roberts (2008) propose a typology that we can use to assess the dynamics and character of knowledge production in communities of practice based on four broad categories: 1) knowledge used and produced, 2) social interaction, 3) innovation, and 4) organizational dynamics. While Amin and Roberts compared different research contexts using the communities of practice approach, for example research
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<th>Enclosed Grinding Rooms</th>
<th>Ramada Shade Structures</th>
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<td>Embodied knowledge of position and mechanics of corn grinding Extensive knowledge of aesthetic qualities of the ground corn required Extensive knowledge of ground stone sharpening for varying grades of coarseness</td>
<td>Embodied knowledge of position and mechanics of corn grinding Knowledge of aesthetic qualities of the ground corn required Knowledge of ground stone sharpening for one grinding stone pair</td>
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<th>Nature of communication and proximity</th>
<th>Co-location and face-to-face communication allowing for on-going demonstration and knowledge transfer</th>
<th>Limited face-to-face interaction with other corn grinders outside of ramada, able to move to alternative locations</th>
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</thead>
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<td>Knowledge transfer requires co-location, face-to-face communication, importance of demonstration</td>
<td>Co-location and face-to-face communication allowing for on-going demonstration and knowledge transfer</td>
<td>Limited face-to-face interaction with other corn grinders outside of ramada, able to move to alternative locations</td>
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<table>
<thead>
<tr>
<th>Social Interaction</th>
<th>Temporal aspects</th>
<th>Long-lived and apprenticeship-based Developing socio-cultural institutional structures</th>
<th>Likely long-lived and apprenticeship-based while learning social roles and structures</th>
</tr>
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<tbody>
<tr>
<td>Interpersonal trust and support through the performance of shared tasks</td>
<td>Strong interpersonal trust and support through performance of shared tasks</td>
<td>Likely long-lived and apprenticeship-based while learning social roles and structures</td>
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<thead>
<tr>
<th>Social Interaction</th>
<th>Nature of Social Ties</th>
<th>Strong personal trust within household group</th>
<th>Limited interpersonal trust from one ramada to next as tasks are not shared Strong personal trust within household group</th>
</tr>
</thead>
<tbody>
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<tr>
<th>Innovation</th>
<th>Enclosed Grinding Rooms</th>
<th>Ramada Shade Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customized, incremental</td>
<td>Replicates existing knowledge, yet responsive to changing cues over time Incremental changes</td>
<td>Replicates existing knowledge, yet responsive to changing cues over time Incremental changes</td>
</tr>
</tbody>
</table>

Table 7.2. Summary of community of practice ways of knowing and corn grinding contexts at Pot Creek. Typology based on Amin and Roberts (2008:357).
based on craft contexts, professional practices, and virtual communities, I use the typology to compare the corn-grinding contexts at Pot Creek (Table 7.2). The typology does not address all characteristics that may be derived from an examination based on a community of practice approach, but is a heuristic that can help provide insight into several areas of social interaction in spatial contexts.

*Type of Knowledge*

Corn grinding fits into this typology as it is a craft-based task that requires specific knowledge to be mastered in order to participate fully in the sociocultural practices (Amin and Roberts 2008:358) of the corn-grinding community. Knowledge is embedded in individuals and the social-cultural context, requiring experience, embodied know-how, and aesthetic awareness of corn-meal production. The sharing of knowledge, learning, and knowing things are part of identity creation and part of belonging to a larger group (Wenger 2000:238). Our ability to deal with boundaries, dealing with both objects and spatial restrictions where encounters occur, enhances our capability to create and maintain our identities (Wenger 2000:236-239). Within both the enclosed corn-grinding rooms and the ramada shade structures, newcomers would need to learn the mechanical elements of body position in order to produce corn meal and tactile knowledge to be able to determine when the meal is ground to the required texture. In the corn-grinding room, women would need to know the cues of when to pass meal on to the next stage of processing, as the coarseness of the meal varies with the abrasiveness of the grinding stone. Sharpening the stones, both *manos* and *metates*, would also be required knowledge as stone surfaces wear down with use. With multiple mealing bins in the grinding rooms, different grades of stone coarseness needed to be maintained. In the ramadas, the corn-grinding process would
have occurred on one *metate* grinding set, with little concern for different grades of stone coarseness.

Preservation and perpetuation of knowledge of ritual songs and stories would also be required by women in both the enclosed grinding rooms and the ramada structures. The oral knowledge would pass to newcomers from more experienced corn grinders.

*Social Interaction: Communication and Proximity*

Social interaction in a craft-based group can be seen as a socially dynamic mechanism for sustaining knowledge and involves “sharing a community-specific language (including physical cues), relating stories, building strong ties of reciprocity, trust, and dependence, [and] drawing on facial, tactile, and emotional contact” (Amin and Roberts 2008:359). In craft-based groups, communication and close geographic proximity require co-presence, face-to-face interaction, and demonstration to spur facial and social familiarity which is woven into shared work and shapes close communitarian interaction (Amin and Roberts 2008:356).

Proximity to others while processing corn meal is demonstrated in the visibility analysis (Section 7.4), where elements of communication of knowledge transfer are evident in dedicated corn-grinding rooms, but less so in the ramada structures. Face-to-face interaction of multiple women occurred in the corn-grinding rooms, and allowed ongoing demonstration and passing of knowledge through verbal and physical communication. Songs, rhythms, and story-telling would have permitted knowledge transfer, not only of the techniques of corn grinding, but also of social-cultural structures. In the ramadas, much less knowledge transfer would have been possible for the individual corn grinder, although there would likely have been inter-generational communication of knowledge within the household.
Wenger and his colleagues (2002:55-58) present a schema for outlining degrees of community participation (Figure 7.16) that provides a useful model when superimposed with the visual interaction analysis presented here. While many communities of practice do not operate exclusively on a visual basis, for example on-line communities, the model is relevant for Pot Creek as face-to-face interaction would have been a large factor in communication and participation in corn-grinding groups. A Face-to-face interaction sphere is related to geographical proximity, or spatial or physical vicinity (Knoben and Oerlemans 2006:74). The model outlines four levels of participation in a community of practice, including: 1) a small core group of people...
taking on leadership or decision-making roles, 2) another small group of participants who are actively involved in the task, 3) a peripheral group of participants who observe the first two groups, and 4) outsiders who are not members of the work group, but have an interest in results of these activities.

The built environment influenced group membership and communication in the corn-grinding communities located in the enclosed grinding rooms and ramadas. Within the enclosed corn-grinding rooms there would likely have been lead females who would make production decisions, such as quantity of meal to produce, degree of grind of the meal, which stores to use, and composition of the grinding team at a given time (Table 7.3). Decisions revolving around social aspects of grinding, including songs or stories to accompany the work, may or may not have been made by the same lead individuals. Lead females would likely have been those with some authority based on experience or knowledge. The bulk of the grinding activity was likely carried out by the core group and others actively involved in the process. The activity group could contain novice and experienced corn grinders, with knowledge being passed to the novice group. The enclosed space of the grinding room allowed facial expression recognition and tactile interpersonal interactions. The enclosed corn-grinding communities may have had peripheral participants, such as musicians or singers, who sat just outside of the room, for example, outside of Room 207. Limited visual interaction would have occurred between those inside and outside of the rooms. The largest group of participants in the corn-grinding community would have been outsiders composed of other inhabitants of the plaza or roomblock. They would have a peripheral interest in corn production as they would need the corn meal for subsistence.

In the ramadas, the core group would likely consist of the lead female of the household, with active members comprised of other females of the household. Peripheral participants would include those located in the plaza and perhaps included females from other ramadas. Limited
<table>
<thead>
<tr>
<th>Participation Categories¹</th>
<th>Enclosed Corn-Grinding Rooms</th>
<th>Ramada Shade Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Group</td>
<td>Female leaders based on age or knowledge in roomblock corn-grinding facility</td>
<td>Head female of household</td>
</tr>
<tr>
<td>Active</td>
<td>Other members of grinding group, including novices and other women not involved in decision-making</td>
<td>Other female household members, including novices</td>
</tr>
<tr>
<td>Peripheral</td>
<td>Possibly musicians and singers providing songs and rhythms to aid grinding process</td>
<td>Other occupants of plaza, including women in other ramadas and casual users of plaza</td>
</tr>
<tr>
<td>Outsider</td>
<td>Occupants in the plazas and other inhabitants from the roomblock</td>
<td>Inhabitants from other roomblocks</td>
</tr>
</tbody>
</table>

Table 7.3. Comparison of corn grinding facilities and degree of community participation.

visibility between ramadas prevented more active roles for females from other ramadas, however. Outsiders would have included inhabitants from other roomblocks who had limited interest in the corn-grinding activities occurring in the ramadas, limited to concern for agricultural production and subsistence for the site as a whole.

*Social Interaction: Temporal Aspects*

Temporal aspects of social interaction in a craft-based group are reflected in knowledge acquisition over a period of time in an apprenticeship style of learning (Amin and Roberts 2008:359). Knowledge is transferred over a period of time through everyday interaction with people involved in the same task, or a period of apprenticeship, where strong community ties are interwoven with objects, people, and ways of doing things. The process of learning contributes to becoming a member of a sustained community of practice and aids in the production and reproduction of a community of practice, where newcomers, gradually through time, become
old-timers (Lave 1991:68). A woman learning to grind corn does so through the course of daily life, as the specific knowledge of the process is part of growing up.

A young child may observe corn grinders from the corner of the grinding room, while an older girl may participate by getting necessary supplies or equipment, allowing some knowledge to be acquired simply as part of growing up. Through the practice of shared common knowledge and gradually increasing participation, young girls learned the techniques to master the craft of corn grinding. Thus, there was a long period of time over which the acquisition of knowledge took place. In both enclosed grinding rooms and ramadas there were likely long-lived apprenticeships spanning several years in order to master corn grinding and learn social roles and structures.

_Social Interaction: Nature of Social Ties_

The practice of engagement in a relatively close-knit community of practice, such as the corn-grinding groups, encourages strong community ties based on particular way of doing things, approved methods, equipment, and shared language and stories. Within the enclosed corn-grinding rooms the preferred mode of transmission of knowledge is through verbal communication and physical cues, where the coarseness of the grind of the corn would be continually assessed and compared to the desired result. The close-knit community passed knowledge to newcomers over a period of time, enlightening newcomers with the culture of the work and their ways of doing things. Interpersonal trust and support developed from the performance of the shared task of grinding corn leading to strong community ties. The enclosed grinding rooms supported task groups from the associated roomblock, while the ramadas supported strong community ties in their associated households.
Craft-based activities are primarily involved in preserving knowledge and perpetuating existing practices (Amin and Roberts 2008:359), yet innovation may occur with incremental changes. Over a period of time, responses to a changing environment and evolving community practices may result in incremental changes in how activities are conducted. The practice of grinding corn in enclosed grinding rooms could be modified in response to the number of families living in the roomblock, differing numbers of women grinding at one time, or the amount of corn available for grinding. An expansion in number of mealing bins in the grinding room may have been one change adopted in the 20-year period. The number of grinding stones used, their degree of abrasiveness, and the shape of the fixed stones could have been adapted over time. Increasing frequency and formalization of ritual practice may also have required innovation in grinding practice as corn meal became an important way to participate in ritual practice. Song and rhythm may have been used to ease the burden of grinding large quantities of corn for use in ritual feasting, which may have been introduced during this time. Women located in ramadas would likely have ground corn for household use, with less emphasis on providing large quantities of ritual meal for larger group activities. Innovation in both spatial situations likely occurred incrementally over time.

7.6 Summary

The spatial manifestation of corn grinding allowed the production and reproduction of social roles and knowledge transfer for female corn grinders at Pot Creek. The built environment encompassed two distinct spatial models surrounding the task of grinding corn: enclosed corn-grinding rooms and ramada shade structures, exhibiting differences in visual affordances, knowledge transfer, and social interaction. Enclosed grinding rooms offered a space for social
interaction with other women drawn from the same roomblock. Visual taskscapes within grinding rooms provided opportunities for intimate face-to-face interaction for occupants, while visual interaction with those outside the grinding room was highly regulated. Two of the grinding rooms had no visual interaction with plazas, while Room 207 had a small doorway that allowed limited visual interaction with the adjacent plaza.

Visual analysis of the spatial environment surrounding grinding rooms considered proximity, and, ultimately, participation in grinding activities. Face-to-face visual interaction became a key determinate of who participated and who was peripheral to the group. A separate core group of women likely were decision makers for each of the enclosed grinding rooms and made decisions related to production processes, such as quantities of meal to produce, and number of hours each woman had to contribute. As well, decisions related to ritual knowledge or group historical knowledge may have been made by the core group. Active participants in grinding corn may have included the leaders of the group and others who had no role in decision-making. Peripheral participants would have included those who interacted with women in the grinding room on a less frequent basis, perhaps by providing leadership for songs, retelling cultural histories, or providing rhythms for grinding. Those outside the grinding room would have included plaza occupants and others from the associated roomblock and beyond. Outsiders would likely have had little influence over the process of corn-meal production, but would have had a vested interest in the final product for subsistence and may have been involved in agricultural production decision-making.

Corn grinding in ramadas drew participants from households attached to the ramadas, resulting in smaller corn-grinding groups than those found in enclosed grinding rooms and fewer opportunities for intimate social interaction outside the household. Ramada core groups would have likely consisted of experienced household females, with the active group comprised of
other women and young girls from the household. Peripheral participants in household-level grinding activities included inhabitants of the plaza and possibly women from other ramadas.

Knowledge transfer would have taken place via many levels of participation in the community of practice surrounding corn grinding, but primarily from within the core and active groups. Newcomers would be indoctrinated into the craft through situated learning, exposure to active, experienced corn grinders, and from overhearing discussions of the decision-making core group. Peripheral participants, such as musicians, would also have contributed to newcomer learning. The apprenticeship period would have spanned a girls’ life from the time she was a young child watching the activity in a spatial environment to the time when she took on increasingly active roles through adolescence. Strong community ties would have been interwoven with the process of everyday life in the corn-grinding room.

Analyzing communities of practice and visual taskscapes surrounding corn-grinding locations allows better understanding of potential participants and connections among the physical setting, the social world of objects, and people who inhabit that world. Archaeological signatures of work groups are connected with the built environment and the contextual evidence of objects used to perform the work. There is potential to apply the visual taskscapes of communities of practice approach to other locations and task groups to aid our understanding of past human behaviour. In the American Southwest, it would be possible to compare corn-grinding facilities at Pot Creek with those of later Pueblo IV and V Rio Grande Pueblos. Communities of practice surrounding any taskcape that requires groups to perform a task over long time frames would benefit from the approach presented here. Further research into relationships between the physical and social worlds could be extended to include different taskscapes, such as taskscapes surrounding agricultural field work or construction of adobe buildings.
Chapter 8
Conclusions and Future Research Directions

Research Questions Revisited

In the preceding chapters, I explore how social interaction occurred within the increasingly complex built environment of Pot Creek Pueblo, New Mexico, during the Talpa Period, A. D. 1250 - 1320. I addressed two main questions:

- How can archaeologists analyze the associations between the built environment and social interaction of past societies?
- How did the inhabitants of Pot Creek use the built environment to contribute to the construction and maintenance of social interaction in the community?

My work aims to create a coherent method, based on theoretical underpinnings, to aid archaeological analysis of spatial systems and social interaction among inhabitants of past communities. The development of an organizational system where social interaction can occur to carry out necessary day-to-day activities is common to every society, yet unique in each individual circumstance (Ferguson 1996:2). The built environment, no matter what form it takes, plays an active role in organizing these unique systems through the production and reproduction of social structures in a community. The methods and theories that I use are presented as an integrated package to help us understand how the built environment and social interaction intersect and reinforce one another. These methods can be useful in a variety of geographic and scalar contexts, including the case of Pot Creek presented here, and has the potential to extend
beyond the Pueblo villages of the American Southwest to societies of varying levels of social complexity.

8.1 Spatial and Social Environments

In order to address my first research question, I have developed an amalgamated approach to spatial and social interaction from a number of different theoretical levels. My primary theoretical assumption proposes that the built environment is more than a passive backdrop for social interaction, but is rather an active element in production and reproduction of social practices that have powerful influences on human behaviour. The design and placement of buildings within a spatial environment acts to organize and materialize social relationships by providing boundaries and limits to human mobility. Architecture acts to structure social relations and produce meaning through the organization and regulation of movement of social actors, as outlined in structuration theory (Giddens 1984). Decision-making with regards to site and building design can reinforce power for those in control (Dovey 1999; Lefebvre 1991), and performs a vital role in structuring social relations and production of meaning (Kolbe and Snead 1997; Stone 2016; Wernke 2007). The amalgamated approach that I develop connects these high-level social theories to everyday theory as used by archaeologists to analyse material culture via a collection of middle-range theories. Integral to this approach is the methods of analysis that I use to investigate the site of Pot Creek. Three-dimensional computer modelling combined with Geographic Information Systems (GIS) 3D Spatial Visual Analysis are used to model the site through its various construction phases.
8.1.1 Amalgamated Theoretical Approach

I use middle-range theories (Merton 1949) to bridge between system-wide social theories, such as structuration theory, and minor working hypotheses, for example those strategies used during excavation. The field of Environmental behaviour studies (Rapoport 1969) encompasses a group of middle-range theories which provide a key link between human behaviour and spatial environments by asserting that nonverbal cues are produced by spatial environments and communicate meaning regarding appropriate human behaviour. This link is further enhanced by considering visual communication of nonverbal meanings while attempting to understand social interaction in both space and time through the analysis of co-presence and awareness of others (Goffman 1963). I integrate ideas of visual spatial perception through distancing mechanisms for communicating meaning and social interaction (Hall 1966). Proximity analysis intersects with social interaction when the physical environment prescribes distances that allow different levels of social interaction. Public space, privacy, and territoriality stem from visual communication of meaning within spatial environments (Altman 1977). A further component in my amalgamated theoretical approach involves taskscapes (Ingold 2000), or the visual panorama surrounding a particular task, and aids our understanding of social interaction through the analysis of proximity of peripheral actors (Wenger, McDermott, and Snyder 2002). The communities of practice approach (Lave and Wenger 1991) supports my approach to spatial and social theory by furthering our understanding of how co-workers interact in different spatial settings, with particular emphasis on the segment of social interaction related to knowledge transmission in a group-work setting.

My amalgamated approach uses a combination of high-level and middle-range social theory to aid our understanding of how people in the past socially interacted within the confines of their spatial environment and could be applied to many geographical and scalar contexts.
Research involving other American Southwest Pueblo communities could benefit from the application of my approach by comparing the built environment and social interaction from different periods of occupation and across the Southwest region. Different taskscapes could be considered; for example, research into taskscapes surrounding construction of adobe buildings could reveal the interplay of architectural decision-makers and social interaction of construction work-groups. On a global scale, understanding how people created, used, and interacted within built environments would enhance our knowledge of past life-ways. The theoretical approach presented here could be applied to research on multiple spatial and social scales, from small-scale villages comprised of vernacular architecture to complex urban societies with monumental structures. For example, villages of the Northwest coast of British Columbia with no standing architecture available for archaeological analysis could be analyzed using the theoretical approach developed here. Reconstruction of buildings in a computer-based model from post-mold data could then be used to analyze visual pathways and potential areas of social interaction in the spatial environment surrounding a task, such as preparing and curing salmon.

8.1.2 Method of Analysis: Three-dimensional Computer Modelling

This research demonstrates the benefits of both three-dimensional computer modelling and geographic information systems (GIS), such as ArcGIS Spatial Analyst, to visualize spatial affordances across a site, and to understand, at a deeper level, the consequences of the built environment on social behaviour. I employ advances being made in other disciplines to understand ways in which computer-generated techniques are being used to analyze modern urban spaces and then demonstrate the relevance and informative power of these techniques for past societies at the scale of a village site, and even within rooms of a building. This method allows us to view potential social interaction at the level of individual actors.
The use of 3D computer modelling software such as Google SketchUp® to recreate ancient sites has tremendous potential within archaeology, expanding the ubiquitous archaeological site map while granting new ways to interpret spatial patterns. ‘Walking’ through a 3D model of a site allows us to see the built environment from a human scale. Being able to see architectural features from ground level enhances our ability to imagine how the spatial environment was experienced in the past. Building height and size, room dimensions, wall boundary types, doorway openings, and plaza size all contribute to the ability of inhabitants to visually connect across spatial environments. The modelling process is particularly relevant when the archaeological record contains incomplete data from the past, where wall fragments, footings for walls, and post holes may be all that exists today, thereby limiting our view of surviving architecture. Three-dimensional computer modelling can recreate structures lost due to past depositional and transformation processes, allowing us to recreate and visualize structures as seen by those who originally constructed and inhabited the space. Improvements to computer modelling software and hardware programs will only enhance our ability to ‘see’ and think about the past.

The method of analysis developed for this research uses visibility tools from ArcGIS 3D Spatial Analyst, including tools associated with skyline barrier and line-of-sight analysis. The skyline barrier tools analyze volumetric visible area from a specified observer point allowing both horizontal and vertical dimensions to be visualized. The skyline barrier analysis recreates the perception of visual openness (or enclosure) within a spatial environment and is particularly useful when considering concepts of enclosure and Pueblo worldview. As well, areas that are seen, or not seen, can be studied to determine public and private visual regions and neighbourhood boundaries. The line-of-sight tool delineates visual points between an observer and a target point and indicates all points along a straight path that are seen or not seen. This
metric is used to determine specific pathways of visual connectivity; for example, the line-of-
sight tool can determine if activities taking place on the ground are visible from roof tops. Both
of these 3D spatial analyst tools were integrated with the 3D computer models of Pot Creek in
order to analyze spatial and social interactions at the site through the 70-year construction
sequence.

8.2 Built Environment and Social Interaction at Pot Creek

My second research question takes on a more specific focus as it relates to how
inhabitants of Pot Creek used the built environment to structure social interaction. I consider how
visual interaction patterns are affected by both building placement and building design to
understand how the built environment influenced production and reproduction of social
structures governing every-day activities. The analysis is framed by a human time-scale of two
or three generations, allowing reflection on social behaviour patterns as lived experiences at the
site. I trace social interaction patterns as they are revealed by the built environment during
occupation of the site throughout the Talpa period (A. D. 1270 -1320), and also from the
perspective of processing corn into meal during the final period of occupation.

8.2.1 Revisiting Old Data: Construction Sequence

A further ingredient in my amalgamated theoretical approach is borrowed from
geography’s urban morphology approach to diachronic change (Conzen 1960). The emphasis is
on the changing nature of the built environment and consequent changes in social interaction,
over the more traditional focus based on the end point of community development. The
morphological approach has been used to study micro changes related to specific plots of land to
investigate neighbour effects in density studies of modern urban communities (Whitehand 2001).
I use this approach to examine architectural alterations which occurred at Pot Creek during the Talpa period in order to comprehend how inhabitants’ behaviour changed and was modified by the expanding physical edifice.

In order to understand site morphology at Pot Creek, I first examine the construction of adobe roomblocks to understand procedures and behaviours that flow from the employed construction methods. The key issue for my interpretation of the construction sequence is an assessment of whether older lumber may have been used in new construction; specifically whether stockpiled lumber was used for new construction or older lumber was reused from remodelled buildings. The assumption that timber was stockpiled over long periods (up to 30 years) (Crown 1991) is a contentious issue and formed one strand of the argument necessitating a review of the construction sequence. The other reason for revisiting the construction sequence for the Pueblo is to include newly revealed roomblocks that were not available at the time of Crown’s analysis.

I review interpretation of the site’s dendrochronological data using Dean’s (1978) scheme for analysis of chronological relationships. This scheme is useful in identifying interpretation issues that relate to hiatuses between the felling of trees and their use in an event, such as room construction. It also addresses gaps that relate to absent or unavailable information, such as when outer tree-rings have been removed from a sample and are not available for analysis. The key point is that timbers missing outer tree-ring layers still have interpretive value and should not be dismissed from analysis. Timbers with missing outer layers still provide a *terminus post quem* date, or the earliest date that an event could have happened. Thus, I argue that some of the roomblocks, such as Roomblocks 1 and 4, were constructed at earlier dates than the analysis provided by Crown (1991).
These analytical procedures allow me to formulate a new construction sequence for Pot Creek, where the timeline is divided into five construction phases related to occupation. Using 3D computer modelling I create a series of models for each phase of construction based on dendrochronology data, wall bonding and abutment sequences, and stratigraphic evidence for upper stories (Section 5.5). Data is unevenly distributed across the site, yet I detect construction patterns that I then apply to similar building types at the site. I find that the C-shaped roomblocks initially consisted of two- to ten-room buildings centered on small plazas, with subsequent construction adding additional rooms outwards from these structures while preserving the plazas. Entranceways into the plazas narrowed over time allowing for more defined and enclosed plazas in the C-shaped roomblocks. I interpret Roomblock 4 as beginning as a series of detached two- and four-room structures, with subsequent construction of in-fill buildings to form the linear roomblock. This interpretation differs from Crown’s (1991) as she argues that Roomblock 4 began at its southern-most extent and then extends northward. The difference in interpretation stems from the interpretation of the dendrochronological data, where Crown uses only the cutting date samples, while I include both cutting and non-cutting date samples. I interpret the large complex designated Roomblock 7, 8, and 9 to have been constructed in a series of building episodes, but further research in this sector of the site is needed to verify this interpretation.

My analysis of architectural material culture is extended to population estimation for all phases of occupation (Section 5.6) and is compared to estimates by Crown (1991). I estimate that population increased at a fairly steep but constant rate from A. D. 1270 to 1299, and then levelled off at a lower rate of increase from 1300 to 1320. My results suggest a gradual rate of population increase caused by low rates of migration and in situ population expansion. While, Crown suggests a bi-modal influx of people, with peak migration in 1280 and again in the early
1300s. The implications of this conclusion needs further research to understand migration patterns into the region and may have implications for other regions in the American Southwest.

8.2.2 Private and Public Spaces

To further my investigation towards understanding the social behaviour of past inhabitants of Pot Creek, I use three-dimensional spatial analysis to visualize the expanding spatial environment and highlight social interaction zones that were present during the five construction episodes. There are a number of trends that can be teased out from this analysis which apply to all of the roomblocks, save Roomblock 1. I found that overall visibility within the site declined over time for each roomblock, with the major period of decline occurring between A. D. 1280 and 1299, reflecting the placement and construction of rooms that limited visibility into plazas. There was an increased sense of enclosure for all of the roomblocks through time. Plaza enclosure was most pronounced in the C-shaped roomblocks as these semi-enclosed plazas became surrounded by newly constructed sections of the buildings. The linear roomblocks also demonstrated increasing enclosure through time, albeit from greater distances as these plazas were much larger than those associated with the C-shaped buildings. There was limited visual connectivity between the plazas of the roomblocks, with this result being consistent for both the C-shaped and linear roomblock types. It is interesting that this trend continued from the earliest time through to the period of abandonment.

A variety of social consequences resulted from these changes to visibility patterns, with the spatial patterning providing clues as to who could communicate with whom, when, and under what conditions. Environment and privacy can be linked to regulation of social interaction by the selective control of access to one’s self or group (Altman 1975). Within plazas, the dynamic visual world allowed social interaction and monitoring of the immediate surroundings, which
facilitated inhabitants to obtain necessary information to ensure appropriate behaviour. Visual segregation of plazas from the plazas of other roomblocks created distinct areas where a level of privacy was provided for individuals who were connected with a particular roomblock-plaza group. The physical structuring of the environment led to the exclusion of others, while allowing various levels of social interaction to occur within each plaza, from close, intimate encounters at short distances of 0 to 0.5 m, to more public distances and communication at social distances up to 5 m. Pueblo-level public spaces were located outside of the internal plazas of the C-shaped roomblocks and were spaces where non-verbal communication could occur based on co-presence of individuals from any of the roomblocks.

Limited visibility between plazas created segmentation of the population within the site forming distinct neighbourhoods where each roomblock consisted of a separate physical entity containing a socially cohesive group (Smith 2010; Smith et al. 2012; Stone 2016). An increased sense of enclosure through time was possibly related to adoption of the cosmology surrounding centre place, concepts identified more fully with later Rio Grande Pueblos during the Pueblo IV Period (Ortiz 1969). My analysis concurs with Fowles’s (2004) arguments about early adoption of rituals and ceremonialism associated with the Katsina religion at Pot Creek Pueblo.

The highly visible nature of Roomblock 1 may have resulted from the desire of community members to ensure that inhabitants of Roomblock 1 were continuously observed, which suggests a variety of social organizational scenarios. Roomblock 1 may have been a building for elite individuals who wanted to be on display, perhaps leaders of the community modeling appropriate behaviour patterns. It is possible that Roomblock 1 housed discredited individuals, who existed outside the social norms of the community, and required visual monitoring. Or perhaps Roomblock 1 was used for those with a particular social status, such as young adolescent women or men, who required visual observation as they progressed through
life transitional rituals. While my research has pointed out an anomaly in the visual patterning surrounding Roomblock 1, I am unable to interpret fully the significance of the pattern. Further research into this area could potentially prove fruitful.

Patterns of visible and non-visible, private and public spaces, and areas that can be considered as neighbourhoods, as revealed by this analysis, demonstrate that the built environment of Pot Creek was carefully orchestrated to structure social interaction. The entranceways into the C-shape roomblocks narrowed throughout the occupation sequence in an attempt to limit access to the interior plazas by appropriating and enclosing the space. Within the roomblock plazas a degree of privacy was possible, fostering close social interaction between occupants, while excluding outsiders. Thus, the built environment can be seen as a tool to ensure that appropriate social interaction occurred in the prescribed manner, and analysis of this environment also reveals that patterns of social interaction changed over the 50-year period of occupation as plazas became more enclosed.

8.2.3 Corn Grinding: Communities of Practice and Knowledge Production

I switch emphasis from a morphological method to a community of practice approach in my focus on the final phase of occupation at Pot Creek, to understand how the built environment produced and reproduced social interaction during the task of grinding corn. A community of practice approach (Lave and Wenger 1991) is combined with visibility analysis to reveal how communication patterns and knowledge were transferred in different physical settings surrounding corn-grinding work groups. The community of practice approach looks at ways work groups interact in close spatial proximity and considers how spatial environments, artefactual localities, and facial and social familiarity are intertwined with the routines of shared work, which may lead to social learning and tacit knowledge production (Amin and Roberts
2008). There are similarities between corn-grinding groups and the small, craft-based groups analyzed in the community of practice literature (Lave 1991), where learners were required to master skills and conventions of the working community through long-term exposure. Based on ethnohistoric (Beaglehole 1937; Cushing 1920; Flint and Flint 2005; Parson 1939; Stevenson 1904) and biological anthropological studies (Martin 2000) the corn-grinding work groups would have been composed of women of varying ages.

Several important conclusions are drawn from the analysis of the two distinct corn-grinding environments found at Pot Creek. The degree of visual transparency of the facilities’ walls reveals differences in visual connectivity beyond the spatial environments, with open-sided ramadas having wide visual interaction outside of the ramadas and enclosed rooms having very limited visual connectivity beyond the enclosed room. Visual connectivity is linked to the ability to socially interact beyond the corn-grinding rooms and influences the degree of participation that the corn grinders could have with others in the community.

I found that both enclosed corn-grinding rooms and open-sided ramadas required co-presence and face-to-face interaction to transfer knowledge; however, since larger numbers of individuals were involved in enclosed grinding rooms, more levels of interaction in these rooms likely occurred. A core group of individuals was likely charged with decision-making while others were less involved with decision-making yet still actively involved in processing the corn. As well, peripheral participants, such as musicians leading songs and rhythms to accompany the work, were spatially more distant at doorways, while outsiders, not directly involved in production, would have been primarily interested in production results and hearing the distant music and songs. In contrast, women working in ramadas were likely from one household and had less extensive groups of involved participants. Close proximity to others while processing corn meal was possible in the enclosed grinding rooms allowing face-to-face interaction with
multiple women, and permitting ongoing demonstration and passing of knowledge through visual, verbal, and physical communication. The enclosed rooms allowed many levels of participation, from young girls learning techniques by observation and peripheral participation, to older and experienced corn grinders.

Differences in the corn grinding equipment located in the rooms influenced knowledge acquisition and transfer. The enclosed rooms had multiple, fixed grinding bins, while the ramadas had individual moveable grinding stone sets. Acquisition of knowledge of grinding technique, body position, the degree of coarseness of ground meal, and techniques to sharpen grinding stones were all relevant. I conclude that different types of knowledge were required depending on the spatial environment where corn production took place, reiterating that spatial environments impact social interaction practices. For instance, women in enclosed grinding rooms required knowledge to maintain the prescribed degree of coarseness on multiple sets of grinding stones, while in the ramadas knowledge of one grinding stone set (and one degree of coarseness) was required.

The distinct differences of the built environment surrounding corn meal production brings to light different patterns of social interaction for corn grinders. Enclosed grinding rooms provided intimate face-to-face social interaction for multiple women within the room, while women in the ramadas had limited face-to-face interaction beyond their own household members. Participation in work groups would have varied widely between the two spatial environments where corn meal production took place.

8.3 Spatial and Social Interaction at Pot Creek: Further Considerations

Overall, I demonstrate that the spatial environment did have profound implications for social interaction and the reproduction of social structures at the site of Pot Creek. The review of
site morphology exposed deliberate actions by planners and builders to divide the community into distinct clusters of buildings, to encourage separate entities within a larger whole. Social interaction of inhabitants was directly influenced by the shape and placement of the buildings across the site.

In this study, I have identified trends and patterns associated with the built environment at the site, yet there are still many unanswered questions. For example, I am intrigued by the two distinctly different systems of corn meal production occurring simultaneously in the same community. Can differences between enclosed grinding rooms and ramadas reflect an underlying incongruence within the community of Pot Creek as a whole? Fowles (2004) argues that the enclosed rooms could have been used for female ritual practice and production of corn meal for ritual and ceremonial use. While this is possible, it leads to further questions. If the enclosed rooms were used exclusively for ritual production, where did production of non-ritual, everyday corn meal occur for the C-shaped roomblocks, and where was ritual corn meal produced in the linear roomblocks? It is possible that both types of corn-grinding facilities produced corn meal for both ritual and mundane consumption, but were based on distinctly different models of production.

Perhaps the differences in grinding facilities reflects a deeper division in the community, one that is reflected in overall architectural patterns at the site. The long, linear roomblocks with large plazas are in contrast to the enclosed form and smaller plazas of the C-shaped roomblocks. I have exposed distinct patterns in public and private space. Entranceways into the C-shaped buildings enclosed the space over time to provide privacy for occupants, while, at the same time, creating social distance from the wider community. The larger plazas formed by the linear roomblocks could have acted as more publicly accessible spaces, perhaps as spaces for forging wider community ties. The Katsina ritual complex, including ceremonial performance of rituals
in large plazas, evident in the Rio Grande in later periods, may have been at an early
developmental stage in the later occupation of Pot Creek. Fowles (2004) speculates that divisions
within the community reflect two distinct moieties. I suspect that the need for private space in
the C-shaped roomblocks, but not the linear roomblocks, may have been an architectural
manifestation of an underlying division in the community, one that ultimately resulted in
community fragmentation at the conclusion of occupation after A. D. 1320 into the two
communities of Taos and Picurís.

It can be stated with certainty that the Talpa period (A. D. 1270 - 1320) at Pot Creek was
a time of experimentation and change both architecturally and socially. The built environment
was transformed from three small buildings containing two to four rooms each to over 10 large
roomblocks containing 100s of rooms with multiple stories. Social interaction patterns
transformed over time as the physical site grew in size and population.

8.4 Final Words

I designed this research to be more than a study of adobe structures at Pot Creek, as I
wanted to explore theories and methods regarding spatial environments and find ways to
understand past social practices. The amalgamated approach that I use draws on theory from
many academic domains, some of which are not usually associated with archaeological
investigation of small, village-sized communities. My use of a computer-generated three-
dimensional visibility approach has been inspired by urban planners to analyze modern urban
environments and is applied to architectural remains of a past Pueblo village. I was also inspired
by the work of Michael Smith (2007) when he challenged archaeological researchers to use
visibility analysis as a tool to explore ancient urban environments. There has been a great deal of
research using visibility at the level of landscape or regional analysis (Bender et al. 2007;
Renfrew 1979; Tilley 2008; 2010; Thomas 1993; Van Dyke 2008; 2009) and within ancient urban environments (Earl et al. 2013; Fisher 2007; Paliou 2013; Paliou et al. 2011). Much less research has been conducted in other contexts and I have attempted to bring visibility analysis into the realm of small villages. Villagers, like urban dwellers, need to organize where and what to build and make decisions on how to use the built environment to segregate space based on their own unique social and cultural contexts. By expanding the potential of this high-resolution approach into village-sized communities, I have opened new avenues for research into village spatial and social cultures in the American Southwest and more widely.

The combination of three-dimensional computer modelling and geographic information systems (GIS) represents only the beginning of research that can play a vital role in intra-site investigation. I introduce a morphological approach to the built environment which is central to understanding human interaction at this level of analysis and for our understanding of diachronic change. Future research into spatial analysis of architectural elements could be enriched by creating additional layers in a GIS model with data about spatial distribution of artefacts and ecofacts, allowing us to have a more in depth appreciation of contextual elements. A 3D GIS model including these components could help identify spatial boundaries of other task-related activities, such as ceramic production or construction activities, and their related social interaction spheres.

I believe that this research endeavour has successfully illuminated the built environment and allowed me to think and see the spatial environment in a humanized way, to ‘see’ from a perspective of past village occupants.
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